

# ARCADIA AREA DRAINAGE PROJECT

Flood Control District of Maricopa County  
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2801 West Durango Street  
Phoenix, AZ 85009

PROJECT NO. 94-21  
FINAL RECOMMENDATIONS REPORT  
MARCH 1997



*Prepared for:*

*FLOOD CONTROL DISTRICT  
MARICOPA COUNTY, ARIZONA  
2801 West Durango Street  
Phoenix, Arizona 85009*

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# Final Recommendations Report

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## **I. INTRODUCTION**

### **A. Project Location**

The Arcadia Area Drainage Project is located in the metropolitan Phoenix area, within the central area of Township 2 North and the westerly region of Range 4 East. The project is bounded by Camelback Mountain on the north, 64th Street (Invergordon Rd) on the east, 40th Street on the west and the Arizona Canal to the south and is shown on the Watershed Boundary Map Figure I-1.

### **B. Project Purpose**

The purpose of the Arcadia Area Drainage Project study is to evaluate and recommend design alternatives for storm drainage collection systems to alleviate lower frequency storm flooding problems in the Arcadia area north of the Arizona Canal, from 40th Street to 64th Street, and to reduce or eliminate the limits of the "A" Zone floodplain along the north side of the canal. The storm drainage collection systems (SYSTEMS) will outlet into the future extension of the Old Cross Cut Canal (OCCC) via an under crossing of the Arizona Canal east of Arcadia Drive (48th Street) and to the Arizona Canal Diversion Channel (ACDC) west of 40th Street. The project is a cooperative project between the Flood Control District of Maricopa County (DISTRICT) and the City of Phoenix (COP), with participation from the Salt River Project (SRP).

A draft Preliminary Recommendations Report was completed in August 1995 which provided the basis for the Final Recommendation Report. The results of the Preliminary Report were presented to local residents at a Public Presentation on November 9, 1995 (see Section IV.B). Comments from the residents, as well as engineering evaluations from the project team, were used to generate final alternatives which are presented in this Final Report.

**C. Project Objective**

At the present time the Arcadia area has no significant outlet capacity to relieve storm runoff which collects and ponds against the north side of the Arizona Canal. The SYSTEMS will collect runoff from lower frequency storms and can utilize the improved OCCC and ACDC as outlets. The improved OCCC is designed to convey runoff from the OCCC corridor, as well as a maximum SRP release of 1,000 cfs from the Arizona Canal. Capacity has been provided in the improved OCCC system to accommodate up to 1990 cfs of direct discharge from the Arcadia Area and from the Arizona Canal. Under no circumstances can the project restrict or prohibit SRP's ability to release up to 1,000 cfs into the improved OCCC system.

An additional relief gate structure from the Arizona Canal into the ACDC was also analyzed. This gate would provide an additional discharge point for the SRP in order to provide more capacity in the Arizona Canal (within the Arcadia Area) for storm water runoff. Since the ACDC is a U.S. Army Corps of Engineers (Corps) facility, close coordination with the Corps would be required in the pursuit of this option. See JDA Report on ACDC Relief Gate (Appendix F under separate cover).

An option was included in the Preliminary Recommendations Report to allow for more than 990 cfs of storm runoff to discharge to the OCCC. This would be allowed when SRP was not releasing flows from the canal and would be controlled by a system of telemetered gages and remotely controlled gates. Control of the gates would have to follow complex operational procedures which would be agreeable to both the District and SRP. However, because of the uncertainties associated with the operation of the gates (including time requirements for decisions, time required for gate opening and closures, travel time in the canal and potential for human as well as mechanical error), the availability of the additional 1000 cfs outflow could not be guaranteed. This option was, therefore, not considered for the selection of the final alternatives. This option could be considered again at a later date, if the questionability of the additional outflow is deemed acceptable, or SRP no longer requires the 1000 cfs capacity.

The final objective of this study is to analyze and recommend alternatives for the extension of the OCCC from Indian School Road north to the Arizona Canal (see Section V). This facility will accept flows from both the SRP gate structure as well as the proposed SYSTEM Undercrossing(s).

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ARIZONA CANAL  
DIVERSION CHANNEL  
WATERSHED BOUNDARY  
D.M. NO. 12  
APRIL, 1986

ARIZONA CANAL  
DIVERSION CHANNEL  
WATERSHED BOUNDARY  
D.M. NO. 12  
APRIL, 1986

INDIAN BEND WASH  
SIDE CHANNEL SYSTEM  
WATERSHED BOUNDARY  
JULY, 1981

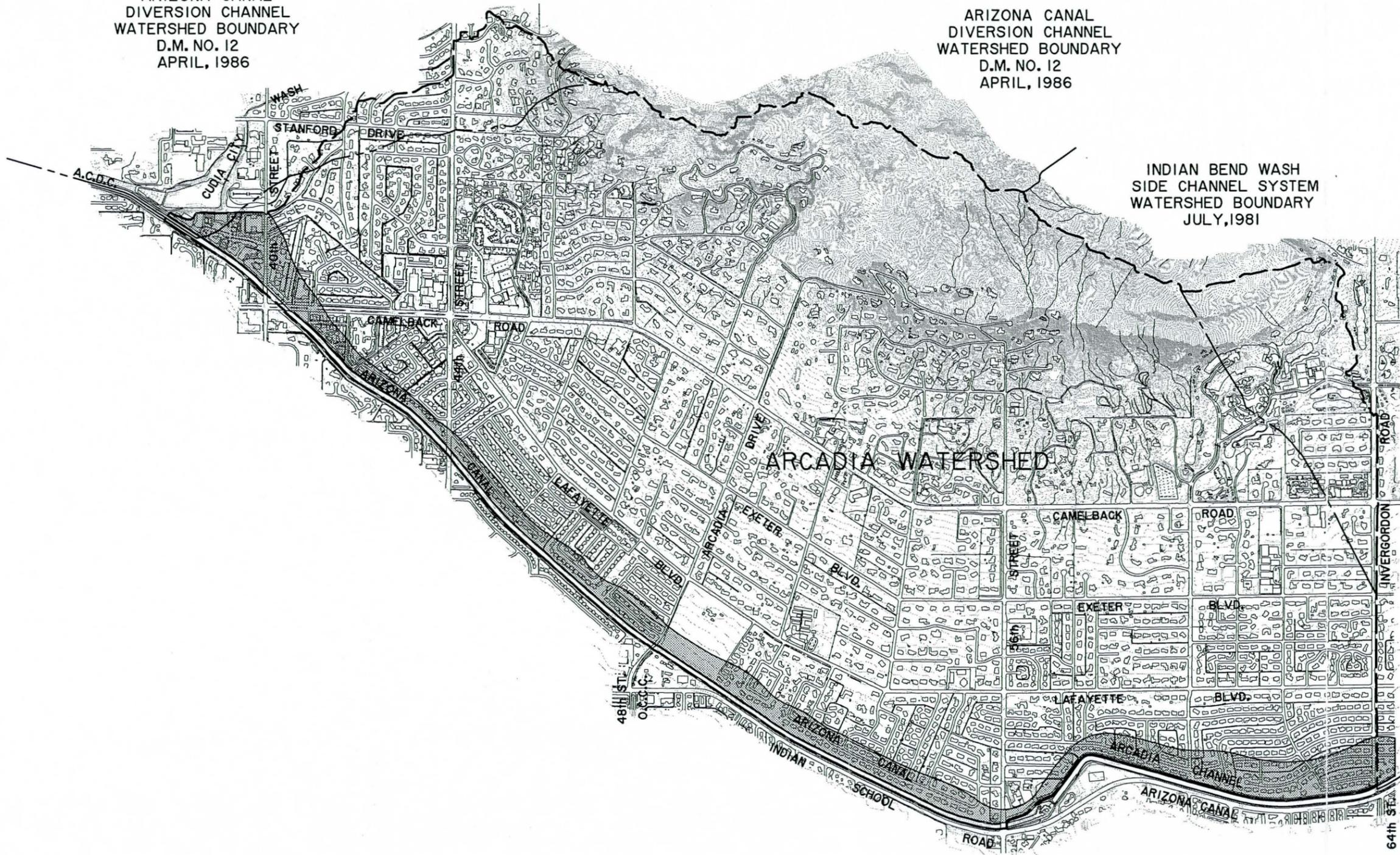
ARCADIA WATERSHED

INDIAN BEND WASH  
SIDE CHANNEL SYSTEM  
WATERSHED BOUNDARY  
JULY, 1981



**LEGEND**

- ARCADIA WATERSHED BOUNDARY
- INDIAN BEND WASH SIDE CHANNEL SYSTEM WATERSHED BOUNDARY JULY, 1981
- ARIZONA CANAL DIVERSION CHANNEL WATERSHED BOUNDARY, D.M. NO. 12 APRIL, 1986
- █ F.E.M.A. ZONE 'A' 100 YEAR FLOOD BOUNDARY



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NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT  
OF MARICOPA COUNTY  
ENGINEERING DIVISION

ARCADIA AREA  
DRAINAGE STUDY  
PROJECT NO. 94-21

	BY	DATE
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DRAWN	S. SMITH	03-97
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WATERSHED BOUNDARY MAP      FIGURE I-1

## **II. BACKGROUND**

### **A. Historical Information**

The Arizona Canal was constructed in the late 1800's to transmit irrigation water from the Granite Reef Diversion Dam to farm lands in the valley. At the time of its construction, there was very little development in what is now Phoenix and there was little concern with regional flooding. The construction of the canal itself has not increased runoff in the study area, however, the canal levees block runoff flow from Camelback Mountain and the surrounding drainage area creating areas of flooding along the north side of the canal.

Originally, this was not a concern relative to flooding problems due to the fact that the land north of the Arizona Canal was irrigated farm land. As the Phoenix city limits began to grow in the mid-1900's, the area north of the Arizona Canal began to transform into prime developed real estate including many affluent homes built adjacent to the north bank of the Arizona Canal. During this time period there was little concern for detaining or conveying the stormwater runoff produced by the newly developed area. Some of the rainfall that percolated into the ground or would runoff in small slow moving rivulets, is now collected in streets, storm channels, and ponding areas north of the Arizona Canal and drain through small drainage pipes into the Arizona Canal. Combined with the increase in development within the watershed, the encroachment of development adjacent to the north bank levee has resulted in a significant threat of flooding and property damage.

Current flooding problems in the Arcadia Area consist primarily of general and nuisance flooding in the streets north of the canal and along the north canal bank. This is due to the lack of any significant storm drain network or outlet for the storm runoff. Small culverts outletting into the canal are the only source of outflow for most of the Arcadia Area (see Section III). There has been significant flooding reported and monetary damages paid under the National Flood Insurance Program in an isolated area of Arcadia -namely, the Camelback Castille Condominium Complex at the southeast corner of Camelback Road and the Arizona Canal (see Section II.C). Again, this flooding was caused by insufficient storm drain facilities upstream of the complex and no place for the water to go as it backs

up against the canal. The two most recent incidents of flooding occurred in July of 1992 and October of 1993. These storms were estimated to be between 2- and 5-year events.

In recognition of this continuing flooding potential, the Federal Emergency Management Agency (FEMA) has designated approximately 125 acres of land adjacent to the canal north bank levee between the study limits of 40th and 64th Streets as 100-year floodplain. The area of this floodplain is shown on Figure I-1. This includes approximately 280 single family and condominium units within the limits of the floodplain.

#### **B. Basin Characteristics**

The study area watershed is approximately four square miles in size. The hydrologic properties of the basin are based on physiographic characteristics and land use. Its physiographical characteristics change from a rugged mountainous outcrop, peak El. 2707 feet and steep side slopes up to 60 percent, to a relatively flat developed residential neighborhood (avg. elevation 1260 feet). Camelback Mountain is undeveloped and accounts for approximately 22 percent of the drainage area. The hillsides adjacent to Camelback Mountain slope to Camelback Road, at rates ranging from 2% to 15% and have natural desert landscape with medium density vegetative cover. The land use for this area can be classified as very light density residential development.

The area south of Camelback Road and north of the Arizona Canal varies from medium density residences to multi-family residential homes with a few business developments along Camelback Road. Most residences in this area utilize flood irrigation.

Runoff begins at the top of Camelback Mountain and flows southward in numerous gullies and poorly defined water courses. Runoff is then conveyed by small washes and streets in the hill slope areas and primarily flows as sheet flow along and across Camelback Road. This occurs at virtually every intersecting street along Camelback Road. South of Camelback Road the interconnecting streets channel the flow to the north bank of the Arizona Canal. The profile along the north bank is relatively flat (slopes less than .05%) with no defined water course with the exception of the Arcadia Drainage Channel east of

56th Street. The lower frequency storm runoff tends to pond and enter the canal at various drainage pipes. For the larger storms, stormwater runoff also overtops the north bank and discharges into the Arizona Canal and flows very slowly in a northwesterly direction. The ponding water backs up into the low lying residences along the north canal bank.

**C. Historic Storms & Flooding History**

The following storm descriptions for the Phoenix area come from the Corps' Old Cross Cut Report (Ref. No. 24).

General Winter Storms

Storms of this type normally move inland from the north Pacific Ocean, spreading generally light to moderate precipitation over large areas. Although they occur any time from late October through May, they are most common and generally heaviest from December through early March. These storms frequently last several days and may occur in series with only slight breaks between storms. They usually reflect orographic effects to a great degree, so the mountains of central Arizona often receive from four to ten times as much precipitation from winter storms as do the desert areas near Phoenix. Snow frequently falls in the mountains above 6,000 feet and occasionally falls at elevations below 3,000 feet (not a factor in this drainage area). Despite the normal low intensities of precipitation during general winter storms, the large areal extent and the relatively long duration of these storms can produce substantial volumes of runoff and high peak discharges on the larger rivers of the region.

General Summer Storms

Storms of this type normally result from a flow of warm and very moist tropical air into the region from the southeast or south, including the Gulf of California (Sea of Cortez), the tropical Pacific Ocean south of Baja California, and, to a slight extent, the Gulf of Mexico. Such storms over Arizona are often associated with tropical storms or hurricanes. General summer storms can occur any time from late June through mid-October, but are most frequent from August through early October. They usually last from 1 to 3 days and generally consist of numerous locally heavy storm cells embedded in more widespread,

general light to moderate rain. Like their general winter counterparts they usually reflect orographic influence, with higher mountains often receiving from three to eight times as much precipitation as do most of the desert areas. Some of the late September and October general storms can show characteristics of both the summer and winter types. The areal extent and duration of general summer storms are usually somewhat less than those of general winter storms, but intensities may be higher. Because infiltration rates are normally higher during summer than during winter, runoff volumes are usually lower than from winter events, but the peak flows on intermediate-sized streams may be higher.

### Local Storms

Local storms consist of heavy downpours of rain over relatively small areas (up to about 300 square miles) for short periods of time (up to about 7 hours). They are usually accompanied by lightning and thunder, and are often referred to as thunderstorms or cloudbursts. They can occur any time of the year, but are most prevalent and most intense during the summer months, July to September, when tropical moisture frequently invades Arizona from out of the south or southeast. During the latter part of the summer season they are often larger, of longer duration, and more apt to be associated with general summer storms. Runoff from local storms is usually of a high-peak, low-volume type, affecting mostly the smaller creeks and washes, and is characterized by a rapid rising and receding hydrograph. They can result in serious flash flood, sometimes with loss of life and serious property damage.

The following flood reports describe the historical flooding characteristics of the Arcadia area.

### Desert Flood of 1943

"In August 3, 1943 rainfall began at 3:30 am and continued until 11:00 am releasing an average precipitation of 2.12 inches for the Phoenix area. The Arcadia area at this time was primarily farmlands and there are no reports of inundation north of the Arizona Canal. There are however, reports of very heavy flow (no estimates of the flow are given) to the Arizona Canal at Camelback around 100 ft. east of 40th Street which today is occupied by the Camelback Castille Condominiums. A point of interest in this report that the author

observed impounded water on the north bank of the Arizona Canal and recommended that culverts be put in the north bank to relieve the pressure on the north bank" (Ref. No. 12, pg. 17).

#### Flood of September 4-6, 1970

"On September 4th, 1970 a storm hit the Phoenix area with the precipitation depths exceeding the 100-year 24-hour storm in Scottsdale while West Phoenix was experiencing the 5-year 24-hour recurrence interval. Flooding occurred in the Arcadia area along the north bank of the Arizona Canal between 56th and 72nd Streets. The runoff flowed westerly to the Falls Substation where part of the flow drained into the Canal with the rest crossing the Canal over the 56th Street bridge and causing damage to the south'. According to a Flood Damage Report by the City of Phoenix eyewitness accounts reported the Arizona Canal's north bank was overtopped northeast of 64th Street." (Ref. No. 2).

#### Report of Flood on June 22, 1972

"The flood that occurred on June 22, 1972 lasted 18 hours with greatest intensity recorded in a two hour span. The unofficial depth recorded at 24th Street and Camelback was 5.25 inches. From 64th Street to Cave Creek approximately 500 acres of property area, north of the Arizona Canal, was inundated costing an estimated \$608,000.00 in damages. The south bank of the Arizona Canal at 40th Street failed flooding homes south of the Arizona Canal. Together, with the break at 38th Street, an additional 2800 acres was flooded causing an estimated \$3.7 million in damages." (Ref. No. 9).

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### III. EXISTING FACILITIES

#### A. Existing Drainage Structures

Few drainage structures exist in the Arcadia area. Two drainage interceptor systems have been built along the north side of the Arizona Canal both east and west of the study area, and a third is under construction along the Old Cross Cut Canal. With the exception of a concrete lined channel along the north canal bank between 56th and 64th Streets (Arcadia Drainage Channel), the Arcadia area has been left virtually unprotected. The following paragraphs describe these existing structures.

##### *Arizona Canal Diversion Channel (ACDC).*

The westerly interceptor system is the Arizona Canal Diversion Channel (ACDC) which begins at Cudia City Wash Basin west of 40th Street and intercepts flows from the north (see Figure III-1). The ACDC was designed by the U.S. Army Corps of Engineers and is located immediately adjacent to the northerly canal bank of the Arizona Canal. A small portion (73 acres) of the Arcadia watershed was included within the ACDC watershed boundary via the Cudia City Wash (Ref. Nos. 18, 19, 20 & 21).

##### *Indian Bend Wash Side Channel System.*

The easterly interceptor system drains runoff from east of 64th Street into Indian Bend Wash. This facility also intercepts storm runoff from the north that would normally discharge into the Arizona Canal (Ref. No. 23) and does include some runoff from the Arcadia watershed.

##### *Arcadia Drainage Channel.*

The Arcadia Drainage Channel was constructed in 1975 along the north bank of the Arizona Canal from 64th Street to 56th Street (see Figure III-1). The channel begins as a 5-foot wide lined channel at 64th Street and expands into a trapezoidal channel with side slopes of 1-1/4:1 and 5-foot bottom width. The channel transitions to a 6' x 12' box culvert, back to an open channel which then outlets to

the Arizona Canal just east of 56th Street via two 48-inch diameter Concrete culverts. The design capacity for the channel is 300 cfs from 56th Street to Jokake Drive and 200 cfs from Jokake Drive to 64th Street. The gunite lined channel, particularly east of Jokake Drive, appears to have deteriorated and the actual capacity may be reduced.

*North Bank Ponding Area Drains.*

To the west of 56th Street there are numerous pipes that drain ponding areas adjacent to the north bank of the canal. These pipes range in size from 3-inches to 3-feet in diameter as shown on Figure III-1. The intent of these pipes are to use the available freeboard capacity in the Arizona Canal to carry the lesser frequency stormwater runoff. The culverts through the north bank do not adequately drain the ponding areas for the larger return year storms. This is primarily due to the canal's limited capacity to carry stormwater runoff as it was originally designed to transport irrigation waters only. In addition, runoff that does get into the canal raises the water surface and further reduces the capacities of the north bank inlets (due to backwater conditions).

*Camelback Road Storm Drain.*

Approximately 600 ft east of 44th Street along Camelback Road there is an 18-inch RCP storm drain. At 44th Street this pipe connects into a 36-inch RCP and runs along the roadway alignment until it goes under the Arizona Canal just east of 40th Street and connects to the 40th Street storm drain with a Salt River outfall (see Figure III-1). This storm drain system, constructed with Camelback Road improvements in 1986, can intercept approximately 55 cfs from the watershed (Ref. Nos. 67 & 71). A second storm drain system in Camelback Road includes a 24-inch pipe that connects to two 24-inch pipes then to a 36-inch pipe which collects flow tributary to the north side of Camelback Road and east of 44th Street. This second storm drain system was constructed by the County in the 1960's and was designed to relieve ponding in the intersection of 44th Street and Camelback Road and to operate under pressure in the low area behind the bank of the Arizona Canal.

The discharge capacity of this 36-inch line is approximately 60 cfs to the Arizona Canal. The development plans for 4255 Camelback Road East (Camelback Road East Apartments) (Ref. No. 44) and Camelback Horizon Estates located east of Camelback Castille Condominiums showed construction of catch basins in the south corner of their parcels connecting them to the 36-inch District storm drain. Water discharging out of these inlets, however, has been reported by local residents.

Pipe culverts cross Camelback Road at various locations and convey water from the north side of the road to the south side. Pipe sizes ranging from 18-inches to 36-inches are found at the following locations: Arcadia Drive, 54th Street, 56th Street, Camino Allenada, Jokake Drive and 64th Street. There are also two small culverts that act as inlets to the Arizona Canal both east and west of 44th Street and 56th Street at the Arizona Canal intersection.

Although not within the Arcadia watershed boundaries, there is an existing 42-inch pipe in Camelback Road east of 64th Street in the City of Scottsdale. Flows which are conveyed east along the north side of Camelback west of 64th Street, and cross 64th Street, would be tributary to the existing facility.

#### *Old Cross Cut Canal.*

There is a recessed channel (Old Cross Cut Canal) along 48th Street just north of Indian School Road (see Figure III-1) which Salt River Project (SRP) uses to transfer water from the Arizona Canal to the Grand Canal and to waste excess stormwater from the Arizona Canal to the Salt River. Its current carrying capacity is 1500 cfs, 1000 cfs of which is reserved for emergency discharge from the Arizona Canal by SRP. A drainage study of the channel prepared by Greiner, Inc. (Ref. No. 11) estimates that future improvements to this channel will increase its carrying capacity to 1990 cfs north of Indian School Road. However, SRP still reserves the right to spill up to 1000 cfs into the Old Cross Cut Canal under any given conditions (see Section V).

*East Lafayette Storm Drain.*

The last drainage structure of significance is the inlet to a storm drain system in 64th Street just north of Lafayette Boulevard. The inlet is a grate-type which spans the entire roadway width of 44-feet and is 3-feet wide. The catch basin is 10-feet deep at the center and tapers to 4-feet at the sides. From the inlet, a 54-inch storm drain runs east in Lafayette Boulevard and outlets into a detention pond west of 68th Street in the City of Scottsdale. From the detention pond the storm drain continues northeast along the Arizona Canal alignment to East Camelback Rd, and then east to the Indian Bend Wash Side Channel System. Although the existing grate inlet does not have the capacity to intercept it, the existing 54-inch RCP has a design capacity of 125 cfs. The tributary area contributing to the 125 cfs includes the area west of Invergordon Road within the Arcadia Area. This structure was constructed in 1986 and was designed to collect water from a 25-year storm. However, since the construction of this drainage structure, The Phoenician Resort has been constructed altering the tributary drainage area (Ref. No. 46).

There are numerous narrow drainage easements within the study area. Nearly all of them are located in the residential areas just north of the Arizona Canal. Most are paved valley gutters in easements between lots and alleys that drain the runoff from the residential streets to the inlets along the north bank.

Although not yet constructed, the City of Phoenix has proposed a number of 2-year storm drain facilities within the Arcadia Area. These facilities would be constructed along with proposed street improvements which include: 44th Street from the Arizona Canal to north of Camelback Road, 56th Street from Indian School to Camelback Road, Indian School Road from 48th Street to 56th Street and Camelback Road from 44th Street to Invergordon Road. Future design of any storm drain facilities within these streets should take these facilities into consideration. The City should also consider the recommendations of this report in the design of the 2-year facilities.

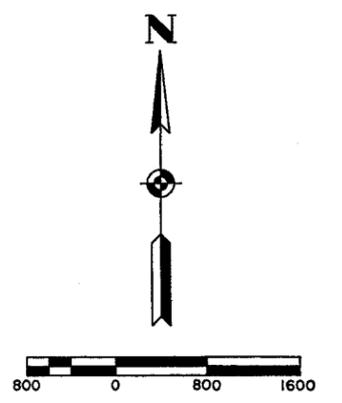
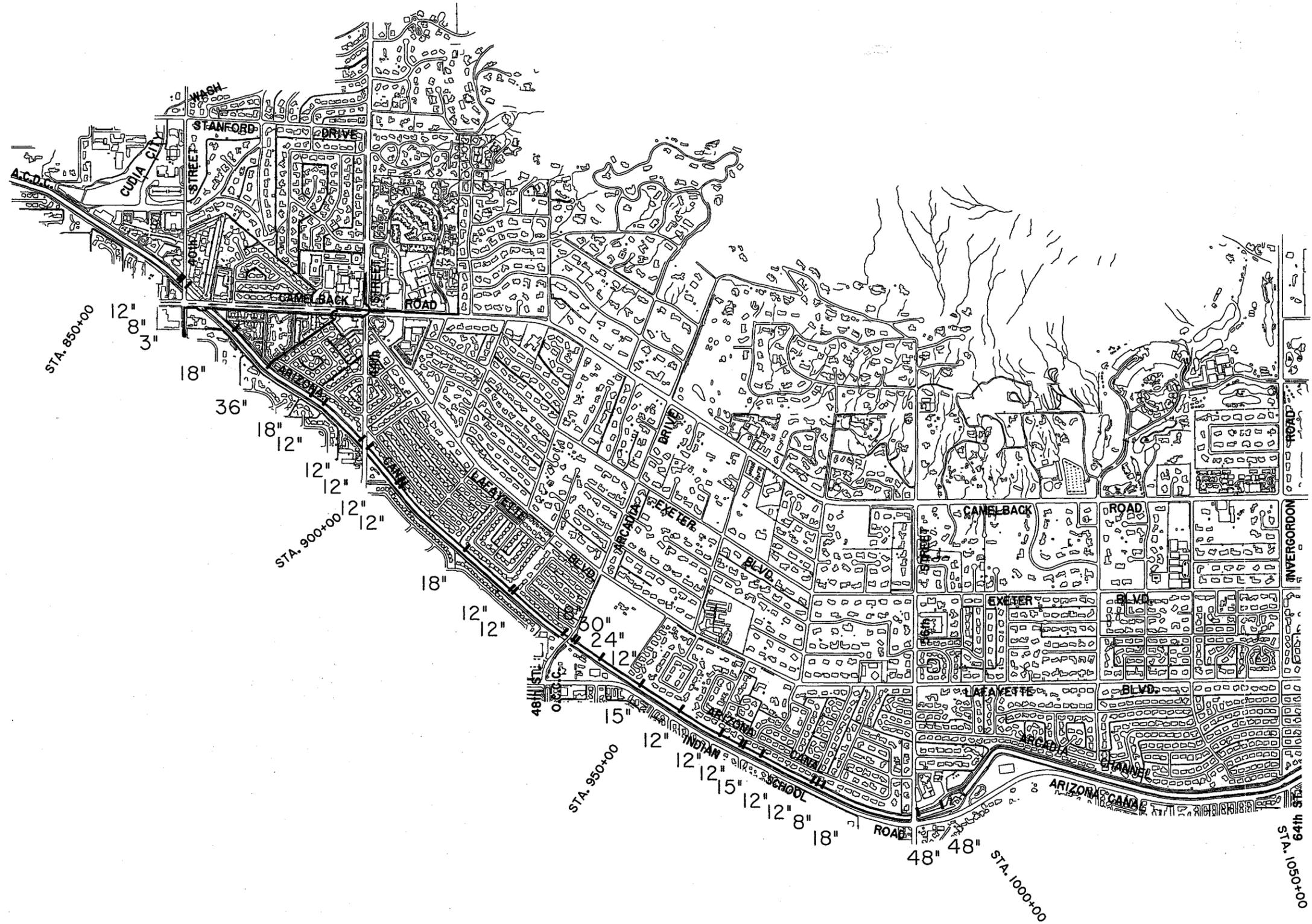
**B. Existing Utilities**

Existing utility information (i.e. approximate horizontal and vertical alignments) was provided by the City of Phoenix, City of Scottsdale, Southwest Gas, Cox Communications (formerly Dimension Cable), US West and Salt River Project via 1/4 Section Maps. An inventory of the major existing utilities is provided in Appendix A for each of the roadway alignments considered in the preliminary SYSTEMS alternates. The size and type of utility, whether the SYSTEMS alignment would parallel or cross the utility, and the general location of the utility within the street section are summarized in the appendix. The utilities are also shown on the plan and profile sheets for the alternate systems (see Appendix C).

The proposed alternate system facilities have been located within existing streets to minimize utility conflicts. Because of the potential trench depths, vertical trenching is proposed to avoid wide trench widths at the surface. Trench shoring has, therefore, been included in all cost estimates (see Section IV.F). As for utility crossings, the proposed storm drain lines will be of adequate depth to avoid relocation of utilities where possible. The existing utilities will, however, require support within the trenched sections.

In cases where only horizontal alignments were shown (i.e., no vertical alignment), potential conflicts could not be identified. These utilities have been identified by an asterisk (\*) on the SYSTEM profiles (see Appendix C). Of most significance are the existing storm drain laterals crossing Camelback Road (namely, 2-24 inch RCP at 44th Street, 30-inch RCP E/O 56th Street, and a 36-inch RCP at 64th Street). If possible, these laterals should be intercepted by the proposed SYSTEM facilities to reduce the need for additional laterals.

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**LEGEND**

- STORM DRAIN LOCATION
- 48" STORM DRAIN SIZE

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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
		BY	DATE
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	DRAWN	S. SMITH	03-97
	CHECKED	R. WISE	03-97
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<b>EXISTING DRAINAGE SYSTEMS</b>			<b>FIGURE III-1</b>

#### IV. FINAL ALTERNATE SYSTEMS DEVELOPMENT

##### A. Introduction

Twelve alternate SYSTEM alignments/approaches were studied as part of the Preliminary Recommendations Report. Only eleven alternates were included in the Draft Report; however, an additional alternate was studied during the review process. These alternates included facilities to collect and detain the storm runoff before it gets to the canal and facilities to intercept the runoff and convey it to the existing outflow facilities (i.e., OCCC and ACDC).

The Corps of Engineers has approved the concept of diverting the 10-year runoff of up to 270 cfs subject to the restriction in the following paragraph.

"The Arcadia drainage area was not included in the design of the ACDC. Any additional runoff added from the outside area must not reduce the 100-year level of protection the ACDC provides. The ACDC can accept additional runoff when capacity is available but the flow must be reduced to zero by hydraulic means when the ACDC design capacity is approached. Based on hydraulic gradients of the Arcadia drainage area, this should be possible. A mechanical gated arrangement is not acceptable."

The facilities were sized for 10-, 25- and 100-year interception providing varying degrees of protection. The benefits of each alternate were estimated in terms of reduction in flooded area; both in acres and in homes removed from the 100-year floodplain. The costs of each alternate were estimated for comparison purposes and included pipe costs, trench excavation and backfill, shoring, pavement removal and replacement and concrete lining.

Alignments were included for interceptor facilities in the east-west streets (Camelback Road, Exeter Blvd and Lafayette Blvd) as well as along the north bank of the canal. Outlet alignments were considered along north-south streets (40th Street, Arcadia Drive, 56th Street and 64th Street) to convey the intercepted flows to the existing outfalls (i.e., OCCC

and ACDC). Detention basin sites were considered within the Camelback Mountain Echo Canyon Recreation Area, along the north canal bank and within existing park areas.

The results of the Preliminary Recommendations Report were presented to the local residents in a Public Meeting held on November 9, 1995 (see Section IV.B). Input from the residents was used along with the technical input from the project team members to select the final alternates for further study. The final alternatives were then presented in another public meeting on September 12, 1996. A discussion of these meetings is provided in the following section.

Five alternates were selected for analysis in the Final Report. Although none of the final alternates match exactly with any of the twelve preliminary alternates, key components were used that best fit the needs and goals identified.

As part of proposed City of Phoenix street improvements plans for Camelback Road, a 2-year storm drain is assumed to be provided in Camelback Road from 44th Street to 64th Street for all alternates. This assumption is based on preliminary design studies done for the City of Phoenix by Huitt-Zollars, Inc. under a separate contract. Alternate alignments along Invergordon Road, 56th Street, Arcadia Drive and 44th Street were considered to outlet the 2-year flows to the OCCC and to the existing City of Scottsdale facility in Lafayette Blvd. The 2-year facility alignments were selected based on compatibility with the SYSTEM facilities to provide the most efficient combination. The assumed 2-year facilities are incorporated into the alternate analysis for modeling and facility sizing purposes only. No costs are included for the 2-year facilities as they are assumed to be constructed by the City as part of their street improvement program. Where the proposed SYSTEM improvements coincide with the City's facility, the 2-year facility will be upgraded to the proposed SYSTEM protection level (i.e., 10 or 100-year). Although there may be some cost sharing between the District and the City in these cases, the SYSTEM costs (Section F) include the total cost of the proposed facility (i.e., no "credit" for the City's 2-year facility cost).

## **B. Public Meetings**

The project was introduced to the Arcadia Area residents on April 5, 1994. On November 9, 1995, the District sponsored a second Public Meeting for the residents of the Arcadia Area. The meeting was held at Arcadia High School with approximately 45 residents attending. An informal "open house" was held during the first 20 minutes which provided the public an opportunity to view various display boards showing the proposed drainage alternates. The formal presentation lasted approximately 40 minutes with the District, City and consultant participating. The meeting concluded with approximately 50 minutes of questions and answers followed by an informal gathering around the display boards to discuss specific resident's concerns.

The residents were asked to fill out a questionnaire designed to obtain their input on issues related to the location of proposed facilities and their acceptance of temporary inconveniences associated with the construction process. The Public Meeting Agenda, Sign-in Sheet, Fact Sheet, Questionnaire and Meeting and Questionnaire Summaries are included in Appendix B.

The main conclusions drawn from the Question and Answer session, individual comments from residents, and the Questionnaire are as follows:

- Elimination of the 100-year floodplain is desirable;
- Basins/multi-use facilities are not objectionable;
- Temporary inconvenience is acceptable; and
- Additional park facilities are desirable.

These conclusions were then used to help formulate the final alternates.

A third public meeting was held on September 12, 1996 to present the final five alternatives. The format was very similar to the second meeting with approximately 30 residents attending.

The Sign-in Sheet, Fact Sheet, Questionnaire, and Meeting and Questionnaire Summaries for the second Public Meeting are also included in Appendix B.

### **C. Hydrologic and Hydraulic Models**

The hydrologic and hydraulic modeling techniques used for this study are consistent with the policies, procedures and practices outlined in the 1992 (revised 1995) version of the "Drainage Design Manual for Maricopa County, Arizona" Volumes I and II. The primary computer programs used were the U.S. Army Corps of Engineers HEC-1 and HEC-2 programs.

The existing condition hydrology was described in detail in a previous report by Huitt-Zollars, Inc. entitled "Arcadia Area Drainage Project Existing Hydrology, Volume I" dated September 8, 1995. In brief, the watershed was subdivided into 42 separate subbasins and flow paths were defined for modeling purposes (see Figure IV-1). A HEC-1 model was prepared by linking hydrographs and routing routines for each subbasin down to the canal. The "stream" flows were then routed in the canal (using modified Puls channel routing) and added together starting from 64th Street and ending west of 40th Street at the ACDC. Rating curves (i.e., discharge and storage capacities for range of elevations) were developed for the canal using HEC-2. The maximum normal operating capacity of the canal was assumed to be unavailable for storm flows (per SRP). An artificial canal bottom was, therefore, created for the HEC-2 model using maximum normal operating water surface elevations provided by SRP. In this way the storm flows could be modeled completely separate from the normal canal flows. Special procedures were also developed for modeling the effects of onsite retention of the irrigated residential lots (i.e., depressed yard areas) and existing storm drains that convey flows out of the watershed. These areas were modeled as "diversions" out of the watershed.

The existing HEC-1 models were modified to reflect the improvements proposed in each of the alternate SYSTEMS. The 2-, 10-, or 100-year flows were "diverted" and conveyed to either a detention basin or storm drain facility (depending on the alternate) and routed

to the SYSTEM outlet. The remaining flows were routed in the existing condition flow paths to the canal.

The peak flows "diverted" by the SYSTEM facilities were then used to size the facilities. Detention basin volume estimates were determined from the hydrograph volume in excess of the basin outflow. Manning's equation was used to size the SYSTEM storm drain facilities. The SYSTEM alignments, peak discharges, pipe sizes and storage volumes for each alternate are shown on Figures IV-2 through IV-6. The final alternates hydrology and hydraulic model results are contained in a separate bound report entitled "Final Alternates Hydrology & Hydraulics Report", dated March 1997.

In the Preliminary Recommendations Reports, the HEC-1 models were altered to compute flood inundation areas along the canal. Inundation areas were modeled as reservoirs where storage volumes were determined based on aerial topography and outflow volumes were based on the canal's capacity to convey flows out of the reservoir. Although the inundation models were not changed to reflect the final alternates, the results from the preliminary alternates would be very similar and are, therefore, used to identify potential benefits for the final alternates (see Section IV.D).

#### **D. Final Alternate Descriptions**

Each of the five final alternates are described below. Included in the descriptions are the Purpose, Concept, Modeling Approach, and Results and Conclusions for each alternate. An overall concept plan for each alternate is provided on Figures IV-2 through IV-6. Preliminary Plan and Profiles are provided for Alternates 1, 2 and 3 in Appendix C. A more detailed concept plan for Alternate 4 is also included in Appendix C. No additional plans were prepared for Alternate 5 which was added to the project as an initial concept level study only. Since the basic concepts of the first four alternates were described in the Preliminary Report, only a brief discussion is included in this report. Alternate 5, however, is a completely new concept and is, therefore, described in much greater detail.

### Alternate 1

*Purpose:* To provide 10-year protection for the area which has historically been flooded most frequently; namely, the Camelback Castille Condominiums (on the south side of Camelback Road, east of the canal). Storm flows from the north and east currently cross over Camelback Road into the condominium complex and back-up against the north canal bank. Most recent flooding has occurred on July 24, 1992 and October 6, 1993. These storms were estimated to be between 2-year and 5-year events.

*Concept:* A storm drain is proposed in Camelback Road from just west of 44th Street to the Arizona Canal ("West" Camelback SYSTEM) along the north side of the canal to 40th Street, north in 40th Street approximately 1000 feet, and then west to the Cudia City Wash Basin (see Figure IV-2). The proposed pipe would intercept flows within Camelback Road and 40th Street, as well as flows in the two existing 36-inch storm drains in Camelback Road west of 44th Street (see Section III.A). One of the two existing 36-inch storm drains outlets to the Salt River via the 40th Street storm drain. This facility would be used as a secondary outfall if backwater effects "shut-off" the Cudia City Wash outlet, as well as an outlet for the flows ponding against the canal bank from the area south of Camelback Road or overflow from Camelback Road (i.e., for longer storm events).

An alternate outlet for the "West" Camelback Road SYSTEM to the OCCC (in lieu of the Cudia City Wash Basin) was considered during preliminary concept development. An alignment along the north canal bank to Arcadia Drive was investigated, as well as an alignment in Lafayette Blvd. Construction of a storm drain along the North canal bank was concluded to be impractical due to the limited right-of-way and high costs associated with construction within the canal levee (i.e., utility and power pole conflicts). Although there is a positive hydraulic gradient between the low point in Camelback Road west of 44th Street and the controlling water surface in the OCCC, the Lafayette alignment would require extremely deep trenching for large storm drain facilities and would also be cost prohibitive. The alignment to the Cudia City Wash Basin was, therefore, the only alternate considered in the Final Report.

Alternate 1 incorporates the City's 2-year storm drain facility in Camelback Road west of Arcadia Drive (i.e., the area east of Arcadia Drive is not tributary to the proposed SYSTEM facilities). The 2-year facility is assumed to outlet to the OCCC via 44th Street to the Arizona Canal and then along the north canal bank to Arcadia Drive (see Figure IV-2). An alternate alignment in Lafayette Blvd. to Arcadia Drive was also considered and may be more efficient due to the conflicts with construction in the canal levee. The 2-year facility relieves a portion of the flow tributary to the SYSTEM facility in Camelback Road west of 44th Street, resulting in smaller facility sizes. The net effect, however, is not quantified in this study.

*Modeling Approach:* With the exception of the 2-year flow diversion from subbasins 37, 39, 40 and 41 (see Figure IV-1), the 10-year runoff from subbasins 37, 39, 40, 41 and 42 is intercepted by the proposed storm drain and conveyed to the Cudia City Wash. This includes flows in the existing 36-inch storm drain in Camelback Road east of the Arizona Canal. The 10-year runoff from subbasin 36 which includes Camelback Castillo Condominiums is collected and conveyed to the existing 36-inch storm drain in Camelback Road at the Arizona Canal Bridge.

*Results and Conclusions:* The 10-year peak discharge of the proposed "West" Camelback SYSTEM ranges from 160 cfs to 272 cfs. The proposed SYSTEM consists of a 60-inch storm drain in Camelback Road, 90-inch along the canal, and a 90-inch in 40th Street to the Cudia City Wash Basin outlet. A 48-inch low flow outlet discharging 122 cfs directly to the ACDC inlet spillway would be provided. Of the initial 160 cfs, 115 cfs would be intercepted within the existing storm drains. The remaining 45 cfs would be picked up via approximately 90 LF of curb-type inlets in Camelback Road. The additional runoff of 112 cfs (totaling 272 cfs) is tributary to both Camelback Road and 40th Street. Assuming the flow were to be equally divided, 56 cfs would need to be intercepted in each street. For Camelback Road, over half of this flow could be picked up in the low point just east of the canal with 30 LF of curb-type inlets; and the remainder (approximately 26 cfs) with 52 LF of inlets to the east.

For 40th Street, approximately 112 LF of curb-type inlets would be needed. As an option to the large number of inlets in Camelback Road and 40th Street, laterals could be extended in to the adjacent developments to intercept runoff before it gets to the streets. The most cost effective approach should be determined during the design phase if this alternate is chosen for final design. For the purposes of this study, however, the inlets in the streets will be used for the cost estimates (see Section IV.E).

This alternate should eliminate flooding within the Camelback Castille Condominiums resulting from runoff crossing over Camelback Road for up to a 10-year event (which includes the last two flooding events). For storm events in excess of 10-year, this alternate would significantly reduce the flooding.

The existing 36-inch storm drain in Camelback Road east of the Arizona Canal is proposed to be replaced by a 60-inch pipe ("West" Camelback SYSTEM). The existing 36-inch storm drain west of the canal, however, would be used as an additional outlet for the Camelback Castille Condominiums. A 36-inch lateral has, therefore, been proposed down the east side of the canal, into the condominium complex, and is included in the SYSTEM cost estimate.

The runoff from a 10-year storm in subbasin 36 is estimated to be 37 cfs; the capacity of the existing Camelback Road storm drain outfall is approximately 55 cfs. A portion of the tributary area is subbasins 40, 41 & 42, which was originally within the ACDC watershed, was developed in a manner diverting storm water runoff away from the ACDC watershed and it's outfall and into the present Arcadia watershed (i.e., the "West" Camelback SYSTEM). The peak discharge for a 100-year storm from the 73 acres which have been diverted would contribute an estimated 122 cfs to 155 cfs to the ACDC. A portion of the proposed discharge (122 cfs) to the sedimentation basin is, therefore, designed to bypass the sedimentation basin and discharge directly to the ACDC. This bypass will offset and facilitate the draining of an area which was originally tributary to the ACDC watershed and provide a system to reduce maintenance operations caused by nuisance drainage water and resulting vegetation in the sedimentation basin. Flows in excess of the 122 cfs will

discharge into the basin via a proposed bubble-out structure. The "West" Camelback facility is reduced from a 90-inch to a 48-inch RCP to force the excess flows out of the SYSTEM and into the basin. It can be anticipated that there will be wet ground areas near the outlet of the pipe until the runoff infiltrates into the ground, is discharged to the ACDC channel, or evaporates. Extension of the outfall line into the apron entrance of the ACDC culvert (i.e., basin, spillway) will eliminate any accumulation of surface water within the sedimentation basin.

The "West" Camelback SYSTEM is proposed to outlet primarily into the Cudia City Wash Basin. The proposed 48-inch RCP outlets into the downstream face of the concrete spillway to the ACDC. The Cudia City Wash Basin (and the ACDC) was designed by the Corps of Engineers and is maintained by the District. Portions of the flow tributary to the "West" Camelback SYSTEM does not currently drain to the basin. Preliminary conversations with the Corps have indicated that the additional runoff might be acceptable if it can be shown that there would be no increase in peak flow to the basin in the 100-year event. Outlet control would be accomplished if the SYSTEM could be shown to hydraulically "shut-off" when the basin reached the 100-year water surface elevation of 1248.2. Since the low point elevations in both Camelback Road and 40th Streets are approximately 1249± feet, there would be minimal available hydraulic head to push water into the basin.

The capacity of the proposed 90-inch RCP from the low point in Camelback Road east of 40th Street to the Cudia City Wash Basin was estimated based on the 100-year flood conditions in the basin (1248.2 water surface). The capacity was estimated based on an estimate of the average available friction slope (i.e., hydraulic gradient) between the low point in Camelback Road and the basin. Flows in excess of the estimated capacity, that are already in the upstream facility, would have to bubble out of the SYSTEM at the low point in Camelback. The head required to "push-out" the excess flows is added to the low point elevation which, in turn, increases the friction slope. An iterative process was used to determine the balance between the flow that remains in the pipe (controlled by the friction slope) and the flow that bubbles out (controlled by the head required for orifice flow).

Based on the results of the hydrologic model, there is 190 cfs conveyed to the low point in Camelback by the proposed 60-inch RCP. Of the 190 cfs, the iterative process concluded that 55 cfs will bubble out of the SYSTEM at the low point and 135 cfs will continue in the 90-inch RCP. Adding the additional 22 cfs at Colter Street would bring the total discharge to the basin in a 100-year storm to 157 cfs. In order to achieve the required 'hydraulic shut-off' of the SYSTEM during the 100-year discharge, the hydraulic grade in the 90-inch RCP must be controlled by the basin water surface elevation. The 10-year bubble-out structure in the basin provides this condition.

### Alternate 2

*Purpose:* To intercept the 10-year runoff in Camelback Road and Lafayette Blvd. before it gets to the Arizona Canal. This would benefit the entire Arcadia Area between Camelback Road and the canal by intercepting and conveying runoff to the OCCC that currently flows on the surface. Protection for the Camelback Castille Condominiums is also provided similar to Alternate 1.

*Concept:* Two storm drains are proposed in Camelback Road: One from west of Jokake Drive to west of Arcadia Drive ("Central" Camelback); and one from Jokake Drive east to Invergordon Road ("East" Camelback) (see Figure IV-3). An additional storm drain is proposed in 44th Street north of Camelback Road to Lafayette Blvd., then southeast in Lafayette Blvd ("West" Lafayette SYSTEM) to Arcadia Drive. The "West" Lafayette storm drain joins the "Central" Camelback storm drain in Arcadia Drive and outlets under the Arizona Canal to the OCCC.

The "East" Camelback storm drain intercepts and conveys a maximum of 125 cfs south in Invergordon Road to Lafayette Blvd. and outlets in the existing City of Scottsdale storm drain (see Section III.A). An intergovernmental agreement with the City of Scottsdale is required to construct this system. This system will intercept flows in Camelback Road that currently flow east to the Indian Bend Wash side channel system.

The proposed SYSTEM in 44th street north of Camelback Road intercepts a significant portion of the flow tributary to the Camelback Castille Condominiums ("West" Camelback). This reduces the required pipe size to 36-inch (60-inch in Alternate 1) in Camelback Road, which will enable the existing storm drain to be used. The City's 2-year facilities in Camelback Road are proposed to be upgraded to a 10-year design with the exception of the facility in Camelback Road west of Arcadia Drive to 44th Street. The 2-year facility only serves to reduce nuisance flooding in Camelback Road and does not significantly benefit the proposed SYSTEM facilities.

*Modeling Approach:* The "East" Camelback SYSTEM intercepts runoff from subbasins 1, 2, 6 and 7 (see Figure IV-1). At Invergordon Road, a maximum of 125 cfs is conveyed in the SYSTEM to the existing storm drain in Lafayette Blvd (see Section III.A). The remainder of the flow, plus runoff from subbasins 3, 4, 5, 8, 9 and 10 are routed to the Arcadia Drainage Channel outletting into the Arizona Canal at 56th Street.

The "Central" Camelback SYSTEM intercepts the 10-year runoff from subbasins 11, 12, 16, 17, 21, 22 and 26 east of Arcadia Drive, and subbasins 30 and 38 west of Arcadia Drive. Subbasins 27, 28 and 29 are intercepted in the Arcadia Drive SYSTEM south of Camelback Road continuing to the OCCC outfall. The remainder of the subbasins east of Arcadia Drive and south of Camelback Road (subbasins 13, 14, 15, 18, 19, 20, 23, 24 and 25) continue to flow to the canal.

The tributary area to the "West" Camelback SYSTEM has been significantly reduced by the 44th Street/Lafayette Blvd SYSTEM. Only the 10-year runoff from subbasin 42 would be intercepted by the proposed "West" Camelback SYSTEM. The 10-year runoff from subbasin 36 would be collected and conveyed in a 36-inch lateral to the existing 36-inch storm drain in Camelback Road, outletting to the existing 40th Street storm drain, as outlined for Alternate No. 1.

*Results and Conclusions:* 110 of the 125 cfs intercepted by the "East" Camelback SYSTEM originates from the Phoenician Golf Club. A storm drain inlet would have to be

constructed at the Phoenician Resort property line to pick up the 110 cfs. The majority of the runoff from the site is conveyed through a series of lakes within the golf course. Interception of the outflow from the most southerly lake would be the most efficient approach to collecting the 110 cfs. Although this would not require modification to the existing lakes, it would require the extension of a storm drain facility into the Phoenician Resort property. This should be evaluated further during the design phase of the project. The remaining 15 cfs would be intercepted along Camelback Road near at Invergordon Road via 30 LF of curb-type inlets. A 48-inch storm drain is proposed to convey the design discharge from Jokake to Lafayette Blvd where it will connect to the existing 54-inch storm drain in Lafayette Blvd east of Invergordon Road. Coordination with the City of Scottsdale would be required to insure consistency in the design assumptions for the existing storm drain. Construction of this system would reduce flooding problems at Kaibab School on 62nd Street south of Camelback Road.

The 10-year peak discharge in the "Central" Camelback SYSTEM ranges from 130 cfs at 56th Street to 485 cfs at Arcadia Drive. The corresponding pipe sizes range from 36-inch to 78-inch. Laterals would most likely be needed in most, if not all, of the north-south streets intersecting Camelback Road in order to intercept the tributary runoff. In addition, curb-type inlets are assumed at every intersection and at 200 ft intervals between intersections. A total of 500 LF of inlets would be needed. The SYSTEM continues south in Arcadia Drive in a 78-inch pipe to Lafayette Blvd. Additional inflow at Exeter Blvd and Lafayette Blvd increase the 10-year discharge to 498 cfs. Approximately 26 LF of curb-type inlets at the intersections would be adequate to pick up the additional 13 cfs.

The 44th Street/"West" Lafayette Blvd SYSTEM begins as a 48-inch pipe carrying 91 cfs from Colter Street to Camelback Road. Approximately 180 LF of inlets would be needed to intercept the flow in the street. Inlets and laterals within the existing developments to the east, however, could reduce the requirement. The 2-year City facility adds 69 cfs at Camelback Road bringing the total discharge to 160 cfs. An 84-inch pipe is proposed to convey this flow to Arcadia Drive intercepting an additional 28 cfs along the way (requiring 56 LF of inlets). The combined flow in Arcadia Drive is 676 cfs which is

conveyed in a proposed 96-inch pipe under the canal to the OCCC. With an additional 5 cfs adding in at the canal (5 LF of inlets), the total discharge to the OCCC is 681 cfs.

This alternate provides the same level of protection for the Camelback Castille Condominiums as did Alternate 1, with the additional 10-year protection for the area south of Camelback Road, east of Arcadia Drive and south of Lafayette Blvd, west of Arcadia Drive. There would also be a significant reduction in the flooding within the streets as the addition of inlets removes surface flow which can cause flooding.

Raising the crown elevation of Camelback Road will aid in increasing the efficiency of the inlets and provide additional protection to properties to the south. The existing 36-inch pipe west of the canal, however, would be used as an additional outlet for the Camelback Castille Condominiums. A 36-inch lateral is shown extending down the east side of the canal.

As was discussed for Alternate 1, the Alternate 2 proposed facility outletting to the Cudia City Wash Basin (i.e., "West" Camelback SYSTEM) will discharge additional flow to the basin. The 10-year design discharge upstream of the low point in Camelback Road is 30 cfs. Assuming once again that additional flow cannot get into the SYSTEM due to the 100-year water surface elevation, the 66-inch RCP could only convey a maximum of 30 cfs. The minimum friction slope available for the 66-inch RCP would be based on the difference between the finish grade elevation at the low point (1249 ±) and the 100-year water surface in the basin (1248.2). The resulting friction slope is 0.00031 which produces a capacity of 59 cfs in the 66-inch RCP. Since this capacity is greater than the 30 cfs in the pipe, there would be no bubble out. The maximum capacity of the 66-inch RCP would be based on the maximum friction slope. This would be equal to the gradient based on the maximum upstream water surface at the low point (1250.0±) or 0.00071. The corresponding discharge in the 66-inch RCP is 90 cfs. Adding the 25 cfs tributary at Colter Street, the range in capacities would be 55 to 115 cfs. Since the total discharge in the SYSTEM is less than the 122 cfs allowed to discharge directly to the ACDC (see Alternate 1), a bubble-out structure is not required for the 10-year discharge. However, to achieve

the required 'hydraulic shut-off' of the SYSTEM during the 100-year discharge, the hydraulic grade in the 66-inch RCP must be controlled by the basin water surface elevation. This condition is provided by the proposed inlet in the basin.

### Alternate 3

*Purpose:* The purpose of Alternate 3 is very similar to Alternate 2 in that the intent is to intercept the 10-year runoff before it gets to the canal. Instead of primarily intercepting the flows at Camelback Road, however, Alternate 3 proposes to intercept flows in Lafayette Blvd and along the north canal bank. This alternate also incorporates the use of the Camelback Road 2-year storm drain system as considered by the City of Phoenix (see Figure IV-4).

*Concept:* The concept for the area west of Arcadia Drive is the same as for Alternate 2; namely, 10-year storm drains in 44th Street and Lafayette Blvd to Arcadia Drive (outletting to the OCCC); and 10-year intercept at Camelback Road east of the canal, north in 40th Street to Cudia City Wash. For the area east of Arcadia Drive, however, the City's 2-year facility in Camelback Road is not upgraded. Instead, a 10-year SYSTEM is proposed in Lafayette Blvd from 54th Street to 56th Street ("East" Lafayette), south in 56th Street to Osborn Road, and then west to the OCCC (see Figure IV-4). The 10-year discharge from the Arcadia Drainage Channel is intercepted at 56th Street and conveyed to the OCCC via the Osborn Road SYSTEM. The area between Arcadia Drive and 54th Street is proposed to be intercepted with three lateral facilities crossing under the canal to Indian School Road. The City's 2-year facilities in Camelback Road are incorporated into the model as shown in Figure IV-4. The Invergordon Road, Arcadia Drive and Lafayette Blvd alignments are assumed for the outlets. The Lafayette facility is upgraded to the 10-year SYSTEM facility. There is also a City 2-year facility proposed for Indian School Road east of 48th Street. This facility is also proposed to be upgraded to a 10-year facility and incorporated into the Alternate 3 SYSTEM. There would be a redistribution of the 2-year peak flows within the SYSTEM facilities if the City facilities are not constructed. The overall concept of the Alternate 3 SYSTEM, however, would not be significantly affected.

*Modeling Approach:* The 2-year discharge from subbasins 1, 2, 3, 4, 6 and 7 is diverted to the City of Scottsdale Lafayette storm drain (see Figure IV-1). The 10-year excess flows, plus the full 10-year flow from subbasins 8, 9 and 10 are routed to the Arcadia Drainage Channel.

The 2-year flows from subbasins 11, 12, 16, 17, 21, 22, 26, 30 and 38 are intercepted and conveyed south in Arcadia Drive to Lafayette Blvd. The 10-year excess flows from subbasins 11 and 12 plus one-half of the 10-year flows from subbasins 13 and 14 are routed down 56th Street to Lafayette Blvd. The other half of the 10-year flows from subbasins 13 and 14 are added to the Arcadia Drainage Channel flows east of 56th Street. The 10-year excess flows from subbasins 16 and 17, plus the full 10-year flows from subbasins 18 and 19 are intercepted at Lafayette Blvd and routed to 56th Street. The combined flows at 56th Street are then routed to the Arizona Canal where the 10-year Arcadia Drainage Channel flows are added. The total combined flows are then routed to the OCCC via 56th Street and Osborn Road.

The 10-year excess flows from subbasins 21 and 22, plus the full 10-year flows from subbasins 23, 24 and 25 are routed to the canal. The total discharge is split between the three laterals under the canal and then routed to the OCCC via the Indian School Road storm drain SYSTEM.

The 44th Street SYSTEM intercepts the 10-year runoff from subbasins 40 and 41 and the 2-year Camelback Road runoff from subbasins 37 and 39 just as in Alternate 2. Continuing in Lafayette Blvd, the proposed SYSTEM intercepts the 10-year excess flow from subbasins 37 and 39 and the full 10-year runoff from subbasins 31, 32 and 34, again, just as in Alternate 2. Different from Alternate 2, however, Alternate 3 also intercepts the 10-year excess flow from subbasins 30 and 38. The total flow in the Lafayette Blvd SYSTEM is combined with the 2-year flow from subbasins 11, 12, 16, 17, 21, 22, 26, 27, 38, 30 and 38 at Arcadia Drive. The SYSTEM is then routed to the Arizona Canal, picking up the 10-year runoff from subbasin 29, routed under the canal and combined with the

Indian School Road and Osborn Road SYSTEMS in the OCCC. Subbasins 33 and 35 continue to drain to the canal.

The "West" Camelback Road SYSTEM is identical to Alternate 2. The 10-year runoff from subbasin 42 is intercepted and conveyed to the Cudia City Wash Basin via the proposed storm drains in Camelback Road and 40th Street. Subbasin 36 is proposed to be collected and conveyed to the existing 36-inch storm drain in Camelback Road (via a 36-inch lateral), outletting to the existing 40th Street storm drain.

*Results and Conclusions:* The 10-year peak discharge of 109 cfs in Lafayette Blvd at 54th Street would require over 200 LF of curb-type inlets. It would, therefore, be necessary to extend a lateral facility north in 54th Street to spread out the inlet spacing. Assuming inlets on both sides of the street, and a minimum inlet spacing of 100 feet, over 1200 LF of lateral would be needed (not included in SYSTEM analysis). The 109 cfs would be conveyed to 56th Street in a 54-inch pipe. The additional 141 cfs tributary at 56th Street would, again, require a lateral facility to intercept. Laterals in 56th Street, east in Lafayette Blvd, and possibly in Exeter Blvd would be needed along with over 280 LF of inlets. The 56th Street SYSTEM is proposed as a 78-inch pipe to the Arizona Canal where 150 cfs from the two existing 48-inch pipes outletting the Arcadia Drainage Channel would be intercepted. The interception of a portion of the Arcadia Drainage Channel flow would provide flooding relief to residents south of the canal from runoff similar to the storm of September 1970. The existing two 48-inch pipes discharging into the Arizona Canal east of 56th Street do not have the capacity to discharge the tributary runoff for the 10-year storm. The 78-inch pipe would continue in 56th Street to Osborn Road and then west to the OCCC with a total discharge of 352 cfs. The Osborn Road SYSTEM would be of additional benefit if upsized to include the tributary area from the north. It is assumed that the cost of upsizing the facility would be the responsibility of the City of Phoenix and is, therefore, not included in this analysis.

The three laterals crossing under the canal between Arcadia Drive and 54th Street are proposed to be extended into the existing residential areas to the north. Approximately 110

LF of curb-type inlets in Calle Redonda would intercept discharges of 20 cfs, 45 cfs and 45 cfs for the three laterals. Lateral facilities of 24-inch (2 each) and 30-inch would cross under the canal to Indian School Road. The Indian School Road SYSTEM ranges in size from 30-inch to 54-inch and conveys a total of 110 cfs to the OCCC. Upsizing of this facility may be required to intercept street drainage in Indian School Road (per City of Phoenix Project P-845842). Coordination with City of Phoenix would be required prior to final design.

The 44th Street/"West" Lafayette Blvd SYSTEM begins as a 48-inch pipe carrying 91 cfs from Colter Street to Camelback Road. Approximately 180 LF of curb-type inlets would be needed to intercept the flow in the street. As an option, inlets and laterals within the existing developments to the east could be used to reduce the inlet facilities in 44th Street. The 2-year City facility adds 69 cfs at Camelback Road bringing the total discharge to 160 cfs. A 78-inch pipe is proposed in Lafayette Blvd from 44th Street to approximately 1000 feet west of Arcadia Blvd. An additional 22 cfs is intercepted along the way via 44 LF of inlets in Lafayette Blvd. The total flow in the "West" Lafayette SYSTEM is increased to 287 cfs at Launfal Avenue. The additional 105 cfs would require over 200 LF of inlets and would most likely need to include a lateral facility in Launfal Avenue. The 287 cfs is conveyed in an 84-inch pipe to Arcadia Drive where it combines with the 2-year facility from Camelback Road. The combined discharge of 459 cfs is conveyed to and under the Arizona Canal via an 84-inch pipe to the OCCC. The total discharge to the OCCC is 907 cfs (including the Indian School Road and Osborn Road SYSTEMS) which is below the maximum allowable discharge of 990 cfs.

The "West" Camelback SYSTEM for Alternate 3 would intercept the 10-year discharge of 60 cfs in Camelback Road east of the canal (via 90 LF of inlets), continue along the canal in a 66-inch pipe to 40th Street. An additional 110 LF of inlets along 40th Street would intercept the necessary 55 cfs to bring the 10-year capacity to 115 cfs. A 66-inch pipe is proposed in 40th Street to the Cudia City Wash Basin outfall with a 48-inch outlet carrying the 115 cfs to the ACDC channel. The existing 36-inch pipe west of the proposed intercept point in Camelback Road would be used to provide an additional outfall for the Camelback

Castille Condominium drainage. It could also be used as a secondary outfall for the proposed "West" Camelback SYSTEM if the Cudia City Wash Basin water surface reduces or eliminates the available outfall capacity.

Alternate 3 provides the same 10-year level of protection as Alternate 2 for the area west of Arcadia Drive. For the area between Arcadia Drive and 56th Street, however, the protection has been increased by moving the intercept facility closer to the canal (i.e., intercepts a greater drainage area). Although the only protection proposed for the area east of 56th Street is the City's 2-year Camelback Road facility, the Arcadia Drainage Channel 10-year flow is intercepted at 56th Street. This is an indirect benefit to the Arcadia Area as this flow is no longer in the canal and, therefore, cannot spill out if canal capacities are exceeded in a severe storm event.

As was discussed for Alternate 1, the Alternate 3 proposed facility outletting to the Cudia City Wash Basin (i.e., "West" Camelback SYSTEM) will discharge additional flow to the basin. The 10-year design discharge upstream of the low point in Camelback Road is 30 cfs. Assuming once again that additional flow cannot get into the SYSTEM due to the 100-year water surface elevation, the 66-inch RCP could only convey a maximum of 30 cfs. The minimum friction slope available for the 66-inch RCP would be based on the difference between the finish grade elevation at the low point (1249 ±) and the 100 year water surface in the basin (1248.2). The resulting friction slope is 0.00031 which produces a capacity of 59 cfs in the 66-inch RCP. Since this capacity is greater than the 30 cfs in the pipe, there would be no bubble out. The maximum capacity of the 66-inch RCP would be based on the maximum friction slope. This would be equal to the gradient based on the maximum upstream water surface at the low point (1250.0 ±) or 0.00071. The corresponding discharge in the 66-inch RCP is 90 cfs. Adding the 25 cfs tributary at Colter Street, the range in capacities would be 55 to 115 cfs. Since the total discharge in the SYSTEM is less than the 122 cfs allowed to discharge directly to the ACDC (see Alternate 1), a bubble-out structure in the basin is not necessary for the 10-year discharge. However, to achieve the required 'hydraulic shut-off' of the SYSTEM during the 100-year discharge,

the hydraulic grade in the 66-inch RCP must be controlled by the basin water surface elevation. This condition is provided by the proposed inlet in the basin.

#### Alternate 4

*Purpose:* To provide 100-year flood protection for the Arcadia Area by collecting and storing the 100-year runoff in regional detention facilities located within the existing 100-year floodplain along the north canal bank (see Figure IV-5). The detention facilities (or basins) would be designed to reduce the 100-year discharge to a 10-year discharge. The OCCC and ACDC would again be used as the outfall facilities.

*Concept:* Detention basins are proposed along the north canal bank between the canal bank and the adjacent residential street from east of 56th Street to Camelback Road. A total of seven basin sites have been identified based on the major concentration points for the existing flow paths. Of the seven sites, one is located east of 56th Street, three are between 56th Street and Arcadia Drive, two between Arcadia Drive and 44th Street and one between 44th Street and Camelback Road. The outflow from each basin will be conveyed in a pipe either along the canal bank or in the adjacent street to the appropriate outfall (i.e., ACDC or OCCC).

Since the proposed basin sites extend along almost the entire length of the north canal bank, major collection facilities would not be needed to get the runoff into the basins. It would be beneficial to the local residents, however, if the lower frequency storm runoff (i.e., 2-to 10-year events) was intercepted and conveyed to the basins via an underground storm drain network (e.g. City's 2-year facilities). This would eliminate the nuisance flooding that is currently being experienced, as well as reduce the local flooding during more significant storm events (i.e., 25 to 100-year). For the purposes of this study, no collection facilities were included in the analysis, design or cost estimates, as the currently mapped 100-year floodplain would not be further benefited (i.e., benefits outside of the mapped floodplain). (Note: a 100-year collection facility alternate was studied in the

Preliminary Recommendations Report (Alternate 9). The cost for this alternate was estimated to be \$10,600,000).

*Modeling Approach:* Both 10-year and 100-year inflow hydrographs were computed for each basin. Subbasins 1 through 10 would continue to be intercepted and conveyed by the Arcadia Drainage Channel to the Arizona Canal (without detention). Subbasins 11 through 15 were routed to the most easterly basin. Subbasins 16 through 20, 21 through 25 and 26 through 29 were routed to the three basins between 56th Street and Arcadia Drive. Subbasins 30 through 33 plus 38 and 34 and 35 are routed to two basins west of Arcadia Drive. The most westerly basin intercepts the 100-year runoff from subbasins 36 and 39 through 42. The 100-year inflow hydrographs from the HEC-1 model were input into a separate storage routing model (Pond 2). The maximum storage volumes necessary to reduce the basin outflow to the 10-year inflow values were then determined.

*Results and Conclusions:* A concept plan was prepared showing the approximate limits of the seven proposed basin sites (see Appendix C). The basins were designed at a maximum depth of six feet with 4:1 side slopes on three sides and a vertical wall along the canal bank. The location and size of the basins would necessitate the taking of existing private property adjacent to the canal. Table IV-1 summarizes the basin requirements.

The outlet pipes for each basin will allow the basins to drain within a 36-hour period. Four pipe systems are proposed to outlet to the OCCC; one from the west (subbasins 33 and 35 at Arcadia Drive) and three from the east (subbasin 29 at Arcadia Drive, subbasins 20 and 25 at Indian School Road and subbasin 15 at Osborn Road). The westerly pipe would be constructed between the north canal bank and the proposed basins from the outlet for the basin at subbasin 35 to Arcadia Drive (see Alternate 4 Concept Plan in Appendix C). The outlet from the basin at subbasin 29 (Arcadia Estates) would then join the westerly system and cross under the canal to the OCCC. Two of the remaining three basin sites tributary to the OCCC would outfall under the canal to a storm drain in Indian School Road. The outlet for the basin site east of 56th Street (subbasin 15) is proposed to cross under the canal at 56th Street to Osborn Road, then continue west in Osborn Road to the OCCC.

Table IV-1  
 Alternate 4 - Detention Basin Requirements  
 Existing Structures Affected

Subbasin	100-Year Inflow (cfs)	10-Year Outflow (cfs)	Required Storage (Ac-Ft)	No. of Existing Structures <sup>1</sup>
15	696	224	24	3 <sup>2</sup>
20	538	151	19	12
25	494	137	18	6
29	241	29	10	0 <sup>3</sup>
33	519	150	21	17
35	316	80	11	9
36	814	247	33	26 <sup>4</sup>
<b>TOTAL</b>	<b>3618</b>	<b>1018</b>	<b>136</b>	<b>73</b>

<sup>1</sup> Single family dwelling units (unless otherwise noted).

<sup>2</sup> Church and 2 single family dwelling units.

<sup>3</sup> The existing onsite basin in the Arcadia Estates would be expanded (i.e., deepened) to provide the additional storage volume needed

<sup>4</sup> 7 of the structures contain a total of 39 condominium units.

The ACDC outfall is proposed to be used for the basin outflow from subbasin 36. The "West" Camelback SYSTEM alignment proposed in Alternates 1, 2 and 3 would be used (i.e., 40th Street north to Cudia City Wash Basin) as well as the existing 36-inch pipe to 40th Street (south to Salt River). An alternative outlet alignment to the OCCC along the north canal bank could also be considered. This would require the construction of a storm drain in the north canal levee, which may be impractical (see Alternate 1 concept), but would eliminate the need for the outfall structure to the Cudia City Wash Basin. There is an additional advantage to the Cudia City Wash Basin Outlet: namely, the ability to pick up the storm runoff in Camelback Road before it gets to the canal (i.e., reduces local flooding problems). For this reason, the Cudia City Wash Basin outlet alignment was chosen for this alternate.

With the exception of the basin within subbasin 15, all of the proposed basin sites are contained entirely within the existing 100-year floodplain (see Figure I-1). The basin within subbasin 15 (east of 56th Street) requires approximately 5.5 acres of surface area, which would necessitate the taking of both the existing church and power station just north of the Arizona Canal. In order to relocate the power station, land would have to be found near the existing site. This would most likely mean the taking of existing homes. An option would be to flood-proof the existing station facilities (i.e., raise above the 100-year water-surface in the proposed basin; however, this would be cost prohibitive. In lieu of using the power station area, the proposed storage area adjacent to 56th Street could be extended to the north. Although this would require the taking of two existing homes outside of the 100-year floodplain, it would be less expensive than relocating the power station (which would also require taking of homes outside of the floodplain). This latter option was, therefore, used for cost estimating purposes.

As an option to the basin site north of the canal and east of 56th Street (subbasin 15), the existing Arcadia Park could be used. The park is located south of subbasin 15, at the northwest corner of 56th Street and Osborn Road, and contains approximately 5 acres of grass play field. Berms and/or walls could be constructed around the field to a depth of 5 feet to provide the 24 ac-ft storage capacity. Although there would be some impact to the

existing park use, flooding within the park would be infrequent and for very short durations. This, as well as other options, should be investigated further if this alternate is recommended for design.

The proposed detention basin within subbasin 29 could be constructed without the taking of any existing structures (i.e., within the Arcadia Estates). There is an existing detention basin which has been provided to mitigate the increase in runoff from the site due to the development. This basin could be expanded to provide the additional storage volume required per this alternate. The basin right-of-way (i.e., easement) would still need to be purchased for use as a regional basin.

The combined outflow from the six basins discharging to the OCCC is 771 cfs. An additional 219 cfs could, therefore, be discharged and not exceed the 990 cfs maximum, which could reduce one or more of the basin storage requirements. It might also be possible to redirect the outfall from the basin west of 44th Street to the OCCC in lieu of the ACDC. This would be needed if the Corps ultimately does not allow additional discharge to the Cudia City Wash Basin, or the outfall availability is contingent upon water surface elevations in the Cudia City Wash Basin (see Section IV-D, Alternate 1 Results and Conclusions). These options should be considered further if this alternate is recommended for design.

Additional uses for the proposed basin sites could include small parks or play areas for the local residents. Access to the basins could be restricted if fenced.

#### Alternate 5

(Note: The Alternate 5 concept was added after the Preliminary Report and is presented here to determine if further investigation and preliminary design is warranted).

*Purpose:* To provide 100-year flood protection for the Arcadia Area by converting the Arizona Canal to a linear detention basin between 40th Street and the Arizona Falls east

of 56th Street (see Figure IV-6). The existing north canal bank would be lowered to allow the 100-year runoff to freely flow into the canal/basin (i.e. without ponding).

*Concept:* Approximately 3 miles of the Arizona Canal would be converted to a detention basin by bypassing the required canal delivery flows in pipe from the Arizona Falls to west of 40th Street. Key elements proposed to be included for the development and evaluation of this alternate include:

1. Removal of 100-year floodplain.
2. Construction of an alternate piped irrigation delivery system from Arizona Falls to west of 40th Street for primary normal operating conditions. The current delivery requirements are for 1125 cfs from the Arizona Falls to the OCCC (including up to 1000 cfs "emergency" discharge or up to 300 cfs "normal" delivery to the OCCC) and 700 cfs west of the OCCC. Future improvements to the canal, however, could increase the canal capacity to 1850 cfs down to the OCCC and 1150 cfs thereafter. The higher discharges are to be used for design of the alternate bypass. The bypass facilities (i.e. pipes and/or box culverts) would be constructed in either the north or south canal banks, under the canal bottom, or a combination of any or all three.
3. The Arizona Canal/Basin would be utilized as a redundant system (i.e., available for emergency operation) assuming that underground facility maintenance could not be performed during a winter shut-down or when required demands could not be met from ground water supplies. Three redundant system alternatives to be evaluated:
  - Single bypass system with design capacity of existing canal (700 to 1125 cfs) and with operational redundancy in the utilization of the canal/basin.
  - Minimal dual bypass system, each pipe having the minimum required capacity based on anticipated operational requirements (700 cfs) and with operational redundancy in the utilization of the canal/basin.

- Maximum dual bypass system, each pipe having the design capacity of the existing canal (700 to 1125 cfs) with no redundancy in the canal/basin.

The redundant capacity of the canal/basin could be affected if maintenance access to the bypass facility is needed from within the canal/basin. This would become more of an issue the closer the bypass facility is to the canal/basin and if "maintenance" includes repair of the pipe wall.

4. The Arizona Canal is designated as waters of the United States by EPA. The Arizona Canal/Basin as a redundant canal system would probably require some protection from degradation. Therefore it is proposed to limit any degradation of canal/basin water quality from the present conditions by interception of the "first flush" runoff in a 2-year drainage system in alleys or streets adjacent to the north bank and bypass these "first flush" flows to the OCCC and/or ACDC. The assumed alignments for the City's 2-year facilities in Camelback Road, Invergordon Road, 56th Street, Arcadia Drive and 44th Street are included, along with an extension of the 56th Street drain to the OCCC in Osborn Road and the upsizing of the Indian School Road 2-year facility to include runoff from Calle Redondo on the north side of the canal. This is included here to be identified as an item for further study. No costs have been included for this study.
5. Lower the north bank to approximately 14 inches below the finish floor elevations of the adjacent residential properties where feasible from 56th Street to 40th Street to permit acceptance of runoff from storms greater than that accepted by first flush drain system into the canal/basin.
6. Installation of low water control structures (weirs) to maintain an aesthetic (wet) channel with assurances from SRP for sufficient deliveries through the canal/basin to maintain the wet channel aesthetics and minimize weed growth and algae growth (minimum depth of 2 feet in basin). The low water volume would not be available for storm water detention and would, therefore, need to be adjusted for final design.

7. Installation of canal/basin storage control structures (weirs) to permit temporary storage of stormwater runoff prior to discharge to the OCCC.
8. Installation of new or modification of existing canal/basin discharge weirs and/or gates to permit draining the canal basin to the OCCC during storm events. Peak outflows from the canal basin would be limited to 1000 cfs for SRP releases and 990 cfs for storm drainage less the calculated discharge from the "first flush" drainage system. During SRP normal piped delivery operations, no special operations procedures would be required to permit the free discharge of storm waters from the canal/basin. During periods when SRP is discharging to the OCCC from the piped system or from the existing OCCC gates, special procedures may be required to assure SRP and the District that the capacity of the OCCC is not exceeded.
9. Grading of existing canal/basin bottom from 40th Street to 48th Street and OCCC to permit dry-up of entire canal/basin system (if desired for maintenance).

The "West" Camelback SYSTEM proposed in Alternate 1 would still be beneficial to the Camelback Castille Condominiums, even with the north canal levee lowered. Flooding within the complex is not only due to the blockage of flows from the canal bank, but is also due to the flow crossing Camelback Road from the north getting to the canal. Interception of the 10-year runoff would eliminate nuisance flooding and significantly reduce local flooding for the 25- to 100-year events. The "West" Camelback SYSTEM could outfall to the canal/basin at Camelback Road which would eliminate the potential Corps concern with the Alternate 1 outfall to Cudia City Wash (see Section IV-D).

The proposed City of Phoenix 2-year storm drain facilities in Camelback Road, Arcadia Drive, 44th and 56th Street, along with an additional 2-year SYSTEM facility proposed in Indian School Road (see Figure IV-6) would be used to collect and bypass the "first flush" storm runoff (discharging directly to the OCCC) for water quality benefits. The need for

these facilities (from a water quality standpoint) should be investigated further if this alternate is considered in the future.

*Modeling Approach:* The 2-year peak discharge (plus the additional 10-year protection for the "West" Camelback SYSTEM) was diverted from the 100-year HEC-1 hydrograph for the entire Arcadia Area. This hydrograph was then imported into the Pond 2 storage routing model. The required storage volume for a basin outflow of 990 cfs (less the 2-year direct discharge) to the OCCC was computed.

*Results and Conclusions:* The conversion of the canal to a linear detention basin, the construction of a bypass facility for the canal flows, and the lowering of the north canal bank would eliminate the ponding along the canal and, potentially, the 100-year floodplain. Elimination of the FEMA floodplain would be dependent on FEMA's review and acceptance of the design concept. The primary concern would be that of the south canal levee. Additional measures may have to be taken to ensure the structural stability of the levee since it would be acting as a "dam". The source of the 100-year FEMA floodplain would also have to be documented to ensure there are no additional flood flows conveyed along the north bank of the canal from the east (i.e., outside of the project boundaries).

The canal/basin would extend from canal stations 841+50 (west of 40th Street) to 1000+00 (east of 56th Street). The existing canal cross-section would be modified as necessary to construct the bypass facility, lower the north bank, provide adequate storage capacity, and provide multi-use amenities and aesthetic features.

The 3 mile long canal/basin (as currently exists) provides approximately 130 ac-ft of storage (top width of 50-70 feet, bottom width of 30-50 feet and a depth of 8 to 12 feet). The net 100-year peak inflow to the basin (2-year flow diverted) is 3392 cfs. The 2-year peak discharge is 318 cfs. For a maximum peak discharge to the OCCC of 990 cfs, 672 cfs can outflow from the canal basin. The corresponding storage volume requirement is 143 ac-ft. Additional excavation within the canal/basin (i.e., lowering the canal/basin bottom) would be needed to provide the 143 ac-ft.

The bypass facility would intercept the canal flows at the top of the Arizona Falls wire/gate structure east of 56th Street (see Figure IV-7, 1 of 3). The existing structure could be used, and modified if necessary, to direct the canal flows to the bypass inlet on either the north or south side of the canal (depending on the location of the bypass facility). Intercepting the canal flows at the top of the Falls allows the use of the additional 16 feet of hydraulic head to increase the bypass facility capacity.

In order to convey the ultimate delivery capacity of 1850 cfs to the OCCC, a double 10' x 10' RCB culvert would be needed. A facility of this size would be very difficult to construct within either canal bank; and construction within the canal bottom would require complete shut-down of the canal for the duration of the construction. A facility to convey the current delivery requirement of 1125 cfs, however, would require only a single 12' x 10' RCB culvert.

This size facility could be constructed in either canal bank (see Section IV.E). The future 725 cfs capacity could then be provided in a structure constructed within the canal invert after the 1125 cfs bypass facility has been connected west of 40th Street.

The 1000 cfs emergency discharge requirement for the canal could be met by diverting the flows from the bypass inlet at the Falls, and discharging directly into the basin. The 1000 cfs could then outlet to the OCCC through the existing gate structure, along with any flood flows in the basin. Adequate storage volume would be needed (above the water surface elevation required to outlet the additional 1000 cfs) in the canal/basin to ensure that the combined 1000 cfs inflow from the canal and the 100-year inflow from the Arcadia Area (less the 2-year intercept) would not outlet more than the 1672 cfs allotted (1990 cfs less 2-year flow of 318 cfs) (see discussion on the outlet structure below).

An alternative to discharging directly to the basin would be to use the future 725 cfs parallel bypass facility. The 725 cfs plus the 300 cfs delivery facility (outletting from the 1125 cfs bypass facility) would provide the 1000 cfs outflow requirement. The 1000 cfs would, therefore, bypass the canal/basin entirely. This would leave the entire canal/basin

storage volume available for flood flows. The existing OCCC gate structure could still be used, but would have to be restricted (i.e. partially closed) to outlet only 672 cfs (i.e. 990 cfs less 2-year flow of 318 cfs).

The 300 cfs delivery requirement could be met by providing a gated outlet from the 1125 cfs bypass facility at the OCCC (see Figure IV-7, 2 of 3). The gate could be operated manually or remotely as specified by SRP.

The ultimate delivery requirement west of the OCCC is 1150 cfs and could also be provided with a 12' x 10' RCB. This facility would also be constructed in either the north or south canal banks and would extend west of 40th Street where it would outlet back into the canal (see Figure IV-7, 3 of 3). An additional outlet from the canal/basin could be provided west of 40th Street into the Cudia City Wash Basin (i.e. ACDC). This would be a gated outlet structure and could provide additional flexibility in providing flood protection, redundant capacity (for emergency or bypass facility down time), and general operation of the canal/basin.

As mentioned previously, the main outlet for the canal/basin would be the OCCC gate structure. According to the OCCC Gate Headworks Model Study done in 1993 by the U.S. Bureau of Reclamation, the gate structure has a capacity of more than 1700 cfs (at an approach depth of 10 feet). The existing canal invert at the gate is at elevation 1238. The proposed 100 year water surface elevation would be approximately elevation 1250. The existing gate would need to pass a maximum of 1672 cfs (if the 1000 cfs SRP discharge is diverted to the canal/basin). The gate structure could be adjusted to provide lesser outlet capacity if needed (i.e. if the 1000 cfs is discharged directly to the OCCC and only 677 cfs capacity is needed). In either case, the gates could be set at the necessary opening and would not need to be adjusted depending on storm or delivery constraints. An additional consideration in the outlet at the OCCC is the bypass structure itself. If constructed in the south bank, the 12' x 10' RCB would need to be either suspended over the entrance to the gates or siphoned under. Depending on the final profile of the 12' x 10' RCB, it would

appear that an adequate opening could be provided under the box to allow the flows to discharge from the gates.

In addition to the SRP discharge requirements to the OCCC, there are three lateral delivery requirements: Laterals 6.0-0.1, 6.1-0.1 and 6.1-0.2 just west of 48th Street (50 cfs capacity) Lateral 6.4 west of 44th Street (4 cfs capacity) and Lateral 7.0 west of Camelback Road (50 cfs capacity). All three laterals outlet through the south bank. These delivery requirements would have to be provided during as well as after construction. Connections to the bypass facility would be made and extended to the existing lateral facility. If the bypass facility was constructed in the north bank, the lateral facility would need to cross under the canal/basin and may require a siphon (cost prohibitive). Adequate hydraulic head would be available in either case, as the bypass facility water surface would be above the existing canal water surface at all locations (i.e. surcharged facility). Aesthetic flows in the canal/basin could be used as irrigation supply to lateral 7.0 at Camelback Road and 40th Street if the elevation of the aesthetic water surface was at least 1241.0.

Modifications to the existing canal section could be required to: provide additional storage volume; construct the proposed bypass facility; lower the north bank to allow free inflow into the canal/basin; and/or to provide multi-use amenities or aesthetic features. All but the last item have been discussed in the previous paragraphs. The concept of a multi-use facility is very desirable from a local acceptance view point. If the canal/basin can be shown to provide benefits other than just flood control (i.e., park and recreational uses), it would become an attraction within the neighborhood instead of a nuisance. Although not studied in detail this report, ideas for multi-use and aesthetic features for the canal/basin include:

- Hike/Bike trails along both banks;
- Greenbelt treatment of north bank (slope cut back and/or terraced);
- Low water feature in the canal/basin bottom (i.e. babbling brook concept) or along the top of either bank;
- Decorative wall treatment for steeper south bank; and

- Picnic and small play areas within the canal/basin bottom.

Preliminary designs and costs for these features are not included in this report. A more detailed study on the canal/basin concept would be required if deemed feasible. Close coordination with SRP, the City of Phoenix Parks Department, local residents and citizen groups (such as the Metropolitan Canal Alliance) would also be needed to ensure the proposed canal/basin would primarily provide the desired level of flood protection, but also be an amenity to the Arcadia Area. An evaluation of this alternate may also be required under the National Preservation Act for an Historic American Building Survey (HABS) and/or for an Historic American Building Engineering Record (HAER). This is required for any project which involves a structure greater than 50 years old utilizing federal funds or on federal lands.

#### **E. Construction Constraints**

The potential construction constraints or conflicts associated with each of the five final alternates are discussed in this section. Construction constraints consist of: other than "normal" construction requirements (e.g., deep trenching, right-of-way or access restrictions, restricted construction schedules, etc.); utility conflicts; additional right-of-way requirements, traffic impacts; and special design features. Costs associated with these constraints have been included in Section IV.F either as line items or as contingencies.

##### Alternate 1

The construction constraints for Alternate 1 are primarily associated with the construction of the 60 to 90-inch storm drain within the existing 40th Street and Camelback Road right-of-ways ("West" Camelback Road SYSTEM). Although there would appear to be sufficient room in both streets for the pipe, there are a number of utility crossings, especially in Camelback Road just east of the Arizona Canal (stations 31+50 to 32+50). With the exception of an 8" sanitary sewer (SS) line at sta. 31+60, temporary support of these utilities, as well as others in Camelback Road and 40th Street, would be sufficient

(i.e. no relocations necessary) as the proposed profile is deep enough to avoid conflict. The 8" SS line would have to be relocated or siphoned.

An additional constraint would be the construction of the 48-inch RCP through the existing concrete spillway section at the Cudia City Wash Basin Outlet to the ACDC. There is approximately 350 LF of concrete spillway that would be open cut to depths ranging from 4 feet at the outlet to 14 feet at the crest. Close coordination with the Corps would be required to minimize the effect of the construction on the spillway capacity.

Traffic control would be critical during the construction process for both Camelback Road and 40th Street. If constructed in the centerline, as shown on the concept plan and profile sheets (see Appendix C), and if vertical trench cutting techniques were used (with shoring), a traffic lane in each direction could be maintained during construction. In the two cases where the proposed storm drain crosses the roadway (stations 31+50 to 32+50 and 16+49 to 16+69), traffic would have to be diverted to one side of the road.

Additional right-of-way would be needed from the storm drain outlet at Cudia City Wash Basin spillway (sta 2+00) to 40th Street (sta 16+30). Although not within street right-of-way, the reach of 90-inch pipe between Camelback Road and 40th Streets (sta 27+50 to 31+60) is within an existing utility easement. No additional right-of-way was assumed for this reach.

System alternates which discharge drainage into the ACDC may impact downstream users along the ACDC, including the Phoenix Country Day School (PCDS) and the City of Glendale (COG). Discussions should be held with the PCDS regarding discharges into the Cudia City Wash lower sedimentation basin, and with the COG regarding discharges into the ACDC which may travel to and impact the use of the Thunderbird Pasco Park. These discussions must occur, and concerns and issues of the PCDS and the COG must be addressed before implementation of any design and construction of alternates.

The estimated time of construction for Alternate 1, based on the total project being constructed under one construction contract, is nine months. This construction time assumes that work in Camelback Road will be done at night.

### Alternate 2

The construction constraints for the 40th Street/"West" Camelback Road SYSTEM would be essentially the same as for Alternate 1. The smaller pipe sizes (36 to 60-inch), however, would require less trenching and right-of-way which are reflected in the SYSTEM cost estimates (along with the reduced pipe costs).

The additional SYSTEM alignments in 40th Street, "West" Lafayette Blvd, Arcadia Drive, "Central" Camelback Road, "East" Camelback Road and Invergordon Road proposed in Alternate 2 would have the same general construction constraints as identified for the 40th Street and "West" Camelback Road SYSTEM for Alternate 1; namely, utility crossings (two additional 8" SS lines would have to be relocated: Camelback Road west of 56th Street (sta. 84+65) and Lafayette Blvd east of 44th Street (sta. 72+35)), vertical trenching and traffic control. These constraints would, however, be amplified by the deeper trench depths needed for the "West" Lafayette Blvd, Arcadia Drive and "Central" Camelback Road SYSTEMS. The deeper trench depths (ranging from 20 to 25 feet deep) are needed to be able to drain low points in the upper reaches of the SYSTEMS (i.e., Camelback Road at 54th Street & Lafayette Blvd at 44th Street). The deeper trenches may require special trenching equipment and shoring techniques/materials, which may in turn create additional utility and traffic conflicts. Construction within Lafayette Blvd (west of Arcadia Drive), Arcadia Drive and Invergordon Road may also require special scheduling. These streets are within residential areas and are used regularly by local residents.

Alternate 2 also proposes a pipe crossing of the Arizona Canal east of Arcadia Drive. A 96-inch pipe is proposed to cross the canal just east of the OCCC gate structure. The crossing of the canal would be done by open-trench excavation (see Section V.B). The construction of the undercrossing would have to coincide with the 30-day winter "dry-up"

of the canal (regular canal maintenance). The 96-inch pipe outlets to the OCCC south of the existing gate structure (see Appendix E). The necessary right-of-way for the reach between the south canal bank and the OCCC (stations 7+50 to 8+10) is being acquired by the District.

The estimated time of construction for Alternate 2 assumes that the project will be built in three projects, which will probably be phased. The west project, discharging into the ACDC is estimated to take eight months; the central project, discharging into the OCCC should be allocated approximately 15 months, and the east project along Invergordon road should be completed in seven months.

### Alternate 3

Alternate 3 would have the same construction constraints as Alternate 2 for the proposed SYSTEM facilities west of Arcadia Drive; namely, utility crossings, vertical trenching and traffic control for the CCW-40th Street-"West" Camelback Road and "West" Lafayette-44th Street SYSTEMS. The Arcadia Drive SYSTEM undercrossing of the Arizona Canal is similar to Alternate 2, with a slightly smaller diameter (84-inch vs 96-inch).

Alternate 3 proposes additional alignments in Indian School road, Osborn Road, 56th Street and Lafayette Blvd (west of 56th Street). There would not appear to be any significant utility conflicts associated with these alignments. Indian School Road and Osborn Road are heavily traveled and would, therefore, be more likely affected by the construction (i.e. lane closures). The storm drains are proposed to be constructed on either the north side (Indian School Road) or south side (Osborn Road) of the roadways which will require rerouting of the traffic to one side of the street.

Four additional undercrossings of the canal are proposed with Alternate 3: three laterals from the Indian School Road SYSTEM and the Osborn Road-56th Street SYSTEM undercrossing. These crossings would also be constructed by open trench (during annual "dry-up") and would require permitting and close coordination with SRP.

The Indian School Road laterals would be extended up into the existing residential tracts to intercept the flow (via inlets in Calle Redonda) upstream of the canal. The three laterals are proposed to be constructed within existing easements between the Arizona Canal and Calle Redonda. These easements are narrow and may require additional protection measures. There would be significant noise and traffic impacts to the local residents during the construction process.

The estimated time of construction for Alternate 3 assumes that the project will be constructed in three projects, which will probably be phased. The west project, discharging into the ACDC is estimated to take eight months, the central project with lines along Arcadia Drive and Indian School Road will take twelve months, and the east project along 56th Street and Osborn Road will take approximately twelve months.

#### Alternate 4

The most significant constraint associated with Alternate 4 is the right-of-way needed for the eight proposed detention basins. As shown in Table IV-I, there are 73 existing structures within the 29.7 acres identified for detention basins. One of these structures is non-residential (Church), and 7 of the structures in subbasin 36 contain a total of 39 condominium units. The other 65 structures are single family dwelling units. The acquisition of the right-of-way would, therefore, necessitate the relocation of 104 families and a church. Costs for the right-of-way acquisition and occupant relocation have been included in the Alternate 4 cost estimates (see Section IV.F).

The construction of the detention basins themselves would not pose any significant problems. Once the existing structures were removed, excavation of the basins could proceed without delay. There should be no problems with existing utilities as they would have to be deep in order to cross under the canal. There would be noise and traffic impacts to the local residents.

The outlet pipes from the basins are proposed to be constructed along the north canal bank to either the 56th Street-Osborn Road, Indian School Road, OCCC or 40th Street-Cudia City Wash Basin SYSTEMS and would include four undercrossings. The construction of these facilities would need to be coordinated with SRP. Associated costs have been included in the Alternate 4 cost estimate (Section IV.F).

The estimated construction time for Alternate 4 assumes that the project will be constructed in three projects, which will probably be phased. These construction times for each of the projects include time for clearing and removal of structures and utilities, besides the times required for construction of the detention basins and outfall lines. Each of the three projects will probably take approximately two to three years to complete. Therefore, if done sequentially, the total time to complete the three projects would be approximately six to nine years.

#### Alternate 5

Since a detailed plan was not developed for Alternate 5, only the major components associated with the canal/basin concept will be discussed. By far the most critical component is the construction of the bypass facility. What makes this so critical is the need to maintain the canal deliveries throughout the construction process (with the exception of the 30-day "dry-up" period each year for canal maintenance). This limits the alignment of the bypass to either the north or south canal banks. The canal deliveries could, therefore, continue in the canal until the bypass connections were made at both ends. Scheduling with SRP for the construction and ultimate connection of the bypass facilities would be critical and would have a significant impact on the construction costs.

In general, the existing canal cross-section is 50 to 70 feet from inside top-of-bank to inside top-of-bank, 8 to 12 feet deep, 1 to 1 concrete lined side slopes, and a bottom width of 30 to 50 feet (see Figure IV-8). With top-of-bank widths of 15 to 20 feet, the total width of the canal/basin section is 80 to 110 feet.

Although the SRP right-of-way extends 50 feet on either side of the bank high water mark of the canal, there is only about 15 to 20 feet from the inside top of bank to some form of existing obstruction, either power pole or wall, on the north side. The same is true on the south bank. Although there aren't any walls, power poles line the entire bank along the outside (or southerly) top of bank.

Construction of the bypass facility in either bank would not be simple. The requirements to provide a minimum delivery of 700 cfs in the canal would require the use of sheet piling around the construction area, unless the bypass facility can be constructed without removing the interior canal bank. This could, however, create a conflict with the existing power poles, requiring temporary support or replacement.

A specific problem associated with the north bank alignment is the height limitation. With the north bank proposed to be cut down to allow overflow into the canal/basin, there would only be about 6-8 feet of height available from the canal bottom. With the proposed 12' x 10' RCB discussed in Section IV.F, 2 to 4 feet of box would be below the canal invert at the outlet. This would make it difficult to transition back into the existing canal (downstream of 40th Street). Since the bypass facility would be flowing under pressure, the flows would be forced back into the canal. Low flows and drying up the canal for maintenance could, however, still be a problem. In addition, the three lateral delivery requirements are south of the canal. This means that the laterals would have to be extended under the canal from the bypass facility, possibly creating a siphon condition.

Specific problems associated with a south bank alignment include: the OCCC gate structure crossing and the additional slope support for the south (or exterior) canal bank. The OCCC gate structure crossing (as discussed in Section IV.D) could be constructed by suspending the box for a span of 30 to 50 feet (depending on the maximum outflow needed). A vertical opening of 5 feet could be provided due to the 6 foot drop in the canal invert at the gate. This would create an opening sufficient to pass the maximum outflow of 1670 cfs. Adequate slope protection for the southerly bank can be obtained by providing a safe distance from the top of bank to the trench wall (2-5 feet).

For the purposes of this analysis, the bypass facility is proposed in the south canal bank. The following assumptions were made in the design (see also discussion in Section IV.D):

- A 12' x 10' RCB (1150 cfs capacity) would be constructed in the south bank from the Arizona Falls to west of 40th Street;
- A 10' x 8' RCB (700 cfs capacity) would be constructed in the canal invert ( or adjacent to the 12' x 10' RCB) from the Arizona Falls to the OCCC; construction would begin after the 12' x 10' RCB has been completed and connected at both ends;
- The 12' x 10' RCB can be no closer than 4 feet to the outside top-of-bank and 2 feet to the inside top-of-bank;
- Sheet piling or coffer dams will be used to create a temporary wall around the construction area if the existing inside bank cannot be supported;
- A 300 cfs gated outlet from the 12' x 10' RCB will be provided at the OCCC;
- The 1000 cfs emergency outflow requirement would be met ultimately by the 10' x 8' RCB (700 cfs) and the gated outlet (300 cfs) to OCCC; in the interim, if the 10' x 8' RCB is not constructed, the 700 cfs can be discharged directly into the canal/basin and outlet through the existing gate to the OCCC;
- The north canal bank is lowered to approximately 14 inches below the finish floor elevations of the adjacent homes; and
- Existing poles will be supported where trench encroaches to within 5 to 10 feet of the pole.

Based on the above constraints, two locations were considered for the centerline of the proposed 12' x 10' RCB within the south bank: Option A - 11 feet from the south top-of-

bank; and Option B - 17 feet from the south top-of-bank (see Figures IV-9). Option A allows the box to be constructed within the existing levee while maintaining the minimum set back from both slopes. This would enable the canal to operate during construction without sheet piles or coffer dams. Both trench walls would need to be supported (vertical sides) during construction. The box sides could be designed as retaining walls and constructed first to support the slopes. The existing power poles would need to be supported and possibly relocated depending on their location (i.e., within the 4 foot set-back from the south top-of-bank).

Option B proposes the box further north to avoid conflict with the existing poles. It is assumed that 10 feet from the south top-of-bank would be an adequate distance. This alignment would require 4 feet of the box to extend out into the canal slope. This would, therefore, result in a 4 foot vertical section of the box exposed below the existing top of bank. It might be possible to construct the north wall of the box while maintaining the bottom 6-8 feet of canal slope (some lateral support might still be needed). This would, in turn, provide the 700 cfs capacity in the existing canal (without freeboard) without additional sheet piles or coffer dams. Depending on the width of over-excavation needed, the 6-8 feet of slope might be reduced to 4-6 feet (2 feet maximum over-ex.). This would then require sheet piles or coffer dams to maintain the canal capacity.

For the purposes of this concept analysis, Option B was selected. Additional consideration should be given to the construction techniques and impacts of this and other options prior to final design.

As mentioned above, construction of the parallel 10' x 8' RCB bypass facility could occur in either the canal invert or adjacent to the 12' x 10' RCB in the south bank. Construction under the existing canal would require the relocation of any utility crossings, but would not be significant. Construction adjacent to the 12' x 10' RCB would require the 10' x 8' box to project further into the canal/basin, using up available storage volume and creating a potential aesthetic problem (i.e. additional exposed concrete walls). The alignment under the canal was, therefore, selected for this analysis. The 700 cfs design discharge would

outlet directly into the OCCC and would have to cross under the 12' x 10' RCB. The 10' x 8' box would be gated at the inlet (i.e. Arizona Falls) to control the flow.

Construction access would be extremely limited due to the need to maintain the delivery capacity of the canal during construction. The only access would be from the top of the south bank and would be one way in and one way out. The trench for the box culvert could be dug with a scraper and the dirt hauled off in front of the trench. There would be no need to stockpile the dirt as there will be very little backfill material needed (mostly sand or other granular material). The sheet pile or coffer dams could be set in for a given reach and then moved after the trench has been dug, the box has been set-in and backfill placed. Precast box sections would be preferred over cast-in-place mainly due to the time constraints. There could be additional access adjacent to the trench for small vehicles depending on the location of the existing power poles. Although not impossible, the construction of the bypass facility in the south levee would be extremely difficult and costly.

Another major construction element associated with Alternate 5 are the proposed 2-year intercept facilities and the 10-year "West" Camelback facility. These SYSTEMS are proposed to work in conjunction with the proposed City of Phoenix 2-year collection facilities to capture and convey the "first flush" runoff to the OCCC and ACDC outfalls. The constraints for these facility alignments have been discussed in the previous alternates and are not repeated here.

The estimated construction time for Alternate 5 assumes that the project will be constructed in at least three to four projects. The first project, undergrounding of the SRP Canal, sedimentation basins, and outfall structures would extend over two years and three annual canal dry up periods. After this portion of the work is completed, work would start on the landscaping and aesthetic treatment sections of the Arizona Canal Detention basin. Phasing construction projects to assure a continual outfall for intercepted storm drainage is estimated to take approximately three years. The last phase would include the construction of the "first-flush" storm drainage system which could be completed in eighteen months.

As has been stated previously in this report, Alternate 5 is presented here only as a concept to determine if further evaluation is warranted. The level of detail to which this alternate was evaluated was provided accordingly. Coordination with SRP is vital if this concept is ever to become a reality anywhere within the canal system. To this end, SRP has provided an extensive list of additional items that would need to be addressed to satisfy their concerns over this concept. Their list has been included below to document their concerns for further evaluation should this concept be studied in greater detail. Some of these issues may have already been addressed in this report, but are repeated for completeness of the SRP comments. The costs, as noted, have been included in the Alternate 5 cost estimates either as separate line items or included within the contingency allocation (see Section IV.F).

1. *SRP Lateral Delivery Head Gates. Three or four of these along the box culvert would be required and may need to be equipped with energy dissipaters (included in contingency).*
2. *SRP Lateral Siphons. Another three or four of these would be required to divert water from the original canal alignment if/when it is used to bypass water around the RCB. Required would be two manholes and perhaps 50 feet to pipe for each facility (included in contingency).*
3. *Sedimentation Basin. An upstream sedimentation basin would likely be required to catch expected sediment loads before they reach the RCB. Estimated cost would be \$1 to 2 million (included as line item).*
4. *Replacement Buffer Storage. If the canal is placed into a RCB, SRP will lose the ability to use the canal cross-section to provide for temporary buffer storage. This could be partially mitigated through the widening of the canal upstream of Az Falls. The cost for this would depend on right of way and construction costs. It could possibly be combined with the sediment basin, described above (not included at this time).*

5. *Utility Relocations.* Several major utilities would have to be relocated in order to construct the box culvert and lower the north canal bank. Upon a cursory review of SRP's license records, it appears there would be at least eight gas lines, two waterlines, two cable TV lines, seven sewer lines, ten telephone lines and 41 drain lines that may have to be relocated. Conceptual costs for utility relocations should be included in the initial draft (included in contingency).
6. *SRP Water Quality Station.* The existing station at Arizona Falls will likely need to be relocated at a conceptual cost of \$100K (included as line item).
7. *Sediment Drying Provisions.* The material removed from the sedimentation basin will need to be dried before it can be transported. Money for either a drying bed or dewatering equipment should be included. Conceptual cost would be \$300K (included in sedimentation basin cost).
8. *300 cfs Delivery to OCCC.* The cost for the valve and energy dissipater for this feature should be included in the cost estimate (included in contingency).
9. *RCB Access Manholes.* These would be needed by SRP to provide access into the RCB as well as allowing for ventilation and lighting during inspections and repairs. Suggest these be placed 600 feet apart (included in contingency).
10. *RCB Equipment Manholes.* Estimate should include at least 5 of these to allow men and equipment into the RCB for maintenance and repair activities. Access entries should be at least 10 ft by 10 ft. (included in contingency).
11. *Aesthetic Feature.* Monies for the construction and perhaps maintenance of a aesthetic feature should be included in the conceptual estimate (included as line item).

12. *Dewatering Structure. Some type of sump facility to allow the timely evacuation of water from the RCB would likely be required. A location near the OCCC and the tailworks facility, with valves and drain lines/sumps might be appropriate (included in contingency).*
13. *Measuring Bridge Relocation. SRP now operates a canal flow measuring bridge just downstream from Arizona Falls. This would have to be relocated if the RCB is installed. Estimated relocation might be \$150K (included as line item).*
14. *RCB Flow Meter. Flow measuring equipment may have to be provided in the RCB in order to determine how much water is being transported. We understand that perhaps \$100K might be an appropriate cost for an ultrasonic type flow meter (included as line item).*
15. *USBR Oversight. The USBR would also be involved in their overseeing and ultimately approving the major modifications proposed and would require reimbursement for this service. Estimated cost would be \$30 to 60K (included in contingency).*
16. *Historic Preservation. Some level of state/federal historic preservation would be required before the existing canal is modified. An estimated cost for this should be included in the estimate (included in contingency).*
17. *SRP Land Use Fee. This would be an ongoing cost, priced at about 1% of the assessed land value. We understand the FCD was going to estimate this figure, but it should be included in the conceptual cost estimate (included as line item).*
18. *Lost Hydrogeneration. For many years, the SRP generated electricity at Arizona Falls. Although the facility was removed, the 18 feet of hydroelectric potential remains. If this potential is utilized to pressure canal water through the RCB, SRP would not be able to reestablish it as a generating site and as a result, would likely*

*require some level of compensation for the lost RP. For conceptually estimating lost energy values, summer flows of 550 cfs and winter flows of 250 cfs might be used (included as line item).*

19. *Facility Maintenance and Replacement Agreement. SRP would require compensation for maintenance and replacement costs greater than the existing canal/lateral head configuration. It might be good to include an estimate of this extra cost in the cost estimate (included in contingency).*
20. *SRP System Records and Files Updates. The change proposed would require SRP to modify many of its monitoring systems, water accounting locations, facility records, files, maps, etc. for which SRP would request reimbursement. Estimated cost could be \$30-\$50K (included in contingency).*
21. *The importance of adequately understanding the hydraulics of the proposed RCB and backup canal operation during normal as well as storm conditions cannot be overstated. Provisions for hydraulic losses at the inlet/outlet structures, trash racks and other structures must be included. Also, the hydraulics of using the original channel during bypass conditions must be thoroughly studied to insure the correct quantity of lateral delivery water can be delivered and measured.*
22. *Another potential cost item is modification of bridge foundations at the major street crossings, in order to install the proposed RCB, should there not be sufficient room for both facilities within the canal right-of-way (not included at this time).*
23. *Because the proposed modification would be deemed a major modification to the SRP system, SRP would retain the right to design and construct all facilities directly related to the canal system*
24. *SRP currently uses fish regulated by the Arizona Game and Fish to control moss growth in this area. Any modifications to the canal would require this issue to be*

*adequately addressed. Fish grates to prohibit fish from leaving the wetted portions of the canal would likely be required. These would be at any structure where water can be released into either the original canal or into the Old Crosscut Canal.*

**F. Engineers Estimate of Alternate SYSTEMS Costs**

An opinion of Probable Construction Cost (or Cost Estimate) was developed for each of the five Final Alternates. For Alternates 1, 2 and 3, these costs included line items for pipes, manholes, inlets/laterals, pavement sawcutting and replacement, trench protection and canal undercrossings. An estimate of the inlet and lateral facilities (and costs) necessary to intercept the tributary runoff to each alternate SYSTEM facility was included for the analysis. The total length of inlet needed was computed using a capacity estimate of 0.5 cfs/ft of inlet for inlets on a continuous grade and 1.0 cfs/ft of inlet for inlets in low points. Unit costs for various sizes of inlets were averaged to develop a cost per foot of inlet estimate. Corresponding lateral sizes were estimated using an average friction slope of 0.002. The lengths of the lateral facilities were estimated based on average spacing of 50 feet between inlets. Costs for both the inlets and laterals were presented in terms of cost per linear feet of inlet. A 25% contingency was added which includes costs for utility protection and/or relocation and traffic controls. A 10% fee for Engineering and Surveying was also included. The unit costs for each of the line items are summarized in Appendix D along with the detailed cost estimates.

Alternate 4 included costs for storm drain facilities similar to Alternates 1, 2 and 3; the most significant line item, however, was Right-of-Way Acquisition for the Detention Basins. Right-of-Way Acquisition includes estimates for purchasing the private property within the proposed basin limits, demolition of existing structures, as well as relocation costs for the affected families. For the single family homes along the north canal bank, an average cost of \$200,000 per dwelling unit (DU) was used for purchasing and demolition. This fee is based on Tax Assessors information as well as knowledge of the real estate market in the area. An average relocation cost of \$50,000 per DU was also included. For the multi-family DU's (i.e. Camelback Castille Condominiums), an average per unit cost of \$45,000 and a relocation cost of \$26,000 was assumed. A cost was also included for the

loss of homeowners association fees bringing the total cost per DU to \$80,000. A 25% Contingency and 10% Engineering and Survey fee was also added.

Since Alternate 5 was studied at a preliminary concept level, only the major costs for the proposed bypass and canal/basin improvements were included. For the canal bypass facility, cost estimates were included for: the 12' x 10' and 10' x 8' RCB culverts, trench protection for the south levee, utility pole support/relocation for both canal banks, the 72-inch RCP delivery pipe to OCCC, the bypass inlet/outlet structures to the canal, special construction requirements (i.e., coffer dams, sheet-piling and access limitations) and an estimate of the loss in hydrogeneration revenues for SRP. Included for the canal/basin were costs for: the north bank and basin bottom excavation, the downstream gate/dam structure, three weir structures (to provide low flow water element) aesthetic features, SRP right-of-ways rental, and the 2-year "first-flush" intercept facilities. The 2-year "first-flush" interceptor facility costs are included in the SYSTEM costs for Alternate 5 due to water quality concerns associated with the potential mixing of the storm runoff flows with the canal flows. The corresponding costs were estimated by the City and have been included as a line item in the cost estimate. The additional items specified by SRP for Alternate 5 (see Section IV.E) have been included in the cost estimates either as a separate line item (if specified by SRP) or included in the contingency as a percent of the project cost (as noted in Section IV.E).

An additional 5-percent was added to the total construction cost (i.e., 30% contingency). The goal of this estimate was to determine an order of magnitude of probable construction costs to compare to those estimated for the other alternates. A decision could then be made on the feasibility of this alternate and the need for a more detailed analysis (i.e., preliminary design).

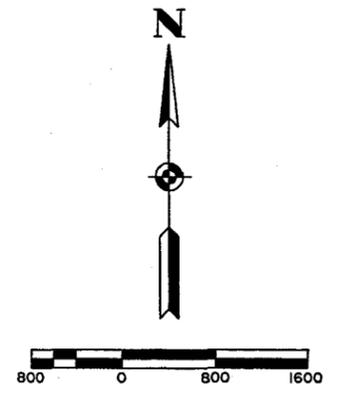
The total cost estimate for each alternate is summarized in Table IV-2. The detailed estimates are provided in Appendix D.

Table IV-2		
Opinion of Probable Construction Cost		
Alternate	Protection Level	Total Cost
1	10 Year	\$2,673,000
2	10 Year	\$10,021,000
3	10 Year	\$10,282,000
4	100 Year	\$36,030,000
5	100 Year	\$45,201,000

**G. Other Alternates Considered**

In an attempt to exhaust all reasonable alternates for providing 100-year flood protection to the Arcadia Area, the concept of providing a full 100-year outfall facility to the Salt River was investigated. As was discussed previously in this report, the ongoing OCCC improvements have been designed to convey up to 990 cfs from the Arcadia Area to the Salt River. The 100-year discharge, however, is approximately 3390 cfs. This leaves a shortfall capacity of 2400 cfs. An independent facility would have to be constructed in 48th Street from the Arizona Canal, approximately 4.4 miles to the Salt River. Using the construction cost estimates for the OCCC improvements and other similar projects, an estimated cost of \$36.6 million was computed for the parallel facility. There are also significant conflicts associated with the alignment which should be considered as well. The Red Mountain (Loop 202) and Hohokam (SH 143) Freeway crossings would cost an estimated \$2 million and the relocation of a major trunk water line would cost another \$750,000. This would bring the total cost of the outfall facility to approximately \$39.5 million. To be consistent with the other alternates (i.e., for comparison purposes), the cost of the collection and conveyance SYSTEM facilities within the Arcadia Area must also be considered. Based on the Preliminary Recommendations Report Alternate 9 (100-year Lafayette Intercept), the SYSTEM costs were estimated to be \$10.6 million. This brings the total cost of this option to \$50.1 million, which is approximately \$5 million more than the most expensive alternate previously considered (i.e., Alternate 5).

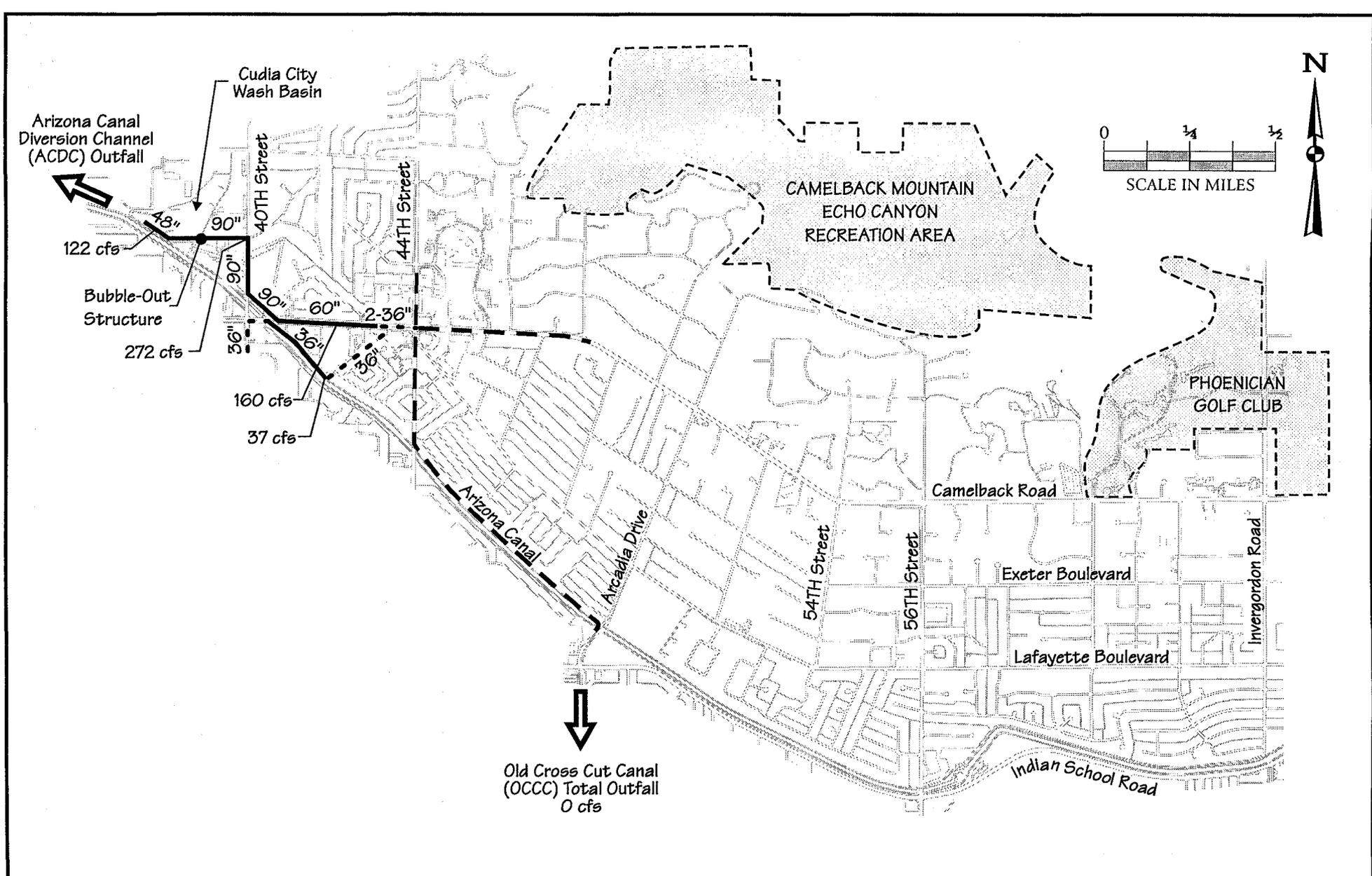
The elimination of the existing storm drain pipes which penetrate the north Arizona Canal bank was also considered. As was discussed in Section III and shown in Figure III-1 of this report, there are a significant number of existing pipes outletting into the canal within the project study limits. These pipes generally drain low points along the north canal bank and range in size from 3-inch to 3-feet in diameter. Because of the limited size of these facilities, they provide minimal capacity and, therefore, minimal benefit during significant storm events. Flooding from these storms is more likely controlled by the levee elevation. The ability to outlet the more frequent, lower intensity storm runoff and residual ponding is, however, a significant benefit to the areas immediately adjacent to the outlets. Even if the depth of flooding would not be significantly impacted, the elimination of these facilities could increase the frequency and duration of flooding. Therefore, unless a parallel collector facility along the north canal bank can be constructed to intercept the tributary runoff and discharge it to one of the proposed outfall facilities, eliminating the existing outlets would not be recommended. Due to the limited available right-of-way adjacent to the canal, the construction of a parallel facility would not be practical.



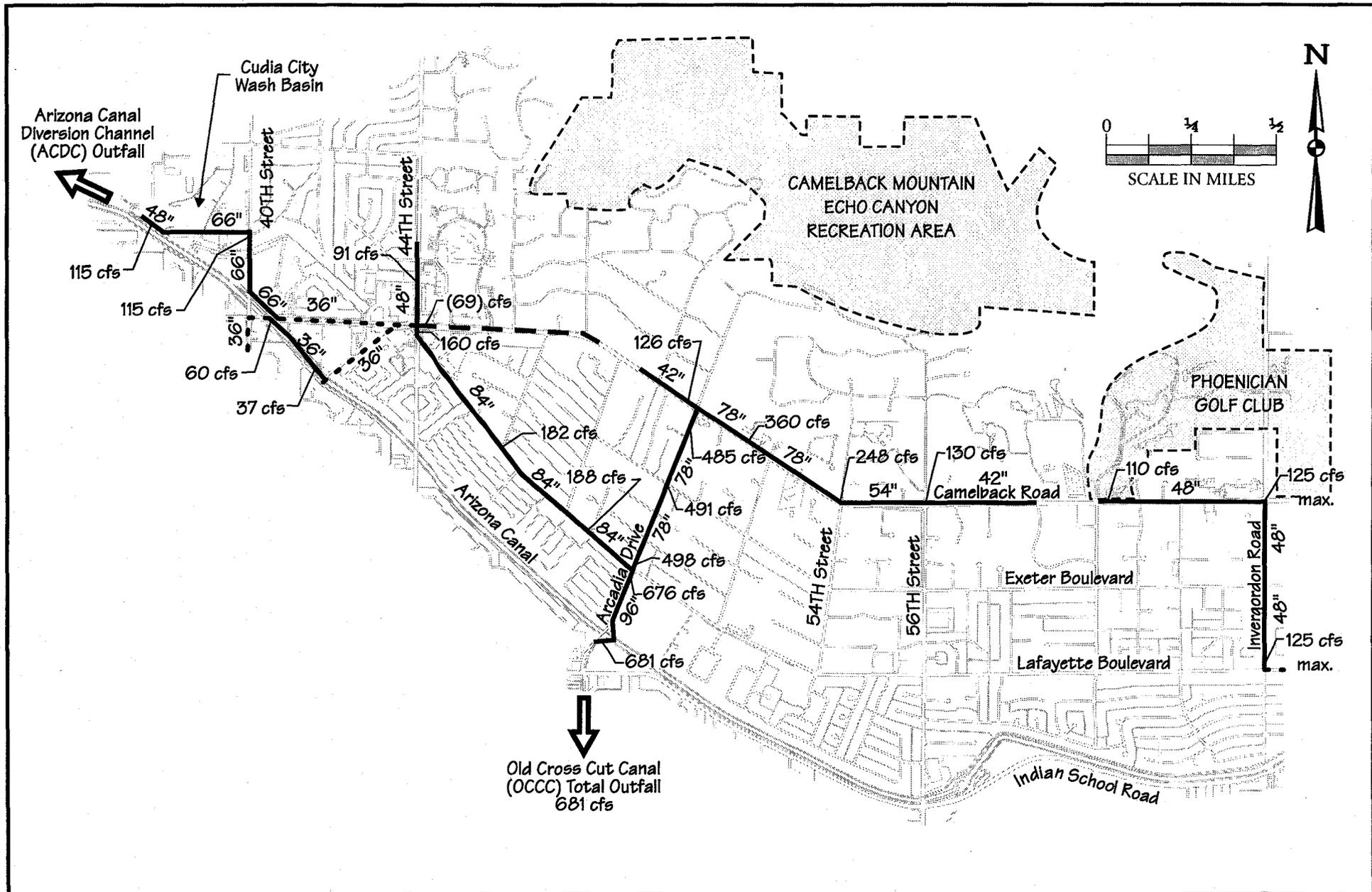
**LEGEND**

- WATERSHED BOUNDARY
- SUBBASIN BOUNDARY
- ROUTING REACH
- 2 SUBBASIN IDENTIFICATION NUMBER
- CONCENTRATION POINT

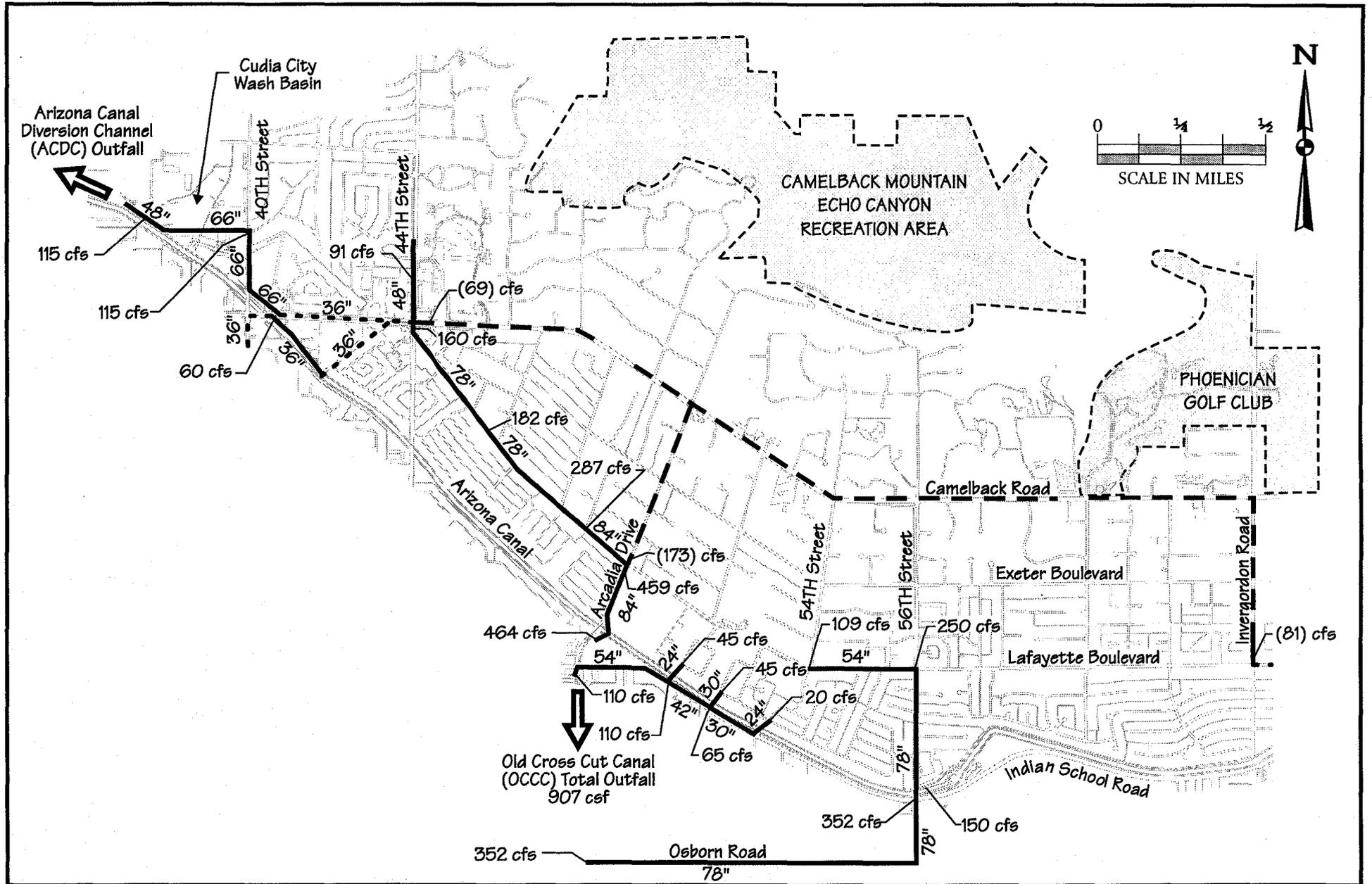
3			
2			
1			
NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
		BY	DATE
	DESIGNED	J. GIRAND	03-95
	DRAWN	S. SMITH	02-93
	CHECKED	R. WISE	08-93
<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY SUITE 102 PHOENIX, ARIZONA 85016-3029 (602) 381-0125 FAX (602) 381-8553</small>			
DRAINAGE AREA MAP			FIGURE IV-1



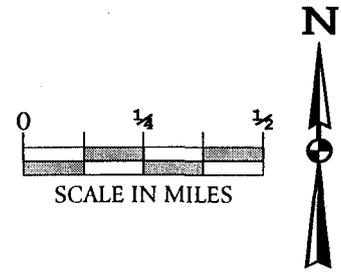
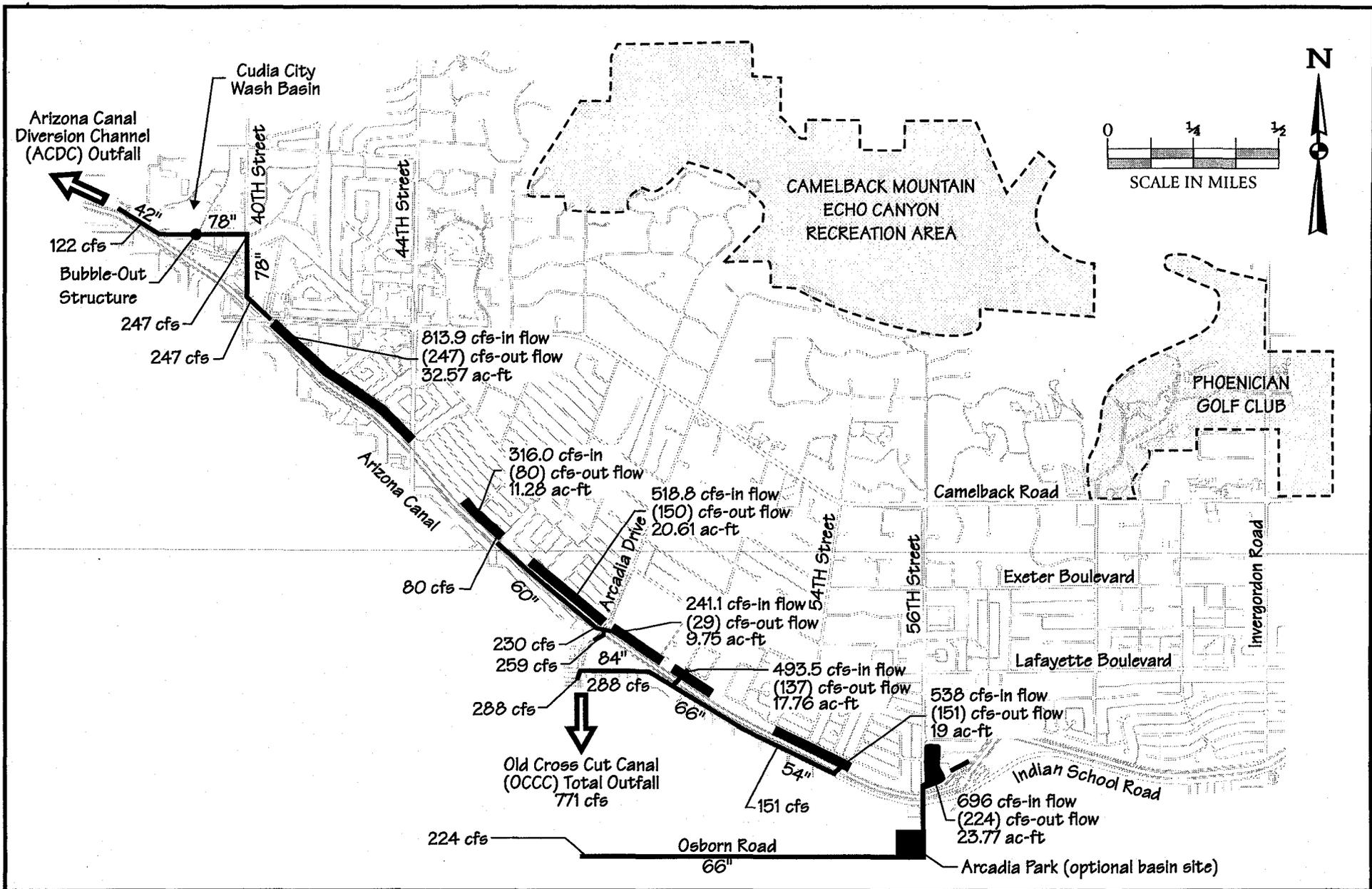
FEATURES	LEGEND	ARCADIA AREA DRAINAGE PROJECT FCD 94-21	
10-Year Camelback Castille Condominium Protection	<p>272 10-Year Flows</p> <p>— FCDMC 10-Year S.D.</p> <p>- - - C.O.P. 2-Year S.D.</p> <p>... Existing S.D.</p>	CAMELBACK CASTILLE CONDOMINIUM ALTERNATE	
			ALTERNATE 1



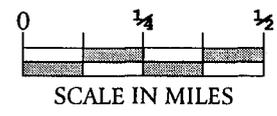
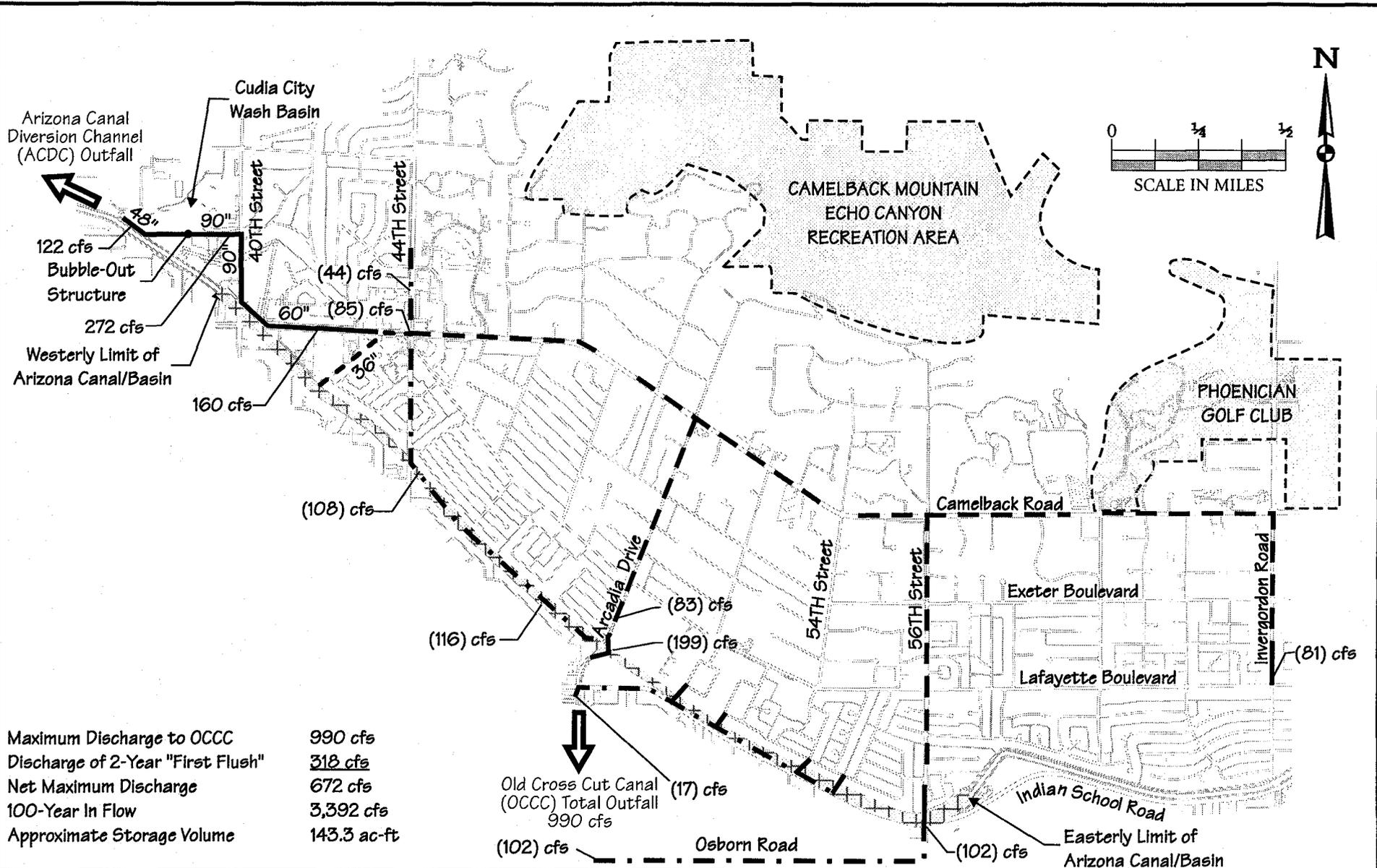
FEATURES		LEGEND	ARCADIA AREA DRAINAGE PROJECT FCD 94-21	
10-Year Camelback Road Alternate	681	10-Year Flows	CAMELBACK ROAD ALTERNATE	
	(69)	2-Year Flows		
	—	FCDMC 10-Year S.D.	ALTERNATE 2	FIGURE IV-3
	- - -	C.O.P. 2-Year S.D.		
	.....	Existing S.D.		



FEATURES	LEGEND	ARCADIA AREA DRAINAGE PROJECT FCD 94-21	
10-Year LaFayette Interceptor Drain System	91 10-Year Flows (173) 2-Year Flows — FCDMC 10-Year S.D. - - - COP 2-Year S.D. ..... Existing S.D.	L.I.D. ALTERNATE	
		ALTERNATE 3	FIGURE IV-4



FEATURES	LEGEND	ARCADIA AREA DRAINAGE PROJECT FCD 94-21	
<ul style="list-style-type: none"> <li>■ Multiple regional detention basins located along the north canal bank</li> <li>■ Detention of 100-Year 6-hour storm to discharge equivalent to 10-Year peaks.</li> </ul>	<p>696 100-Year inflows (224) Detained 10-Year outflows</p> <p>■ Detention Basin — FCDMC 10-Year outflow S.D.</p>	<b>REGIONAL DETENTION BASIN ALTERNATE</b>	
		ALTERNATE 4	FIGURE IV-5

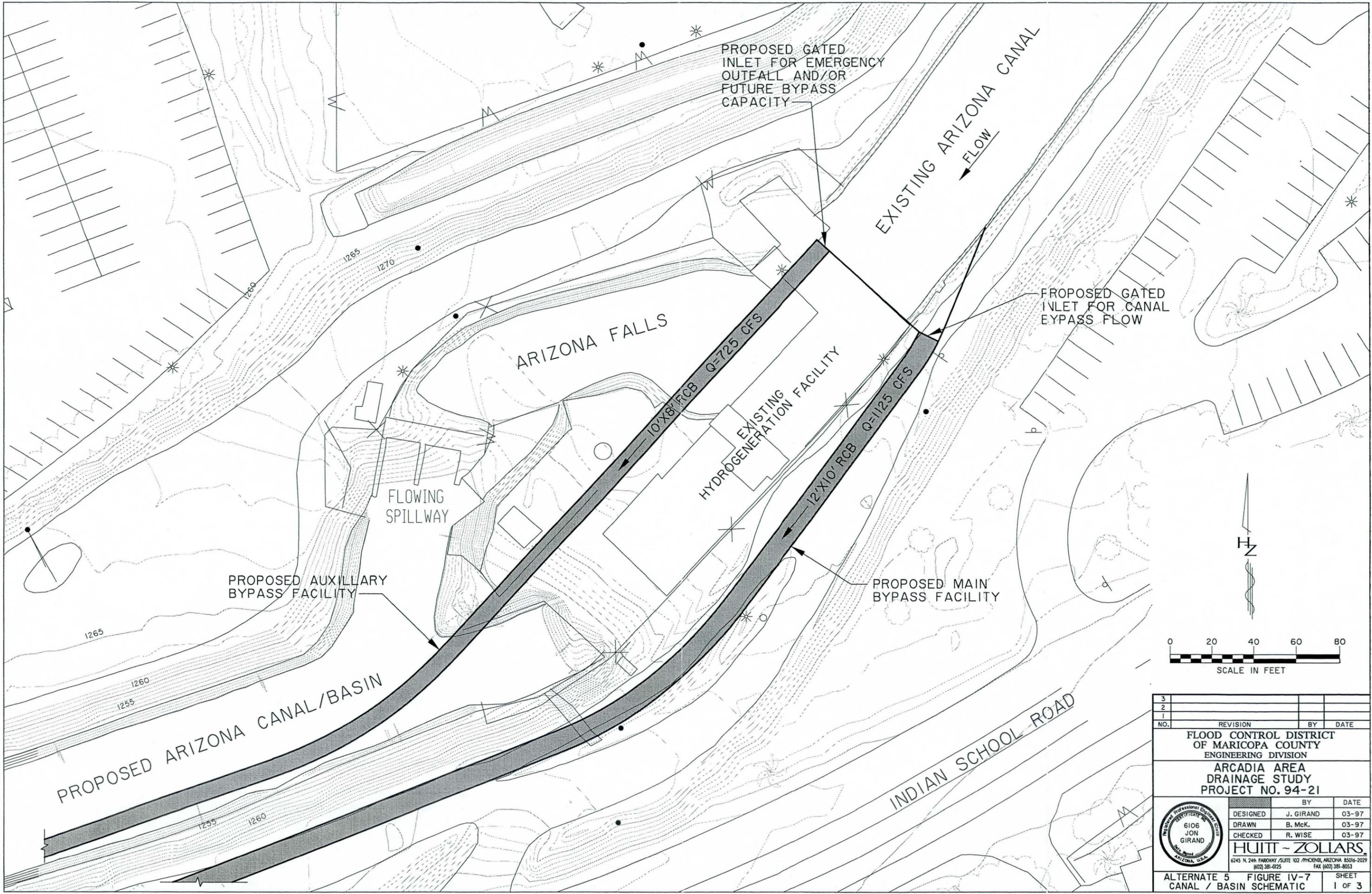


Maximum Discharge to OCCC	990 cfs
Discharge of 2-Year "First Flush"	318 cfs
Net Maximum Discharge	672 cfs
100-Year In Flow	3,392 cfs
Approximate Storage Volume	143.3 ac-ft

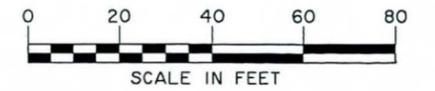
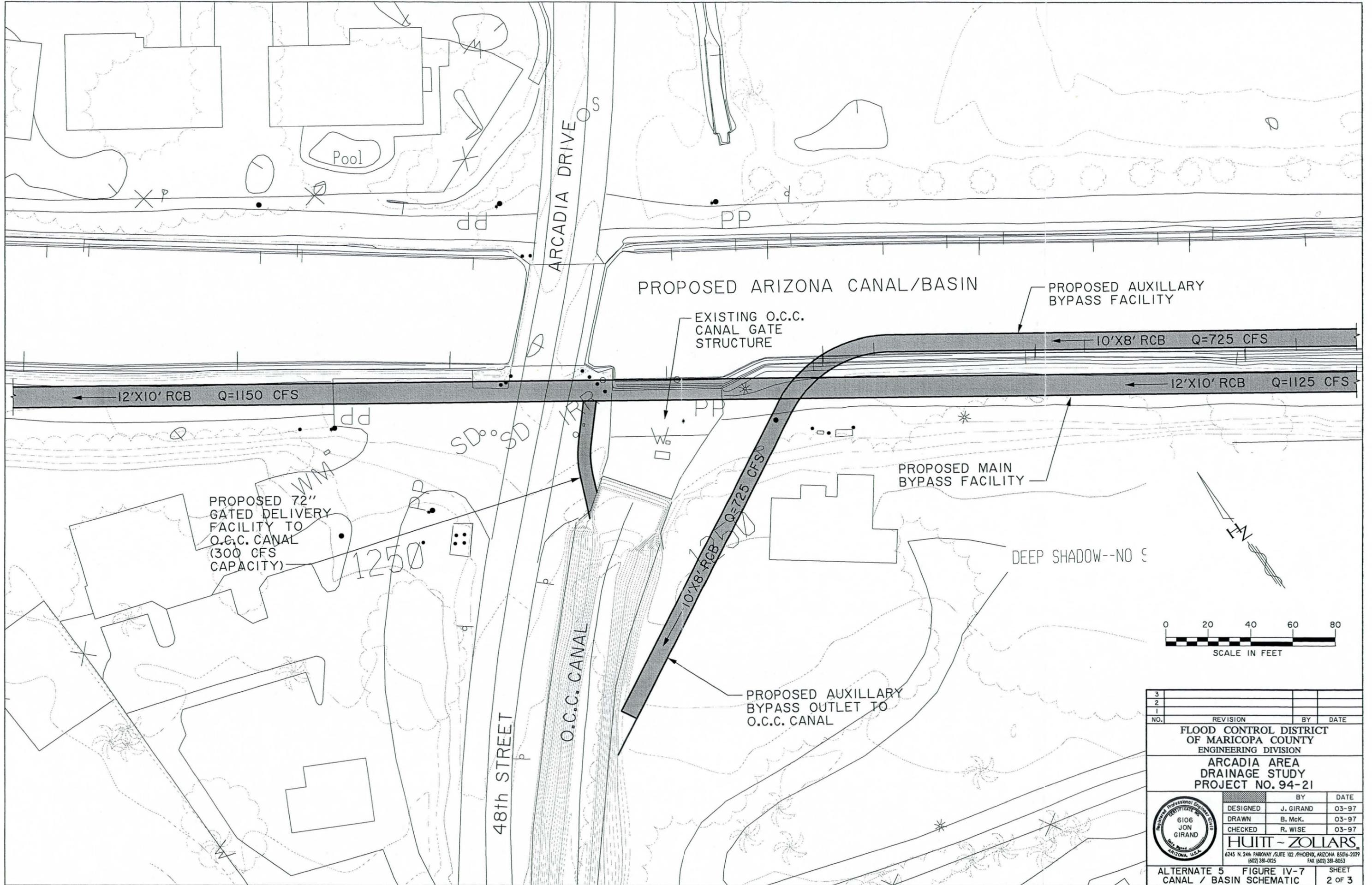
FEATURES
■ AZ Canal Detention Basin with 2-Year "First Flush"
■ Detention of 100-Year 6-hour storm to discharge in 36-hours
■ 10-Year protection for Camelback Castille Condominiums

LEGEND
(116) 2-Year Flows
187 10-Year Flows
--- FCDMC 2-Year S.D.
- - - C.O.P. 2-Year S.D.
— FCDMC 10-Year S.D.
- - - Existing S.D.

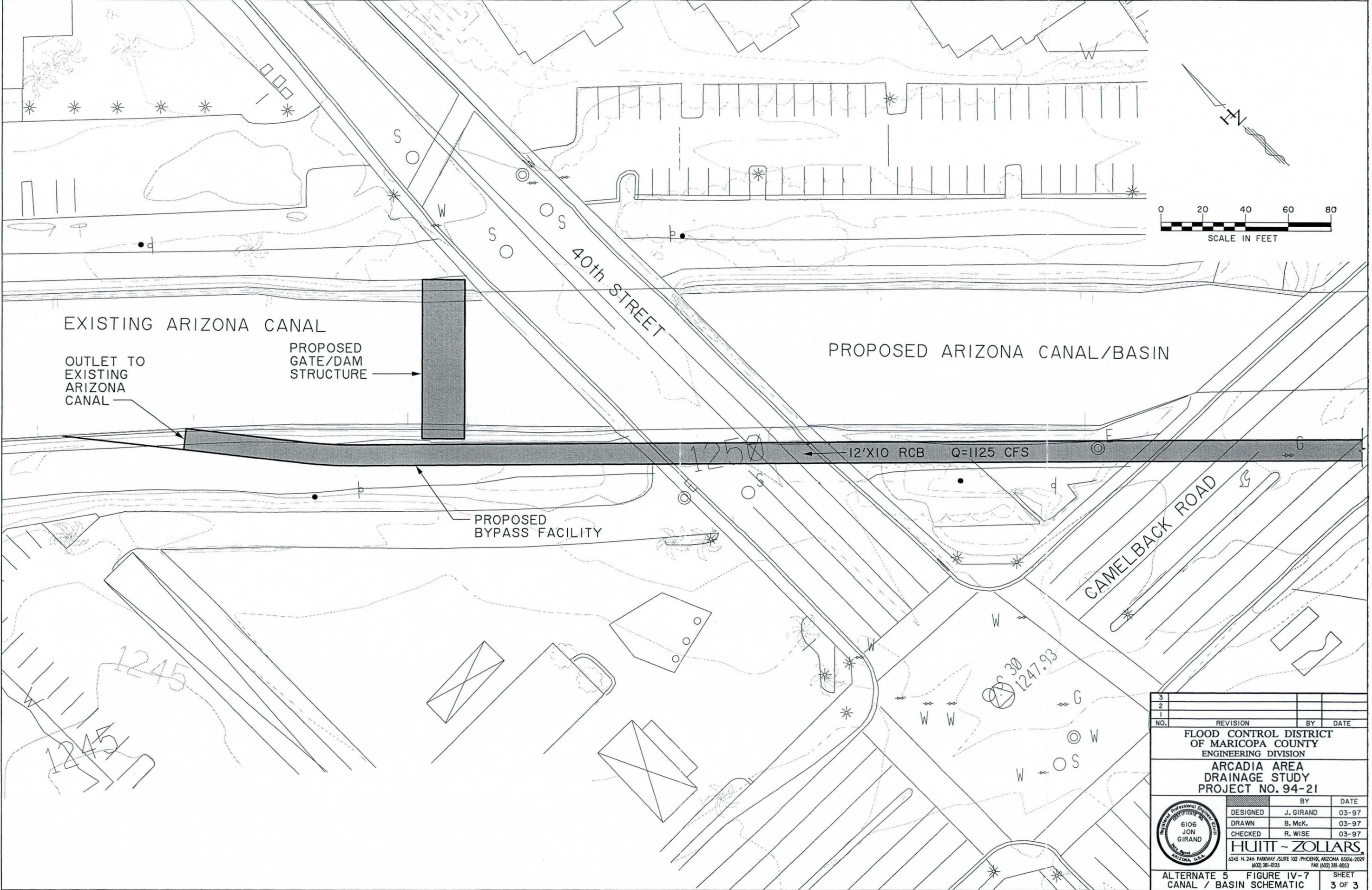
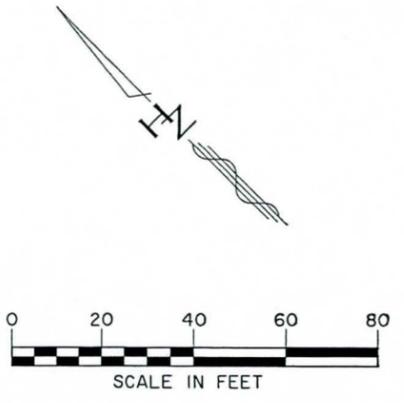
ARCADIA AREA DRAINAGE PROJECT FCD 94-21	
AZ. CANAL DETENTION BASIN	
ALTERNATE 5	FIGURE IV-6



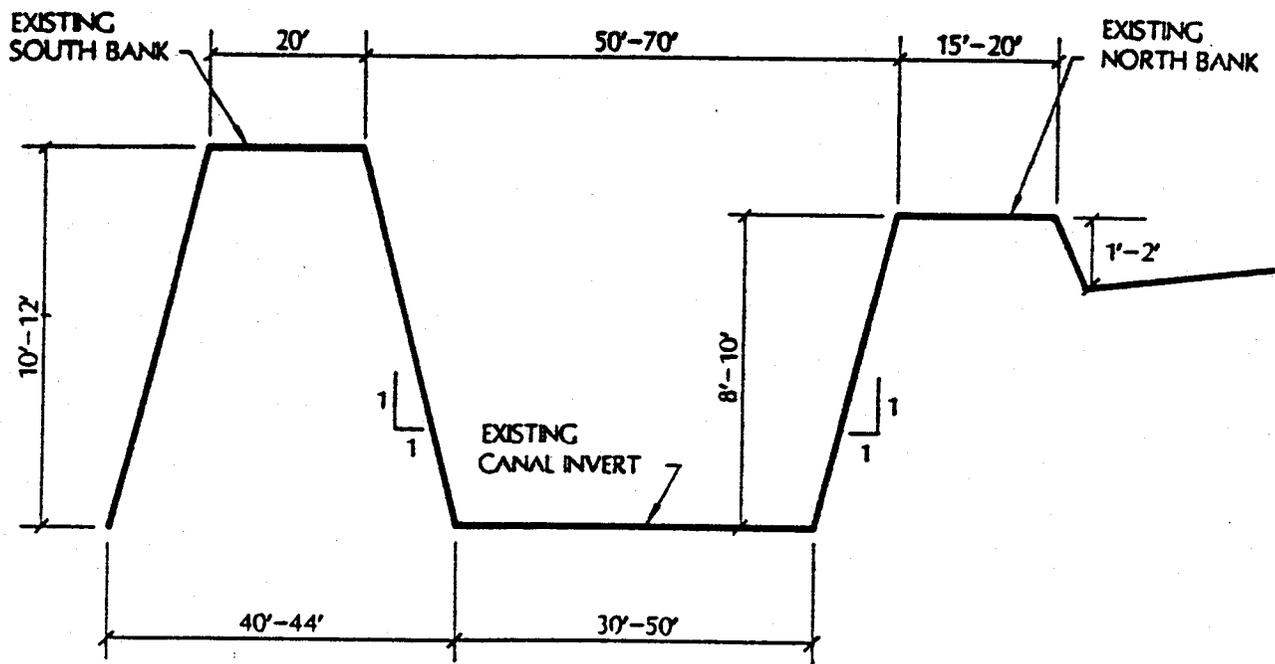
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
		BY	DATE
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85016-2029        (602) 381-0125 FAX (602) 381-8053</small>			
ALTERNATE 5		FIGURE IV-7	SHEET
CANAL / BASIN SCHEMATIC			1 OF 3



3			
2			
1			
NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY</b> <b>ENGINEERING DIVISION</b> <b>ARCADIA AREA DRAINAGE STUDY</b> <b>PROJECT NO. 94-21</b>			
		BY	DATE
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
		<b>HUIT - ZOLLARS</b> <small>6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85016-2029</small> <small>(602) 381-0125 FAX (602) 381-8053</small>	
ALTERNATE 5		FIGURE IV-7	SHEET
CANAL / BASIN SCHEMATIC			2 OF 3

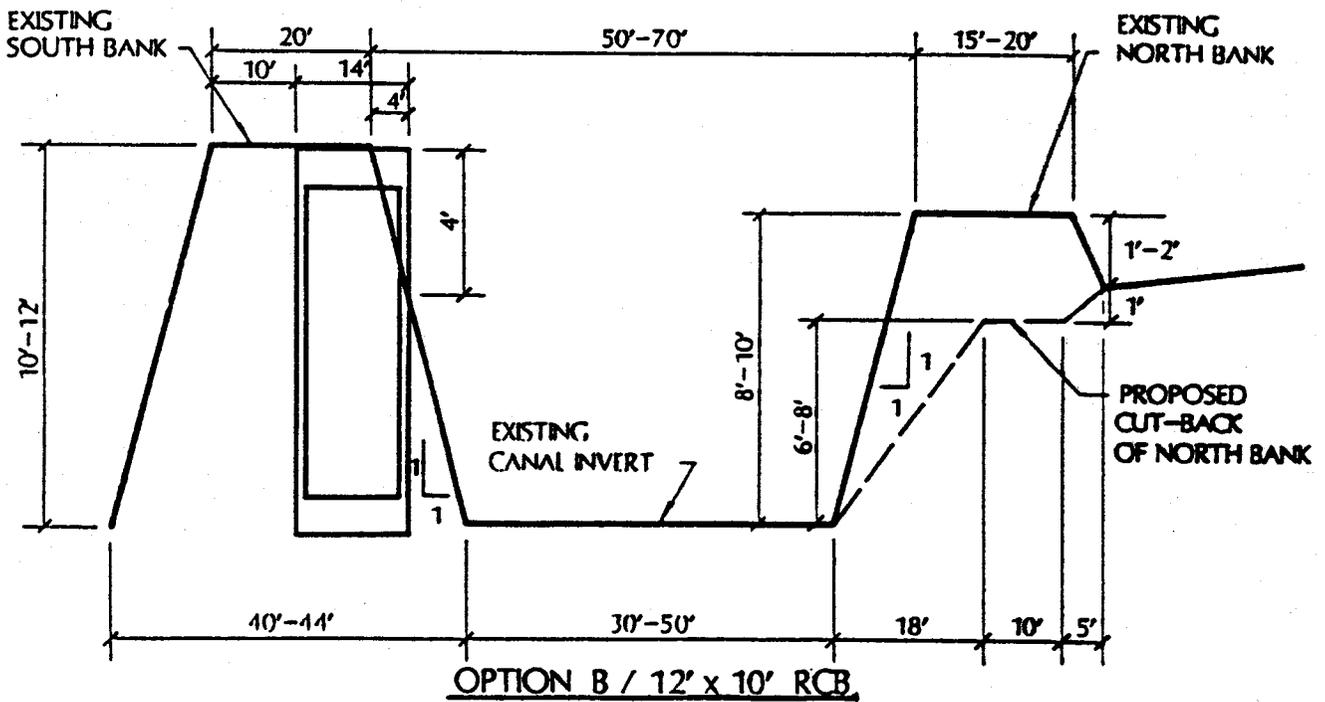
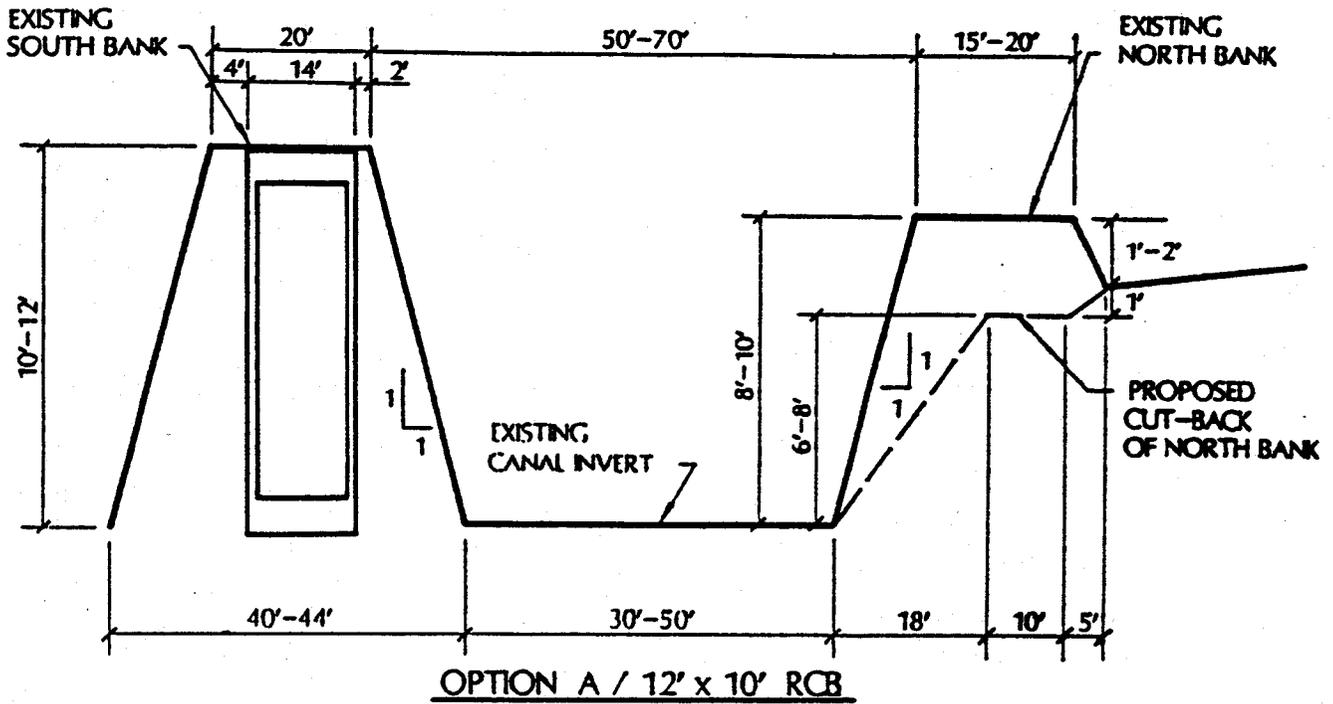


3			
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1			
NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
		BY	DATE
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85016-2029          (602) 381-0125 FAX (602) 381-8053</small>			
ALTERNATE 5 CANAL / BASIN SCHEMATIC		FIGURE IV-7	SHEET 3 OF 3



TYPICAL SECTION OF  
EXISTING ARIZONA CANAL

3			
2			
1			
NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY</b> ENGINEERING DIVISION ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21			
		BY	DATE
	DESIGNED	M. SEITS	05-96
	DRAWN	G. SCOLARO	05-96
	CHECKED	J. GIRARD	05-96
<b>HUTT-ZOLIARS</b> <small>INCORPORATED</small> <small>ENGINEERING ARCHITECTS</small> <small>AND PLANNING FIRM OF PHOENIX, ARIZONA</small>			
FIGURE IV-8			SHEET OF



**TYPICAL SECTION OF  
PROPOSED CANAL/BASIN**

3			
2			
1			
NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
	BY	DATE	
	DESIGNED	M. SEITS	05-98
	DRAWN	G. SCOLARO	05-98
	CHECKED	J. GIRARD	05-98
<b>HUTT-ZOLIARS</b> <small>INCORPORATED</small> <small>ENGINEERING ARCHITECTS</small> <small>2000 N. 24th Street, Suite 107, Phoenix, AZ 85016</small>			
FIGURE IV-9			SHEET OF

## V. EXTENSION OF OCCC CHANNEL

### A. Introduction

The existing Old Cross Cut Canal (OCCC) is an earthen ditch adjacent to 48th Street. The OCCC is owned and operated by the Salt River Project (SRP) and is used to transport water from the Arizona Canal to the Grand Canal. With the construction of the "new" Cross Cut Canal east of 64th Street, the potential use of the OCCC is significantly reduced. Coordination between the District and SRP will allow for use of an improved OCCC facility to carry storm flows in addition to the water delivery requirements.

Improvements to the OCCC have recently been designed by Greiner, Inc. (Ref. Nos. 11 and 47). These improvements include a double 10' x 10' RCB culvert extending approximately 130 feet north of the Indian School Road centerline. The ultimate design capacity of this facility is 1990 cfs north of Indian School Road. One of the objectives of the Arcadia Area Drainage Project is to extend the design north to the Arizona Canal.

Extension of this facility must accommodate discharge from both the Arizona Canal gate structure (see Figures V-1 & V-2), and the proposed SYSTEMS outlets. The design discharge of 1990 cfs would consist of up to 1000 cfs from the Arizona Canal and up to 990 cfs from the proposed SYSTEMS.

Three alternate alignment configurations were studied in the Preliminary Report. Two of the three alternates proposed an open channel configuration (optional undercrossing plans) and the other proposed an underground box culvert.

The alternate alignments and configurations for the OCCC were evaluated based on how they:

- Minimize impacts to Arcadia Drive (i.e., 48th Street);
- Accommodate SRP releases from the Arizona Canal (maximum 1000 cfs);
- Accommodate the SYSTEMS undercrossing of the Canal (discharging up to 990 cfs);

- Minimize additional right-of-ways requirements; and
- Provide maintenance access to the facility.

A concrete-lined vertical wall channel (referred to as Alternative 1 in the Preliminary Report) was selected as the recommended configuration. The channel will extend 450 LF from the proposed double 10' x 10' RCB at Indian School Road (per the Greiner Plan) north to the existing gate structure (see Appendix E). The proposed base width is 20 feet and has a height of 18-20 feet. The SYSTEM undercrossing (see Section V.B) outlets into the channel on the east side just below the OCCC gate structure. The channel base is flared to 30 feet within this section to help dissipate the energy and allow for turbulence due to the mixing flows.

The west channel wall is proposed to be extended vertically to match the existing top of slope elevation adjacent to 48th Street. This will provide the maximum separation from the roadway. The east wall is proposed as vertical to a height of 16 feet and then tapered at a 3:1 slope to existing grade. It would be feasible, however, to extend the vertical wall all the way to the top on the east side, as well, if there is a need for the excess right-of-ways.

The proposed slope of the channel is 0.017 ft/ft with the exception of the northerly most 75 feet which is increased to a slope of 0.076 ft/ft in order to join the existing gate structure spillway elevation (approximately 1235.0). Preliminary Plan and Profile sheets for the proposed OCCC exterior are contained in Appendix E.

Due to a proposed development on the east side of the OCCC, north of Indian School Road, an option to extend the double 10' x 10' RCB an additional 235 feet was included. This would provide access to the site from 48th Street as well as reduce the safety hazards associated with the open channel section. The cost of the double 10' x 10' RCB has been included in the cost estimate (as an option) as well.

**B. Arizona Canal Undercrossing**

As discussed in Section IV of this report, the proposed Alternate SYSTEMS facilities include an outlet pipe to the OCCC. The maximum facility size is a 96-inch pipe. The crossing of the canal has been proposed in previous studies to be east of the radial gate structure at 48th Street. There is an existing ramped section in the canal invert which drops 6 feet (from el. 1244.0 to el. 1238.0) at a 10:1 slope (see Figure V-1). The crossing is proposed to be located just east of this ramped section.

The canal crossing is proposed to be constructed by the open trench method per SRP's Standard Lined Canal Undercrossing and Replacement Detail (see Figure V-3). The costs for the undercrossing have been included in the alternate SYSTEMS facility cost estimates in Section IV.D and the Plan and Profile have been included with the SYSTEM alternates (see Appendix C).

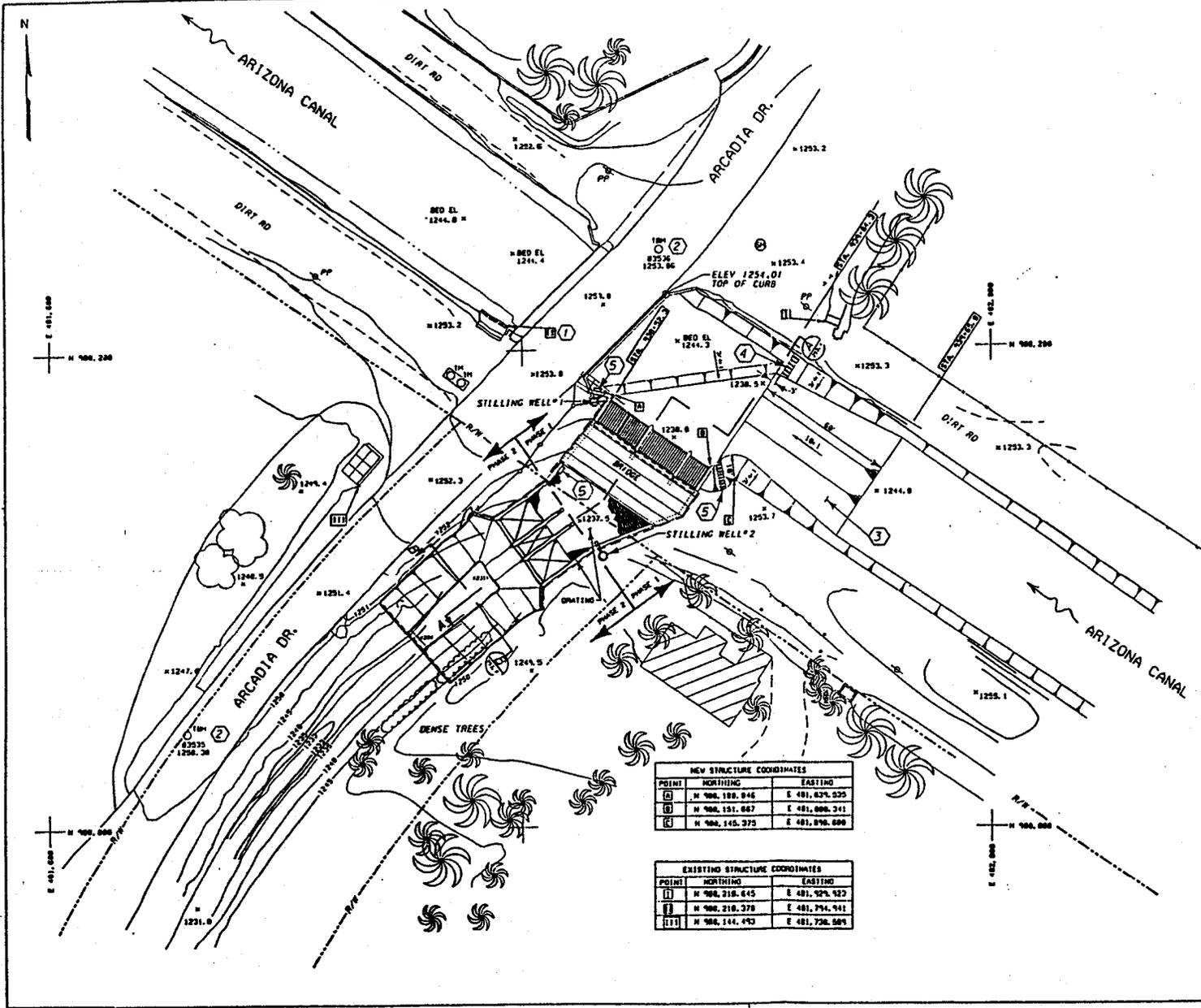
**C. Maintenance Access**

Maintenance access to the channel invert has been provided via a 15 foot wide paved ramp. The proposed ramp extends north from the channel invert (between the box headwall and the canal gate structure), up the easterly channel wall, at a slope of 10%. The ramp is proposed to join the existing Arizona Canal access road just east of the existing gate structure. Larger maintenance vehicles that could not turn around in the 20 or 30 foot channel widths would have to back up the ramp to get out. An alternate ramp alignment was considered with a south access from Indian School Road via an existing street east of the channel. A 180-degree turn-around (with a 40 foot minimum radius) would be needed to allow the maintenance vehicles to head downstream in the OCCC. This would require more right-of-ways than the north access and would also make it more difficult for the large vehicles to back up the ramp. For these reasons, the north access is recommended. If SRP restrictions preclude use of their maintenance road for access, then the alternate alignment should be reconsidered. Construction costs for the north access ramp have been included in the cost estimate (see Section V.D).

**D. Engineer's Estimate of Channel Costs**

An opinion of Probable Construction Cost (or Cost Estimate) for the OCCC channel improvements has been developed. The estimate includes line items for excavation, concrete lining, access road paving, fencing and trench protection. Trench protection is included for construction of the westerly wall of the channel (i.e., protection of Arcadia Drive) and for the westerly side of the undercrossing trench adjacent to the existing gate structure.

The probable Construction Cost for the OCCC Extension was estimated to be \$828,650. The quantities, unit costs and detailed cost estimates are contained in Appendix D.



NEW STRUCTURE COORDINATES		
POINT	NORTHING	EASTING
1	N 906, 188, 846	E 481, 629, 525
2	N 906, 151, 667	E 481, 686, 241
3	N 906, 145, 375	E 481, 876, 688

EXISTING STRUCTURE COORDINATES		
POINT	NORTHING	EASTING
1	N 906, 218, 645	E 481, 929, 132
2	N 906, 218, 378	E 481, 754, 941
3	N 906, 144, 493	E 481, 736, 589

**GENERAL NOTES**

- 1 EXISTING POINT 11 IS A BRASS CAP LAMP 4" DIA. 1400.00. CAP ELEV. 1251.61 STA. 937+96.50.
- 2 TMH IS SET FOR MARICOPA COUNTY FLOOD CONTROL DISTRICT.
- 3 FOR 4" THICK CONCRETE RAMP AND OTHER CANAL LINING REPLACEMENT WORK SEE STD. DETAILS CES-30100-006.
- 4 SAFETY STEPS PER DETAIL DWG. CES-30100-005
- 5 SAFETY LADDER PER DETAIL DWG. CES-30100-001

**REFERENCE DWG'S**

STILLING WELL DWG. \_\_\_\_\_ B-135-253.16  
 SECTIONS 'A' & 'B' \_\_\_\_\_ B-135-253.4

FEB 01 1993

SURVEY FIELD BOOK, VOLUME 77

**PHASE 2 ISSUE FOR CONSTRUCTION**

1 RT-10276/01/93 TAP KAL 1/8/93 2/4  
**PHASE 1 ISSUE FOR CONSTRUCTION**

0 RT-10276/12/92 TAP KAL - TAP CMB GMB  
 REV. NO. JOB NO. DATE DESIGN OFFICE/INCHARGE ENGINEER/SUPPLIER ISSUE DATE/ISSUED BY

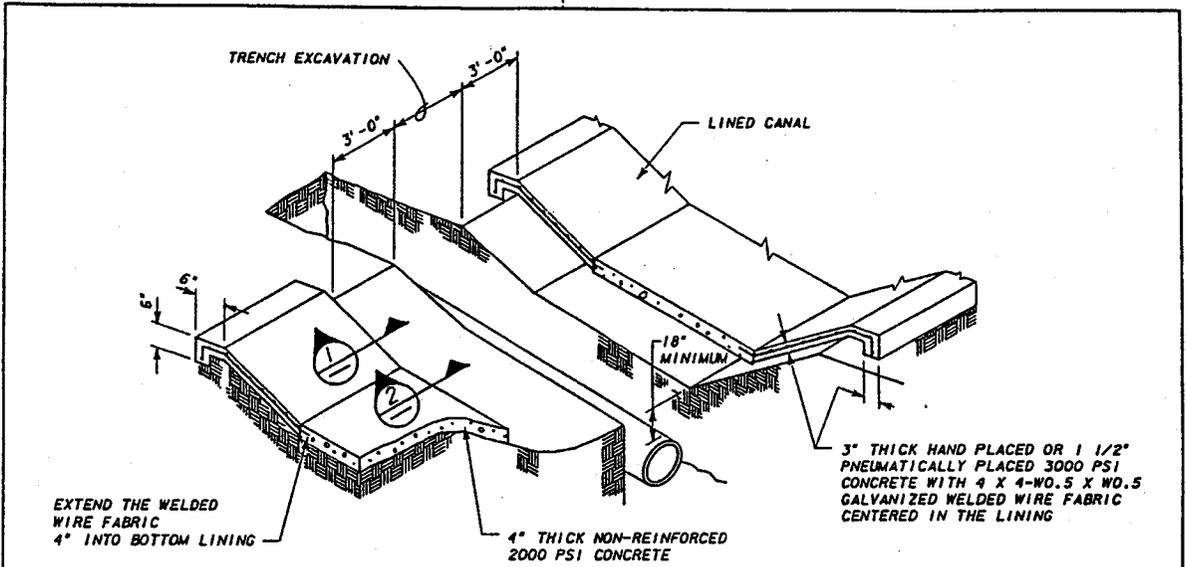
**SALT RIVER PROJECT**  
 WATER ENGINEERING PHOENIX, ARIZONA

**OLD X-CUT HEADWORKS AT ARIZONA CANAL  
 NEW SITE PLAN**

SCALE: 1" = 40' PROJECT NO. RT-10276/01/93  
 SHEET NO. 1 OF 1 DRAWING NO. B-135-253.1  
 DATE: Y-3 22X34  
 CIVIL ENGINEERING DIVISION

FIGURE V-1





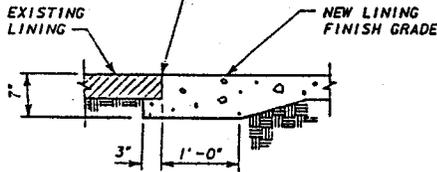
EXTEND THE WELDED WIRE FABRIC 4" INTO BOTTOM LINING

4" THICK NON-REINFORCED 2000 PSI CONCRETE

3" THICK HAND PLACED OR 1 1/2" PNEUMATICALLY PLACED 3000 PSI CONCRETE WITH 4 X 4-WO.5 X WO.5 GALVANIZED WELDED WIRE FABRIC CENTERED IN THE LINING

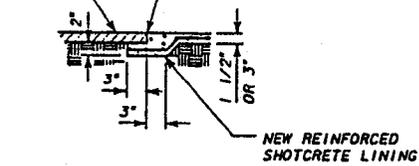
**UNDERCROSSING LINED CANAL**

SAWCUT EXISTING LINING TO A NEAT VERTICAL EDGE. REMOVE ANY LOOSE OR FOREIGN MATERIAL



**BOTTOM LINING TIE DETAIL ②**

SAWCUT EXISTING LINING TO A NEAT VERTICAL EDGE. REMOVE ANY LOOSE OR FOREIGN MATERIAL



**BANK LINING TIE DETAIL ①**

**NOTES**

1. NO MANHOLES, RISERS, OR OTHER SIMILAR FACILITIES ARE TO BE PLACED IN ANY PORTION OF CANAL RIGHT-OF-WAY WITHOUT SPECIFIC AUTHORIZATION IN AN SRP LICENSE.
2. THE TOP OF PIPE AND/OR CONCRETE ENCASUREMENT IN ANY PORTION OF THE CANAL ROAD RIGHT-OF-WAY IS TO BE A MINIMUM OF 36 INCHES BELOW THE ROAD SURFACE.
3. THE TOP OF PIPE AND/OR CONCRETE ENCASUREMENT WITHIN THE CANAL SECTION IS TO BE A MINIMUM OF 18 INCHES BELOW THE BOTTOM OF THE CANAL BOTTOM CONCRETE.
4. BACKFILL IS TO BE NATIVE MATERIAL MOISTENED AND COMPACTED IN 6 INCH LIFTS TO A MINIMUM OF 90 % OF MAXIMUM PROCTOR DENSITY (ASTM D698). WHEN NATIVE MATERIAL IS PREDOMINANTLY NON-COHESIVE, THE UPPER 2 FEET SHALL BE REPLACED WITH A SUITABLE MATERIAL APPROVED BY THE SRP ENGINEER.
5. EXISTING BANK AND BOTTOM LINING SHALL BE SAWCUT OR MECHANICALLY SCORED AND REMOVED 36 INCHES (EACH SIDE) FROM THE EDGE OF EXCAVATION TO A NEAT VERTICAL EDGE. REMOVE ANY LOOSE OR FOREIGN MATERIAL.
6. A WHITE PIGMENTED CURING COMPOUND SHALL BE APPLIED IMMEDIATELY AFTER PLACING ALL NEW CONCRETE.
7. CANAL ROADWAY SURFACES SHALL BE RESTORED TO THEIR ORIGINAL CONDITION OR BETTER.
8. DIRT AND ANY DEBRIS PLACED IN CANAL FOR ANY REASON SHALL BE COMPLETELY REMOVED UPON COMPLETION OF THE CROSSING.

DEC 2 8 1992

REFERENCES		REVISIONS							SALT RIVER PROJECT CIVIL ENGINEERING STANDARDS	
PREPARATION OF SUBGRADE FOR CANAL LINING SPECIFICATION	CE 02.490	REV NO	DATE	DFTR	CHKR	ENGR	SUPV	ISSUE	<p align="center"><b>LINED CANAL UNDERCROSSING AND REPLACEMENT DETAIL</b></p> <p>SCALE: NOT TO SCALE    P&amp;C 128, 348, 381, 888, 897, CES</p> <p>DWG SIZE: 17 X 22    <b>CES-30100-007</b></p>	
CANAL BANK REINFORCEMENT SPECIFICATION	CE 03.212	INITIAL ISSUE.								
CONCRETE MATERIALS & CONCRETE SPECIFICATION	CE 03.300	0	12/88	AK						
PLACEMENT OF CANAL BOTTOM CONCRETE SPECIFICATION	CE 03.361									
PLACEMENT OF CANAL BANK SHOTCRETE SPECIFICATION	CE 03.362									
THIS DRAWING REPLACES B-54-225										

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#### MAPPING

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CITY OF PHOENIX STORM DRAIN AS-BUILTS

	AS-BUILT #	PROJECT #	DESCRIPTION
53.	43390	ST72164.00	Arcadia Drainage Channel 56th St. to 64th St.
54.	6-92-11		Improvement Plans 64th St. & AZ Canal

55.	36928	W70141.00	Water Main AZ Canal & Jokake Dr.
56.	1006		Devel Plans Villa Arcadia Lafayette & 52nd St.
57.	16254		Improvement Plans Lafayette & Arcadia
58.	94375	M503-7(4)	Paving Plans Indian Sch. Rd. 32nd St. to 48th St.
59.	26975	P64186.00	Paving Plans 44th St. Indian Sch. to AZ Canal
60.	22587	S63208	Improvement Plans 46th Pl. & Turney
61.	101369	P87442.0	Lafayette Blvd. 50th St. to 54th St.
62.	19243		Drain Plans Lot 11 Del Ray Estates 12 Amended
63.	45670	14010	NE Corner 44th St. & Camelback Rd.
64.	88717	P76007.03	(FMS-P-769091) Camelback 40th St. to 44th St.
65.	16809	60-C-13A	Intersection Drainage Camelback Rd. & 44th St.
66.	36696		Development Plans for 4255 E. Camelback Rd.
67.	65994	P76007.00	Drainage Plans Camelback Rd. 32nd St. to 40th St.
68.	67145	ST76043.02	Drain Plans 40th St. Thomas to Camelback Rd.
69.	63937	NP7618302(ID)	Improvement District Arcadia Vista
70.	42685	P14128	Grade & Drain NW Cor Camelback Rd. & 44th St.
71.	64737	P76007.00	Camelback Rd. 32nd St. to 40th St.
72.	30038		Paving Plans NW Cor Camelback Rd. & 44th St.
73.	22757	P63111	Improvement Plans 43rd St. & Minnezona Ave.

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**APPENDIX**

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**APPENDIX A**  
**EXISTING UTILITY INVENTORY**

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**APPENDIX A  
EXISTING UTILITY INVENTORY**

The following table summarizes the major utility types and locations as determined from information (i.e., 1/4 section maps) provided by the City of Phoenix, City of Scottsdale, Cox Communication (formerly Dimension Cable), Southwest Gas, US West and SRP. Identified in the table are the street names where the utilities are located, the size and type (S = Sanitary Sewer, W = Water, SD = Storm Drain and G = Gas), whether the utility is "parallel" with the street alignment or crosses ("xing") the street (i.e., potential conflict), the general location of the utility within the street section (i.e., adjacent to the curb or centerline and on which side) and notes relative to the specific utility or location and whether the utility would need to be relocated for one of the final alternates studied.

**EXISTING UTILITY INVENTORY**

<b>ROADWAY/ALIGNMENT</b>	<b>UTILITY</b>	<b>CONFLICT</b>	<b>LOCATION</b>	<b>NOTES</b>
40TH ST.	12"S	Parallel	W'ly Curb	
	10"S	Xing	Alley S/O Colter	
	12"S	Xing	N/O Colter	
	2-8"W	Xing	S/O Colter	
	18"W	Parallel	E'ly Curb	
	18"W	Xing	N/O Canal	
	8"W	Xing	N/O Canal	
ALLEY	10"S	Parallel	Alley	
CAMELBACK RD.	8"W	Parallel	N'ly Curb	
	16"W	Parallel	N'ly Curb	
	8"W	Xing	Medlock Dr.	
	4"G	Parallel	S'ly Curb	
	2"G	Xing	E/O AZ Canal	

ROADWAY/ALIGNMENT	UTILITY	CONFLICT	LOCATION	NOTES
	2"G	Xing	41th St	
	36"SD	Parallel	C/L	
	8"S	Xing	E/O Canal	Relocate (Alts 1,2 & 3)
	8"S	Parallel	N'y Curb	
	8"S	Xing	W/O 56th Street	Relocate (Alt 2)
44TH ST.				
AZ Canal to Camelback Rd.	8"S	Parallel	E'y Curb	
	8"S	Xing	N/O Redonda	
	8"S	Xing	N/O Calle Felix	
	8"W	Parallel	E'y Curb	may be outside of st. section
	6"W	Xing	Redonda	
	6"W	Xing	Calle Felix	
	8"W	Xing	Camelback	
	16"W	Xing	Camelback	
	2"G	Parallel	E'y Curb	may be outside of st. section
	2"G	Xing	N/O Calle Felix	
	2"G	Xing	Lafayette	
	4"G	Xing	Camelback	
	36"SD	Xing	Camelback	
	36"SD	Xing	Camelback	

ROADWAY/ALIGNMENT	UTILITY	CONFLICT	LOCATION	NOTES
N/O Camelback Rd.	8"W	Parallel	W'y Curb	
	2"G	Parallel	W'y Curb	
	8"G	Parallel	E'y Curb	
	27"D	Parallel	4' W/O C/L	To 300 ft N/O Camelback
W. LAFAYETTE	8"S	Parallel	N'y Curb	46th to 44th
	8"S	Xing	E/O 44th St.	Relocate (Alts 2 & 3)
	8"S	Xing	46th St. (N)	
	8"S	Xing	47th Pl.	
	8"S	Xing	Arcadia	
	8"W	Parallel	S'y Curb	44th to Launfal
	4"W	Parallel	N/O C/L	
	6"W	Xing	45th St.	
	8"W	Xing	46th St. (N)	
	6"W	Xing	46th St. (S)	
	4"W	Xing	46th Pl.	
	6"W	Xing	Launfal	
	6"W	Xing	47th Pl.	
	8"G	Parallel	N'y Curb	
	2"G	Parallel	S'y Curb	
	2"G	Xing	Launfal	
	2"G	Xing	Dromedary	

ROADWAY/ALIGNMENT	UTILITY	CONFLICT	LOCATION	NOTES
	2"G	Xing	Arcadia	
ARCADIA DRIVE				
AZ Canal to Lafayette	8"S	Xing	N. Canal Bank	
	8"S	Parallel	W'ly Curb	
	8"S	Xing	Lafayette	
	8"W	Parallel	E'ly Curb	
	8"W	Xing	N/O Canal	
	6"W	Xing	Redonda	
	6"W	Xing	Calle Ventura	
	6"W	Xing	Tuberia	
	4"W	Xing	Lafayette	
	8"G	Parallel	E'ly Curb	
	2"G	Parallel	W/O C/L	
Lafayette to Exeter	8"S	Parallel	W'ly Curb	Ends at Calle Del Medio
	4"W	Parallel	E'ly Curb	
	8"W	Parallel	W'ly Curb	
	4"W	Xing	Calle Del Medio	
	4"W	Xing	Calle Del Medio	
	4"W	Xing	Exeter	
	2"G	Parallel	W'ly Curb	
	2"G	Xing	Exeter	

ROADWAY/ALIGNMENT	UTILITY	CONFLICT	LOCATION	NOTES
E. LAFAYETTE				
Arcadia to 56th St.	8"S	Parallel	N'y Curb	Rubicon to W/O 56th St. only
	8"S	Xing	E/O Rubicon	
	8"S	Xing	54th St.	
	8"S	Xing	E/O 54th Ct.	
	8"S	Xing	W/O 56th St.	
	6"W	Parallel	S'y Curb	
	6"W	Xing	Rubicon	
	6"W	Xing	54th St.	
	2"G	Parallel	S'y Curb	Arcadia to E/O 54th St. only
	2"G	Parallel	N'y Curb	from E/O 54th St. to 56th St.
	2"G	Xing	Rubicon	
	2"G	Xing	54th St.	
	2"G	Xing	E/O 54th St.	
56th St. to 62nd St.	8"S	Parallel	N'y Curb	
	12"S	Parallel	S/O C/L	
	8"S	Xing	57th St.	
	8"S	Xing	62nd St.	
	8"W	Parallel	N'y Curb	
	24"W	Parallel	S'y Curb	
	6"W	Xing	57th Pl.	

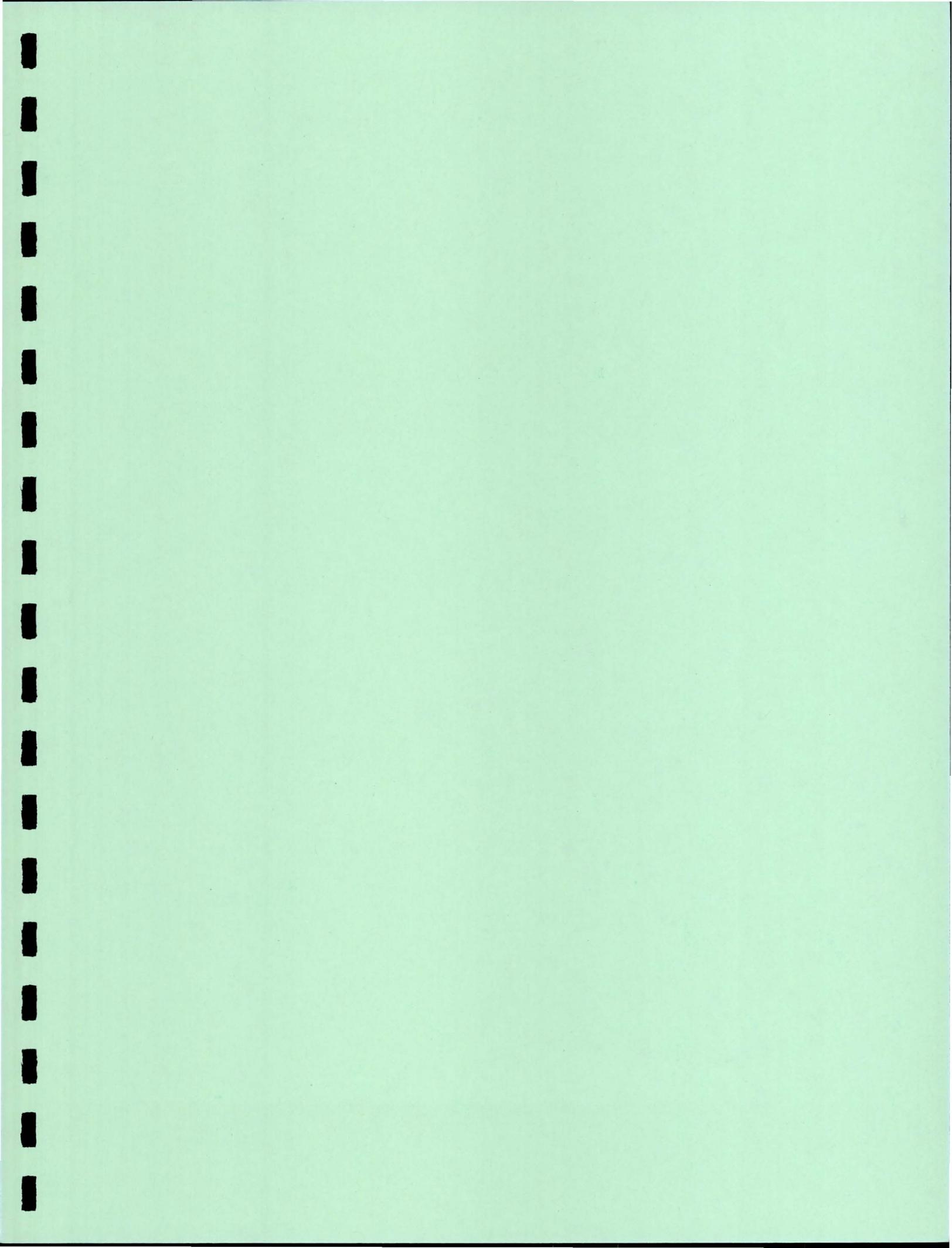
ROADWAY/ALIGNMENT	UTILITY	CONFLICT	LOCATION	NOTES
	6"W	Xing	58th St. (S)	
	12"W	Xing	60th St.	
	2"G	Parallel	N'y Curb	
	2"G	Parallel	S'y Curb	
	2"G	Xing	57th Pl.	
	1.25"G	Xing	E/O 58th St. (N)	
	2"G	Xing	E/O 58th Pl.	
	2"G	Xing	W/O 60th St.	
	4"G	Xing	60th St.	
	2"G	Xing	60th Pl.	
EXETER				
Arcadia to 56th St.	8"S	Parallel	N/O C/L	Arcadia to 51st Pl. only
	8"S	Parallel	N/O C/L	54th to 56th
	8"S	Xing	E/O Arcadia	
	8"S	Xing	Rubicon	
	8"S	Xing	54th St.	
	8"S	Xing	W/O 56th St.	
	12"W	Parallel	N'y Curb	
	4"W	Parallel	S/O C/L	Arcadia to 54th St. only
	6"W	Parallel	S/O C/L	54th to 56th
	6"W	Xing	54th St.	
	24"W	Xing	56th St.	

ROADWAY/ALIGNMENT	UTILITY	CONFLICT	LOCATION	NOTES
	2"G	Parallel	S'y Curb	Arcadia to 54th St. only
	2"G	Parallel	N'y Curb	54th to 56th
	2"G	Xing	51st Pl.	
	2"G	Xing	54th St.	
56th to 62nd St.	8"S	Parallel	N'y Curb	
	8"S	Xing	57th Pl.	
	8"S	Xing	58th St.	
	8"S	Xing	61st St.	
	8"S	Xing	E/O 61st St.	
	12"W	Parallel	N'y Curb	
	4"W	Parallel	S'y Curb	
	6"W	Xing	57th Way	
	12"W	Xing	60th St.	
	12"W	Xing	62nd St.	
	2"G	Parallel	N'y Curb	
	2"G	Xing	60th St.	
	2"G	Xing	Paradise Way	
56TH ST.	12"S	Parallel	E/O C/L	
	10"S	Parallel	E'y Curb	Calle Ventura to Calle Del Paisano
	8"S	Xing	N/O Canal	
	8"S	Xing	S/O Calle Del Paisano	

ROADWAY/ALIGNMENT	UTILITY	CONFLICT	LOCATION	NOTES
	10"S	Xing	N/O Calle Del Paisano	
	6"W	Parallel	Wly Curb	
	6"W	Xing	Calle Camelia	
	6"W	Xing	Calle Del Paisano	
	3"W	Xing	Calle Tuberia	
	24"W	Xing	Lafayette	
	2"G	Parallel	Easterly Curb	
	2"G	Xing	Calle Ventura	
	1.25"G	Xing	Calle Del Paisano	
	1.25"G	Xing	Calle Tuberia	
N. CANAL BANK				
Cudia City Wash Basin to 40th St.	12"S	Xing	40th St.	
40th St. to 44th St.	8"S	Parallel	SRP R/W	E/O Camelback Castille Condos
	8"S	Xing	E/O Camelback Castille Condos	
	8"W	Parallel	SRP R/W	40th St. to Camelback Rd.
	16"W	Parallel	SRP R/W	40th St. to Camelback Rd.
	8"W	Xing	Camelback Rd.	
	16"W	Xing	Camelback Rd.	

ROADWAY/ALIGNMENT	UTILITY	CONFLICT	LOCATION	NOTES
	36"SD	Xing	Camelback Rd.	
	36"SD	Xing	E/O Camelback Castille Condos	
44th St. to Arcadia	8"S	Parallel	SRP R/W	
	8"S	Xing	44th St.	
	8"W	Xing	Arcadia	
	2"G	Xing	44th St.	
Arcadia to 56th St.	8"S	Parallel	SRP R/W	
	8"S	Xing	E/O Arcadia	
	8"S	Xing	W/O 52nd St.	
INDIAN SCHOOL ROAD				
	2.5"G	Parallel	N'ly Curb	
	8"SS	Xing	E/O 48th Street	
	12"W	Parallel	S'ly Curb	
	8"W	Parallel	S'ly Curb	
	8"SS	Xing	W/O 56th Street	
64TH STREET				
	8" SS	Xing	W'ly Curb	
	10" SS	Parallel	C/L	

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**APPENDIX B  
PUBLIC MEETINGS**

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# FLOOD CONTROL DISTRICT

of

## Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009

Telephone (602) 506-1501

Fax (602) 506-4601

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### BOARD OF DIRECTORS

Betsey Bayless

Ed King

Tom Rawles

Don Stapley

Mary Rose Garrido Wilcox

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### ARCADIA AREA DRAINAGE PROJECT PUBLIC MEETING OF NOVEMBER 9, 1995 MEETING SUMMARY NOVEMBER 21, 1995

The subject public meeting occurred at the Arcadia High School on East Indian School Road. The meeting agenda and the sign-in sheet is attached for information.

An informal "open house" was held from 6:00 pm until about 6:20 pm, which provided the public an opportunity to view various display boards showing proposed drainage alternatives. The formal presentation began at about 6:20 pm. The meeting was conducted by Jim Phipps of the District, with participation from the City of Phoenix, and from the project consultant Huitt-Zollars.

Approximately 45 residents attended the meeting. There were 9 District, City, and consultant staff in attendance, some of whom participated in the actual meeting presentation. A video tape of the meeting was made by the District.

A summary of the meeting follows.

#### **Introduction by Jim Phipps, District P.I.O. -**

Explanation of what the project is about, and that the District was invited to undertake this project study at the request of the City. This is the second public meeting, the first having been held in April 1994. Introduction of participants.

#### **Remarks by Ray Acuna, City Project Manager -**

Explanation of the project and why the City invited the District to undertake this study project.

#### **Overview of the project by Don Rerick, District Project Manager -**

Provided an over-view of the project, history of the project, the difficulties to be dealt with in developing drainage alternatives, and an explanation of the consultant tasks. Mentioned the need to look at the FEMA floodplain problem and what might be done to alleviate the problem. It was emphasized that some of the solution components to resolve the floodplain issue may not be acceptable to the citizens; such as large detention basins.

**Presentation of the study drainage alternatives by Jon Girand and Mark Seits of Huitt-Zollars -**

A slide presentation format. Jon explained the existing conditions, hurdles, and other obstacles that must be dealt with to address drainage problems in the Arcadia area, and to develop drainage improvement alternatives. Mark presented the specific components of the various drainage alternatives that have been developed. Components specifically to address the floodplain issue were more strongly emphasized.

The slide presentation was completed about 7:10 pm.

**Questions and answers conducted by Jim Phipps -**

The following are examples of the type and kind of questions asked by the citizens.

Q (Victor Conti) -

Why not locate storm drains closer to the Arizona Canal rather than farther north?

A - Storm drains can be located in any number of locations. The farther north, the less protection from the remaining runoff south of the storm drain.

Q (John Phipps) -

Why not utilize the Arizona Canal as part of any flood control system?

A - SRP operates the canals for water delivery and not flood control. SRP is working closely with the District and the City in the project providing whatever assistance they can, and allowing the project to include elements within SRP rights-of-way wherever possible.

Q (Dick Weston) -

What is the estimated size and lining type for any channels along the Arizona Canal?

A - 10 to 15 feet wide and 3 to 4 feet deep, and concrete lined.

Citizen comment (made by many in attendance) -

"We don't want any open ~~channels~~ channels along the canal".

Q (Thor Anderson) -

What is the basis of hydrology for the project?

A - The study looked at 10, 25, 50, and 100-year storms over the Arcadia watershed.

Citizen comment (Bruce Suppes) -

"Why not place storm drains under the Arizona Canal".

Citizen comment (Katie Westerlund) -

"Extend the Arcadia Channel to the west.

Citizen comment (Lee Moy) -

"Have never been flooded since the IBW was completed, why not just get rid of the floodplain designation".

Citizen comment (John Phipps) -

Do not take property (right-of-way) from home along the Arizona Canal for channels.

Q (John Phipps) -

Who pushed this project?

A - The City invited the District to undertake the project. This request is a result of the numerous citizen requests and complaints to do something about the drainage problems in Arcadia area.

Q (Shirley ?) -

Why not just construct a storm drain all the way to the Salt River rather than have to construct basins in the Arcadia area?

A - This would be cost prohibitive, but we will attempt to provide some costs comparisons.

Q (Joel Schmitz) -

Would the existing storm drain pipes into the Arizona Canal be plugged as part of the project?

A - Some of the existing storm drains would be plugged if the runoff they capture can be collected by a new storm drain facility as part of the project. Otherwise, they would probably be left in place.

Citizen comment -

Regarding SRP's role in local flooding problems and why they cannot be held accountable.

A - The canal and the associated ponding problems were in existence long before any homes were built. SRP canals are for water delivery, and are not used for flood control purposes. Joe Rauch of SRP provided additional explanation of SRP's canal operations, etc.

Q (Michael Pickard) -

Will storm drains be constructed within existing street right-of-way or in private improvements behind the curb?

A - Storm drains would be constructed within the limits of existing streets and/or alleys, and not behind curbs.

**Closing remarks by Jim Phipps -**

Explained the next step in the study process, and that another public meeting will be held in the next 6 to 7 months to present the final recommended alternatives. These alternatives will take into consideration the input received from the public at this meeting. The project prioritization process and funding of projects was explained.

The meeting was formally concluded at about 8:00 pm.

A number of citizens remained after the formal meeting until about 8:45 pm to view the displays and ask additional questions of District, City, and consultant staff.

Questionnaires were provided to all in attendance, and the public was encouraged to complete and return them before they left the meeting. The citizens were also asked to take questionnaires with them and pass them out to any interested neighbor, having them fill them out and mail them back to the District.

Arcadia Area Drainage Project Study  
November 9, 1995 Public Meeting

SIGN-IN SHEET

NAME	ADDRESS	PHONE
Marie Carter	4102 E. Calle Redonda	952-2809
Leland L. Moy	6047 E. Calle Camelia	947-2677
Dick Weston	4501 E. Calle Tuberia	840-7425
Paul Barnes	5518 East Mariposa	840-1579
Richard Fogarty	4101 E. Camelback Rd.	833-5604
Fran Dallimore	4818 E. Calle Redonda	990-2741
Katie Westlund	5304 E. Calle Redonda	840-5633
<del>DAVID WOODY</del>	4114 E. CALLE REDONDA 47	952 2131
JAMES BARR	4463 CALLE DEL NORTE	840-2120
Mike Phalen	4611 E. Calle Tuberia	952-8471
Russ Swzes	4643 E. Calle El Medio	952-8457
Lisa Davis	4131 E. Camelback #37	8520733
Ginnie Ann Sumner	4739 E. Lewis	840-3881
Charlotte Zek Benson	4114 E. Calle Redonda #50	952 15 25
BRUCE E. JUPPER	5601 E. CALLE CAMELIA AX	9450665
Chris Stevens	4114 E. CALLE Redondo #51 (mail: 3111 E. Minnesota Ave 85216)	956-5482
Richard Stauneak	4571 E. Calle Redonda	542-5491
MICHAEL HIGGINS	6044 E. CALLE CAMELIA	990-8897
GLADYS LARSEN	4132 E. Calle Redondo	840-3142
GLADYS RUTT	4553 E. Palovina	240-3460
Victor A. Conti	5749 E. Calle La Reina	990-1286



FLOOD CONTROL DISTRICT of Maricopa County  
2801 West Durango Street  
Phoenix, Arizona 85009  
Telephone: 506-1501/FAX: 506-4601

### ***Questionnaire for Arcadia Area Drainage Project Study***

Public input and support will be crucial to the success of any drainage improvement project developed for the Arcadia area. Your opinions about the drainage problems and preferences for resolving them are important to us. Please take a few minutes to answer the questions below. **Thank you!**

- (1) Have you experienced flooding in Arcadia area streets or on your property? **Yes 20 No 8**
- (2) Has stormwater ever entered your home? **Yes 9 No 19**
- (3) Do you pay flood insurance? **Yes 16 No 12**
- (4) Do you believe drainage improvements are needed within the Arcadia area? **Yes 21 No 3**
- (5) Would you be willing to experience some short-term, temporary inconvenience so that storm drains could be constructed within the local streets? **Yes 27 No 0**
- (6) Would you object to the construction of small collector channels and/or swales within alleys and/or along the north side of the Arizona Canal? **Yes 5 No 19**
- (7) Would you object to the construction of a detention basin(s) within the Arcadia area to reduce and possibly eliminate the existing 100-year floodplain? **Yes 6 No 21** (NOTE: Even if such basins would require the purchase and removal of homes? **Yes 11 No 14**)
- (8)
- (9) Would you object to a detention basin which would function as a multi-purpose facility, i.e., as a park? **Yes 3 No 25**
- (10) Would you object to the construction of small detention basins (less than 3 feet deep) in the Phoenix Mountain Preserve? **Yes 4 No 22**
- (11) Would you object to short-term, temporary inconvenience for the construction of storm drain facilities to improve drainage conditions within the Arcadia area, even if such improvements do not directly benefit you? **Yes 2 No 25**
- (12) Would any of the improvement options presented be beneficial to you or your neighborhood? **Yes 19 No 4** (Do you have a preferred option? If so, please write your option on the line below:

ACDC Area \_\_\_\_\_ West Arcadia Area \_\_\_\_\_

Central Arcadia Area \_\_\_\_\_ East Arcadia Area \_\_\_\_\_

What suggestions for other drainage improvements would you like us to consider? (respond on back)

What benefits from the drainage improvements would you like to see? (respond on back of survey)

Name: \_\_\_\_\_ Phone: \_\_\_\_\_  
Address: \_\_\_\_\_ Zip Code \_\_\_\_\_

Questionnaire  
Arcadia Area Drainage Project Study  
Project Manager - D. Rerick

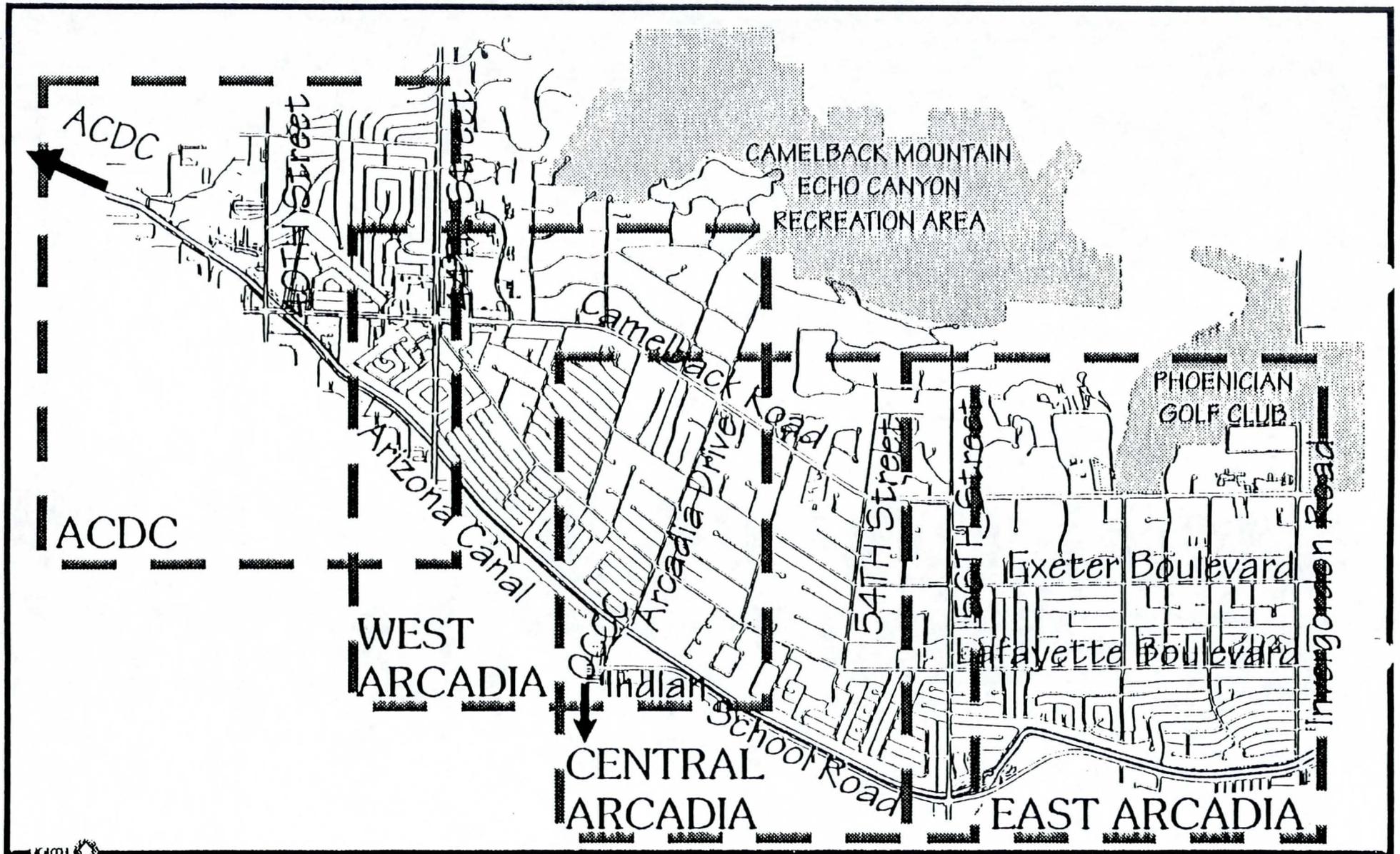
QUESTION	ACDC		WEST		CENTRAL		EAST		CASTILLE		TOTAL	TOTAL
	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO
1		1	4	4		1	4	2	11		19	8
2		1	2	6		1	1	5	6	5	9	18
3		1		8	1		3	3	11		15	12
4		1	5	1	1		4	1	10		20	3
5			8		1		6		11		26	
6	1		1	5		1	1	5	2	8	5	19
7		1	2	6		1	2	4	1	9	5	21
8		1	6	2		1	2	3	2	7	10	14
9		1	2	6		1	1	5		11	3	24
10		1	2	5		1	1	5	1	9	4	21
11			1	7		1	1	5		11	2	24
12		1	6	1	1		2	2	10		19	4
Responses	27	1	8	1	6	11						

All Options

OPTIONS	A	B	C	D	E	F	G
ACDC	1				1		
CASTILLE/ACDC	2	2		2	1		
WEST	1	1	2	2	2		
CENTRAL	2						1
EAST	1	1	1		1		

Option in Respondants Area

OPTIONS	A	B	C	D	E	F	G
ACDC							
CASTILLE/ACDC	2	2		2	1		
WEST		1	2	2	2		
CENTRAL							
EAST		1	1		1		



**DRAINAGE SYSTEM AREAS**  
**ARCADIA AREA PROJECT STUDY**

**HUITT-ZOLIARS**  
 \* Engineering/Architecture



# ARCADIA AREA DRAINAGE PROJECT STUDY PUBLIC MEETING

*NOVEMBER 9, 1995*

## AGENDA

- I. INTRODUCTION - Jim Phipps, Flood Control District
- II. REMARKS - Ray Acuna, City of Phoenix
- III. OVERVIEW OF PROJECT STUDY - Don Rerick, Flood Control District
- IV. PRESENTATION OF STORM DRAIN AND OTHER PROJECT ALTERNATIVES -  
Jon Girand and Mark Seits, Huitt-Zollars, Inc.
- V. QUESTIONS AND ANSWERS  
» Please give your name and address before asking your question «
- VI. SUMMARY REMARKS - Jim Phipps

---

**NOTE:** Please take the time to fill out the questionnaire and return it to the District tonight, or mail it to the District at your earliest convenience.

***THANK YOU FOR YOUR PARTICIPATION!!!***



**City of Phoenix**



FLOOD CONTROL DISTRICT of Maricopa County  
 2801 West Durango Street  
 Phoenix, Arizona 85009  
 Telephone: 506-1501/FAX: 506-4601



City of Phoenix

**Questionnaire for Arcadia Area Drainage Project Study**

Public input and support will be crucial to the success of any drainage improvement project developed for the Arcadia area. Your opinions about the drainage problems and preferences for resolving them are important to us. Please take a few minutes to answer the questions below. Thank you!

Have you experienced flooding in Arcadia area streets or on your property? Yes\_\_\_\_ No\_\_\_\_

Has stormwater ever entered your home? Yes\_\_\_\_ No\_\_\_\_

Do you pay flood insurance? Yes\_\_\_\_ No\_\_\_\_

Do you believe drainage improvements are needed within the Arcadia area? Yes\_\_\_\_ No\_\_\_\_

Would you be willing to experience some short-term, temporary inconvenience so that storm drains could be constructed within the local streets? Yes\_\_\_\_ No\_\_\_\_

Would you object to the construction of small collector channels and/or swales within alleys and/or along the north side of the Arizona Canal? Yes\_\_\_\_ No\_\_\_\_

Would you object to the construction of a detention basin(s) within the Arcadia area to reduce and possibly eliminate the existing 100-year floodplain? Yes\_\_\_\_ No\_\_\_\_ (NOTE: Even if such basins would require the purchase and removal of homes? Yes\_\_\_\_ No\_\_\_\_)

Would you object to a detention basin which would function as a multi-purpose facility, i.e., as a park? Yes\_\_\_\_ No\_\_\_\_

Would you object to the construction of small detention basins (less than 3 feet deep) in the Phoenix Mountain Preserve? Yes\_\_\_\_ No\_\_\_\_

Would you object to short-term, temporary inconvenience for the construction of storm drain facilities to improve drainage conditions within the Arcadia area, even if such improvements do not directly benefit you? Yes\_\_\_\_ No\_\_\_\_

Would any of the improvement options presented be beneficial to you or your neighborhood? Yes\_\_\_\_ No\_\_\_\_ (Do you have a preferred option? If so, please write your option on the line below:

ACDC Area \_\_\_\_\_ West Arcadia Area \_\_\_\_\_

Central Arcadia Area \_\_\_\_\_ East Arcadia Area \_\_\_\_\_

What suggestions for other drainage improvements would you like us to consider? (respond on back)

What benefits from the drainage improvements would you like to see? (respond on back of survey)

Name: \_\_\_\_\_ Phone: \_\_\_\_\_

Address: \_\_\_\_\_ Zip Code \_\_\_\_\_



Flood Control District of Maricopa County  
2801 West Durango Street  
Phoenix, Arizona 85009  
(602) 506-1501  
(602) 506-4601 (FAX)

# FACT SHEET

## Arcadia Area Drainage Project Study

### Background

The Flood Control District of Maricopa County and the City of Phoenix have been studying ways to address drainage problems in the Arcadia area north of the Arizona Canal between 40th and 64th Streets. The engineering consulting firm of Huitt-Zollars, Inc., has been on contract with the District since November, 1994, and has surveyed drainage and flooding problems in the study area and developed various drainage system alternatives to address these problems. These alternatives include improvements such as storm drains, drainage channels and detention basins which intercept stormwater runoff before it can flood homes and property.

### The Problem

There is no existing storm drainage system in the Arcadia area and no outlet for stormwater runoff which flows primarily from Camelback Mountain south to the Arizona Canal. Stormwater runoff flows down streets and across property. On occasion, major flooding occurs, as experienced in June, 1972. Numerous homes along the north side of the Arizona Canal are located within a 100-year floodplain associated with ponding areas. Residents within the floodplain are required to pay flood insurance if their mortgages are federally secured.

### Major Engineering Challenges

The type of drainage system required to eliminate the existing 100-year floodplain along the north side of the Arizona Canal would necessitate the construction of a large storm drain system and a large detention basin(s) within the Arcadia area. To make room for the basin(s), some homes and property would need to be acquired. An alternative would be to construct smaller drainage systems that will alleviate flooding from smaller, more frequent storm events, but such systems would not eliminate the 100-year floodplain. These smaller systems could be constructed within existing street right-of-way and would involve storm drains, small collector channels and/or swales and possibly small basins.

### Current Status

Residents of the Arcadia area are being asked to comment on the various drainage system alternatives developed by the engineering consultant. The comments will be used to refine and complete a "Recommendations Report" to include those alternatives which have merit and public support. The District and City of Phoenix will evaluate the recommended alternatives for consideration as design and construction projects. Selected projects will be prioritized along with all other District projects and included in the budget process with an ultimate goal of construction.

**ARCADIA AREA DRAINAGE STUDY  
"QUESTIONNAIRE RESULTS"  
THIRD PUBLIC MEETING**

On September 12, 1996 the District held a Public Meeting to present the final results of the Arcadia Area Drainage Study project. At the meeting questionnaires, a sample of which is included with this summary, were provided to the citizens in order to obtain their input. Each citizen was encouraged to take extra copies of the questionnaire and pass them out to their neighbors who could not attend.

As of the preparation of this summary the District had received 22 completed questionnaires. Because of the manner in which many of the questionnaires were filled out, the total numbers of tallied responses does not equal the total numbers of questionnaires received.

In addition to the questionnaires, some citizens, as well as some organized groups, felt it necessary to respond in writing to the five recommended alternatives. These written responses focused primarily on Alternatives 4 and 5, with most attention given to Alternative 5. Copies of these written responses are included with this summary as letters from - Arcadia/Camelback Mountain Homeowners Association, The Metropolitan Canal Alliance, the Sierra Club - Grand Canyon Chapter, and one private citizen.

A tabulation of the questionnaire results is as follows:

The first question of the questionnaire asks -

"..., then rank the alternative(s) that you feel are best, with 1 being your top choice."

Not all questionnaires included responses to this question using numbers to rank their choices. Rather, some citizens used the second question as a means of "ranking" their preferred alternative(s).

Ranking	1	2	3	4	5	6	Total
Alternative No. 1	2	1	5 *		1		9
Alternative No. 2	10 * **	1	2				13
Alternative No. 3	2	6 *		2			10
Alternative No. 4				1	2 *	4 **	7
Alternative No. 5			1	3 *	2	1 **	7
"Do Nothing"	3	1		2	1	2	9
<b>Total</b>	17	9	8	8	6	7	55

NOTE: The responses of one questionnaire denoted by the asterisk (\*) represents the 88 homeowners of the Camelback Castille Condominium complex at 40th Street and Camelback Road. The responses, denoted by the double asterisk (\*\*), of the Arcadia Camelback Mountain Homeowners Association to the questionnaire were provided to the District in a letter rather than by use of the questionnaire. The homeowners association represents about 1,200 households in the Arcadia area.

The second question of the questionnaire asks -

“... provide your opinion of the timing for the construction of the alternative(s) you have selected.”

Many responses to this question did not correlate to the responses in the first question. Generally the responses to this question included more alternative choices than were ranked in the first question.

<b>Timing</b>	<b>“ASAP”</b>	<b>“Any Time”</b>	<b>“Not Needed”</b>	<b>Total</b>
<b>Alternative No. 1</b>	10 *	1	3	14
<b>Alternative No. 2</b>	14 * **	2	3	19
<b>Alternative No. 3</b>	9 *	1	5	15
<b>Alternative No. 4</b>	1		15 **	16
<b>Alternative No. 5</b>	1	1 *	14 **	16
<b>Total</b>	35	5	40	80

NOTE: The responses of one questionnaire denoted by the asterisk (\*) represents the 88 homeowners of the Camelback Castille Condominium complex at 40th Street and Camelback Road. The responses, denoted by the double asterisk (\*\*), of the Arcadia Camelback Mountain Homeowners Association to the questionnaire were provided to the District in a letter rather than by use of the questionnaire. The homeowners association represents about 1,200 households in the Arcadia area.



# SIERRA CLUB

## Grand Canyon Chapter · Arizona

Palo Verde Group  
516 E. Portland  
Phx., Az. 85004

Perry Baker  
Flood Control District  
2801 W. Durango  
Phx., Az. 85009

Sept. 30, 1996

Regarding: Arcadia Flood Control Alternatives

Dear Mr. Baker,

We have reviewed your agency's proposed alternatives to remedy flooding in the Arcadia area in east Phoenix and would like to offer the following comments. We are interested in your proposals as the Sun Circle Hiking Trail parallels the Arizona Canal. Our organization also provided extensive comment for the Reach IV Arizona Canal Diversion Channel project downstream of the Arcadia area.

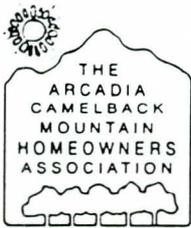
Of particular concern to us is your proposed alternative that would run the canal waters into an underground pipe from 68th street west to 44th street and create a detention basin above the pipe to receive flood waters. We are concerned that such a project would detract from the high recreational values the canal banks now provide and would negatively affect the aesthetics of the area. No mention is made in the description of this alternative of landscaping the detention basin to accommodate recreation or to perhaps provide wildlife habitat as was done with the Reach IV ACDC. Our assumption is that no money is thought to be available for such restoration efforts.

Unless some proposals are offered in that would include high recreational and / or wildlife values, we recommend that one of your other, less expensive alternatives, such as storm drains emptying into the ACDC, be given first consideration. Our canals are considered by many to be among our valley's finest amenities. Lets thoroughly explore all other options before destroying this asset.

yours,

A handwritten signature in cursive script, appearing to read "Don Steuter".

Don Steuter  
conservation chair  
956-5057



Arcadia/Camelback Mountain Homeowners Association  
4730 E. Indian School Road, Suite 120 • Phoenix, Arizona 85018

October 10, 1996

Richard M. Spiegel  
*President*

B. Paul Barnes  
*Vice-President*

Joan Warne  
*Recording Secretary*

Craig Steblay  
*Corresponding Secretary*

Dwayne Lewis  
*Treasurer*

**Board of Directors**

Karen Applewhite  
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David Dodge  
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Michael Phalen  
Peter Reinstein  
Anne Salzman  
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Susan Van Sickle

**Past Presidents**

David Dodge  
Michael Phalen  
Tom Smith  
Garrit Steenblik

Perry Baker  
Flood Control District  
Maricopa County  
2801 W. Durango  
Phoenix, AZ 85009

Dear Mr. Baker,

Thank-you for attending our Board meeting last week, and for the presentation by you and the Flood Control staff concerning the alternatives proposed to alleviate the drainage problems in the Arcadia area. As you are well aware, our association has been eager, for some time, to find a way to eliminate the existing 100 year floodplain on the north side of the Arizona Canal.

The Board of Directors emphatically feels, however, that alternatives 4 and 5 to accomplish this are not only prohibitively expensive, but represent a cure worse than the ill. We urge any consideration of these measures to be abandoned completely.

The Board, on the other hand, feels that alternative #2, concerning a storm drain system primarily along Camelback and Lafayette, represents a reasonable and appropriate response to the more regular drainage problems, and strongly endorses this alternative. Alternative #1 is an inadequate answer to the situation, and alternative #3 not only seems less efficiently designed, but also much more disruptive of the community, particularly in view of the City of Phoenix's plans to redo Camelback Road in the near future.

We look forward for your advice on how we can best get the funds to implement alternative #2 prioritized by our City and County, and, also, how we can get the floodplain reevaluated once the drains are emplaced, to potentially deminish, at least, its area.

Sincerely,

Richard M. Spiegel, M.D.  
President  
Arcadia/Camelback Mtn. H.A.



METROPOLITAN  
**CANAL**  
ALLIANCE

FLOOD CONTROL DISTRICT	
RECEIVED	
SEP 19 1996	
	P & PM
	REG
	LMGT
	FILE
REMARKS	

September 19, 1996

Mr. Perry Baker  
Maricopa Flood Control District  
2801 W. Durango  
Phoenix, Arizona 85009

Dear Mr. Baker:

This letter is written in response to the Arcadia Area Drainage Study Questionnaire distributed at the public meeting on September 12th at Arcadia High School by the Maricopa County Flood Control District and the City of Phoenix.

The Metropolitan Canal Alliance strongly opposes Alternative No. 5 -- undergrounding the waters of the Arizona Canal from 40th Street to 56th Street so the emptied space functions as a flood detention basin -- because:

1. It burdens the entire County with a costly project of questionable community value;
2. It is inconsistent with the City of Phoenix's stated policy of canal area preservation and enhancement;
3. It is inconsistent with the City of Phoenix's Planning Department's Design Guidelines for the Canal Area and the Zoning Ordinance currently being drafted by a citizen's committee under its guidance. Both the Guidelines and the proposed Ordinance discourage the destruction of visual and physical accessibility to the canal;
4. It destroys an historic engineering structure that reminds us of how and why we are able to live in the desert as comfortably as we do, also noted by the Bureau of Reclamation as eligible for listing on the National Historic Register;
5. It renders worthless the \$42,000 invested by the Phoenix Arts Commission to begin improvement of the Arizona Falls at 56th Street and the Arizona Canal, the Arizona Falls was the second of five sites selected for canal development by the City of Phoenix following Sunnyslope;
6. It sets a bad precedent for the entire Valley by encouraging those wanting to underground a canal to gain space for other purposes -- parking lots, for example;
7. It rejects the Valley-wide trend by all municipalities to enhance the recreational experiences offered at the water's edge;

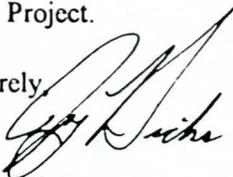
Page 2  
P. Baker  
9/19/96

8. There has been insufficient opportunity for public input. For example, neither the MCA nor any MCA Board member was given written notification of MCFCD/City of Phoenix public meetings to discuss Arcadia Area Drainage. Officers of Arcadia homeowner's associations who attended the two public meetings held prior to the "Final Public Meeting" on September 12th, and had signed attendance sheets, were not notified by the MCFCD of the Final Meeting.

Further, a MCFCD representative misled the public on September 12th when stating that the MCA had had input into the proposed alternatives. In fact, a member of the MCA's Board was contacted by MCFCD representative Don Rerick in April by phone to discuss the possibility of undergrounding the canal. The Board member opposed the idea and asked for further information to present to the MCA's Board. Her request was refused. All requests to provide a copy of the Draft Report of the Arcadia Drainage Study to the MCA or its representatives have been denied.

For the above reasons, the Metropolitan Canal Alliance strongly opposes Alternative No. 5 and recommends its removal from any further consideration by the MCFCD, the City of Phoenix, and Salt River Project.

Sincerely,



Jay V. Hicks  
Metropolitan Canal Alliance

cc

Skip Rimsza, Mayor of Phx  
Sal DeCiccio, Councilman, City of Phx  
Stan Smith, Director, MCFCD  
Tom Rawles, Supervisor, MCFCD  
Don Stapley, Supervisor, MCFCD  
Betsey Bayless, Supervisor, MCFCD  
Mary Rose Wilcox, Supervisor, MCFCD  
Ed King, Chairman, MCFCE  
Ray Bladine, Deputy City Manager, City of Phx  
David Moody, Deputy Dir Dev Services, City of Phx  
Jim Colley, Parks Director, City of Phx  
Bruce Swanson, Parks Dept., City of Phx  
Joy Mee, Planning Dept., City of Phx

Richard Silverman, SRP  
Paul Cherrington, SRP  
Dennis Schroeder, AZ Projects Mgr, BOR  
Phil Jones, Phoenix Arts Commission  
Ignacio San Martin, ASU  
Carla Wortley, Valley Forward  
Kathleen Ingley, Arizona Republic  
Ginnie Ann Sumner, Arcadia Citizen  
Paul Barns, Arcadia Citizen  
Virginia Ulman, Citizen  
Don Rerick, MCFCD  
Bill Hamman, Assistant Manager, City of Phx

September 30, 1996

Mr. Perry Baker, Public Involvement Coordinator  
Maricopa County Flood Control District  
2801 West Durango  
Phoenix, AZ 85009

RE Arcadia Area Drainage Study

Dear Mr. Baker:

As a resident of Maricopa County and a tax payer, I am particularly concerned with cost containment and the quality of our neighborhoods. On both accounts I was horrified to learn of alternatives 4 and 5 for flood control in the Arcadia area.

Thirty million plus (and whatever flood control project has ever come in on budget?) represents a heck of a lot of taxpayer dollars. If there really is flooding problem in the Arcadia area (yes, I know all about water sheeting off of Camelback Mountain, but I am unaware of any serious problem in the area under consideration), then priority should be given to the less expensive alternatives.

Meanwhile, neighborhoods are an essential element of our quality of life, and both alternatives 4 and 5 are very negative in this respect. Alternative 4: Sixty-five single family homes, 39 condominium units, and one church? Nothing whatsoever would warrant such wholesale disruption in a long-settled district.

Alternative 5: As bad as alternative 4, and not just because of egregious cost. Canals are our best parks, ones that could not be replicated today for any amount of money. Families bicycle down their banks, parents push their babies' prams, young (and sometimes not so young) men and women jog daily while older types feed the ducks and amble along. I can see no justification in denying a whole area of the city these healthful pleasures. In fact, this is one of the reasons why we pay the taxes we do, to maintain ~~a certain~~ a certain quality of life.

I am hoping that the Flood Control District added alternatives 4 and 5 merely from a laudable effort to cover every possibility, no matter how absurd, and that these alternatives are not under serious consideration.

Most sincerely,



Elizabeth B. Lewis  
4325 East Palo Verde Drive  
Phoenix, AZ 85018

**ARCADIA STUDY PUBLIC MEETING**  
**September 12, 1996**  
**Arcadia High School**

Perry Baker opened the meeting at 7:20 p.m. and introduced the panel.

Ray Acuna talked about how all the entities working together is a process.

Tom Sands talked about SRP's participation in the project and the role of the Arizona Canal.

Don Rerick outlined the history of public involvement in the Arcadia project. He polled the citizens and discovered more than half in attendance had not attended previous public meetings on the Arcadia project. He told residents there were currently no funds in place for the project and he explained the FCD's project prioritization process.

Jon Girand outlined the history behind the alternatives that were developed and Mark Seits explained in great detail the five project alternatives for the Arcadia area. He also explained the difference between the 5-, 10- and 100-year storm.

Comments, Questions and Answers: (Responses to citizen questions are noted in italics. Questions that are believed to be rhetorical in nature are not answered in the summary.)

Paul Barnes, 5518 E. Mariposa:

1. Wanted to distribute questionnaires to Homeowners' Association.
2. Alternatives 4 and 5 will significantly impact the area. They are different from what was originally proposed.
3. Does Alternative 5 include funds for aesthetic issues?  
*Yes, \$1 million.*
4. What is "mitigation" in 100-year floodplain?  
*To remove the floodplain.*

Jeff Kiser, 5808 E. Calle del Paisano:

1. All the options are west of 56th Street. Do the plans affect the entire 100-year floodplain?  
*Yes.*
2. Who determines when houses are out of the floodplain?  
*FEMA.*
3. Alternative 5 looks like it does the same thing as Alternative 4 yet it's \$6 million cheaper.

Michael Dollin, 6502 E. Calle del Media:

1. What was the sample size of our previous survey? Why would we eliminate 65 homes to protect 15 homes?  
*The sample size was those who attended the last meeting. (Around 40 people)*
2. Wants copy of watershed analysis that addresses the FEMA floodplain.
3. With respect to Alternatives 4 and 5, did we factor in other things to the value of the

canal? (Historical factor of the canal, cooling factor of the canal, recreational value of the canal.)

*No, it is strictly the cost of construction, right-of-way acquisition, etc.*

4. How much flood insurance does \$36 million buy?
5. Dollin held up a copy of the MCA Study done by ASU which showed that underground canals should be avoided.

Dan Colton, 5630 E. Calle Tuberia:

1. Size of pipe for two-year flood vs. 10-year flood?  
*It varies; but once you are opening up the ground to install a two-year storm drain pipe, it isn't much more costly to upgrade to a 10-year pipe.*
2. Does 56th Street get bad flooding?  
*Yes.*
3. Which church will be impacted? Will the church be removed? There is a successful pre-school program going on there.  
*The church is located at the east side of 56th Street, on the north side of the canal.*

Alan Richardson, 5201 E. Calle Redonda:

1. What is a detention basin?  
*It is a hole in the ground to capture and detain storm water runoff.*

Gladys Larsen, 4132 E. Calle Redonda:

1. How many homes have been flooded? (This question was directed at audience members.)

Don Voss, 5802 E. Calle del Paisano:

1. When was FEMA floodplain put into effect? Who changes the floodplain? Why does he have to pay for a site elevation certificate?  
*Late 1970s. FEMA changes the floodplain. Certificates are not done for free.*
2. Does Alternatives 1,2 and 3 take us out of the floodplain?  
*No.*

Bill Dominick, 3801 N. 60th Place:

1. He pays flood insurance and thinks people should be more concerned about the loss of property values and other issues, such as safety, because the wet streets are a constant threat to the safety of the neighborhood kids. (Wet brakes)
2. Concerned about Alternative 5. Can he still recreate on the canal?  
*Yes.*
3. Was concerned about allowing the Homeowners' Association vote on the questionnaire because those people don't pay flood insurance and didn't come to the meeting. The reason, he said, they didn't come to the meeting is that they are not affected by flooding or insurance requirements so why should they come?

(Paul Barnes jumped up and stated the reason they should be allowed to vote is because the solutions affect all the homeowners.)

Marlyne Jones, 6628 E. Exeter Blvd.:

1. She said she had previously spoken with SRP reps. who told her the cost of Alternative 5 is really \$10 million higher than outlined. Is that true?  
*No, although this only a feasibility study level of estimate.*
2. She cited numerous committees she sits on and then stated our alternatives were counter to the City of Phoenix's strict policy to keep canals above ground. "Bad precedent."

Jay Hicks, Metro Canal Alliance:

1. Alternatives 4 and 5 affect the whole region. Does not want canals covered.

Marika McCue, 5841 E. Calle del Paisano:

1. When was the last time FEMA did a floodplain map of the area? Wants a re-analysis done.  
*Late 1970s.*

Sally Geyer, 6164 E. Calle Camelia:

1. Was the FEMA floodplain map done prior to the 1972 flood in the area?  
*No.*

PLEASE PRINT  
MEETING ATTENDANCE ROSTER

MEETING: ARCADIA STUDY LOCATION: ARCADIA H.S.  
DATE: SEPT. 12, 1996

NAME	ADDRESS	PHONE
IGNACIO SAN MARTIN	4590 E. CALLE REDONDA	840-1552
BILL DOMINICK	3801 N. 60TH PLACE	990-0531
VIA CONTI	5749 E. Calle Del Porsano	990-1286
GLADYS LARSEN	4132 E. CALLE REDONDA #60	840-3142
CHARLES CONNETT	4622 E. CAMINO SANTO	948-7689
Judy Chamberlin	6125 E. Calle Camelia	946-7688
Donald S. Joss	5802 E. CALLE DEL PARSANO	990-7101
RITA BARNES	5578 E. Mariposa <sup>85048</sup> PHX	840-1579
Paul Barnes	5518 E. Mariposa <sup>85048</sup> PHX	840-1529
MARWYN JONES	6628 EAST EXETER BLVD SCOTTDALE 85251	990-3441
WOLF GROTE	4512 E LAFAYETTE BLVD PHX 85018	840-2980
Bruce Buchanan	5303 F. Calle Ventura Phx 85018	840-0918
MICHAEL DALIN	6502 E. Calle Del Medio Phx 85251	945-9948
Richard P. Hill	FCD	506-1501
Jan Colton	5630 E. Calle Tuberia	423-1448

PLEASE PRINT  
MEETING ATTENDANCE ROSTER

MEETING: ARCADIA STUDY LOCATION: ARCADIA H.S.  
DATE: SEPT. 12, 1996

NAME	ADDRESS	PHONE
ALAN RICHARDSON	5201 E. CALLE REDONDA	840 9413
Jay Hicks	METROPOLITAN CANAL ALLIANCE c/o 1327 N. LAROSA DR. TEMPE 85281	970-1745
Marie Carter	402 E. Calle Redonda #44 Phoenix 85018	952-2809
SALLY GEYER	6164 E. CALLE CAMELIA SOUTH 85251	949-9048
DAVID WOODY	4114 E. CALLE REDONDA 47	752 2131
E.D. DRIVER	3600 N 56 <sup>th</sup> STREET	952-9204
MICHAEL PICKARD	4626 E LAFAYETTE	852-0559
Genet + Ginnie Ann Sumner	4739 E Lewis	840-3881
Pat #marika m-cue	5841 E. Calle Del Paisano	994-0205
ROGER BREWERT	6034 Calle Paisano	947-4352



**ARCADIA AREA DRAINAGE STUDY "FACT SHEET"**

In 1994, the Flood Control District was invited by the City of Phoenix to evaluate drainage and flooding problems in the Arcadia area and to recommend solutions to those problems. In 1994, and again in 1995, the District presented the project to the citizens of the Arcadia area at public meetings. During those meetings, the citizens in attendance asked that we also look into mitigating the existing 100-year floodplain. Presently, storm water runoff in the Arcadia area flows south from Camelback Mountain to the Arizona Canal, occasionally flooding streets and homes in the area. In addition, when the runoff reaches the canal, it ponds along the north side of the canal creating a 100-year floodplain.

The District, along with input from the City and Salt River Project has completed its assessment of the flooding and drainage problems and offers the following five alternatives for consideration and possible implementation:

- Alternate No. 1 - Located west of 44th Street and along Camelback Road; consisting of underground storm drains along Camelback Road and 40th Street to the ACDC basins west of 40th Street. Will alleviate the 10-year flooding problems in the area of the Camelback Castille Condominiums. Estimated cost of about \$2,125,000.
- Alternate No. 2 - Located from 40th to 64th Streets, primarily along Camelback Road and Lafayette Blvd.; consisting of underground storm drains along Camelback Road, Lafayette Blvd., and Arcadia Dr., and 40th, 44th, and 64th Streets. Will alleviate the 10-year flooding problems along Camelback Road corridor, with residual benefits to the areas south of Camelback. Estimated cost of about \$9,650,000.
- Alternate No. 3 - Located from 40th to 64th Streets, primarily along Lafayette Blvd. and Osborn Road, consisting of underground storm drains along Lafayette Blvd., Osborn Road, Arcadia Dr., and Indian School Road, and 40th, 44th, and 56th Streets. Will alleviate the 10-year flooding problems along Lafayette Blvd. corridor, with residual benefits to the areas south of Lafayette, for example the area of the Camelback Castille Condominiums, and Calle Redondo east of Arcadia. Estimated cost of about \$9,950,000.
- Alternate No. 4 - Located along the north side of the Arizona Canal; consisting of large detentions basins along the canal, and underground storm drains to drain the basins to the Old Cross Cut Canal and the ACDC. An underground 2-year storm drain system will be included parallel to and north of the basins. The basins will require the removal of 65 single family homes, 39 condominium units, and one church. Will alleviate the 100-year floodplain problems along the canal. Estimated cost of about \$36,000,000.
- Alternate No. 5 - Located along the Arizona Canal; consisting of a large detention basin within the limits of the existing SRP Arizona Canal, and underground storm drains along Camelback Road and 40th Street to the ACDC. The existing canal waters will be rerouted to an underground pipe and culvert system, thereby creating an open basin within the canal section from east of 56th Street to west of 40th Street. An underground 2-year storm drain system will be included parallel to and north of the basin. Will alleviate the 100-year floodplain problems along the canal. Estimated cost of about \$30,500,000.

## ARCADIA AREA DRAINAGE STUDY "QUESTIONNAIRE"

The District, along with input from the City of Phoenix and Salt River Project has completed its assessment of the flooding and drainage problems in the Arcadia area and offers the following five alternatives, as well as the option of doing nothing, for consideration and possible implementation.

Two plans could alleviate the 100-year floodplain along the north side of the canal. However, one requires the removal of 65 homes, 39 condominiums, and a church. The other requires that the Arizona Canal be placed underground in a culvert system. There are also three alternatives which can address the more frequent local flooding problems caused by a 10-year storm, and require no removal of homes or modifications to the canal. Any of the five alternatives will provide improved drainage protection to the area.

Your input is important to us. The information you provide us in this questionnaire will help us to select the alternative(s) that should be considered for design and construction. After we have received your input, we will begin the process, with the City of Phoenix and the Salt River Project, of selecting an alternative(s) for design and construction consideration. The recommendation will then be made to the Flood Control District Board of Directors, who are the County Board of Supervisors, for approval. Next, the District will work with the City and, if necessary, with SRP, to develop an Intergovernmental Agreement, secure funding, prepare construction plans and specifications, and ultimately construct the selected alternative(s).

Please take a moment to review the various alternatives, then rank the alternative(s) that you feel are best, with 1 being your top choice. Please refer to the Project Fact Sheet for information on each of the alternatives. Thank you for your interest and commitment to our community.

- Alternate No. 1 - 10-year underground storm drain system, located west of 44th Street and along Camelback Road. Estimated cost of about \$2,125,000.
- Alternate No. 2 - 10-year underground storm drain system, located from 40th to 64th Streets, primarily along Camelback Road and Lafayette Blvd. Estimated cost of about \$9,650,000.
- Alternate No. 3 - 10-year underground storm drain system, located from 40th to 64th Streets, primarily along Lafayette Blvd. and Osborn Road. Estimated cost of about \$9,950,000.
- Alternate No. 4 - 100-year detention basin system, located along the north side of the Arizona Canal; requiring the removal of residential structures, and a church. Estimated cost of about \$36,000,000.
- Alternate No. 5 - 100-year detention basin system, located within the limits of the Arizona Canal; requiring placement of the existing canal water into an underground pipe and culvert system. Estimated cost of about \$30,500,000.
- Alternate No. 6 - Do nothing.



Please return questionnaire to: Flood Control District, 2801 W. Durango, Phoenix, AZ 85009. Attn: P. Baker.

FLOOD CONTROL DISTRICT

# FLOOD CONTROL DISTRICT

Your input is also requested regarding the timing for the construction of one or more alternatives. Please provide your opinion of the timing for the construction of the alternative(s) you have selected. Check the box and circle the number of the alternate that applies.

- |                          |                       |            |   |   |   |   |   |
|--------------------------|-----------------------|------------|---|---|---|---|---|
| <input type="checkbox"/> | AS SOON AS POSSIBLE - | Alternates | 1 | 2 | 3 | 4 | 5 |
| <input type="checkbox"/> | ANY TIME -            | Alternates | 1 | 2 | 3 | 4 | 5 |
| <input type="checkbox"/> | NOT NEEDED -          | Alternates | 1 | 2 | 3 | 4 | 5 |

## GENERAL

COMMENTS: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone number: \_\_\_\_\_

THANK YOU FOR YOUR INPUT!

# Arcadia Area Drainage Study

The Flood Control District of Maricopa County and the City of Phoenix have completed their study of the flooding problems in the Arcadia area.

The final alternative drainage system recommendations have been identified and will be presented for community review and comment at a public meeting on September

**Thursday, September 12, 1996**

**7:00 p.m. to 8:30 p.m.**

**Arcadia High School Cafeteria**

**4703 E. Indian School Road**

This will be the final planning meeting, and your input into this project is important. This project will impact residents of the Arcadia area, so please plan to attend and give us your opinions of the alternatives now being considered. For further information contact: Perry Baker, Public Involvement Coordinator, FCDMC, 506-1501

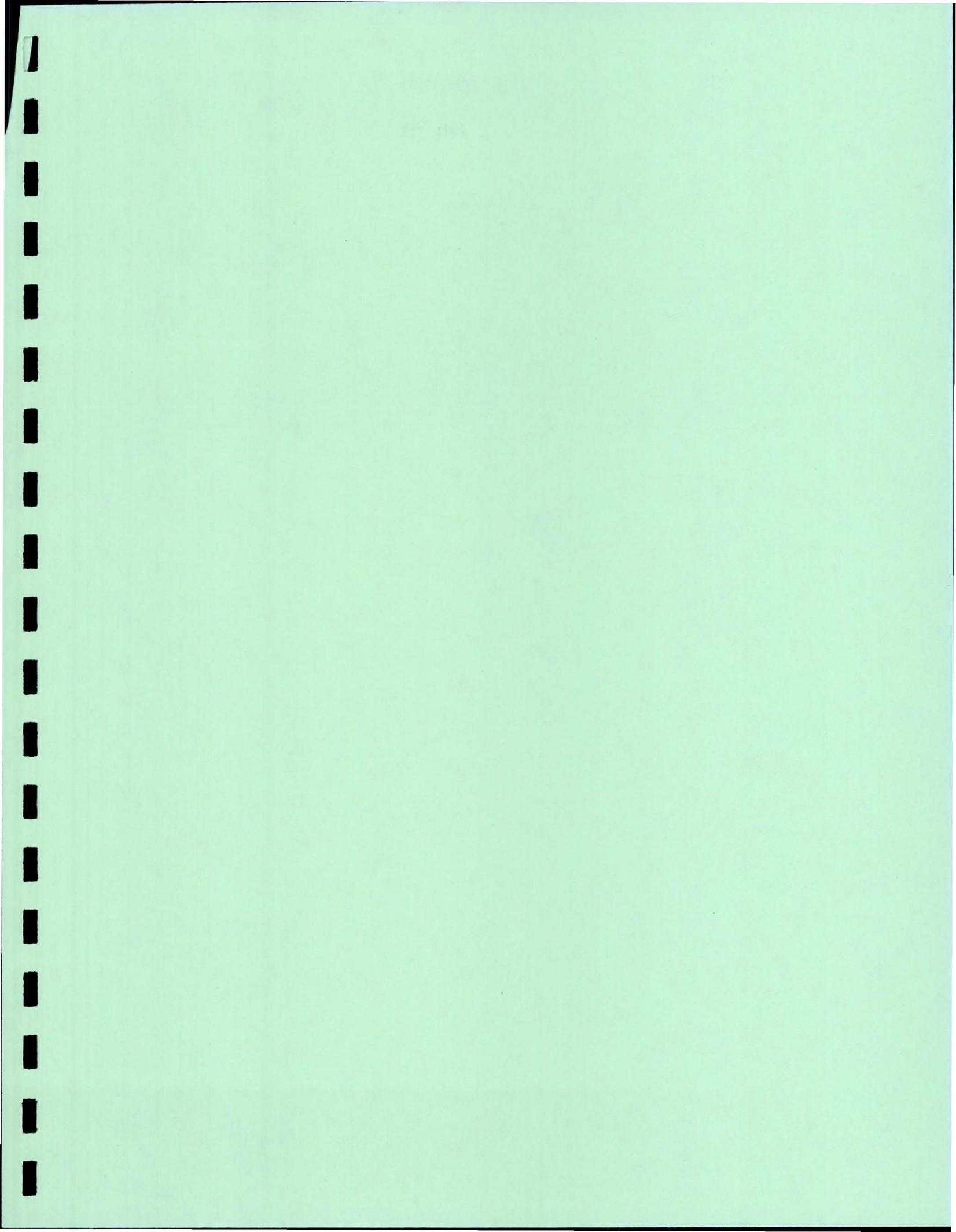


**Public Meeting Notice**  
**For All Arcadia Homeowners**  
**Inside**



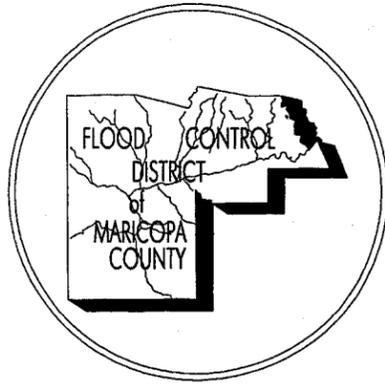
**Flood Control District**  
of Maricopa County  
2801 W. Durango Street  
Phoenix, AZ 85009

**Arcadia Area Drainage Study**  
**Public Meeting, September 12th**



**APPENDIX C**  
**ALTERNATE CONCEPT PLAN AND PROFILE SHEETS**

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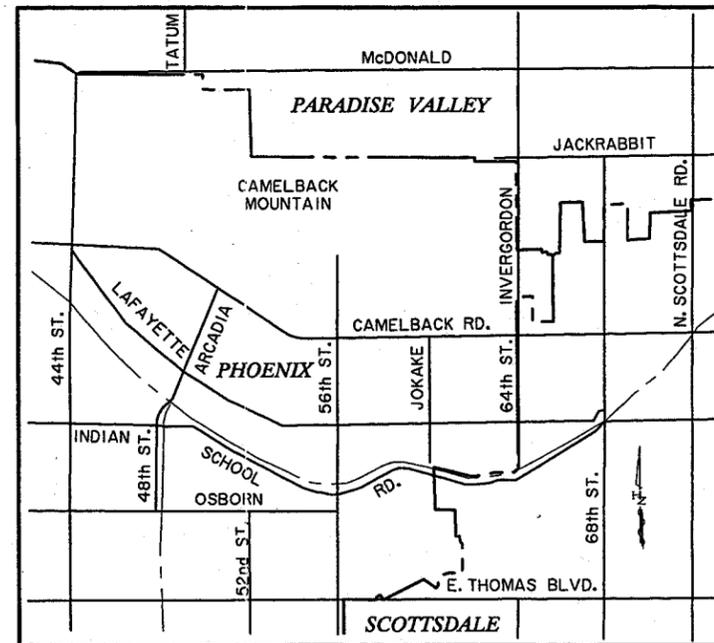
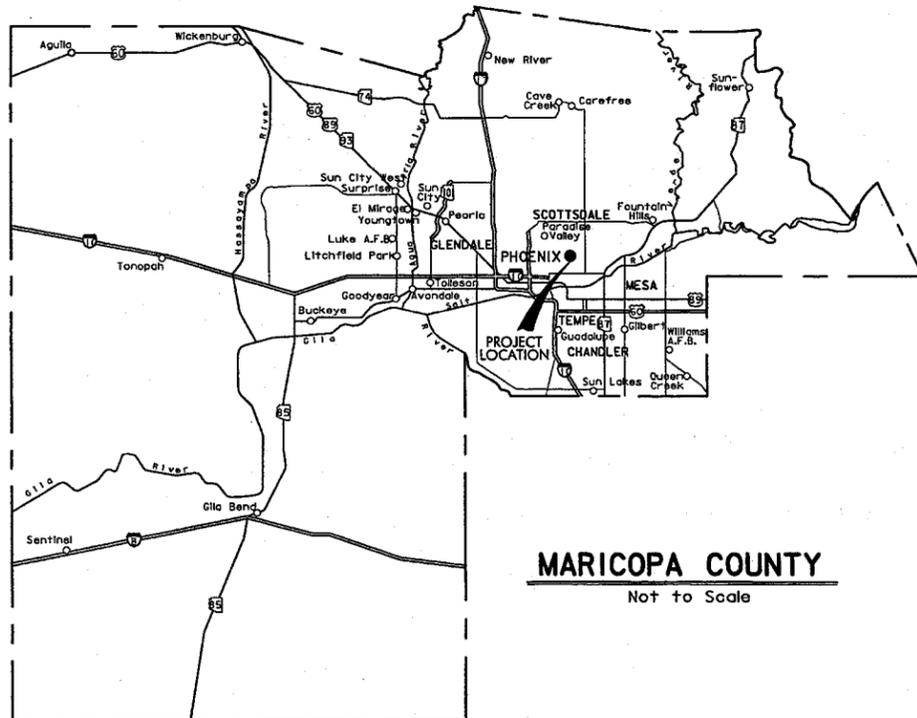


# FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPENDIX C

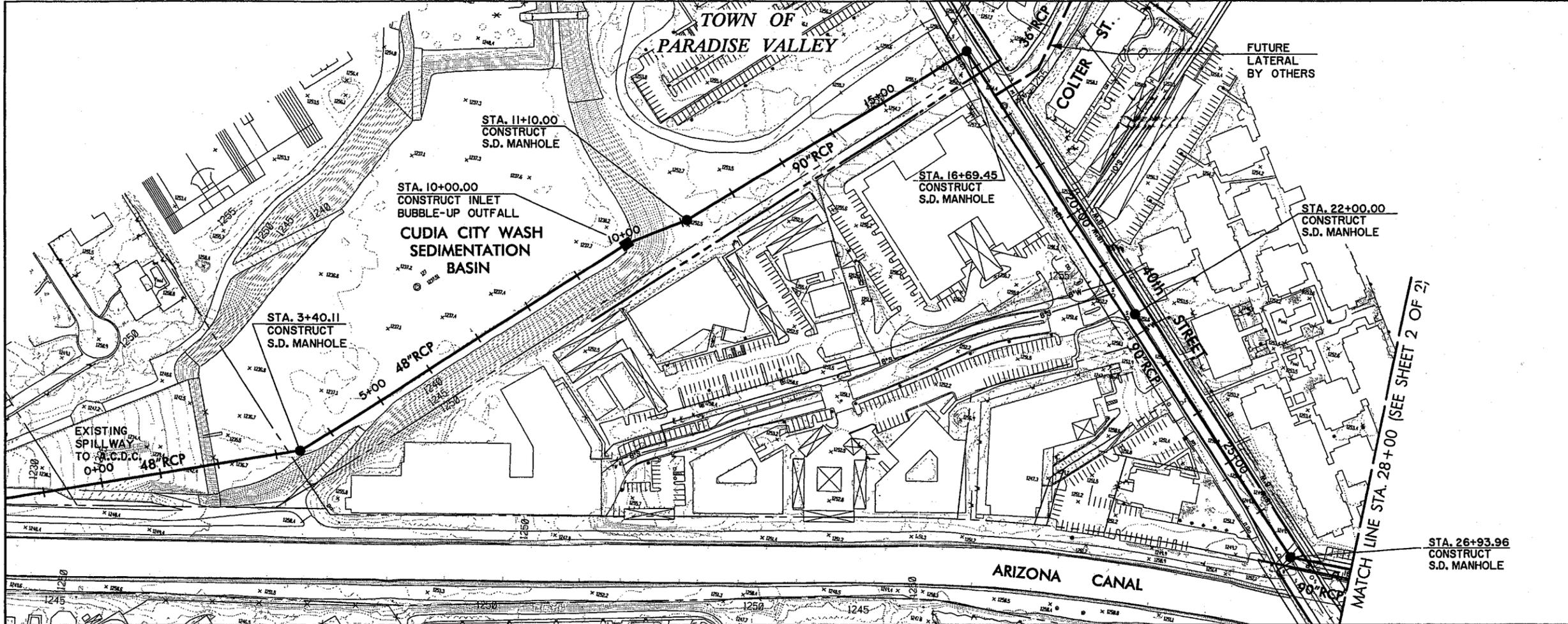
## ARCADIA AREA DRAINAGE PROJECT

PROJECT NO. 94-21

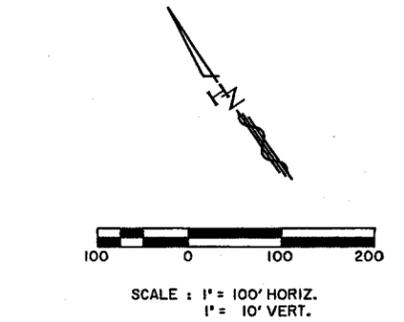
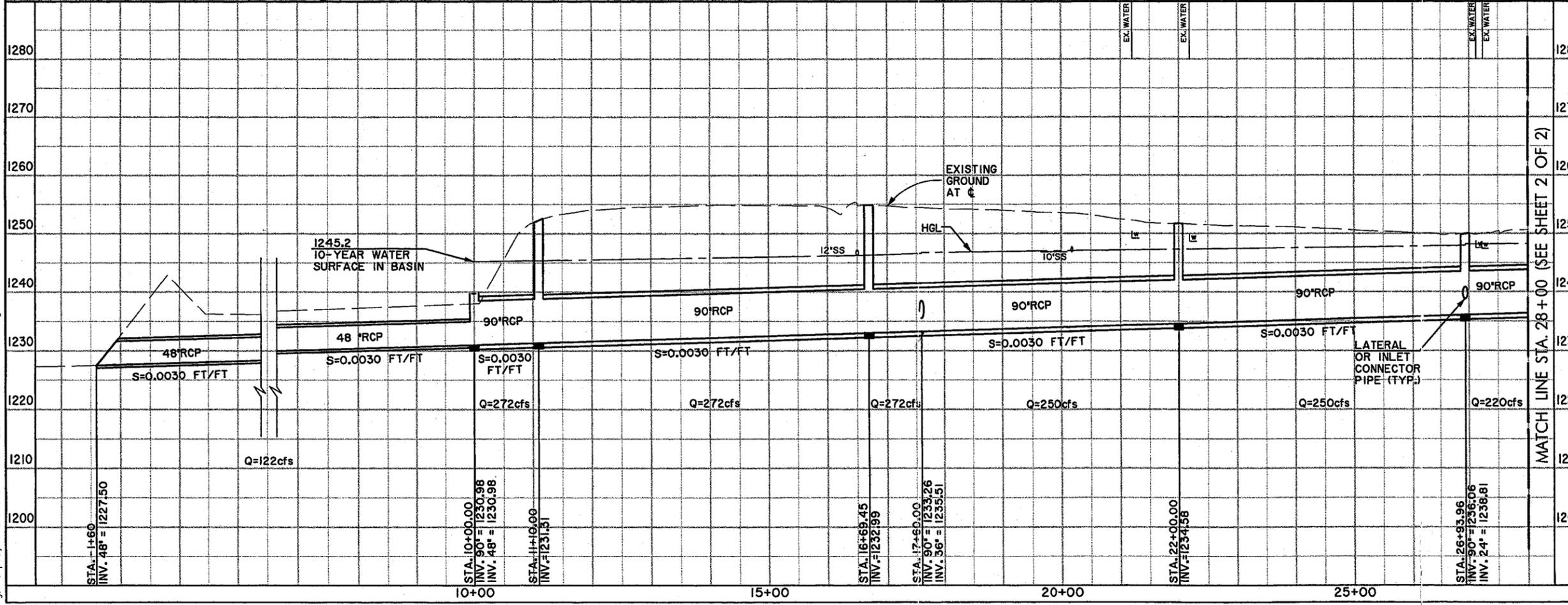


**PROJECT  
VICINITY MAP**  
NOT TO SCALE

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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
	<b>HUITT-ZOLLARS</b> <small>6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85016-2029 (602) 261-0725 FAX (602) 261-8653</small>		
			SHEET 1 OF 1



NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
\*



NO.	REVISION	BY	DATE
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1			

**FLOOD CONTROL DISTRICT OF MARICOPA COUNTY**  
 ENGINEERING DIVISION  
**ARCADIA AREA DRAINAGE STUDY**  
 PROJECT NO. 94-21

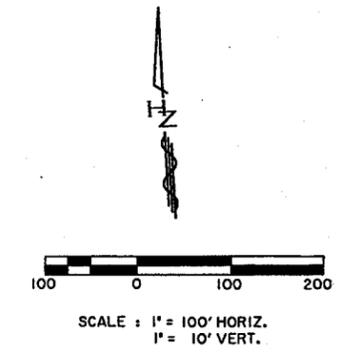
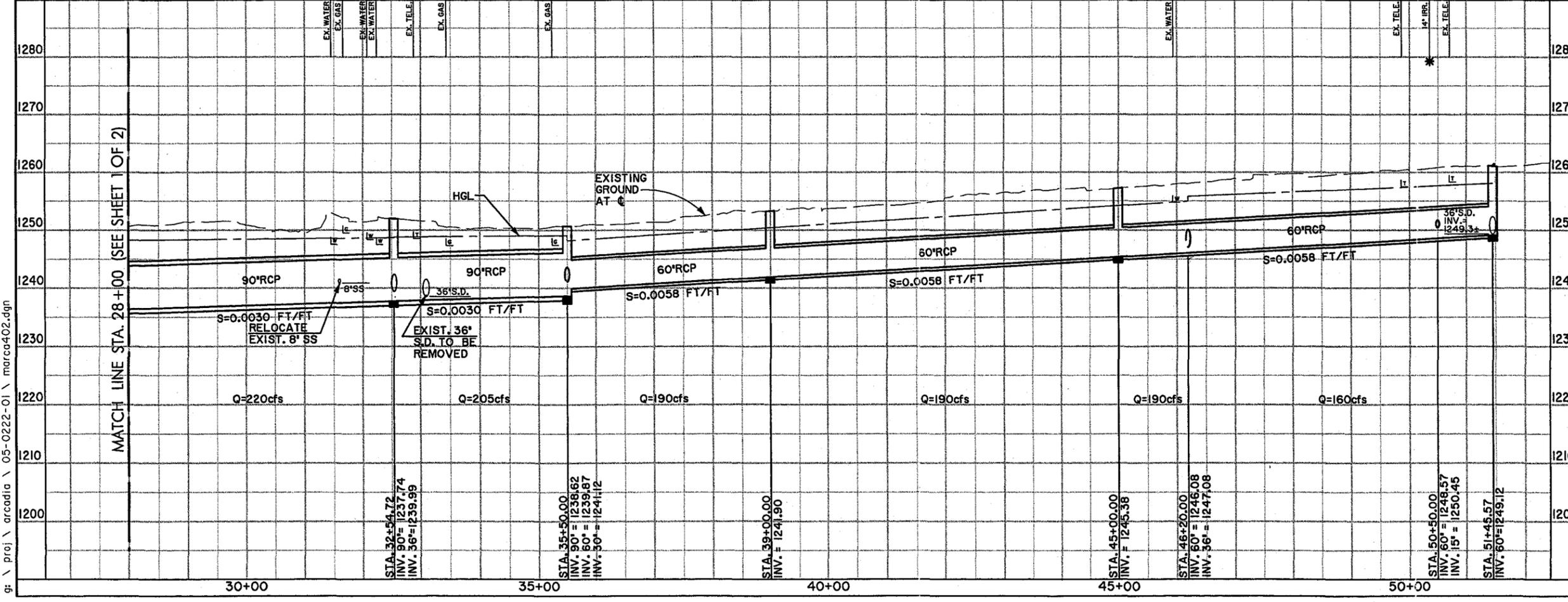
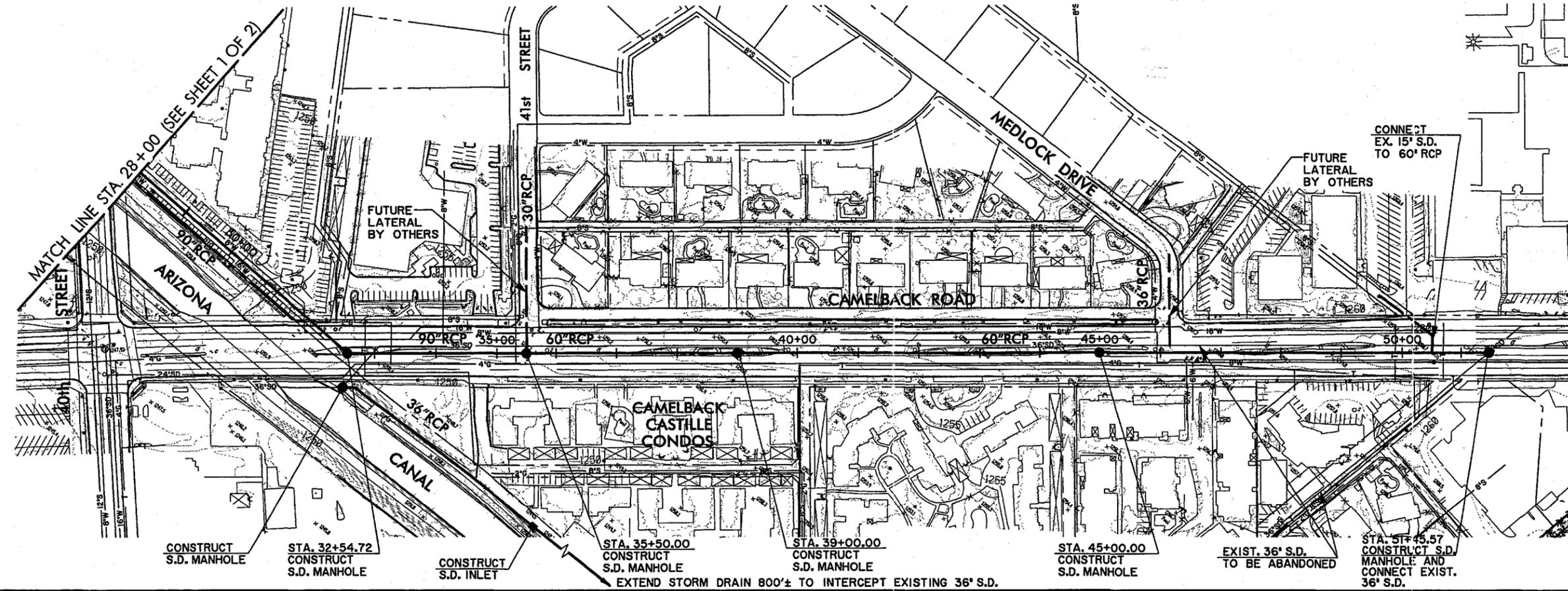
	BY	DATE
DESIGNED	J. GIRAND	03-97
DRAWN	B. MCK.	03-97
CHECKED	R. WISE	03-97

**HUITT-ZOLLARS**  
6245 N. 24th PARKWAY SUITE 102 PHOENIX, ARIZONA 85016-2029  
 (602) 381-0125 FAX (602) 381-8053

ALTERNATE 1 CUDIA CITY WASH - 40th STREET - "WEST" CAMELBACK SHEET 1 OF 2

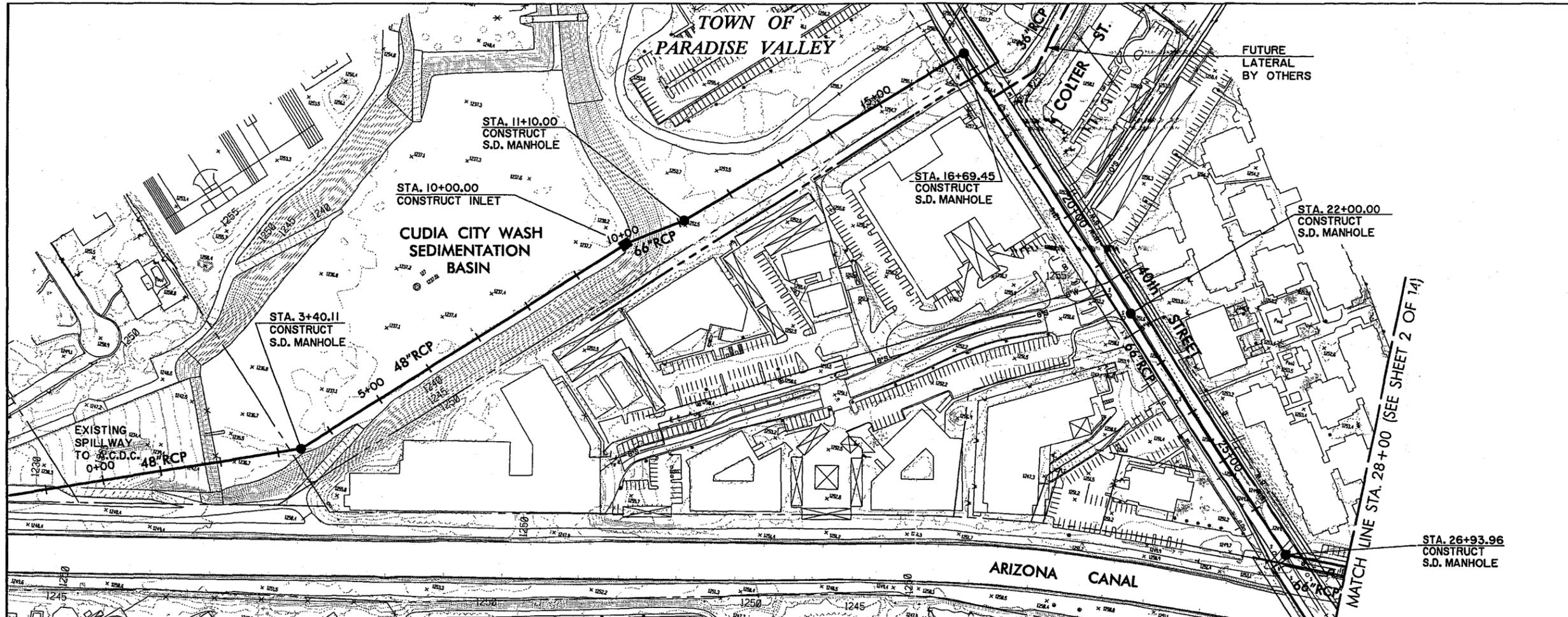
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NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.

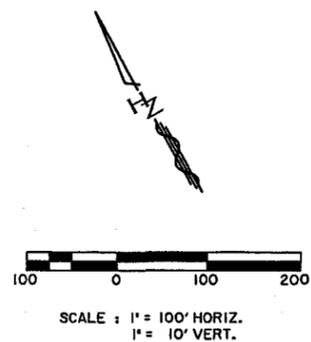
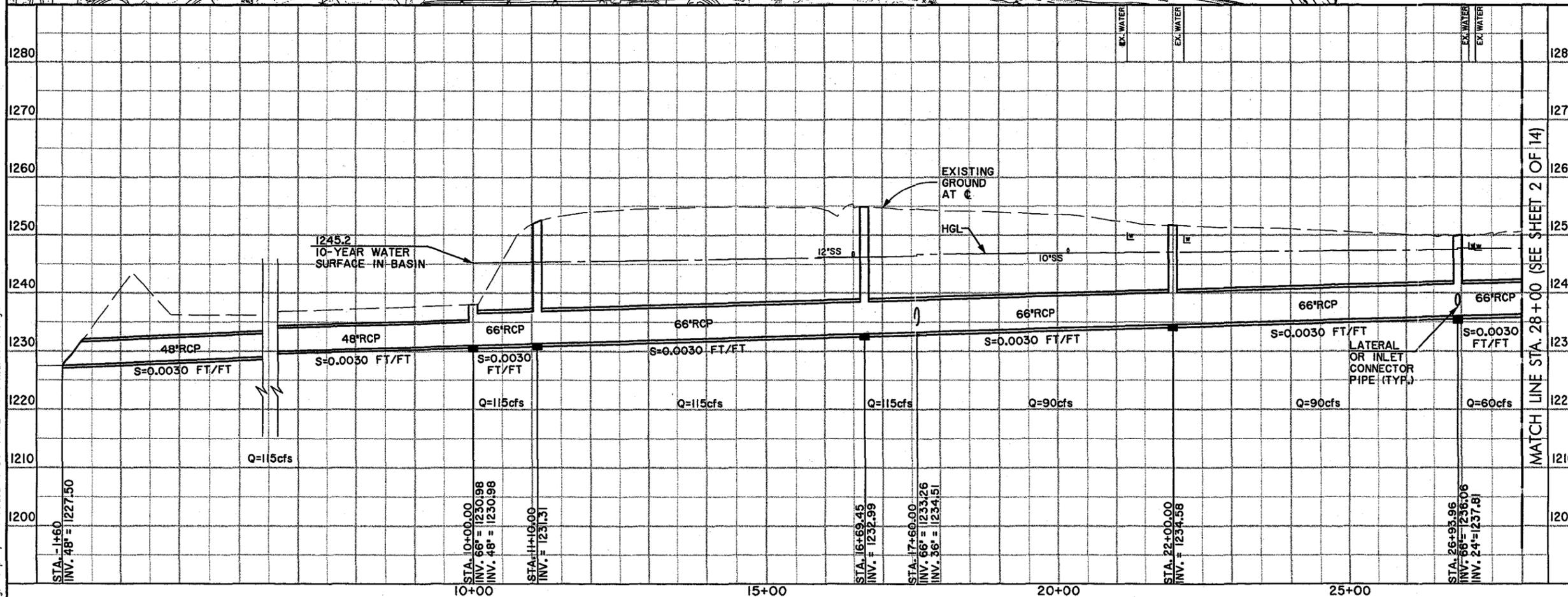


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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY</b> ENGINEERING DIVISION <b>ARCADIA AREA DRAINAGE STUDY</b> <b>PROJECT NO. 94-21</b>			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
	<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85016-2029          (602) 381-0225 FAX (602) 381-8053</small>		
ALTERNATE 1 CUDIA CITY WASH - 40th STREET - "WEST" CAMELBACK			SHEET <b>2 OF 2</b>

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NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
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NO.	REVISION	BY	DATE
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**FLOOD CONTROL DISTRICT  
OF MARICOPA COUNTY  
ENGINEERING DIVISION**

**ARCADIA AREA  
DRAINAGE STUDY  
PROJECT NO. 94-21**

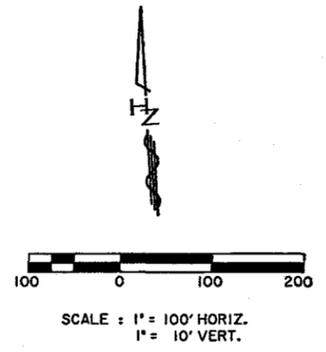
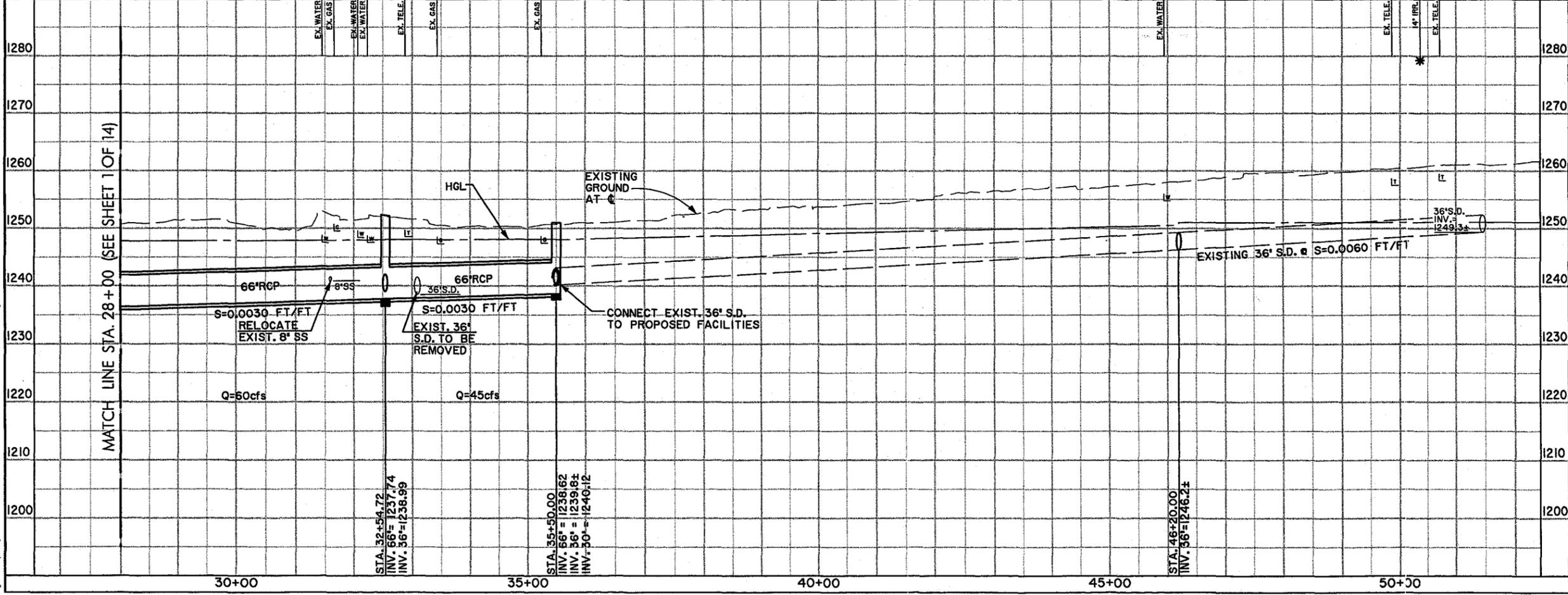
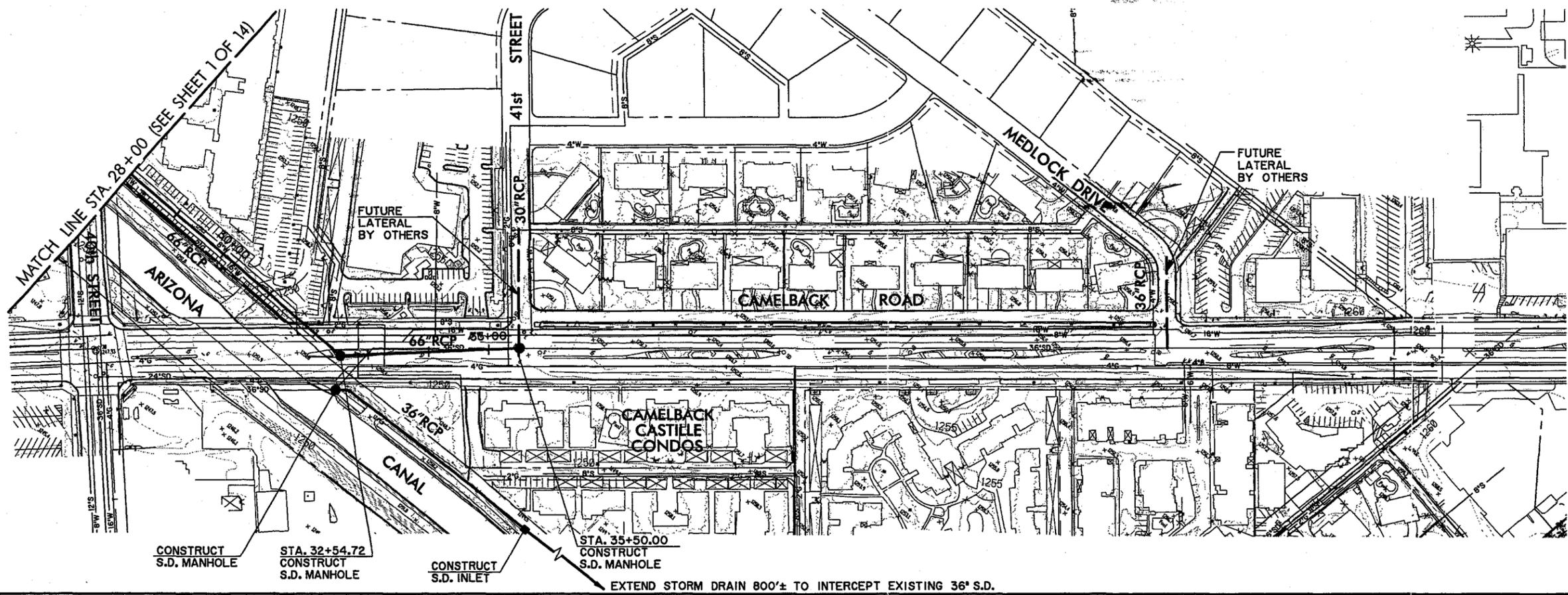
	BY	DATE
	DESIGNED J. GIRAND	03-97
	DRAWN B. MCK.	03-97
	CHECKED R. WISE	03-97

**HUITT - ZOLLARS**  
6245 N. 24th PARKWAY / SUITE 102 PHOENIX, ARIZONA 85014-2029  
(602) 381-0125 FAX (602) 381-8053

ALTERNATE 2 CUDIA CITY WASH - 40th STREET - "WEST" CAMELBACK SHEET 1 OF 14

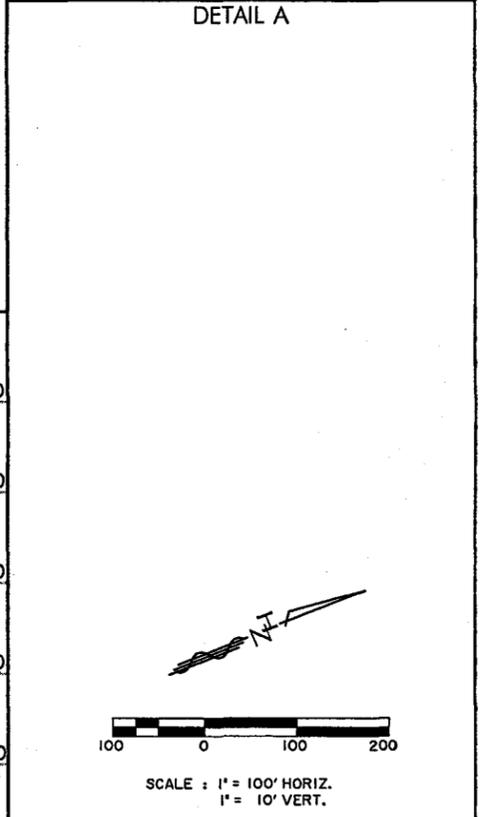
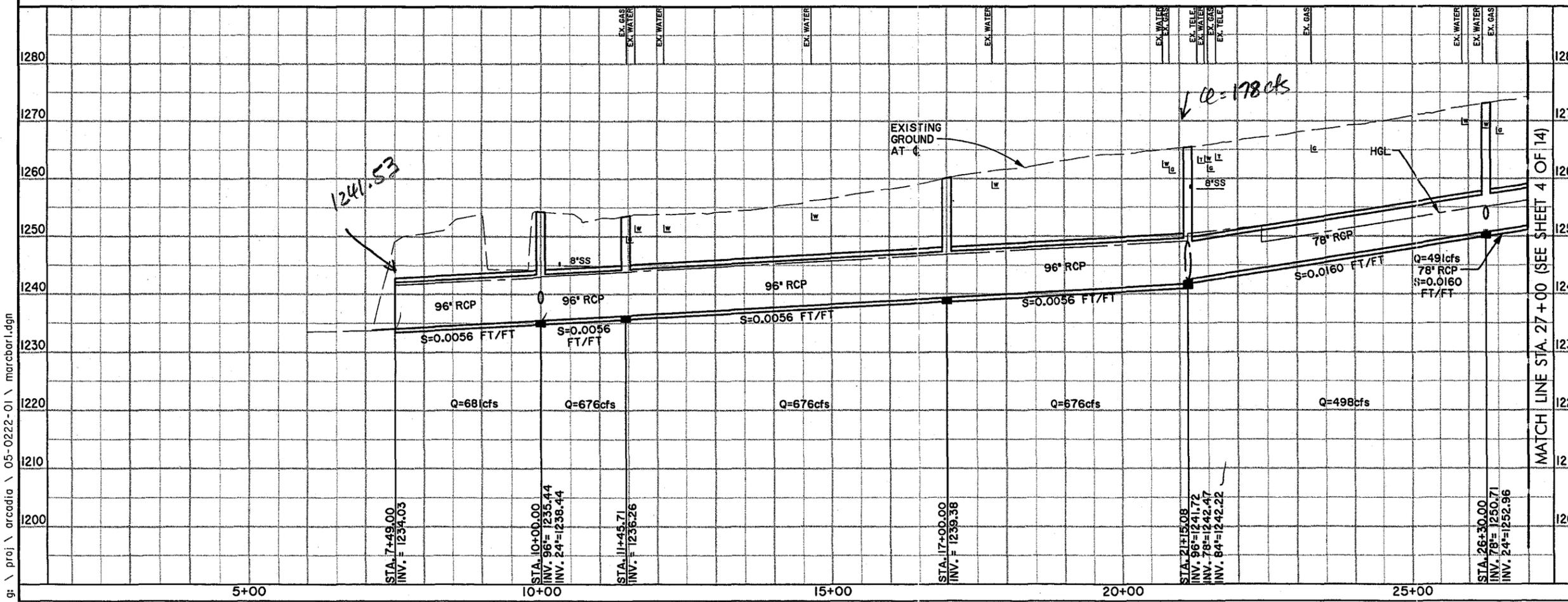
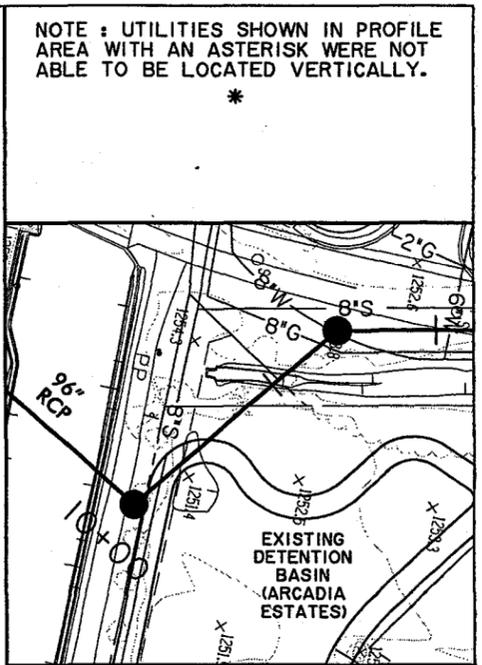
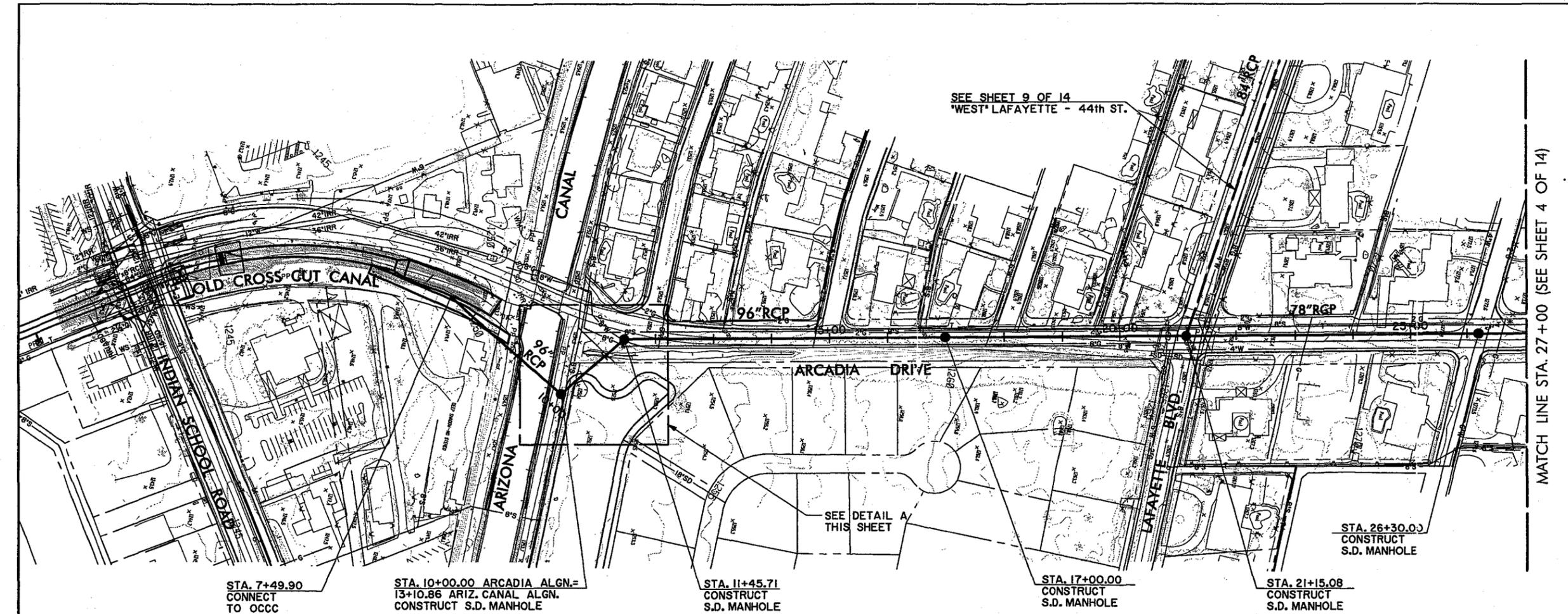
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NOTE : UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85016-2029          (602) 381-0725 FAX (602) 381-8053</small>			
ALTERNATE 2 CUDIA CITY WASH - 40th STREET - "WEST" CAMELBACK			SHEET 2 OF 14

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NO.	REVISION	BY	DATE
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**FLOOD CONTROL DISTRICT  
OF MARICOPA COUNTY  
ENGINEERING DIVISION**

**ARCADIA AREA  
DRAINAGE STUDY  
PROJECT NO. 94-21**

	BY	DATE
DESIGNED	J. GIRAND	03-97
DRAWN	B. McK.	03-97
CHECKED	R. WISE	03-97

**HUITT - ZOLLARS**  
6245 N. 24th AVENUE, SUITE 102 / PHOENIX, ARIZONA 85016-7029  
(602) 381-0225 FAX (602) 381-8053

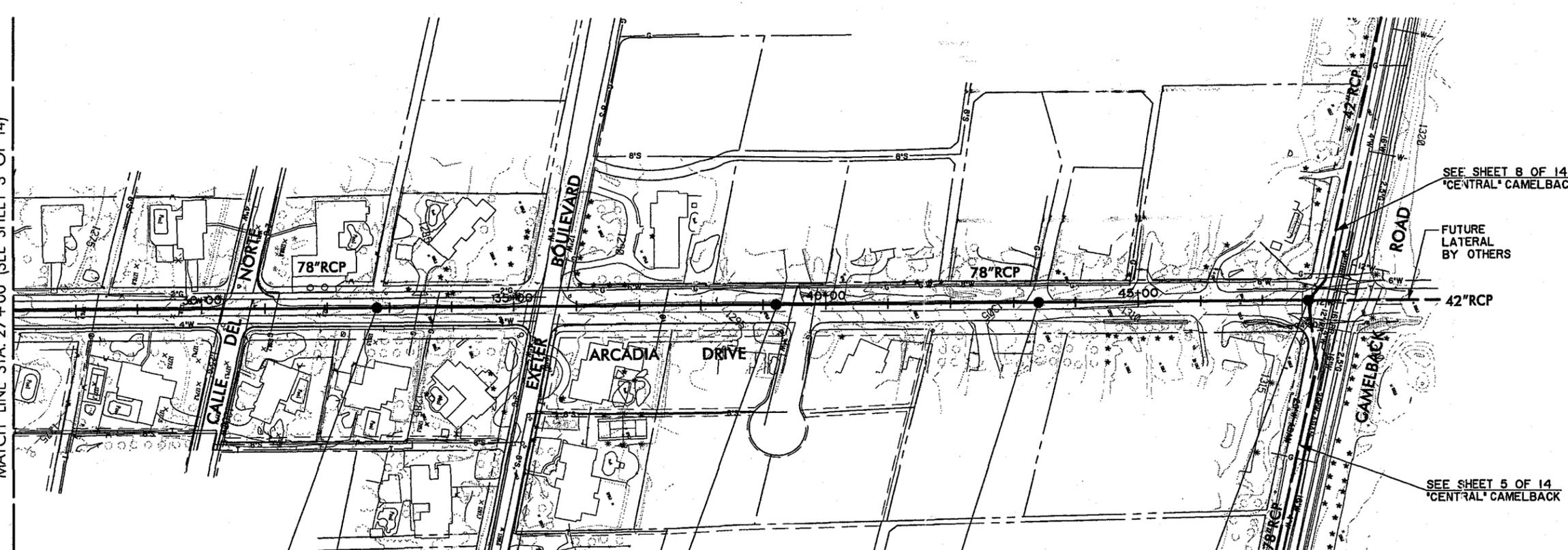
ALTERNATE 2  
ARCADIA DRIVE

SHEET  
3 OF 14

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NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
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MATCH LINE STA. 27+00 (SEE SHEET 3 OF 14)



SEE SHEET 8 OF 14  
"CENTRAL" CAMELBACK

FUTURE LATERAL BY OTHERS

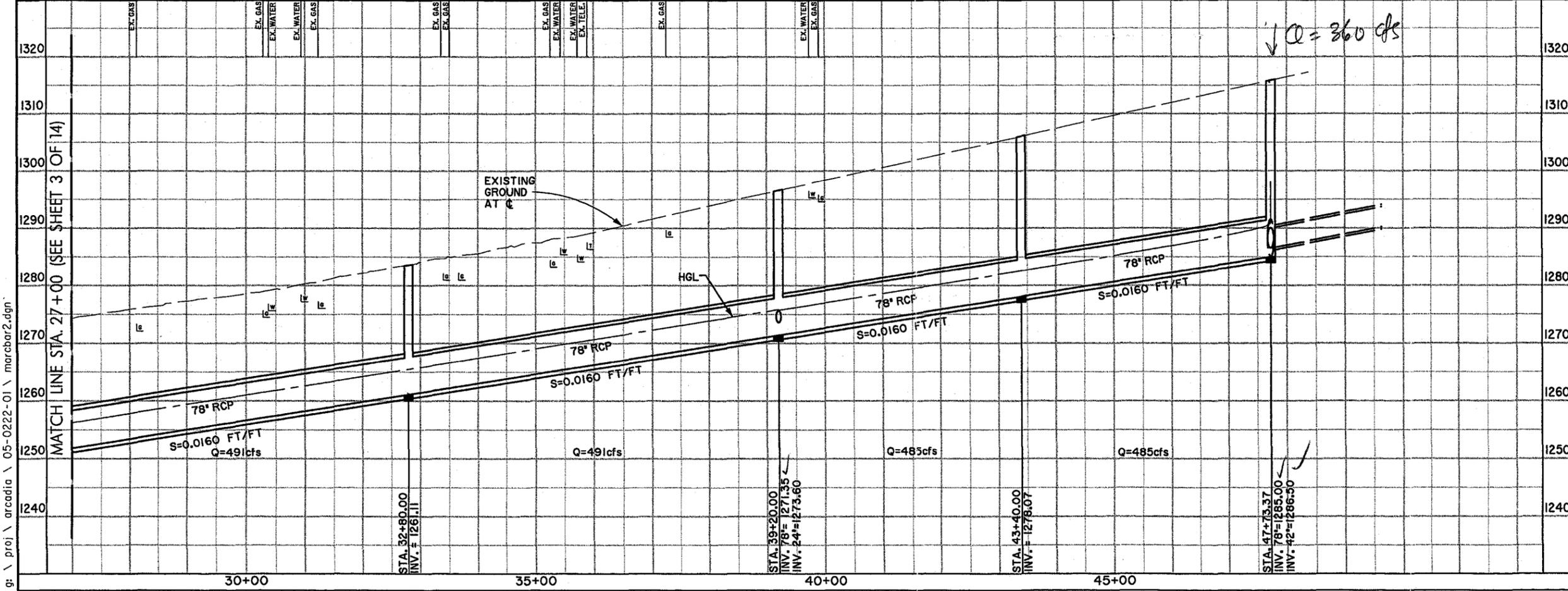
SEE SHEET 5 OF 14  
"CENTRAL" CAMELBACK

STA. 32+80.00  
CONSTRUCT  
S.D. MANHOLE

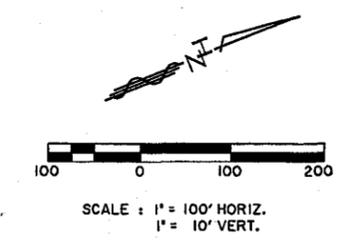
STA. 39+20.00  
CONSTRUCT  
S.D. MANHOLE

STA. 43+40.00  
CONSTRUCT  
S.D. MANHOLE

STA. 47+73.37  
CONSTRUCT  
S.D. MANHOLE



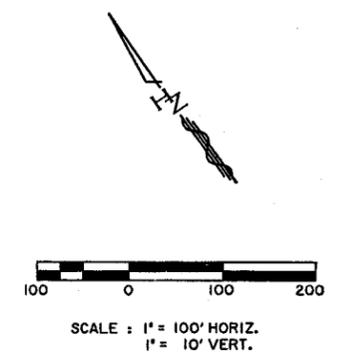
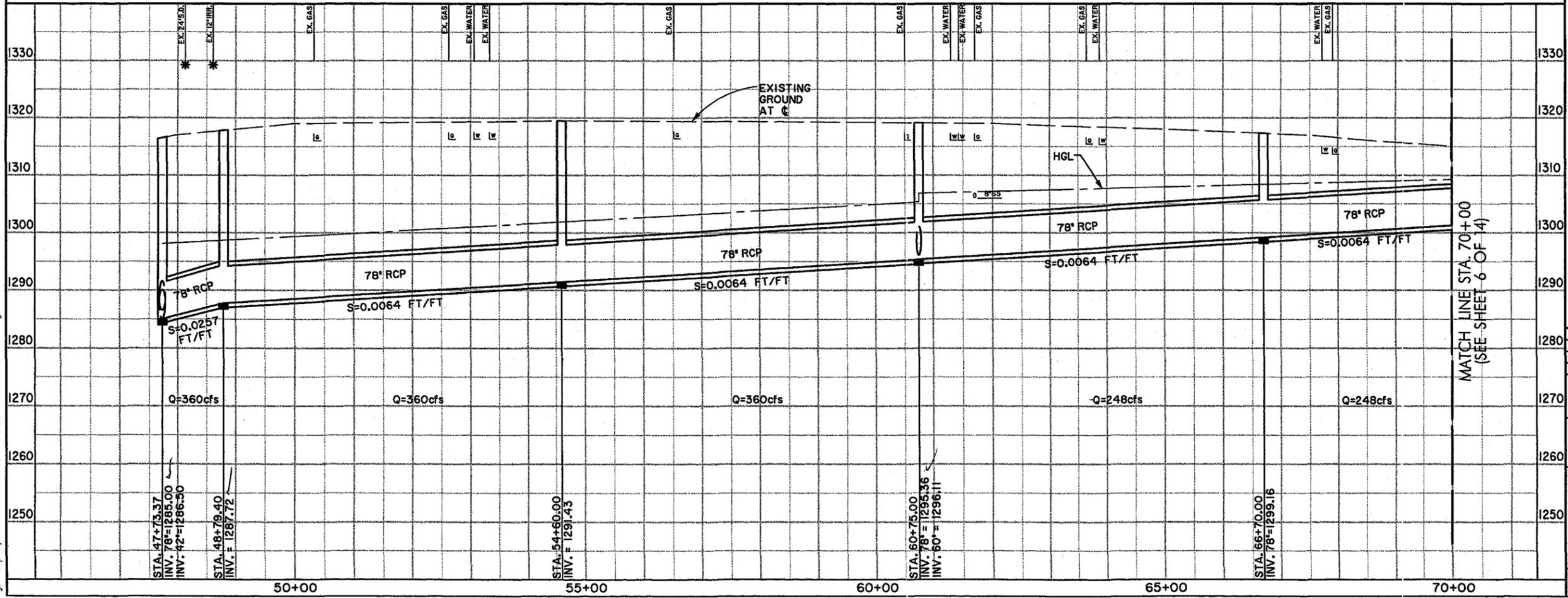
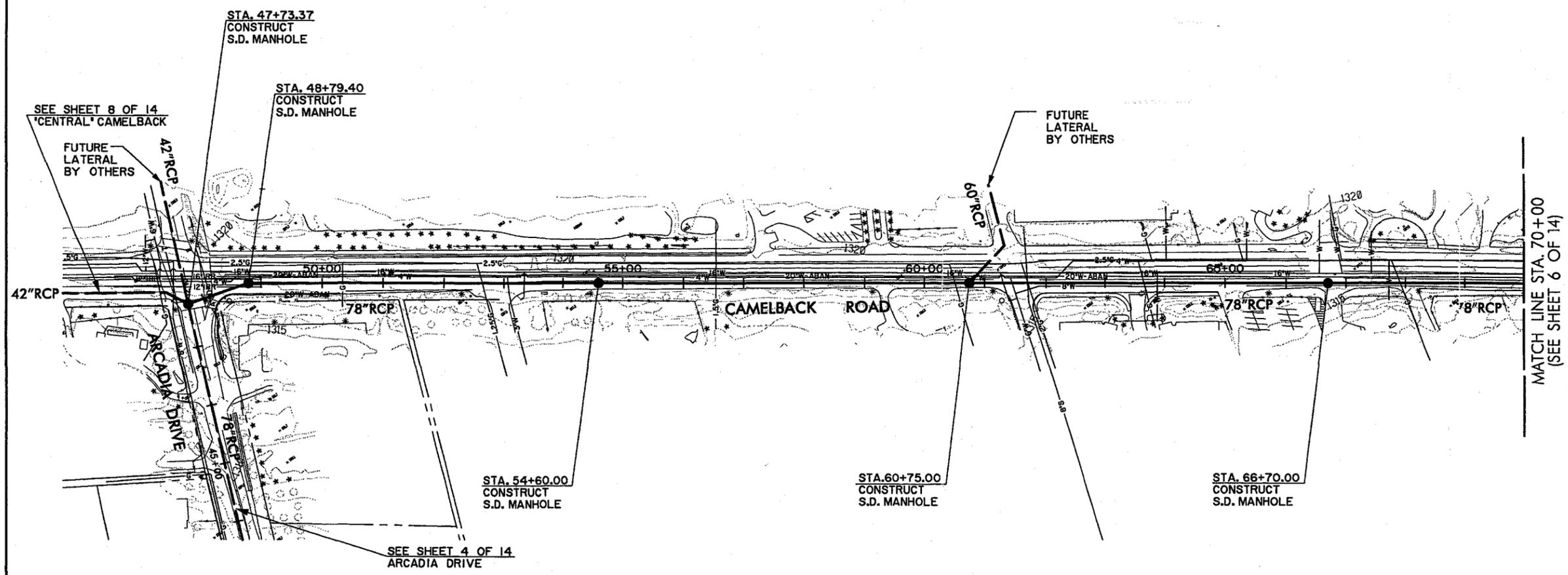
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
	<b>HUITT - ZOLLARS</b> <small>6245 N. 24th Parkway / Suite 102 / Phoenix, Arizona 85016-2029 (602) 381-0125 FAX (602) 381-8853</small>		
ALTERNATE 2 ARCADIA DRIVE			SHEET 4 OF 14

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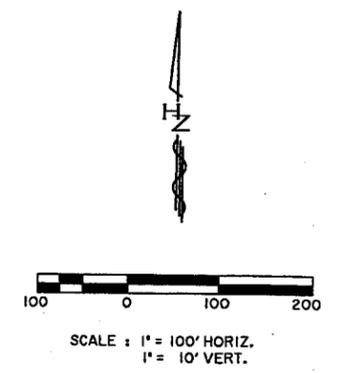
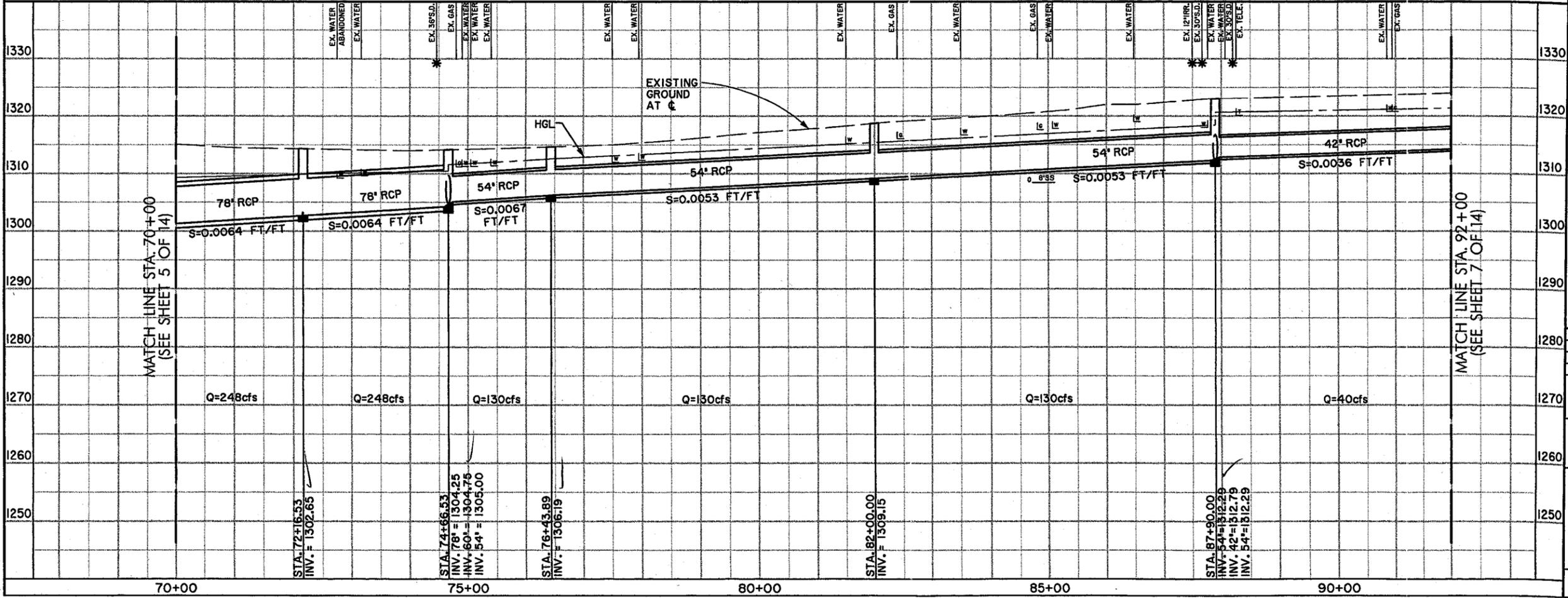
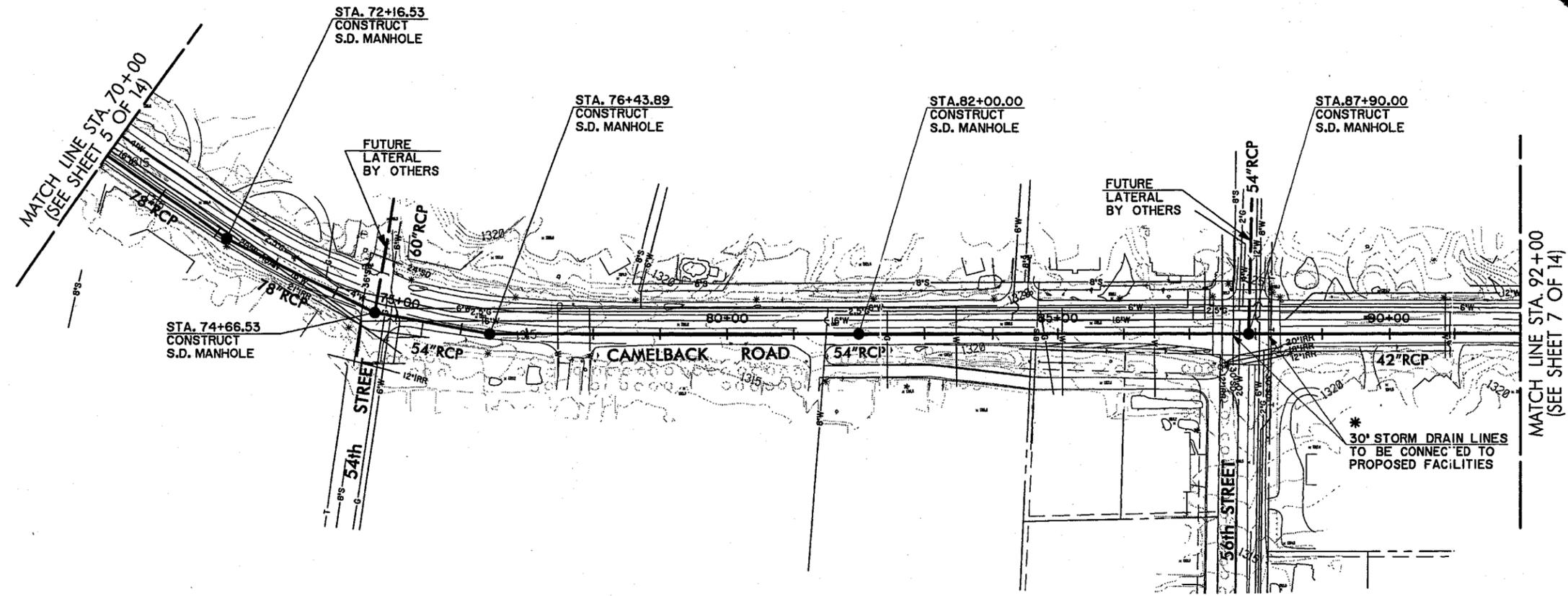
NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
\*



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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY</b> ENGINEERING DIVISION <b>ARCADIA AREA DRAINAGE STUDY</b> PROJECT NO. 94-21			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY SUITE 102 / PHOENIX, ARIZONA 85016-2029</small> <small>(602) 381-0125 FAX (602) 381-8053</small>			SHEET <b>5 OF 14</b>

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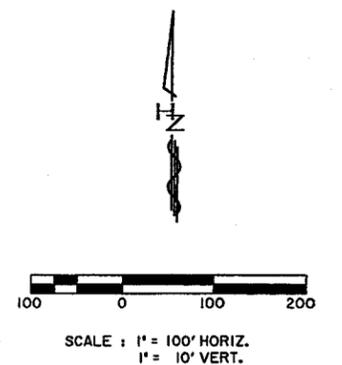
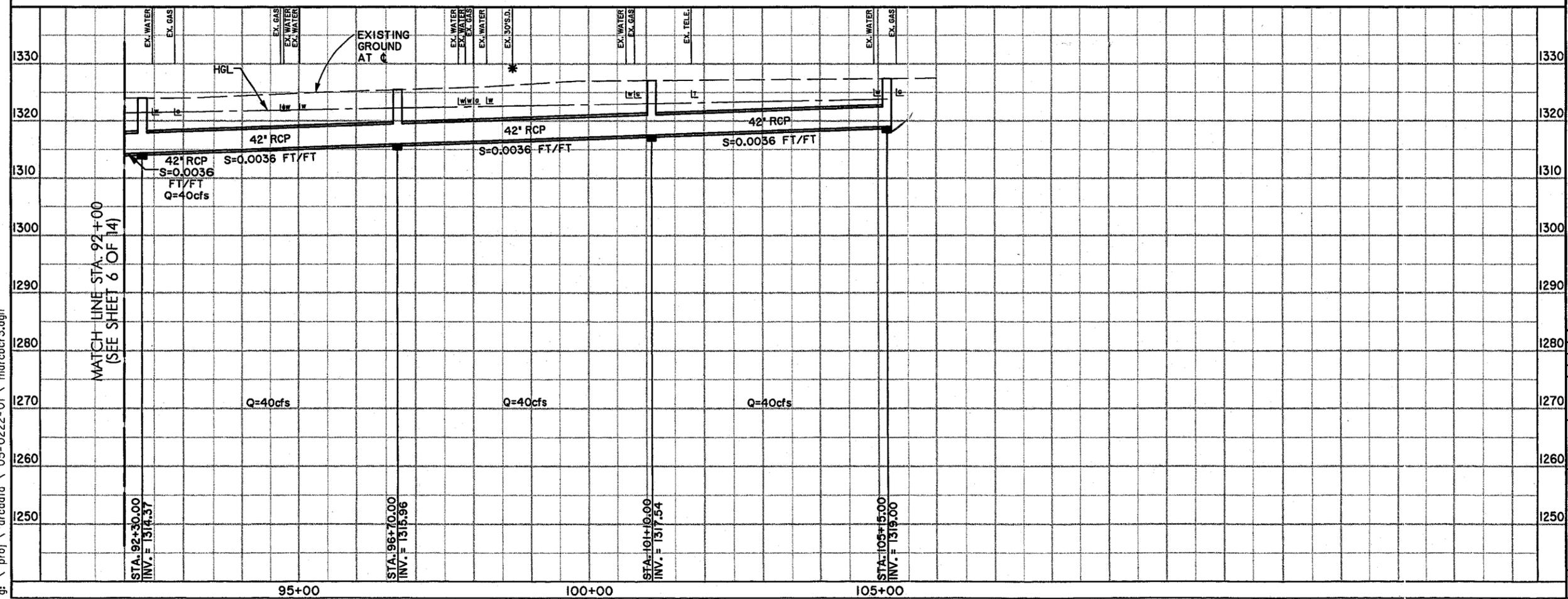
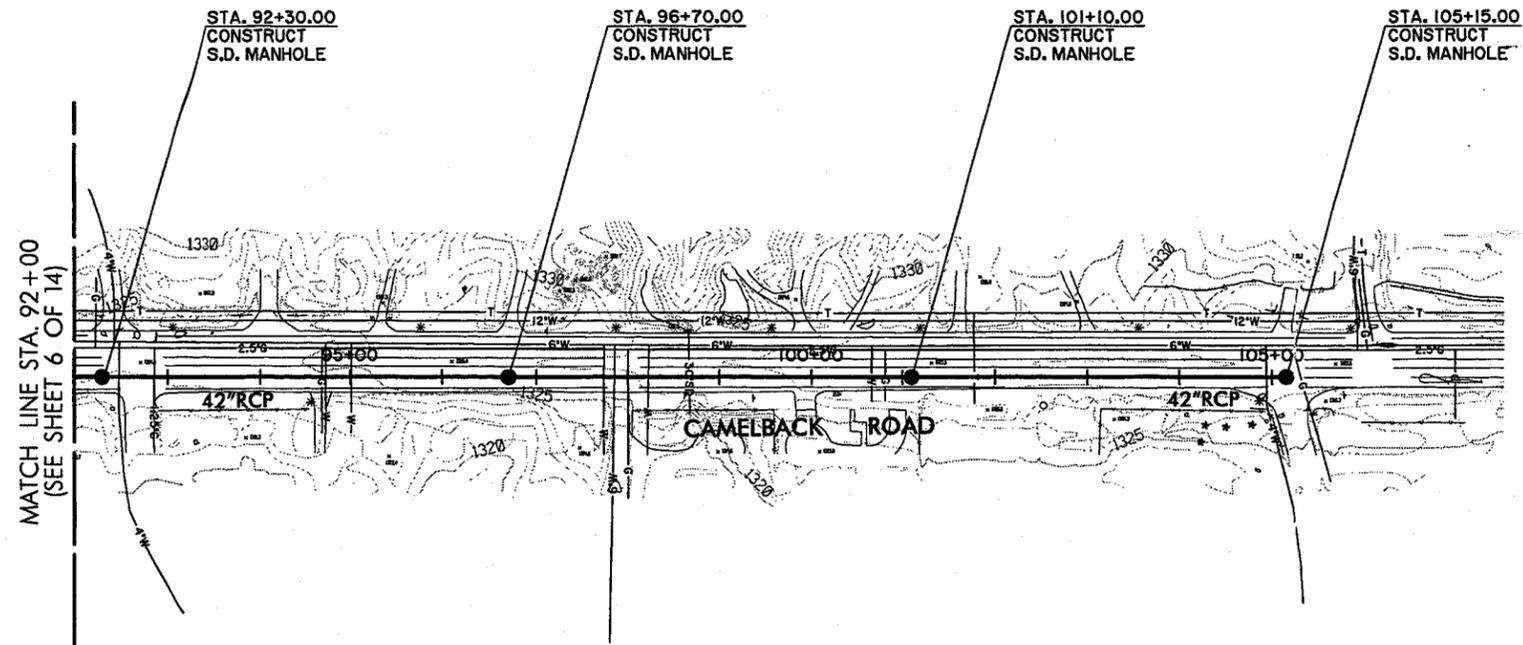
NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY</b> ENGINEERING DIVISION <b>ARCADIA AREA DRAINAGE STUDY</b> PROJECT NO. 94-21			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85016-2029</small> <small>(602) 381-0125 FAX (602) 381-8053</small>			
ALTERNATE 2 "CENTRAL" CAMELBACK			SHEET 6 OF 14

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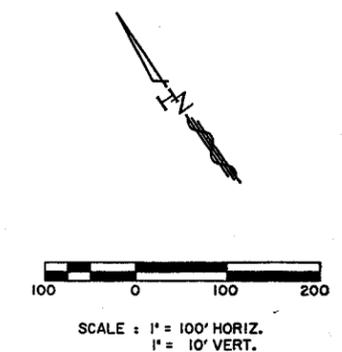
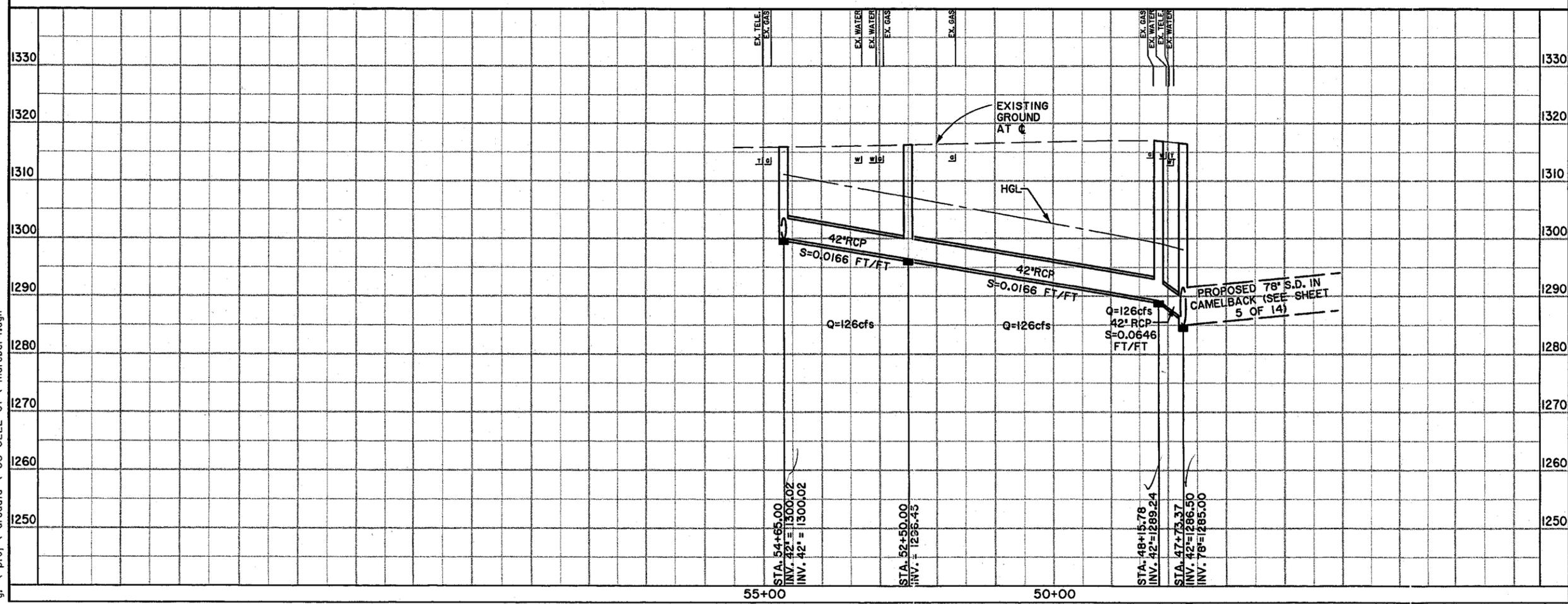
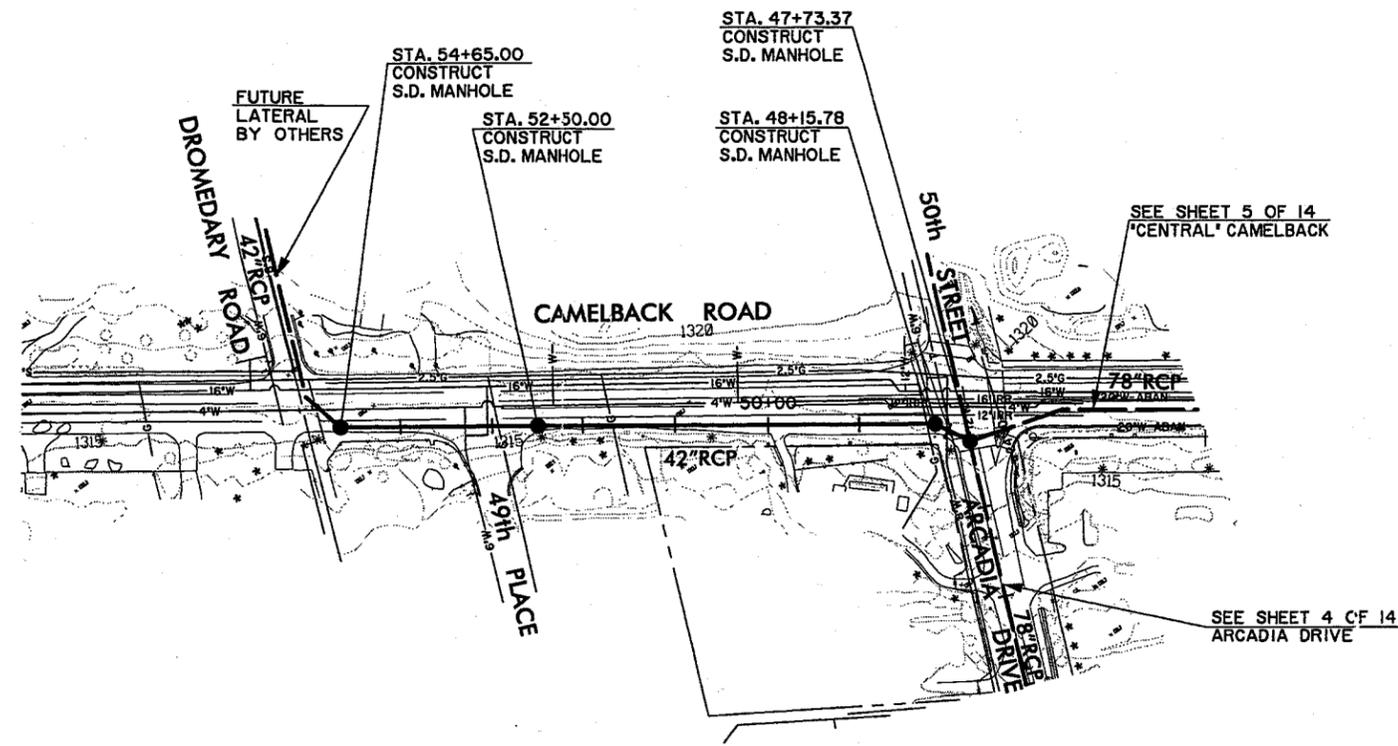
NOTE : UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. MCK.	03-97
	CHECKED	R. WISE	03-97
	<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85014-2029          (602) 381-0125 FAX (602) 381-8053</small>		
ALTERNATE 2 "CENTRAL" CAMELBACK			SHEET 7 OF 14

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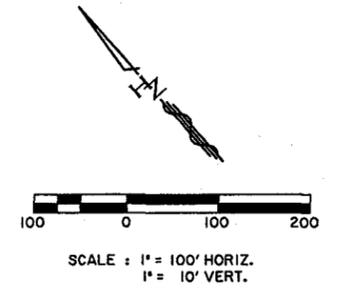
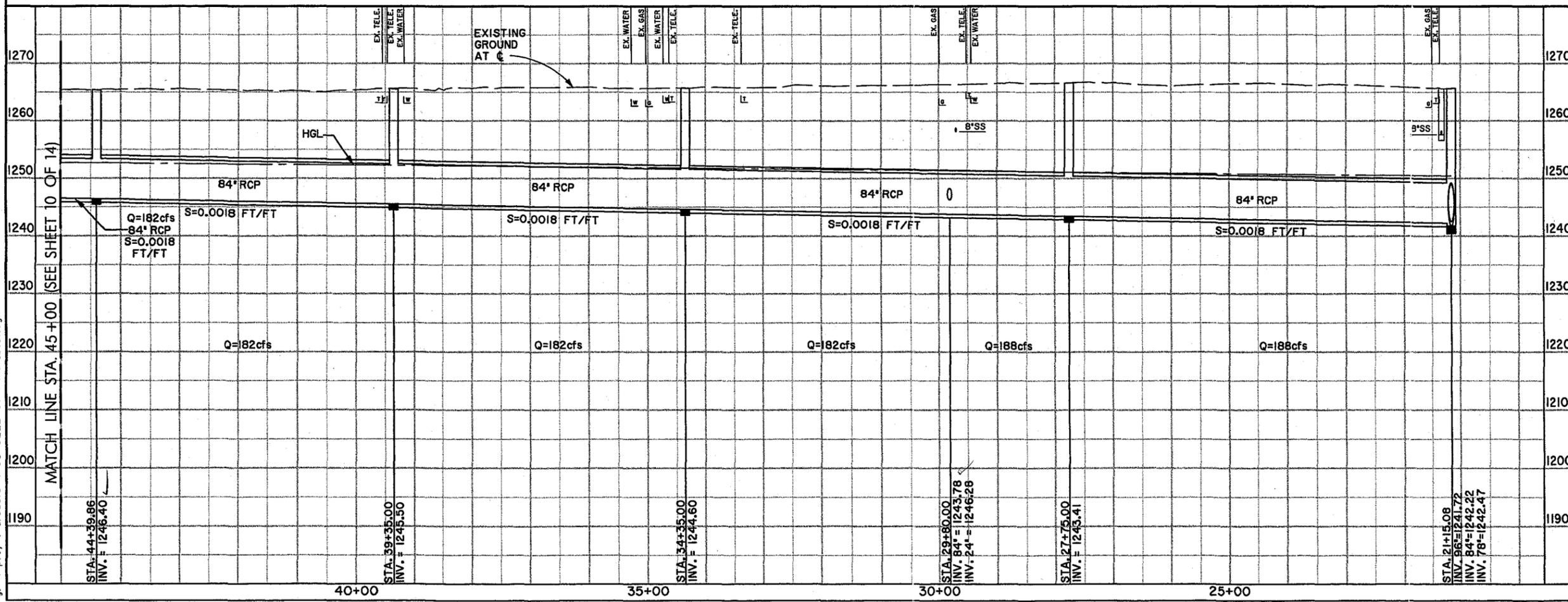
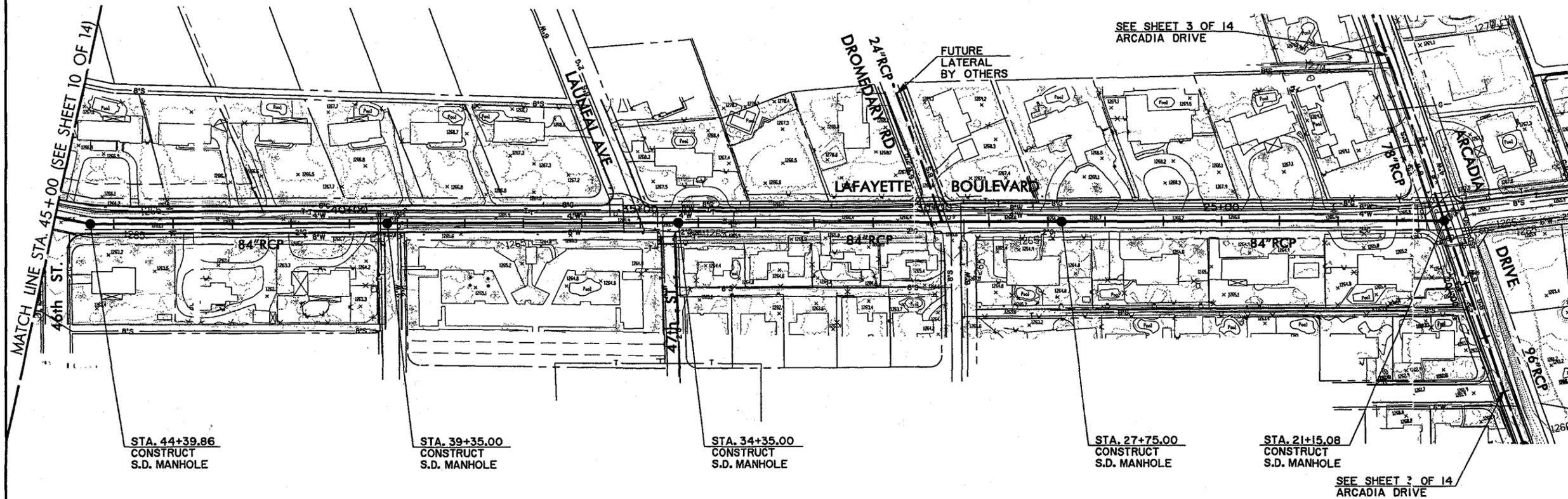
NOTE : UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
	<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85016-2029          (602) 381-0125 FAX (602) 381-8053</small>		
ALTERNATE 2 "CENTRAL" CAMELBACK			SHEET 8 OF 14

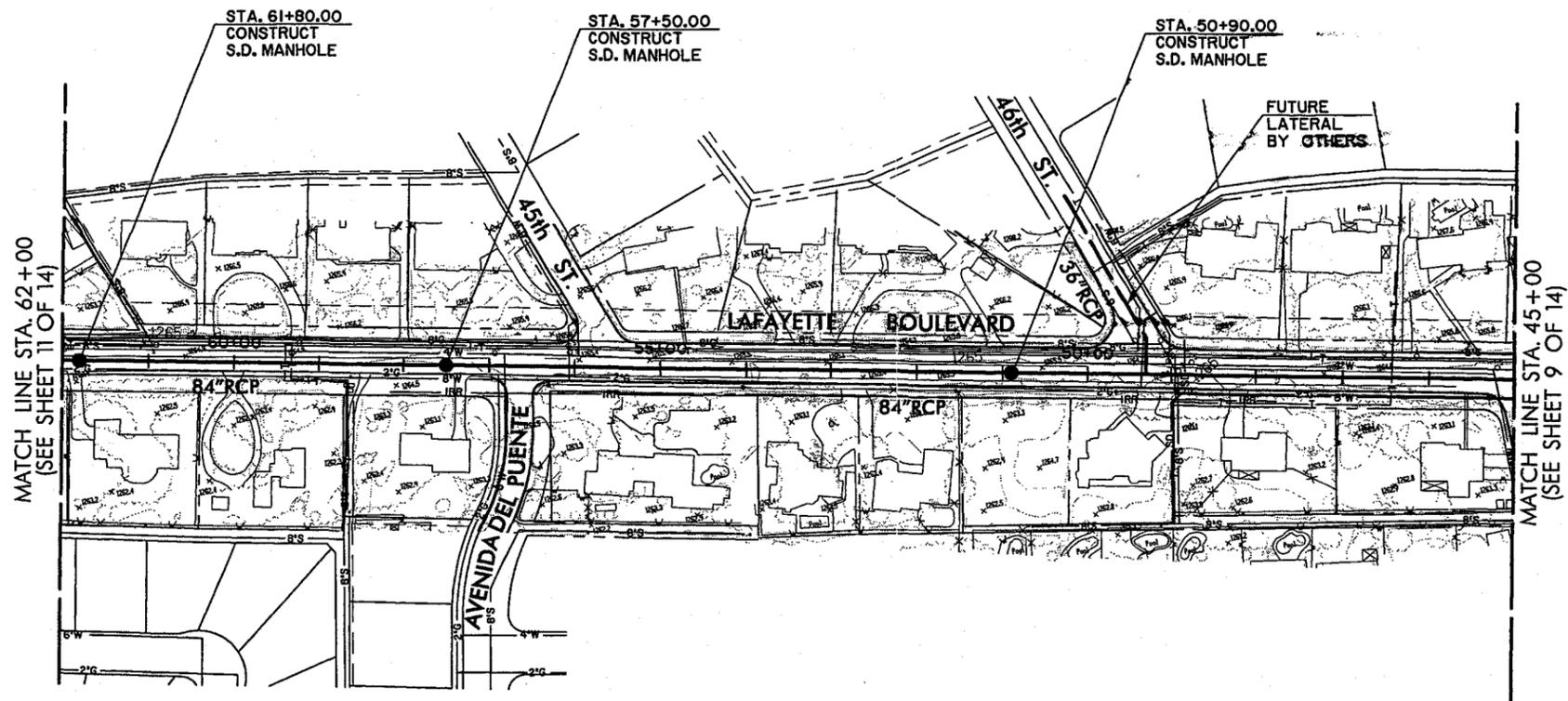
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NOTE : UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
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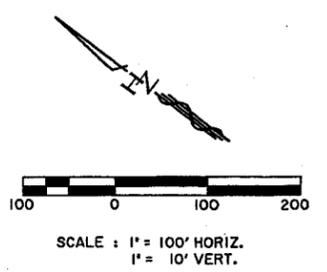
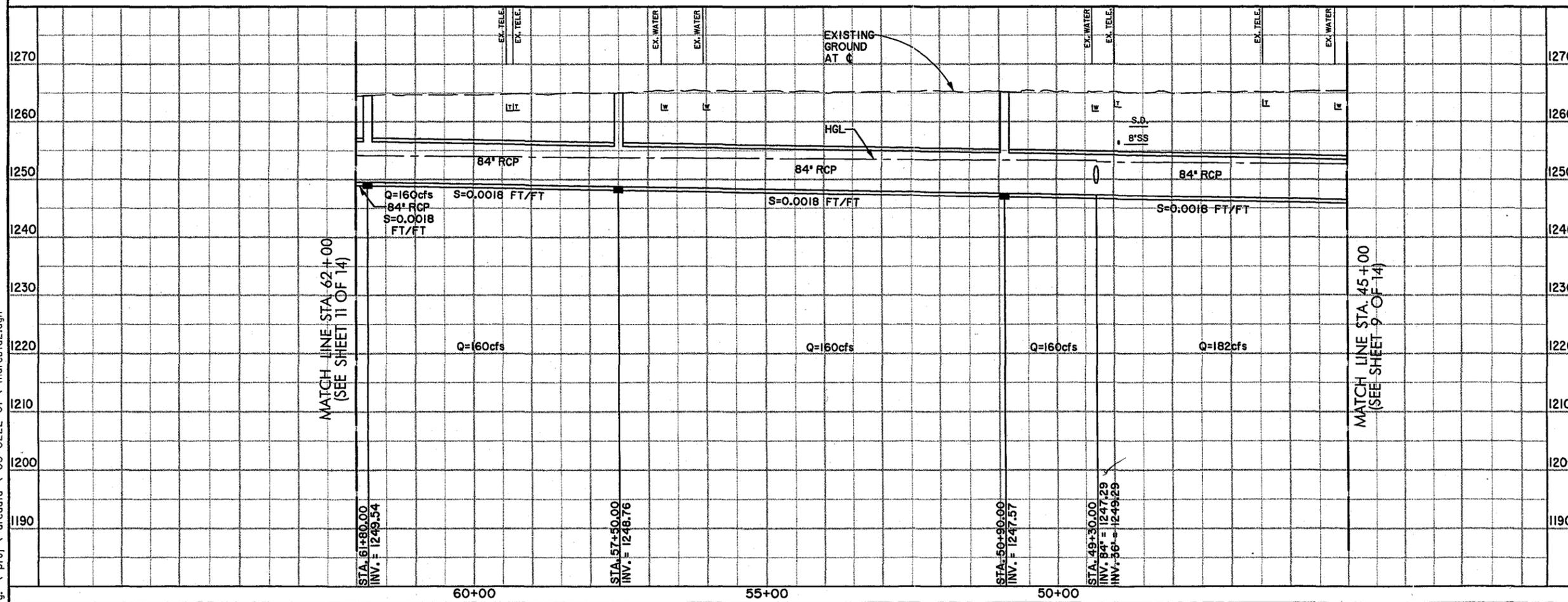


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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY</b> ENGINEERING DIVISION <b>ARCADIA AREA DRAINAGE STUDY</b> PROJECT NO. 94-21			
		DESIGNED	J. GIRAND 03-97
		DRAWN	B. McK. 03-97
		CHECKED	R. WISE 03-97
<b>HUITT - ZOLLARS</b> <small>4245 N. 24th PARKWAY, SUITE 102, PHOENIX, ARIZONA 85016-2029          (602) 381-0125 FAX (602) 381-8053</small>		ALTERNATE 2 "WEST" LAFAYETTE - 44th ST.	
		SHEET	9 OF 14

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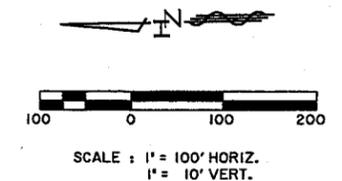
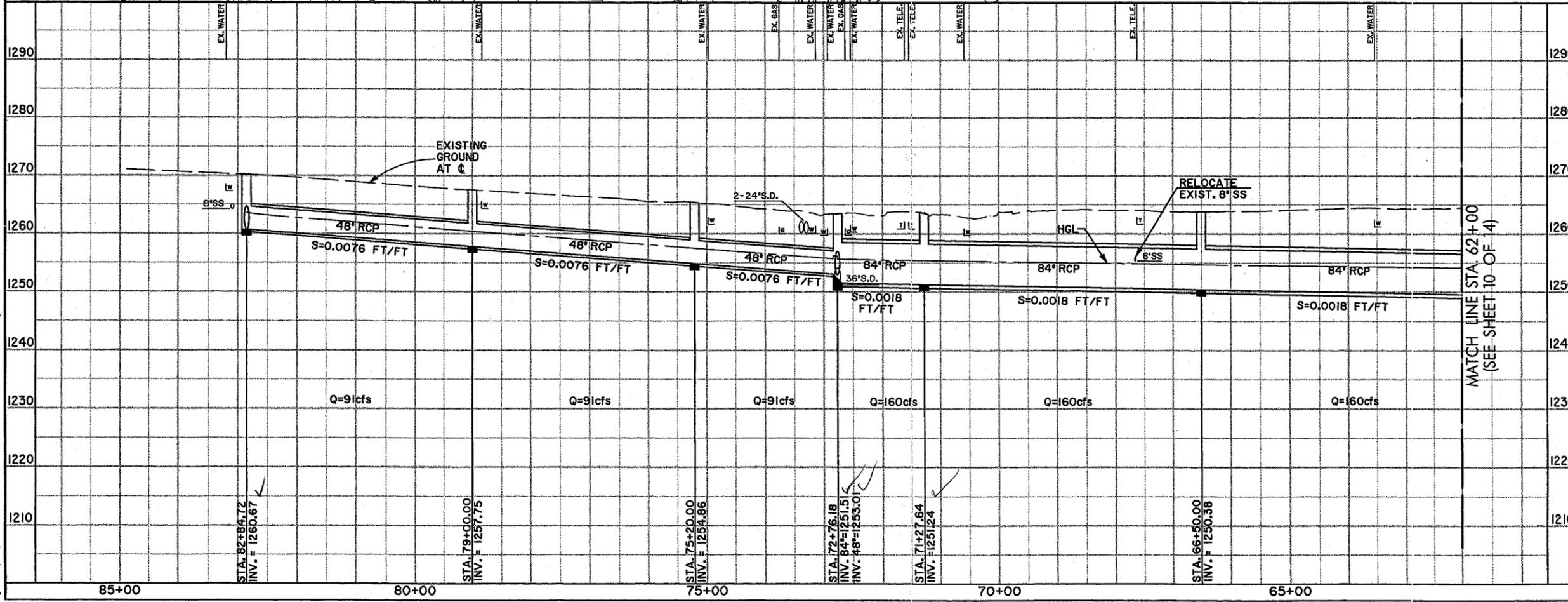
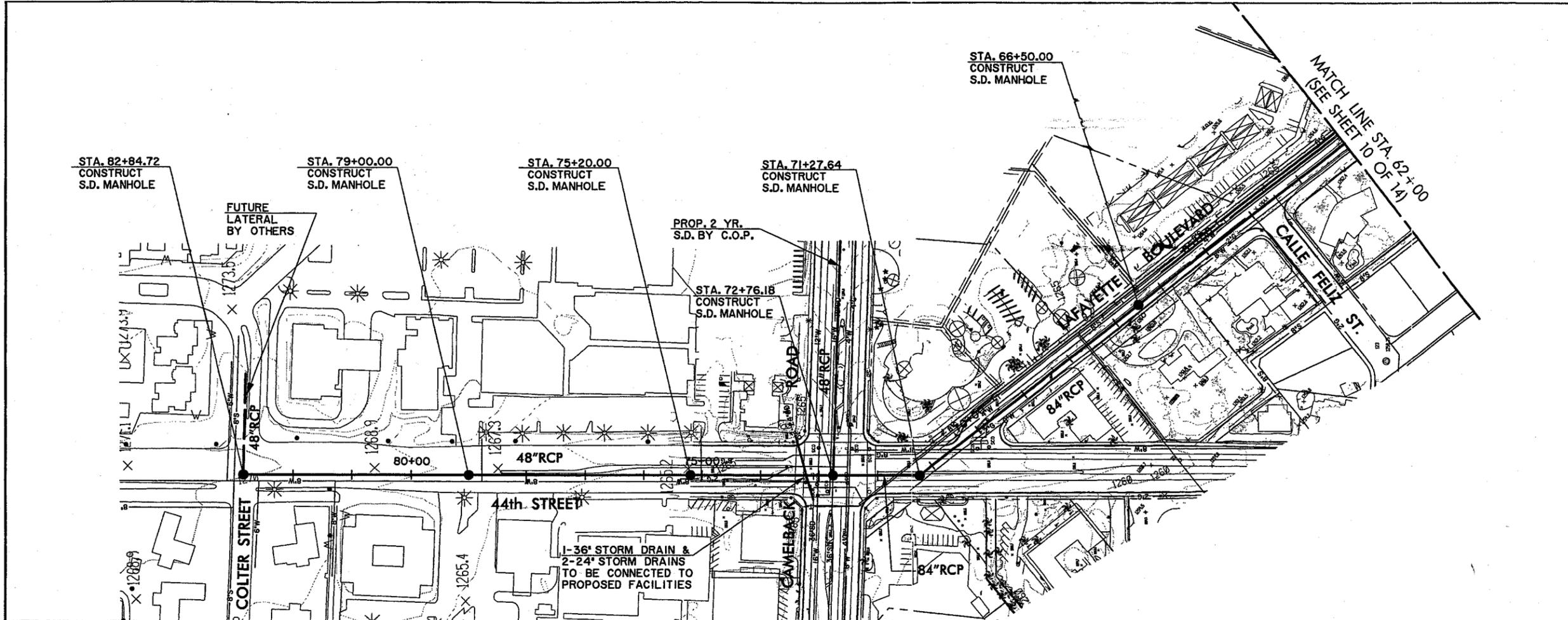
NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY</b> ENGINEERING DIVISION <b>ARCADIA AREA DRAINAGE STUDY</b> PROJECT NO. 94-21			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
	<b>HUITT-ZOLLARS</b> <small>6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85014-2029          (602) 381-0125 FAX (602) 381-8053</small>		
ALTERNATE 2			SHEET
"WEST" LAFAYETTE - 44th ST.			10 of 14

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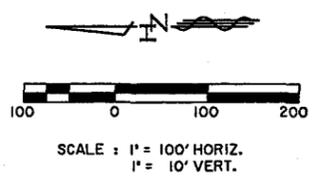
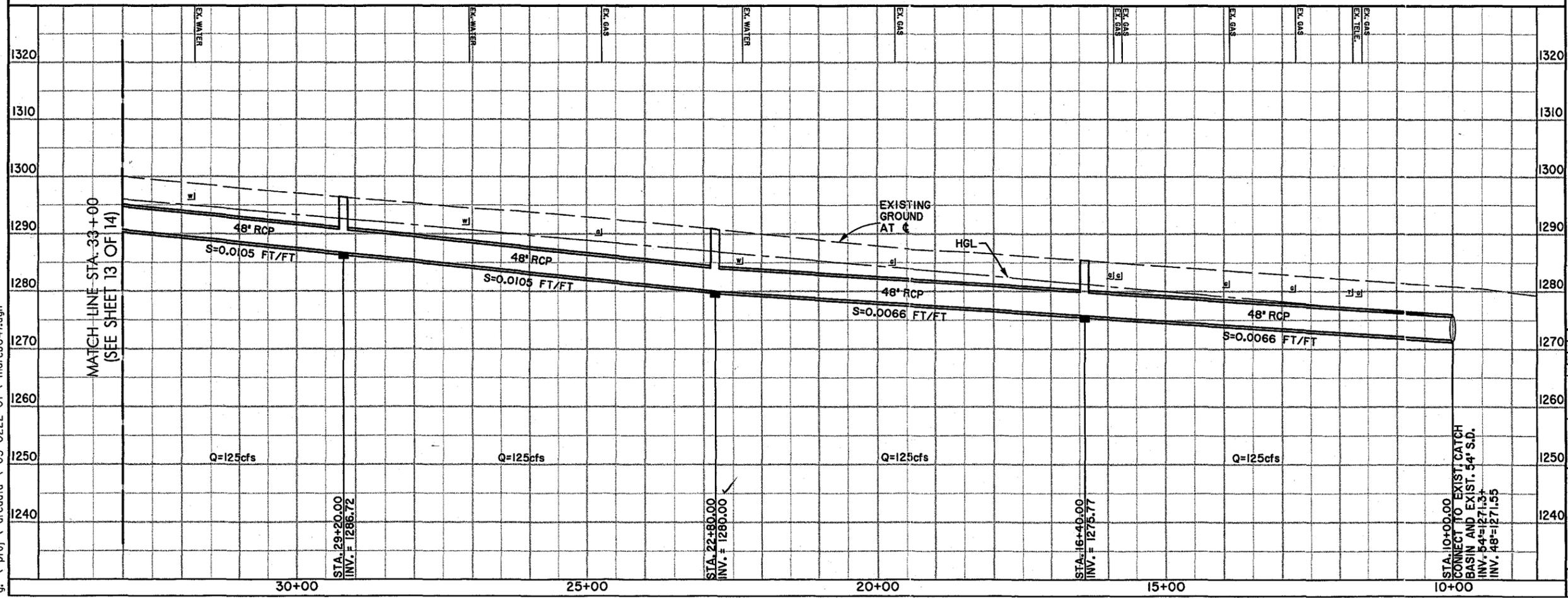
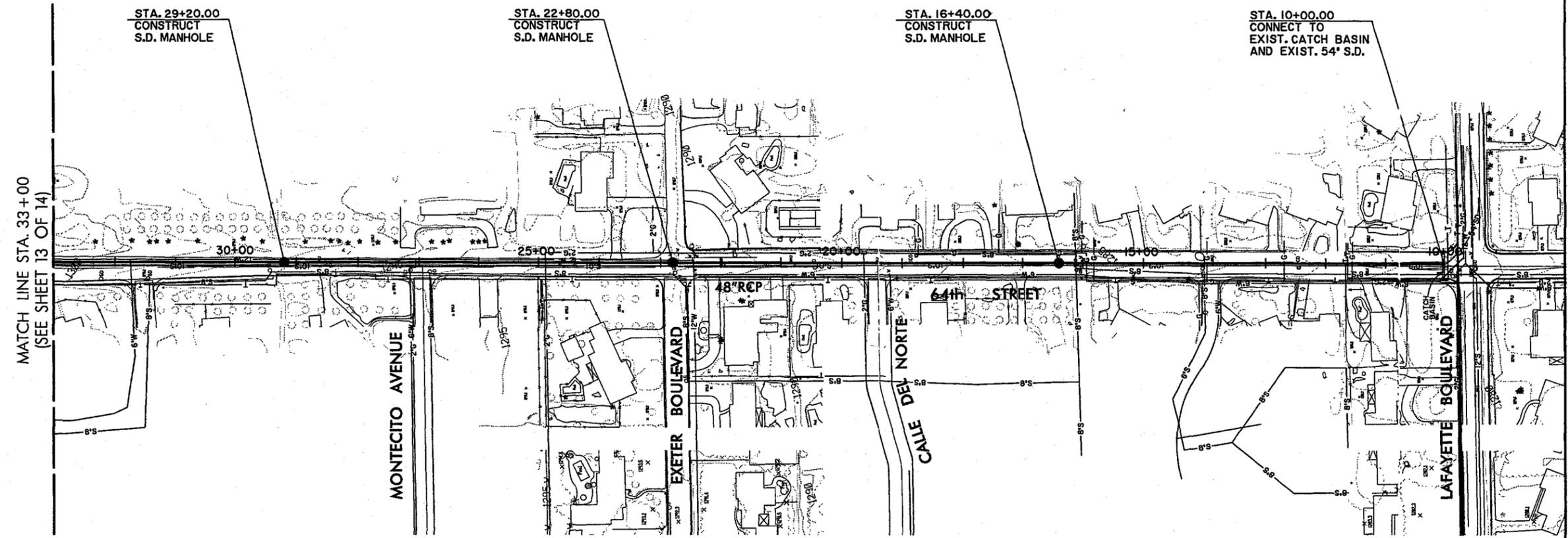
NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85016-2029          (602) 381-0125 FAX (602) 381-8053</small>			
ALTERNATE 2 "WEST" - LAFAYETTE - 44th ST.			SHEET 11 OF 14

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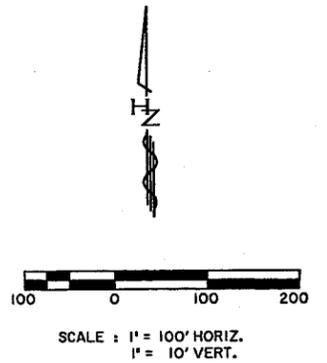
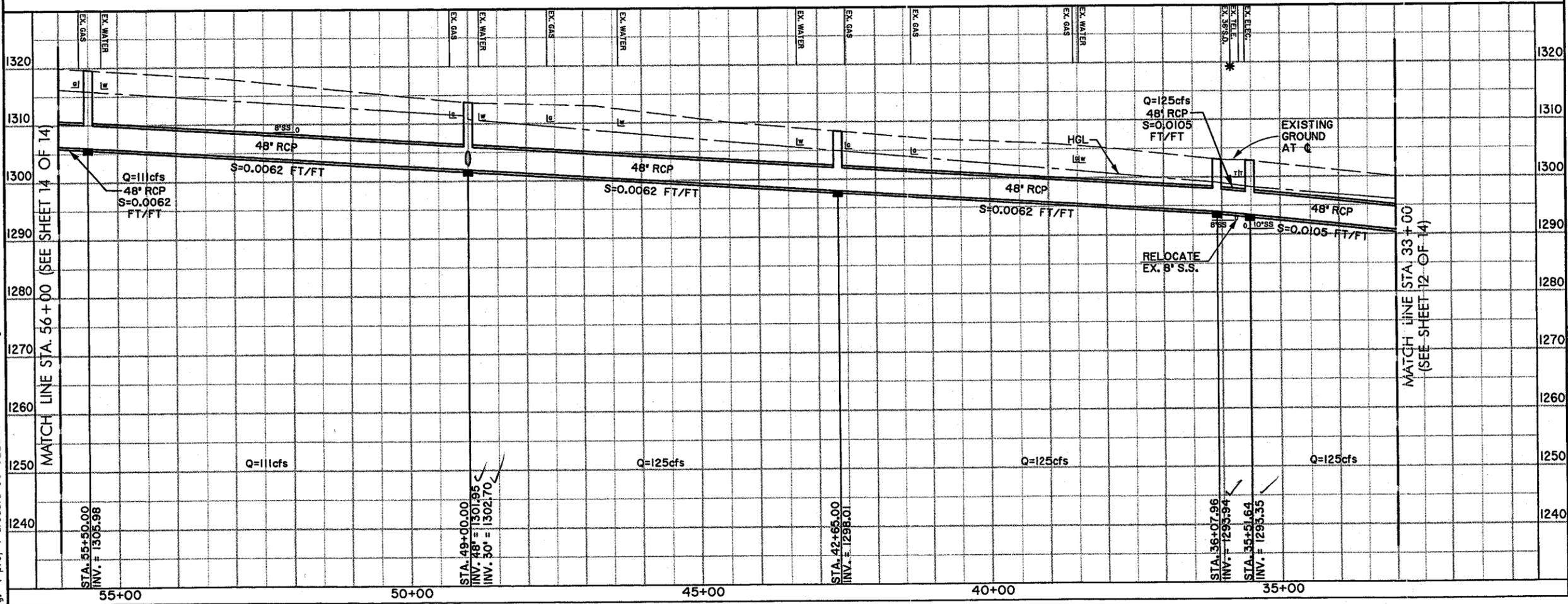
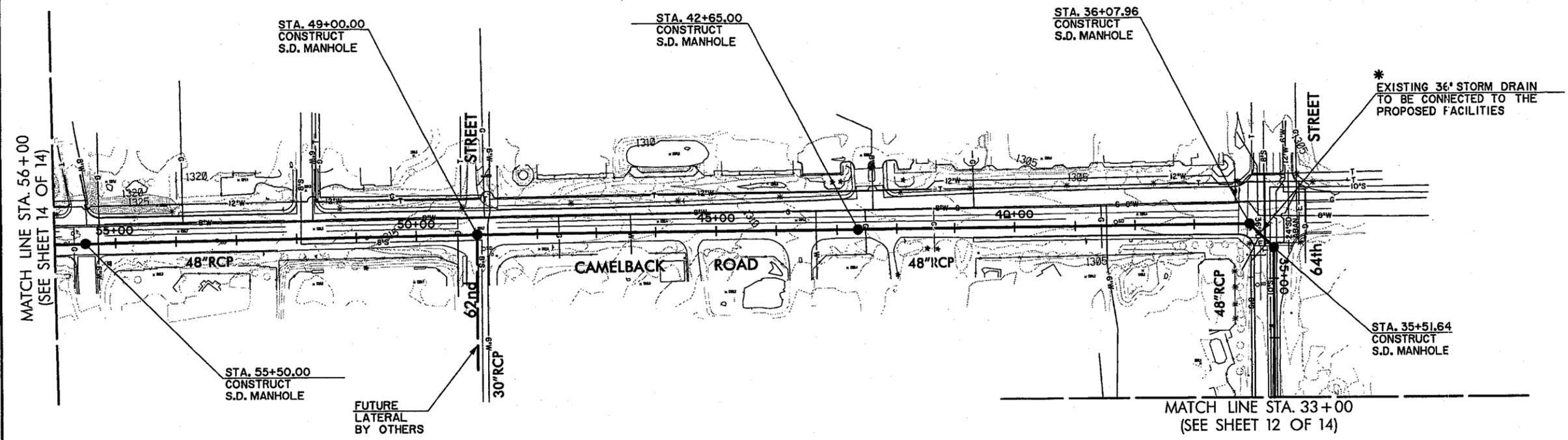
NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY</b> <b>ENGINEERING DIVISION</b> <b>ARCADIA AREA DRAINAGE STUDY</b> <b>PROJECT NO. 94-21</b>			
		BY	DATE
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. MCK.	03-97
	CHECKED	R. WISE	03-97
		<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85016-2029</small> <small>(602) 381-0125 FAX (602) 381-8053</small>	
ALTERNATE 2			SHEET
64th STREET - "EAST" CAMELBACK			12 OF 14

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NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
\*



NO.	REVISION	BY	DATE
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**FLOOD CONTROL DISTRICT OF MARICOPA COUNTY  
ENGINEERING DIVISION**

**ARCADIA AREA DRAINAGE STUDY  
PROJECT NO. 94-21**

	BY	DATE
DESIGNED	J. GIRAND	03-97
DRAWN	B. McK.	03-97
CHECKED	R. WISE	03-97

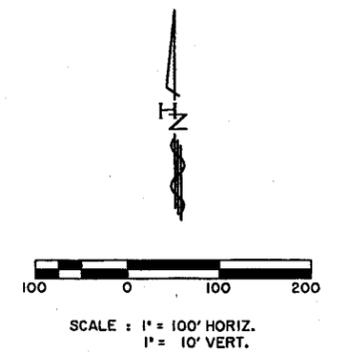
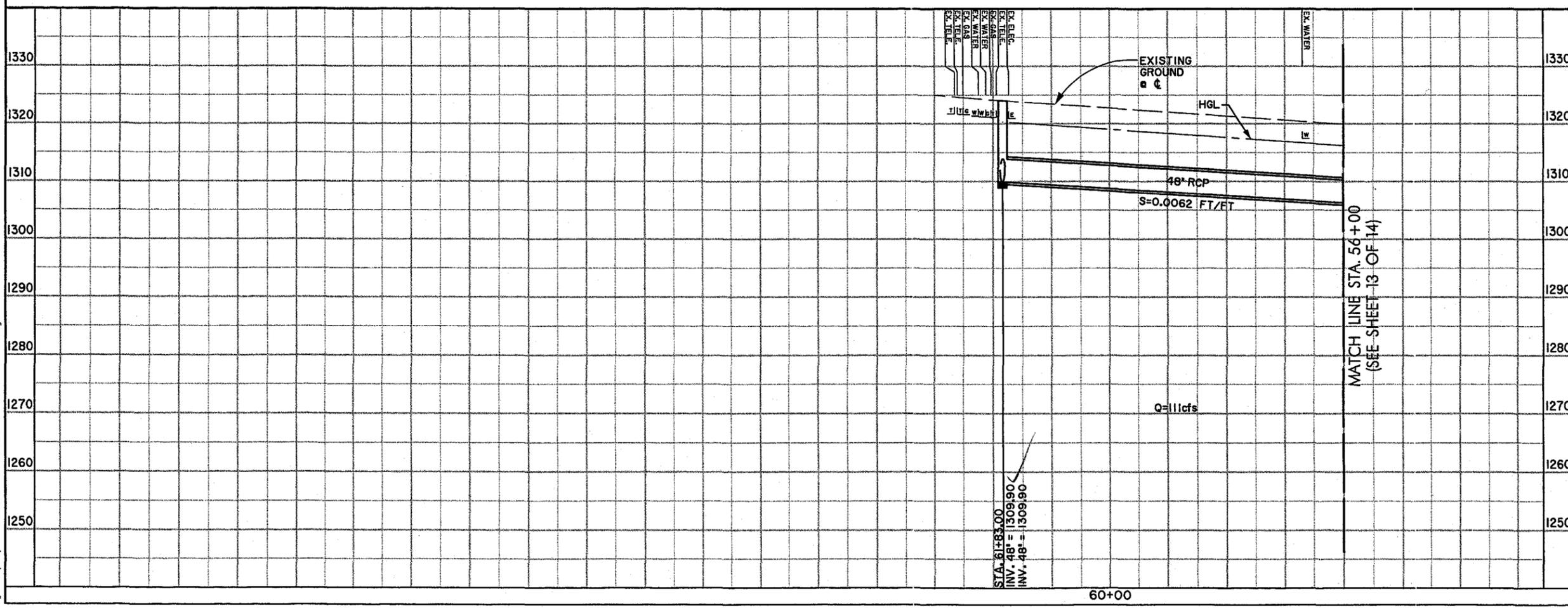
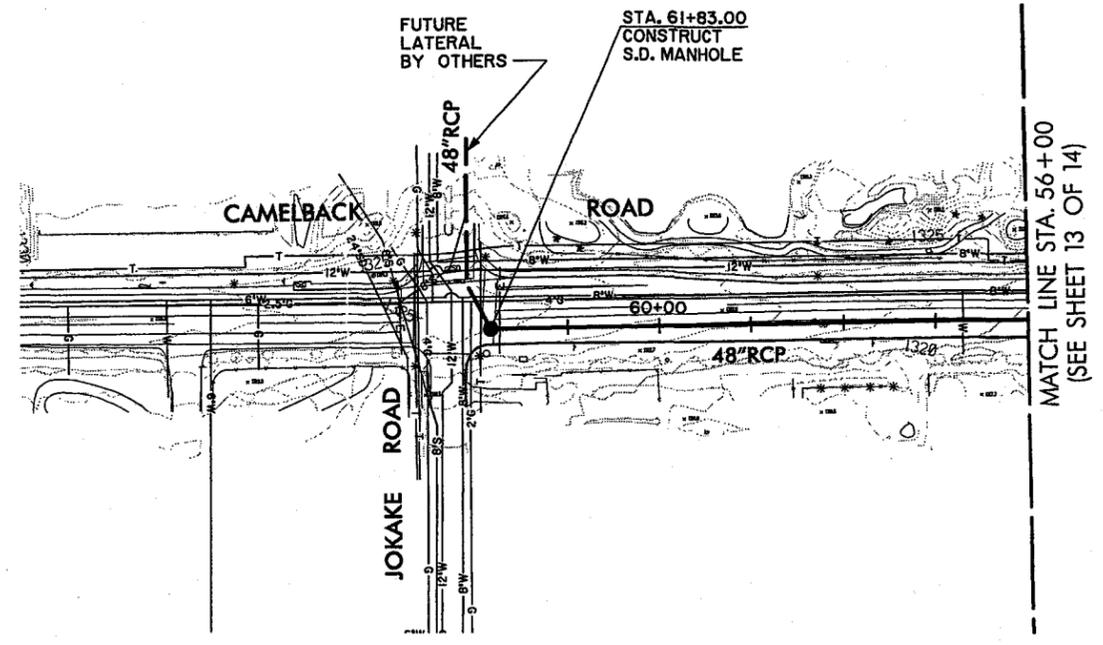
**HUITT - ZOLLARS**  
6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85016-2029  
(602) 381-0725 / FAX (602) 381-8053

ALTERNATE 2  
64th STREET - "EAST" CAMELBACK

SHEET  
13 OF 14

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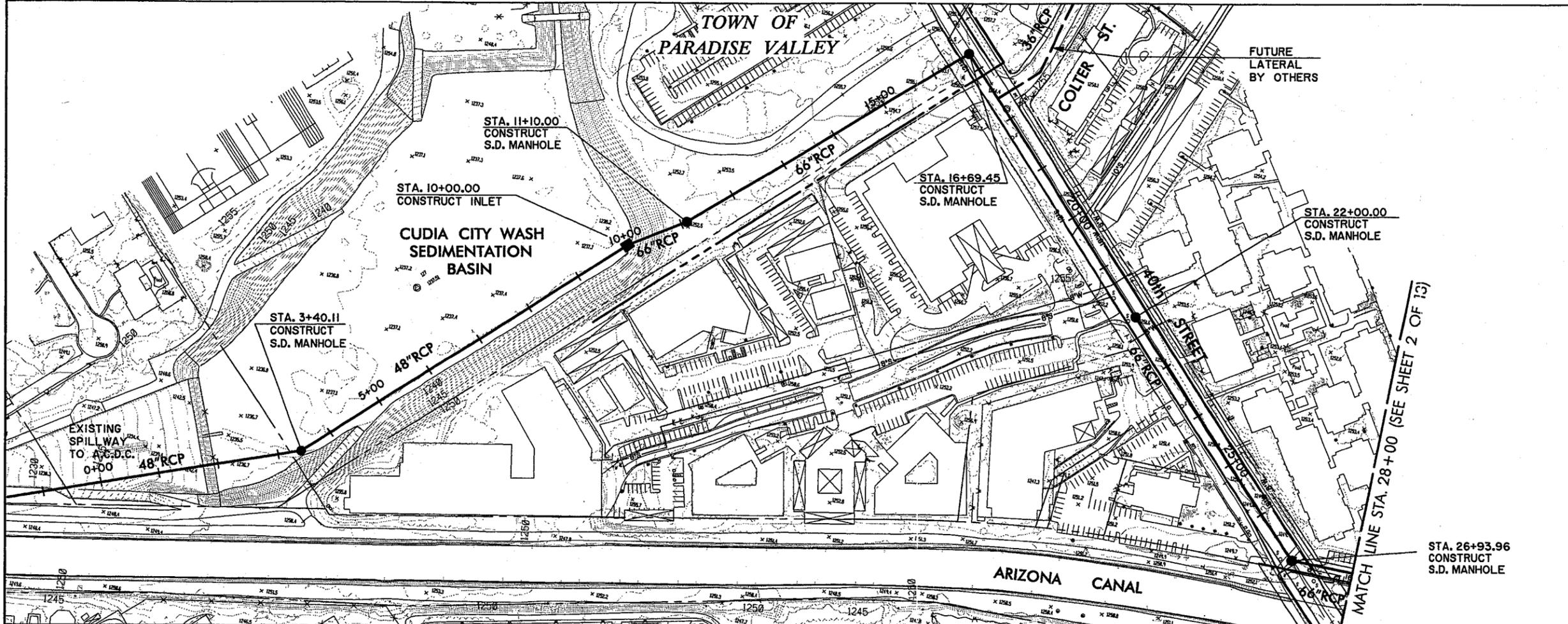
NOTE : UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
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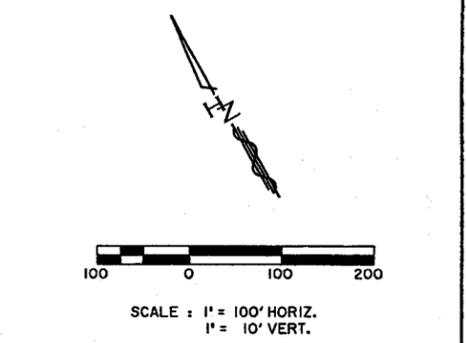
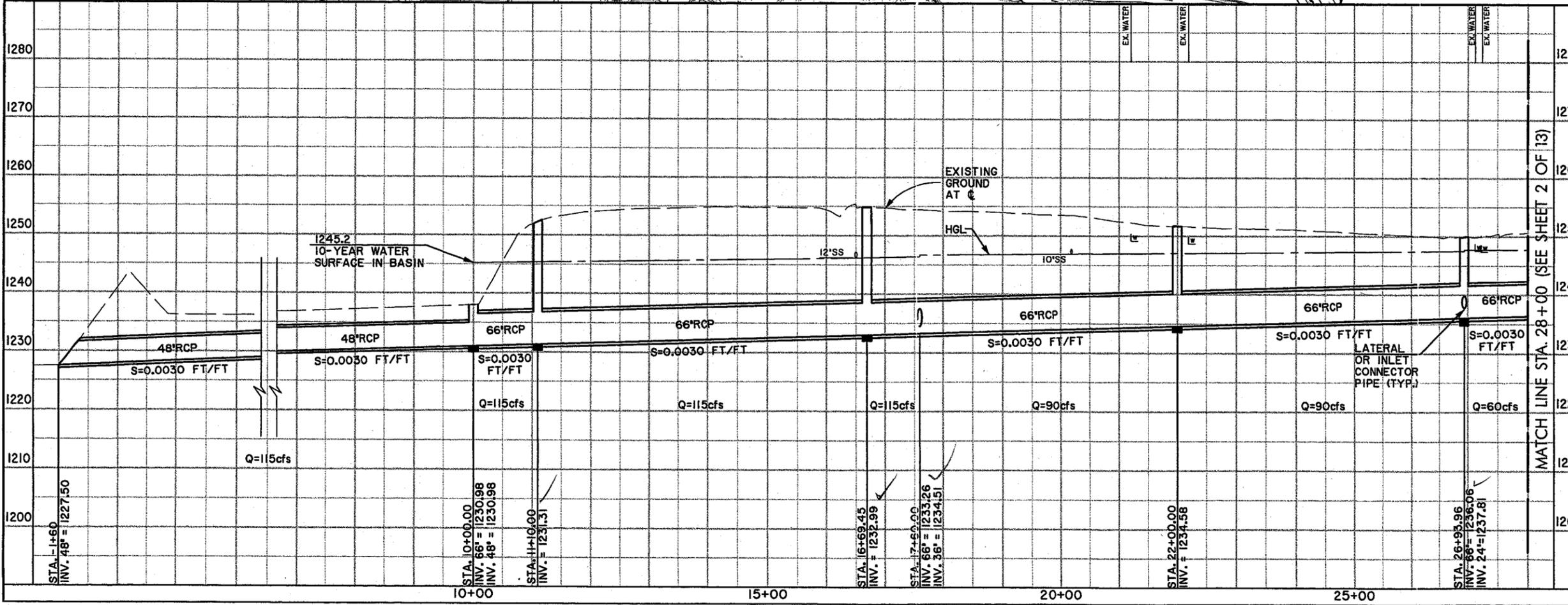
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY SUITE 102 PHOENIX, ARIZONA 85016-2029 (602) 381-0125 FAX (602) 381-8053</small>			SHEET <b>14 OF 14</b>

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ALTERNATE 2  
64th STREET - "EAST" CAMELBACK



NOTE : UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
\*



NO.	REVISION	BY	DATE
3			
2			
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**FLOOD CONTROL DISTRICT  
OF MARICOPA COUNTY  
ENGINEERING DIVISION**

**ARCADIA AREA  
DRAINAGE STUDY  
PROJECT NO. 94-21**

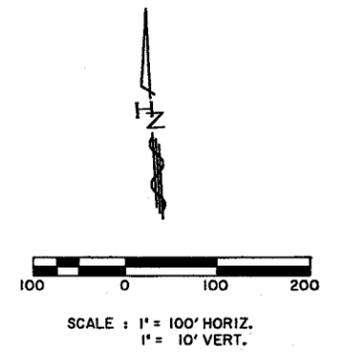
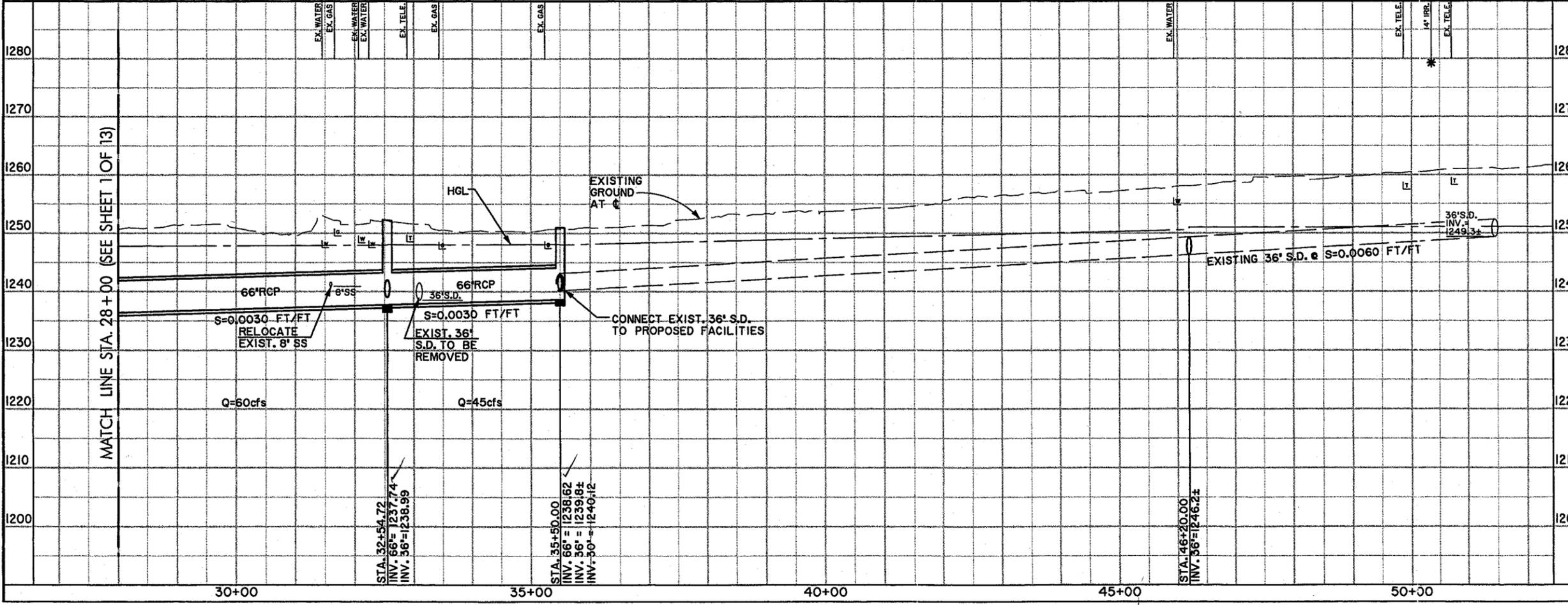
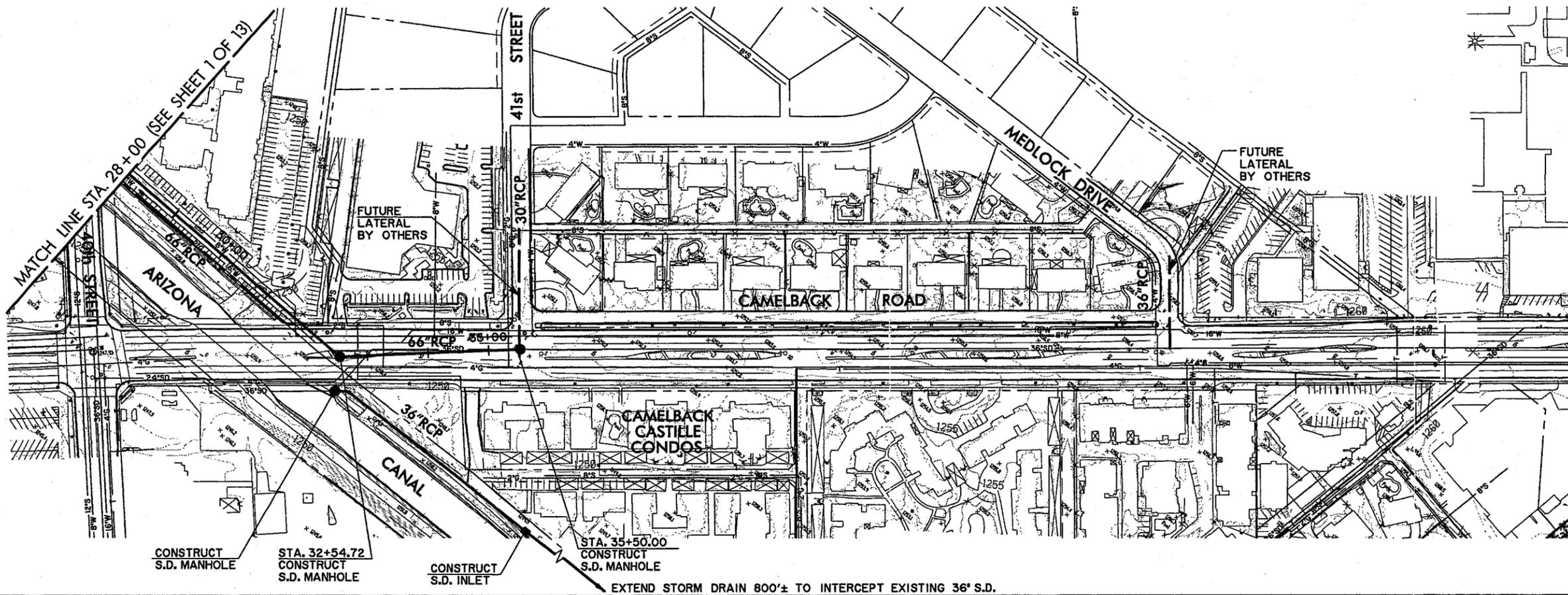
	BY	DATE
DESIGNED	J. GIRAND	03-97
DRAWN	B. McK.	03-97
CHECKED	R. WISE	03-97

**HUITT - ZOLLARS**  
4245 N. 24th PARKWAY, SUITE 102, PHOENIX, ARIZONA 85016-2029  
(602) 381-0125 FAX (602) 381-8053

ALTERNATE 3 CUDIA CITY WASH - 40th STREET - "WEST" CAMELBACK SHEET 1 OF 13

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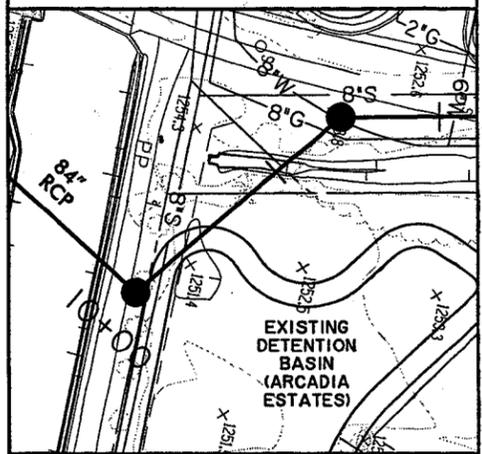
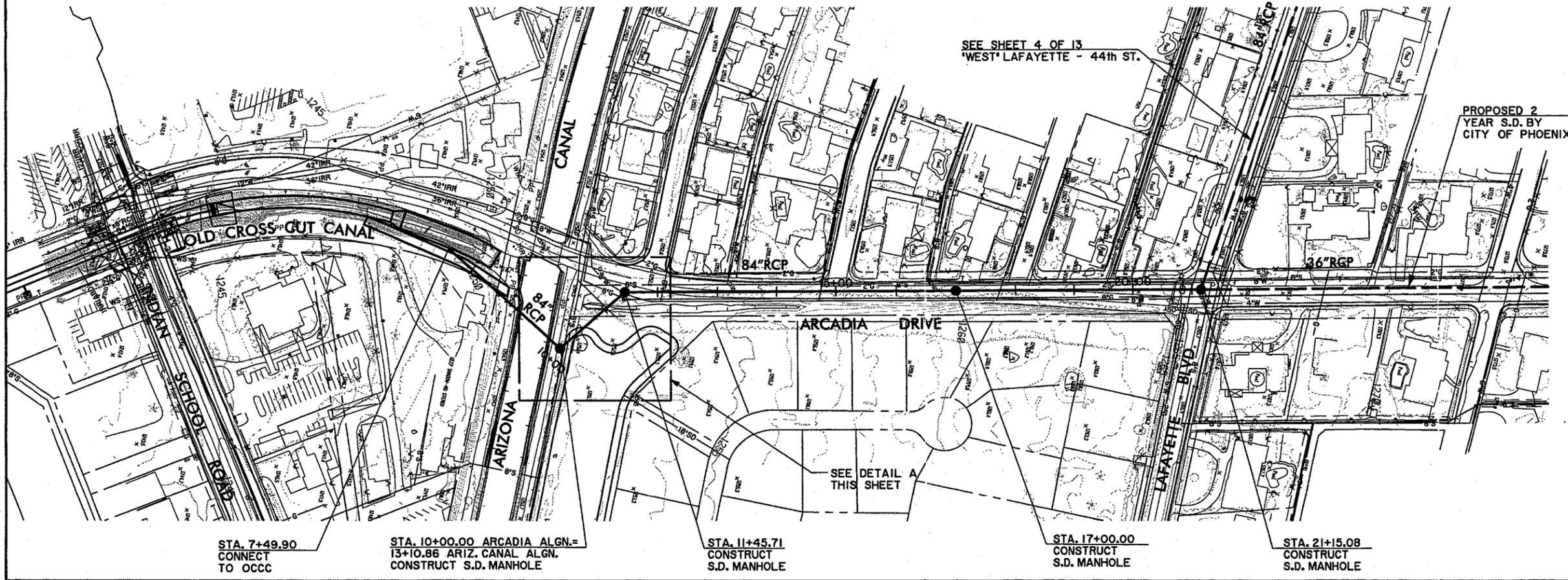
NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.



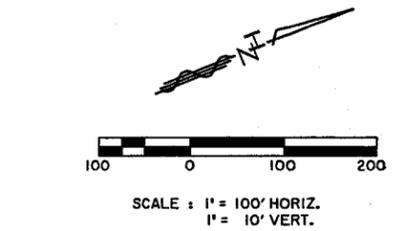
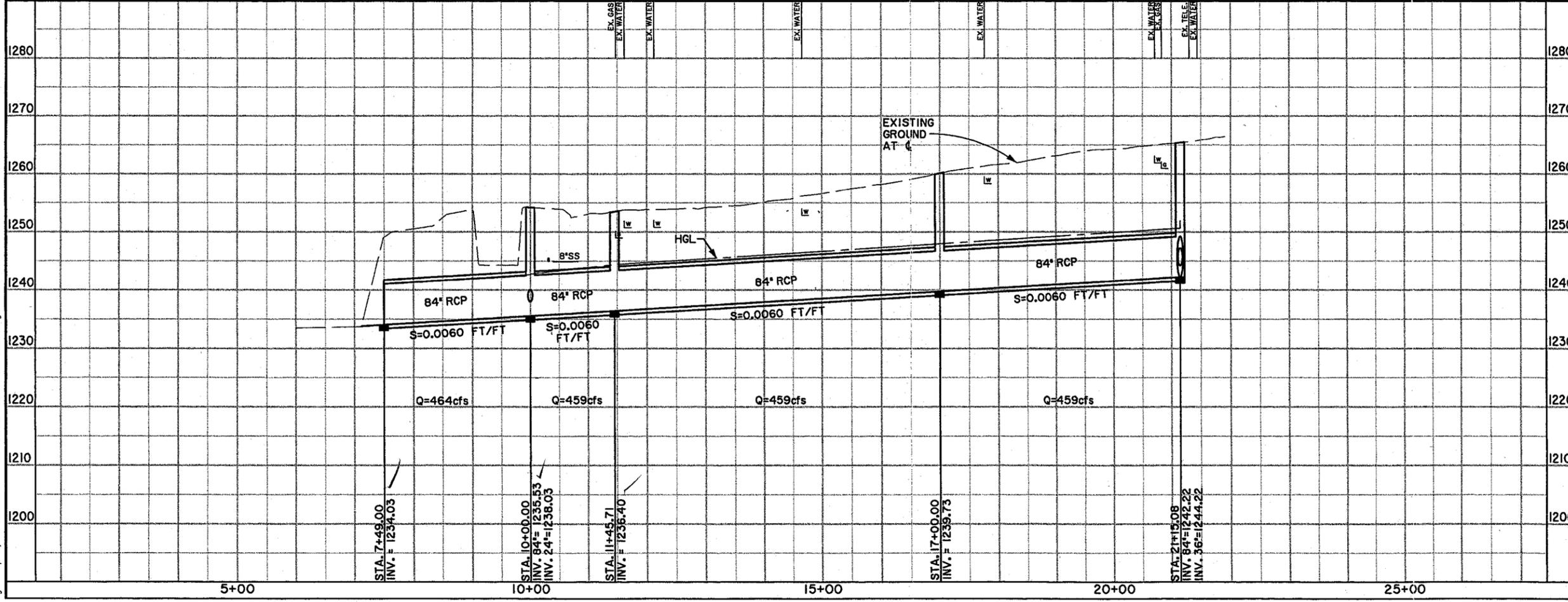
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
	<b>HUITT - ZOLLARS</b> <small>4245 N. 24th PARKWAY SUITE 102 PHOENIX, ARIZONA 85016-2029 (602) 381-0125 FAX (602) 381-8053</small>		
ALTERNATE 3 CUDIA CITY WASH - 40th STREET - "WEST" CAMELBACK			SHEET 2 OF 13

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NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.



DETAIL A



NO.	REVISION	BY	DATE
3			
2			
1			

**FLOOD CONTROL DISTRICT  
OF MARICOPA COUNTY  
ENGINEERING DIVISION**

**ARCADIA AREA  
DRAINAGE STUDY  
PROJECT NO. 94-21**

	BY	DATE
DESIGNED	J. GIRAND	03-97
DRAWN	B. McK.	03-97
CHECKED	R. WISE	03-97

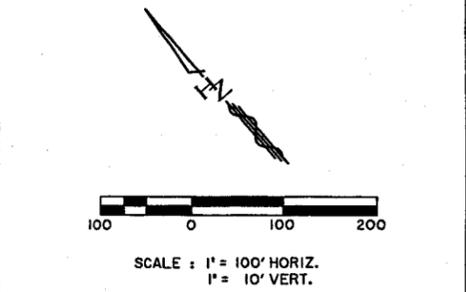
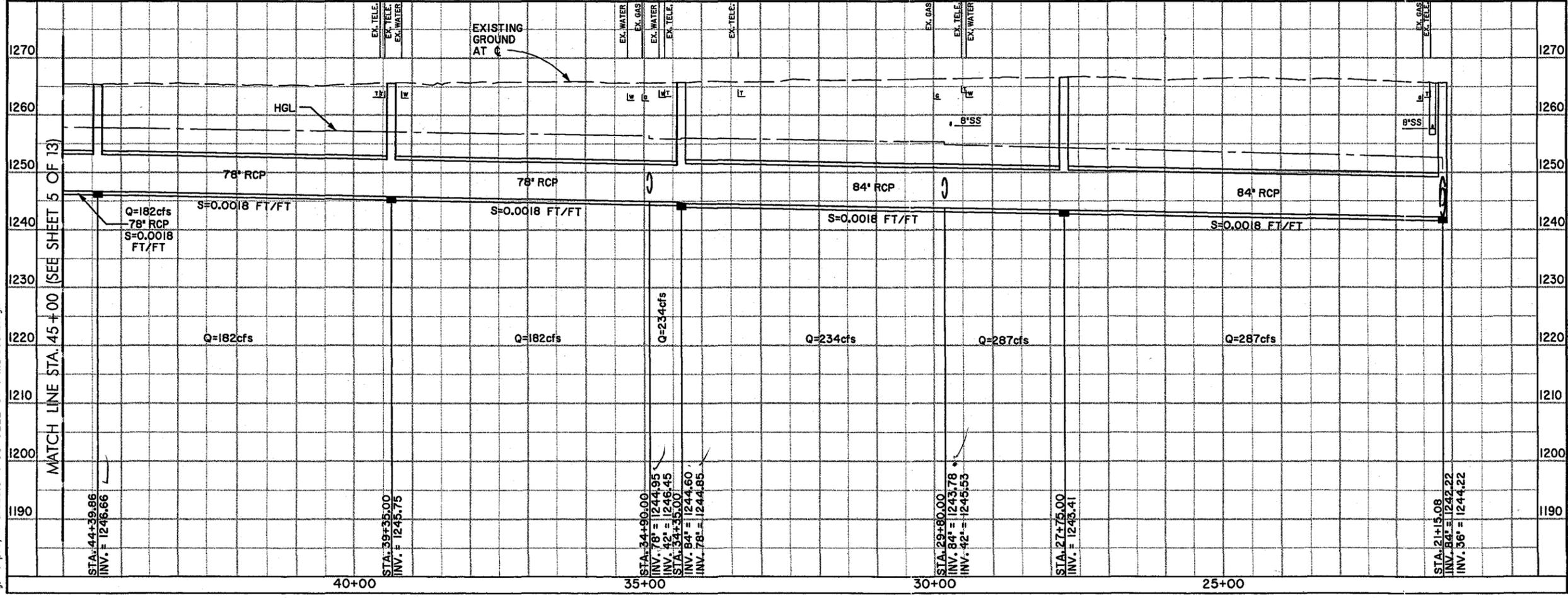
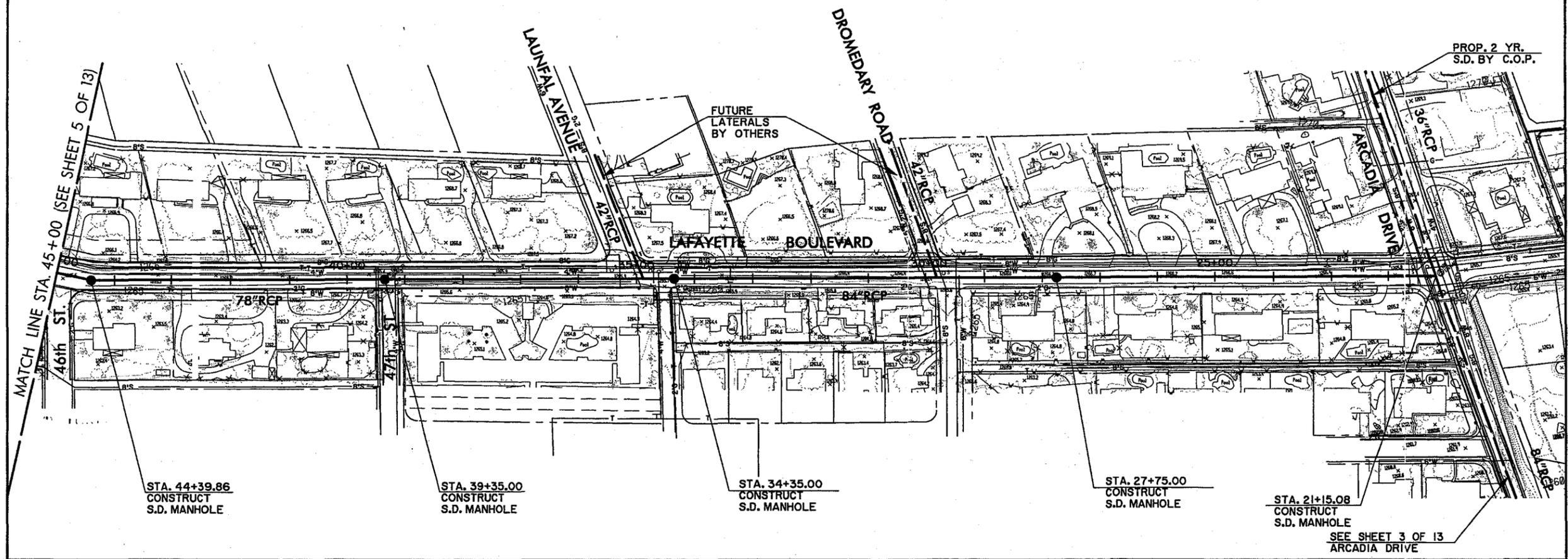
**HUITT-ZOLLARS**  
6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85016-2029  
(602) 381-0125 / FAX (602) 381-9053

ALTERNATE 3  
ARCADIA DRIVE

SHEET  
3 of 13

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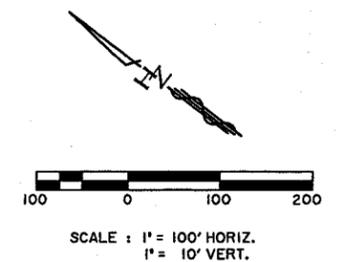
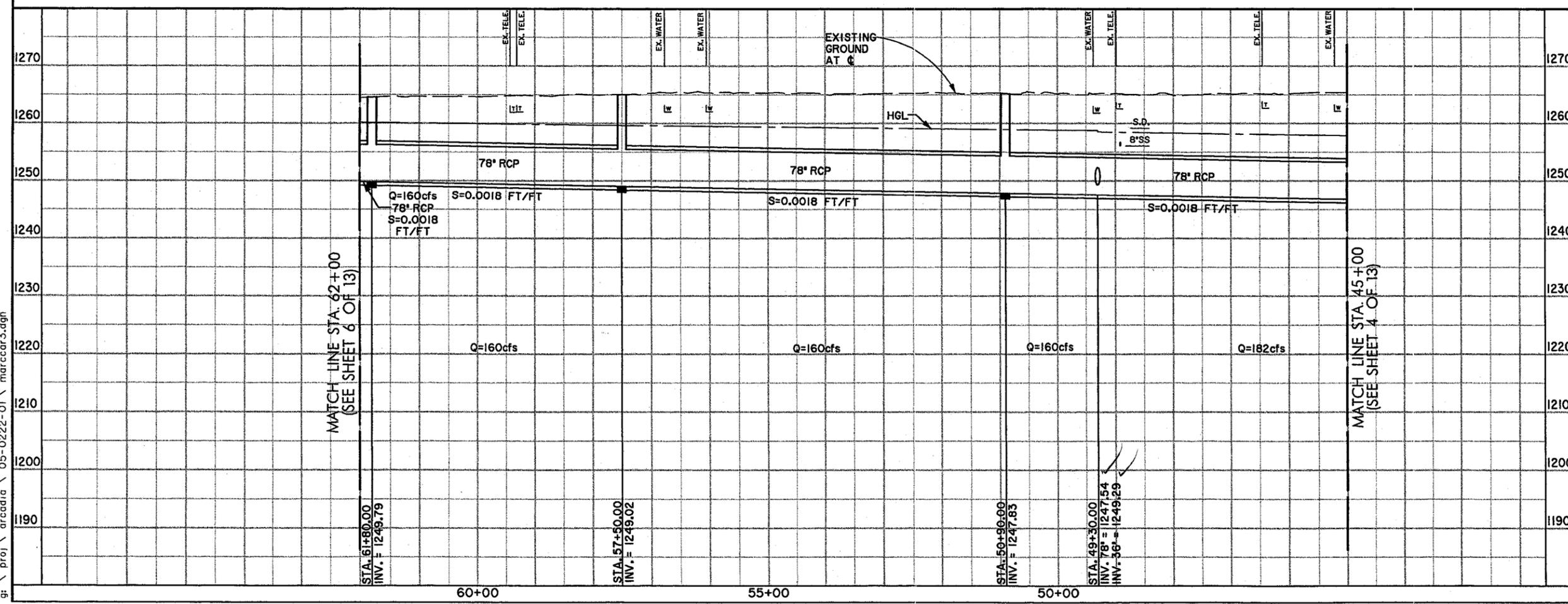
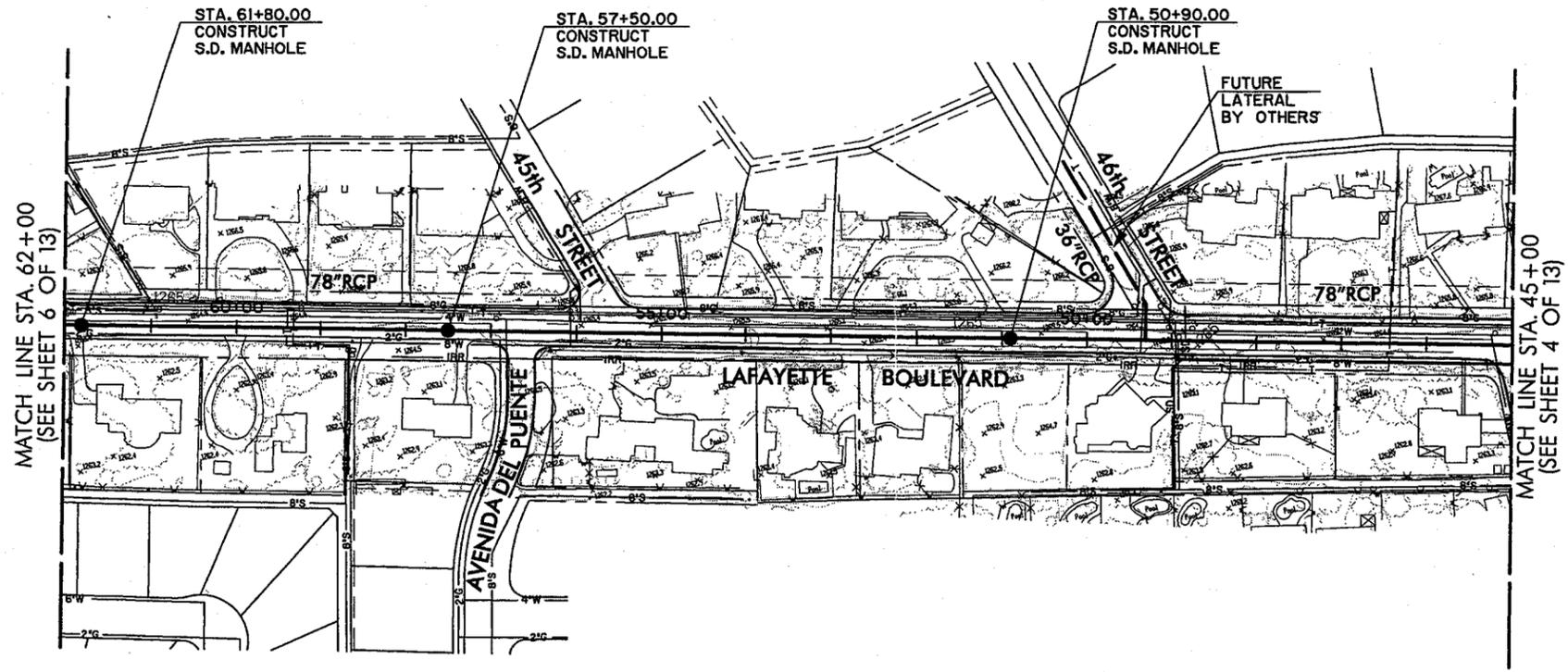
NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
\*



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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. MCK.	03-97
	CHECKED	R. WISE	03-97
	<b>HUITT-ZOLLARS</b> <small>6245 N. 24th PARKWAY SUITE 102 PHOENIX, ARIZONA 85016-2029          (602) 381-0125 FAX (602) 381-8033</small>		
ALTERNATE 3 "WEST" LAFAYETTE - 44th ST.			SHEET 4 of 13

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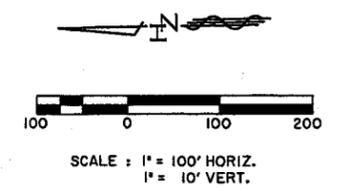
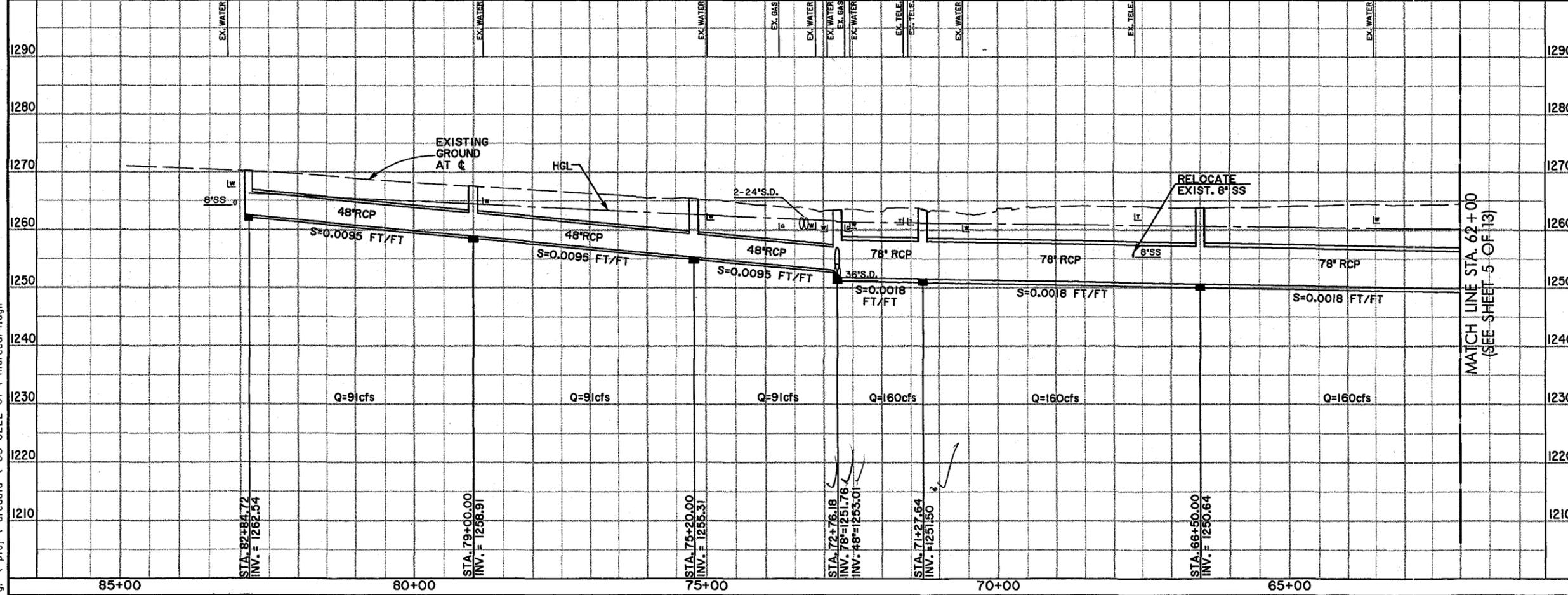
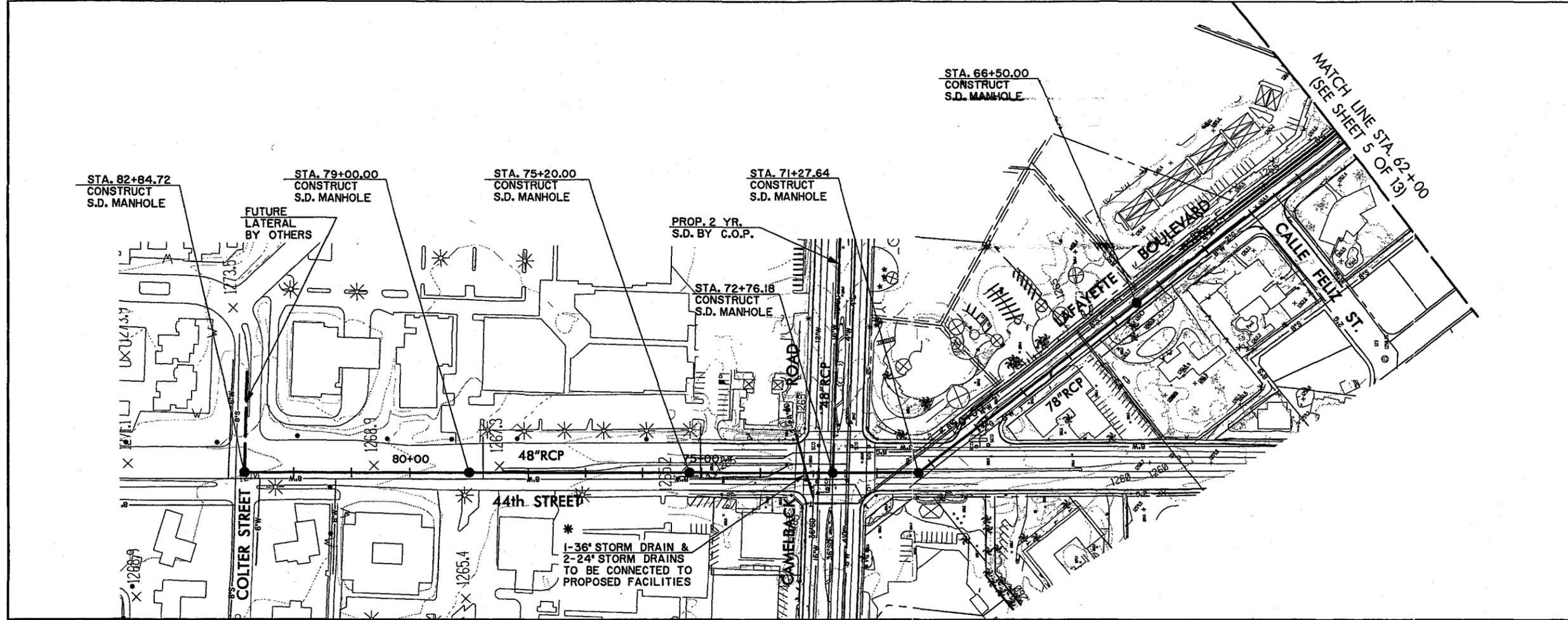
NOTE : UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
\*



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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. MCK.	03-97
	CHECKED	R. WISE	03-97
<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY SUITE 102 PHOENIX, ARIZONA 85016-2029          (602) 381-0125 FAX (602) 381-8853</small>			
ALTERNATE 3 "WEST" LAFAYETTE - 44th ST.			SHEET 5 OF 13

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NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.



NO.	REVISION	BY	DATE
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**FLOOD CONTROL DISTRICT OF MARICOPA COUNTY**  
ENGINEERING DIVISION

**ARCADIA AREA DRAINAGE STUDY**  
PROJECT NO. 94-21

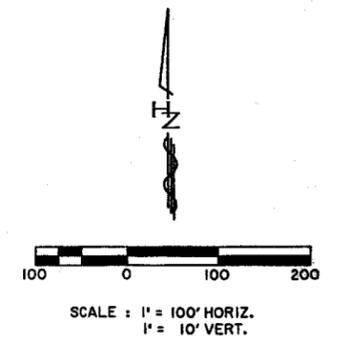
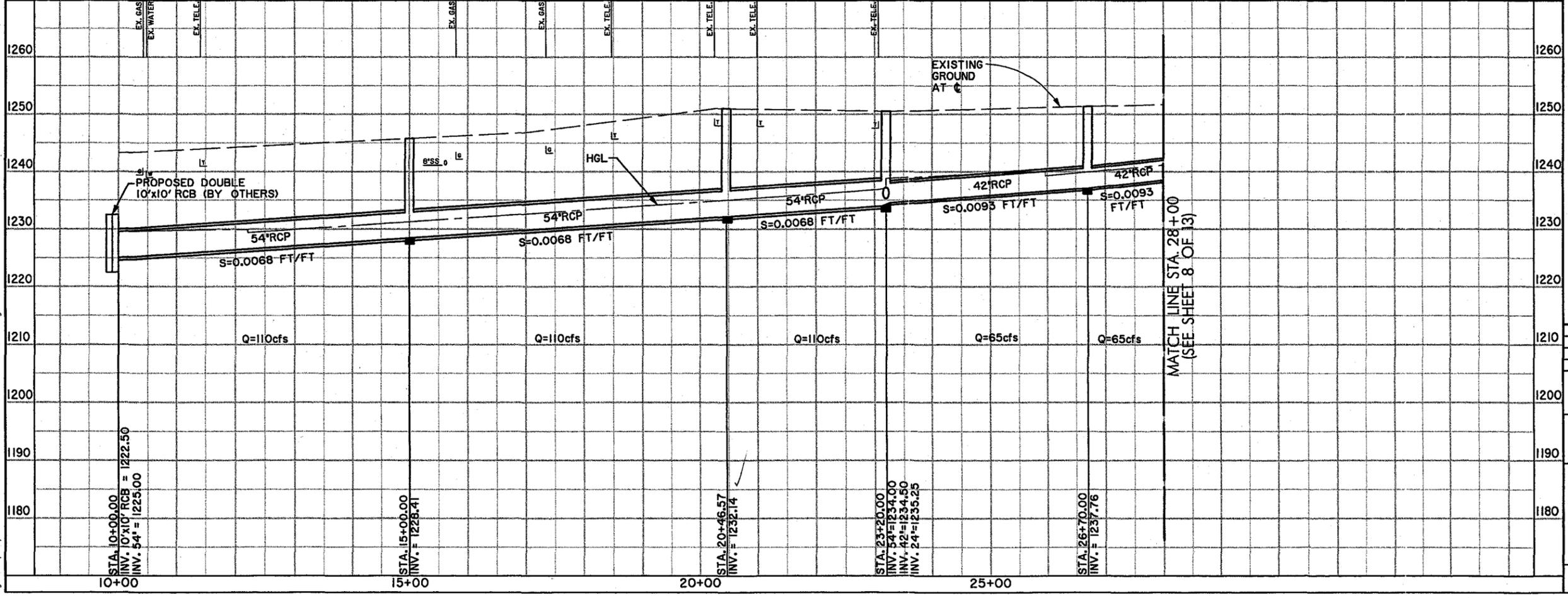
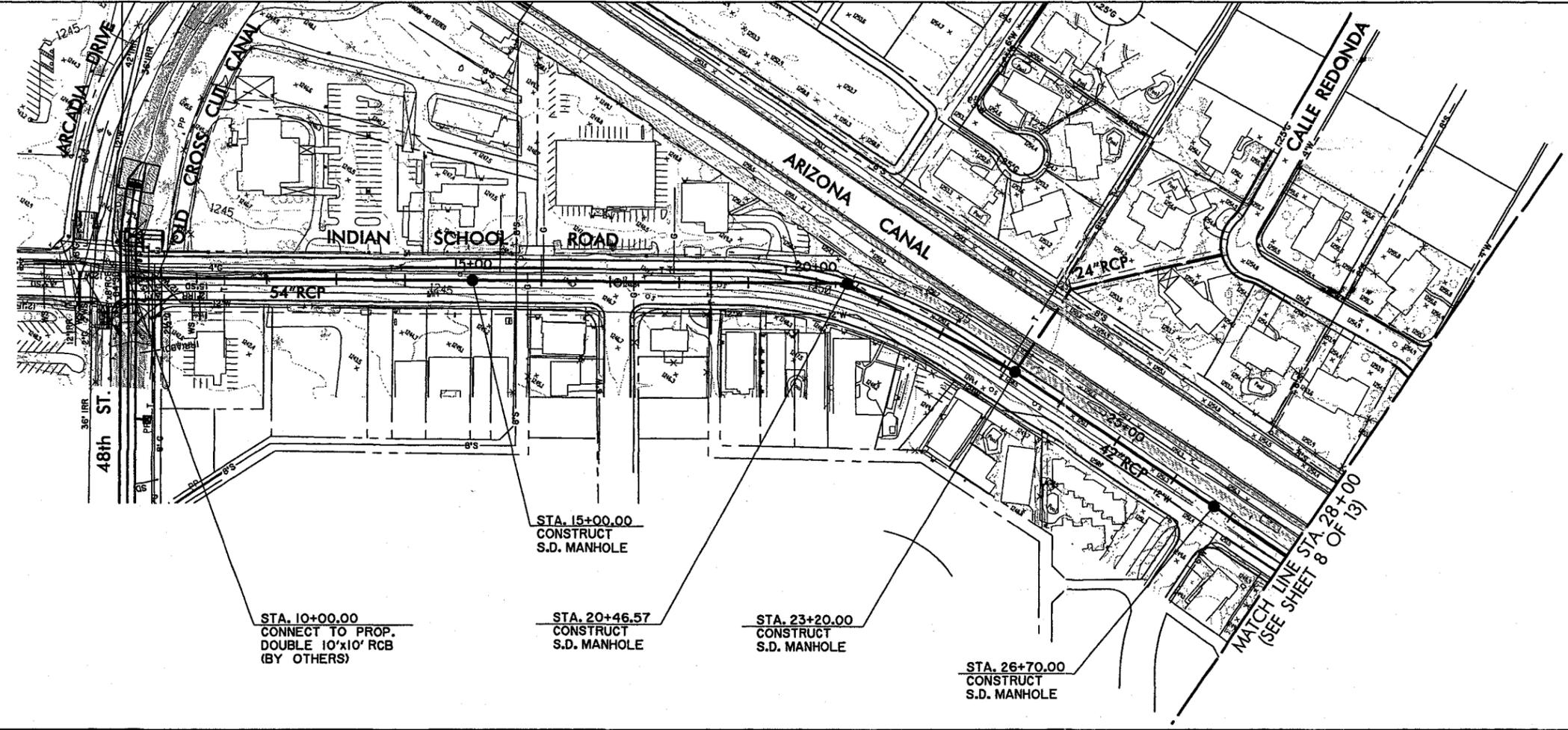
DESIGNED	J. GIRAND	03-97
DRAWN	B. MCK.	03-97
CHECKED	R. WISE	03-97

**HUITT-ZOLLARS**  
6245 N. 24th PARKWAY SUITE 102 PHOENIX, ARIZONA 85016-2029  
(602) 381-0125 FAX (602) 381-8053

ALTERNATE 3 SHEET  
"WEST" LAFAYETTE - 44th ST. 6 OF 13

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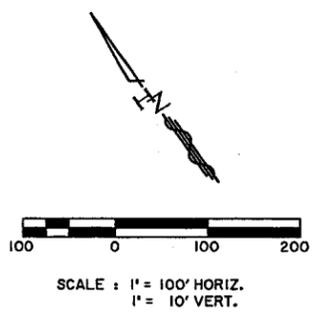
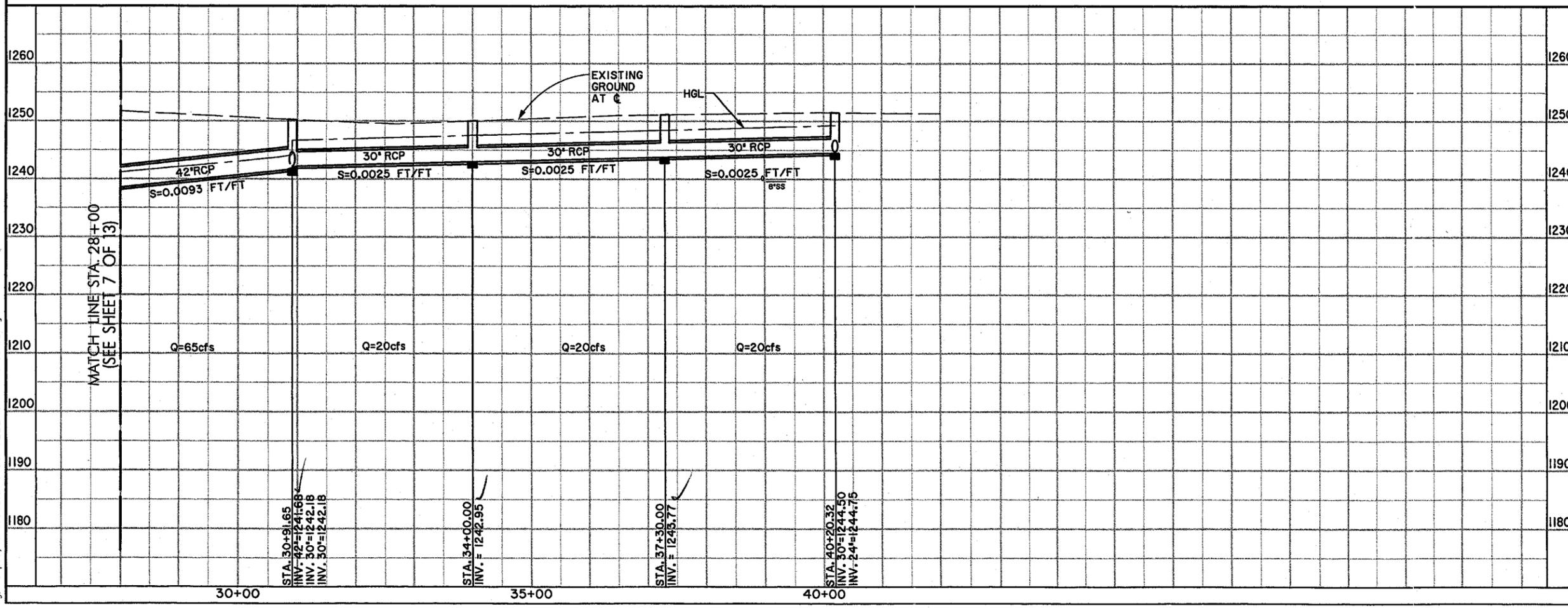
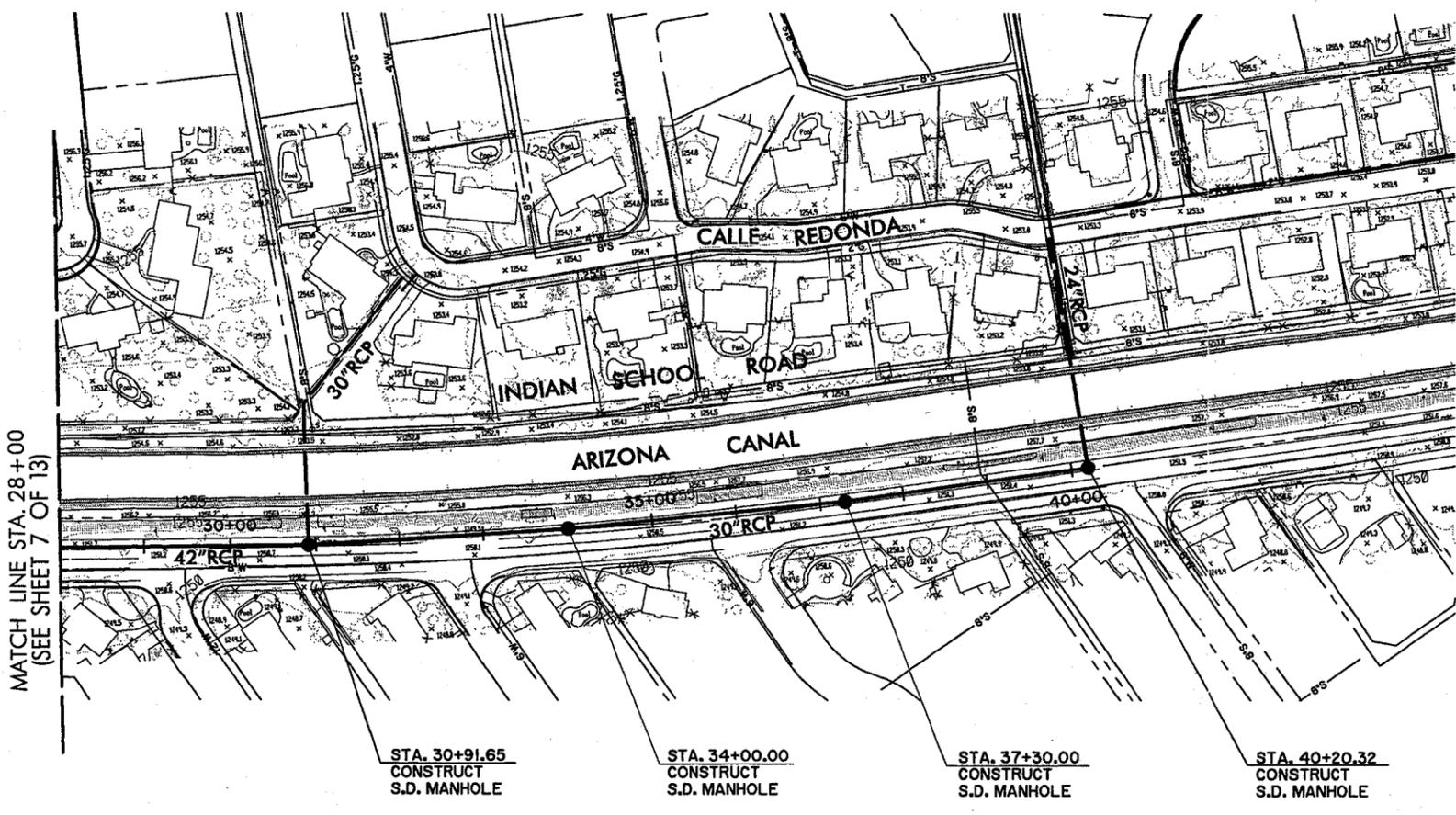
NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY</b> ENGINEERING DIVISION <b>ARCADIA AREA DRAINAGE STUDY</b> <b>PROJECT NO. 94-21</b>			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. MCK.	03-97
	CHECKED	R. WISE	03-97
	<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY, SUITE 102, PHOENIX, ARIZONA 85016-2029          (602) 381-0225 FAX (602) 381-8053</small>		
ALTERNATE 3 INDIAN SCHOOL RD.			SHEET 7 OF 13

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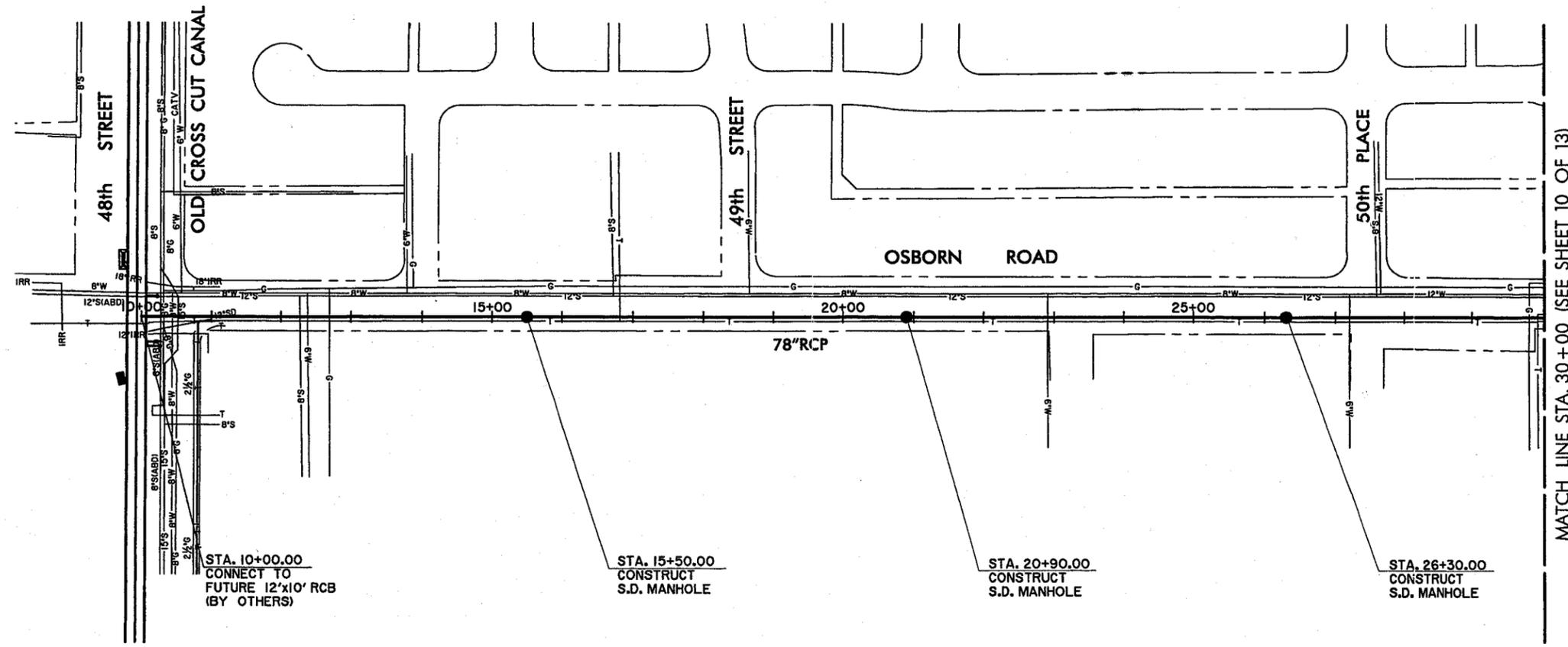
NOTE : UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
	<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85016-2029 (602) 381-0125 FAX (602) 381-8553</small>		
ALTERNATE 3 INDIAN SCHOOL RD.			SHEET 8 OF 13

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NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
\*



NOTE: MAPPING UNAVAILABLE FOR THIS AREA.

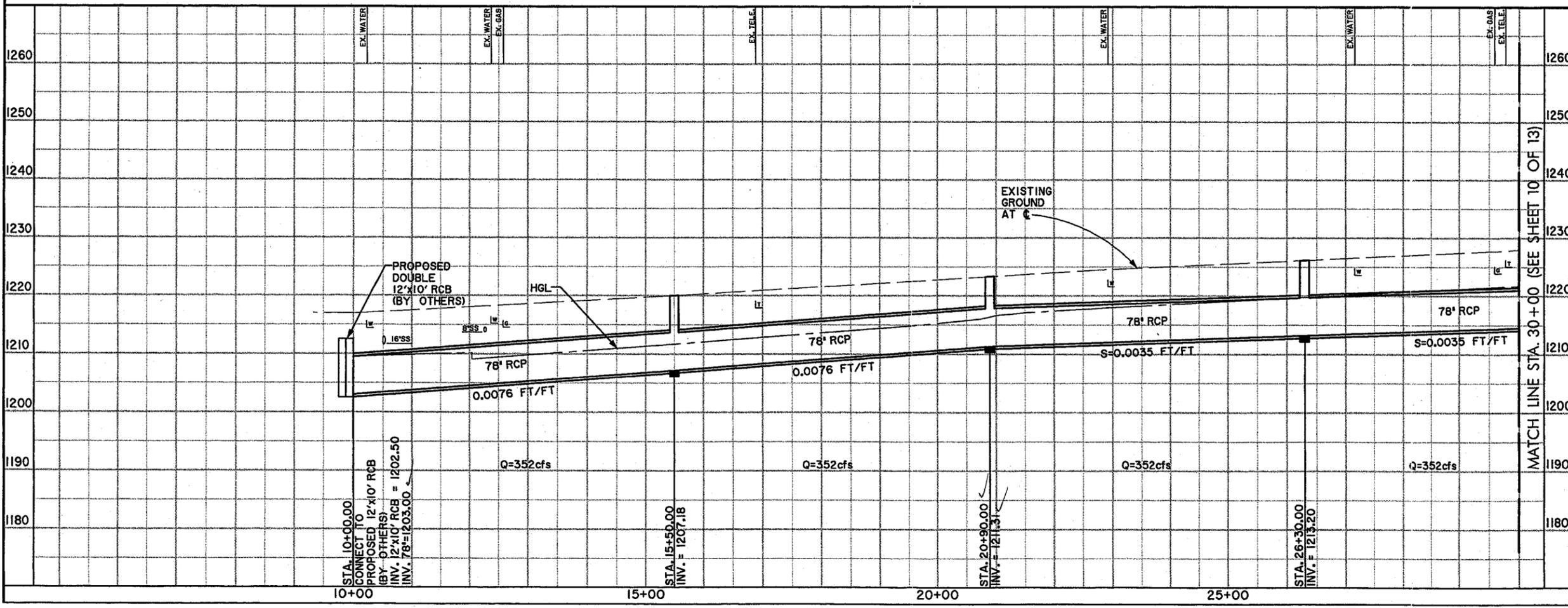
STA. 10+00.00  
CONNECT TO  
FUTURE 12"x10' RCB  
(BY OTHERS)

STA. 15+50.00  
CONSTRUCT  
S.D. MANHOLE

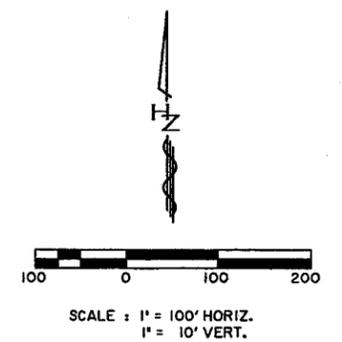
STA. 20+90.00  
CONSTRUCT  
S.D. MANHOLE

STA. 26+30.00  
CONSTRUCT  
S.D. MANHOLE

MATCH LINE STA. 30+00 (SEE SHEET 10 OF 13)

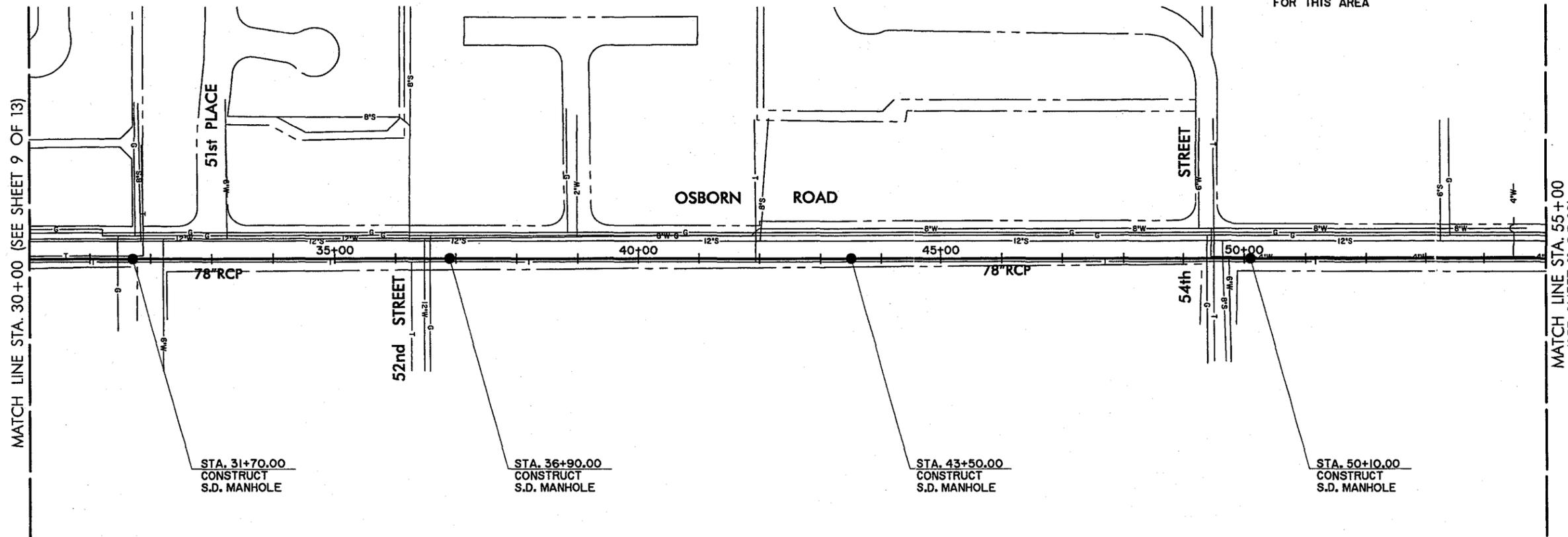


MATCH LINE STA. 30+00 (SEE SHEET 10 OF 13)



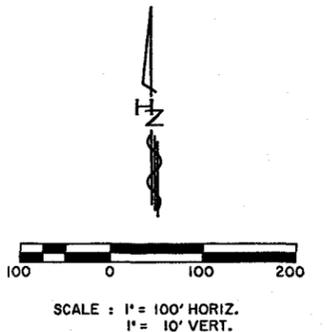
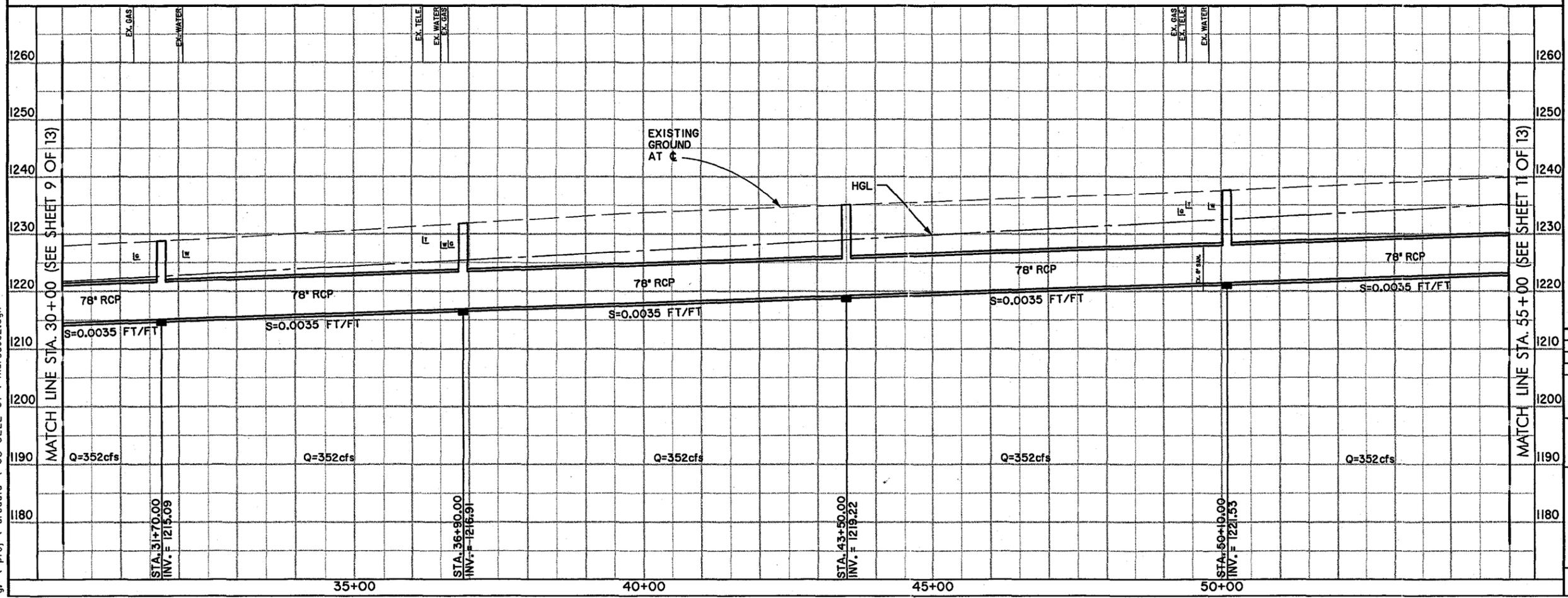
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
	<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY, SUITE 102, PHOENIX, ARIZONA 85016-2029 (602) 381-0125 FAX (602) 381-8053</small>		
ALTERNATE 3 OSBORN - 56th ST. - LAFAYETTE			SHEET 9 OF 13

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NOTE:  
MAPPING UNAVAILABLE  
FOR THIS AREA

NOTE : UTILITIES SHOWN IN PROFILE  
AREA WITH AN ASTERISK WERE NOT  
ABLE TO BE LOCATED VERTICALLY.  
\*

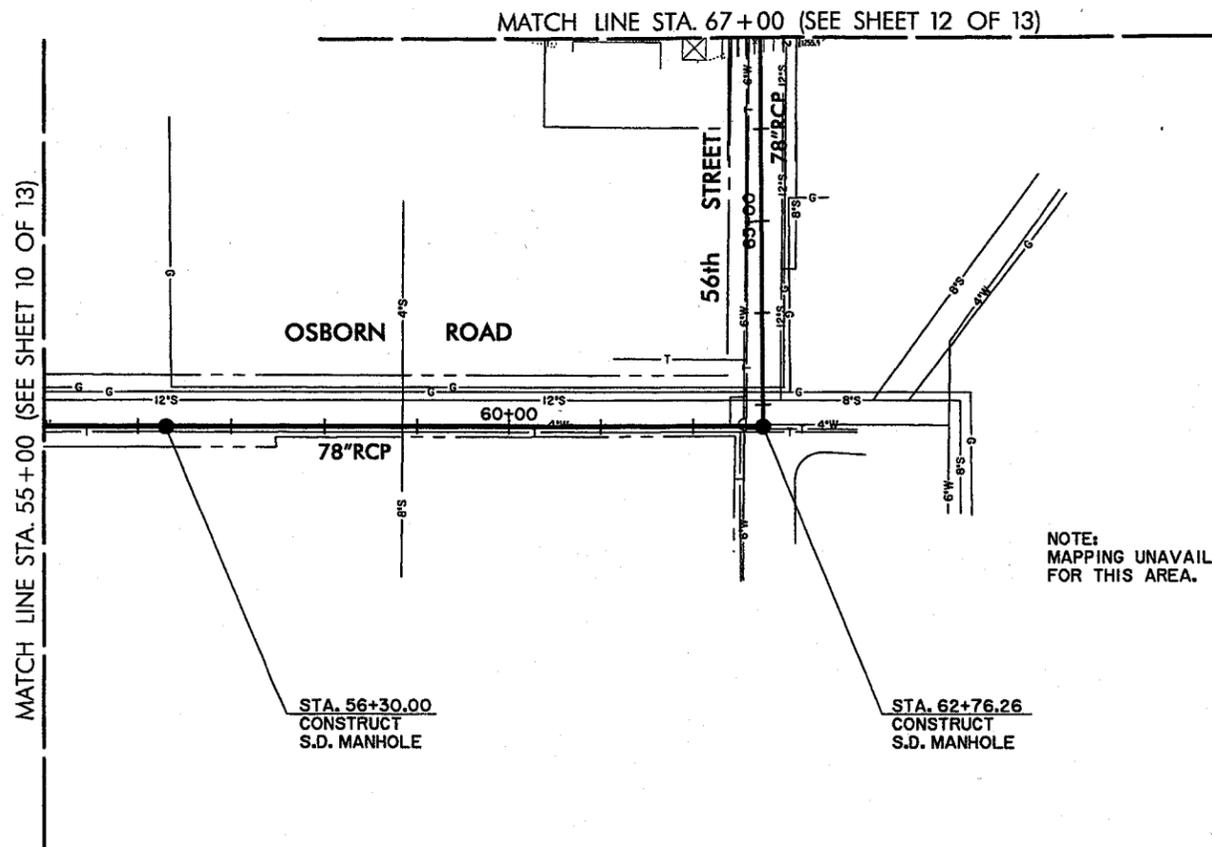


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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
		BY	DATE
		DESIGNED	J. GIRAND 03-97
		DRAWN	B. McK. 03-97
		CHECKED	R. WISE 03-97
		<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY SUITE 102 PHOENIX, ARIZONA 85016-2029 (602) 381-0125 FAX (602) 381-8053</small>	
ALTERNATE 3			SHEET
OSBORN - 56th ST. - LAFAYETTE			10 OF 13

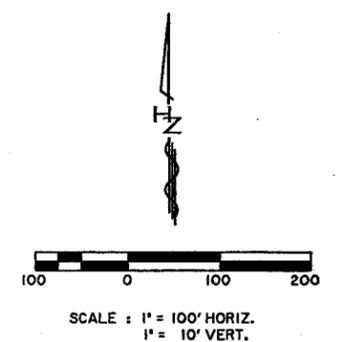
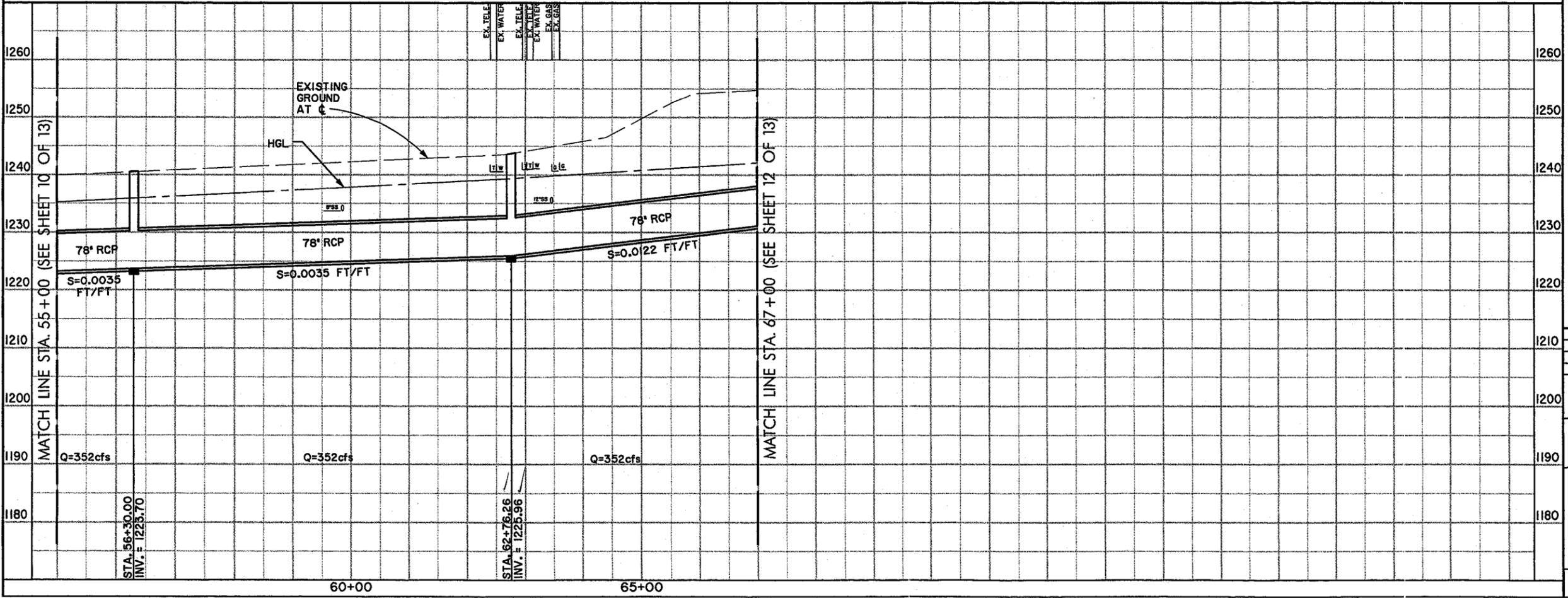
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NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.

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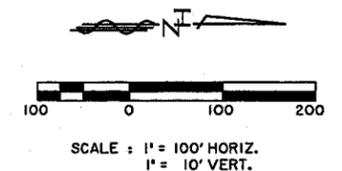
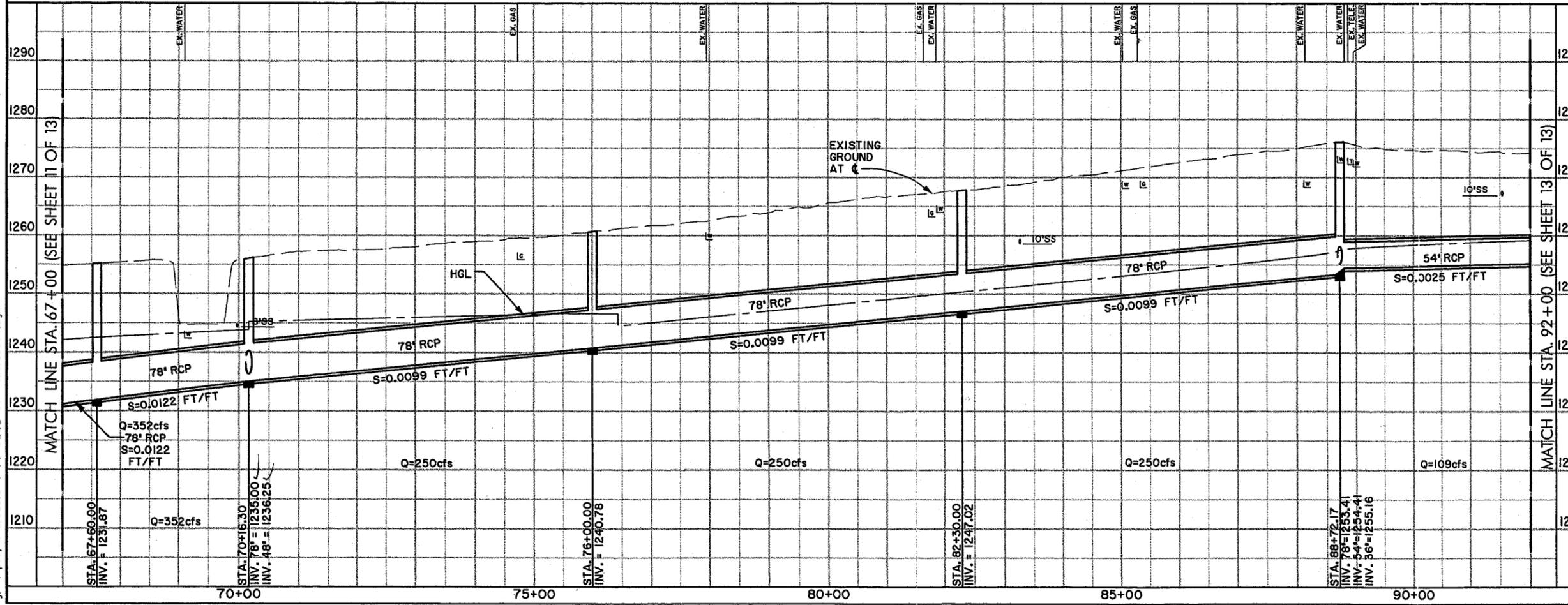
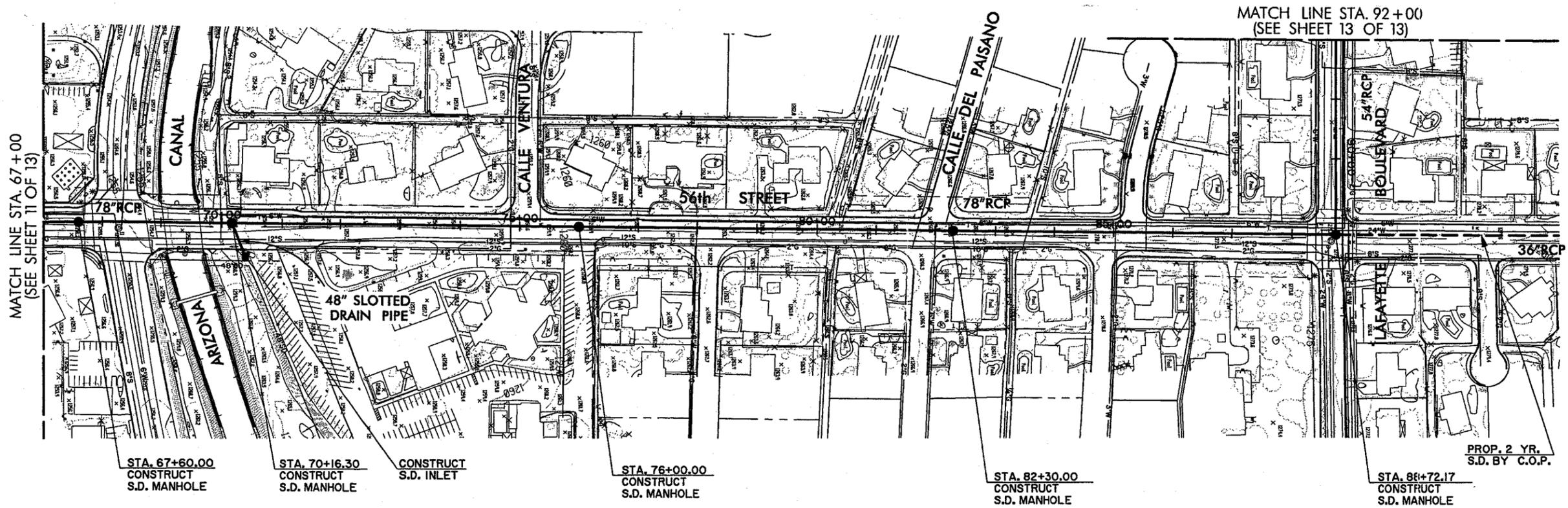
NOTE: MAPPING UNAVAILABLE FOR THIS AREA.



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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY</b> ENGINEERING DIVISION <b>ARCADIA AREA DRAINAGE STUDY</b> PROJECT NO. 94-21			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
	<b>HUITT - ZOLLARS</b> <small>6245 N. 24th AVENUE / SUITE 102 / PHOENIX, ARIZONA 85016-2029</small> <small>(602) 351-0725 FAX (602) 351-8053</small>		
ALTERNATE 3 OSBORN - 56th ST. - LAFAYETTE			SHEET 11 OF 13

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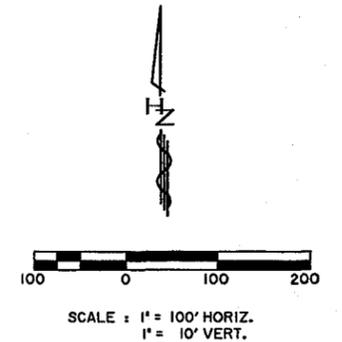
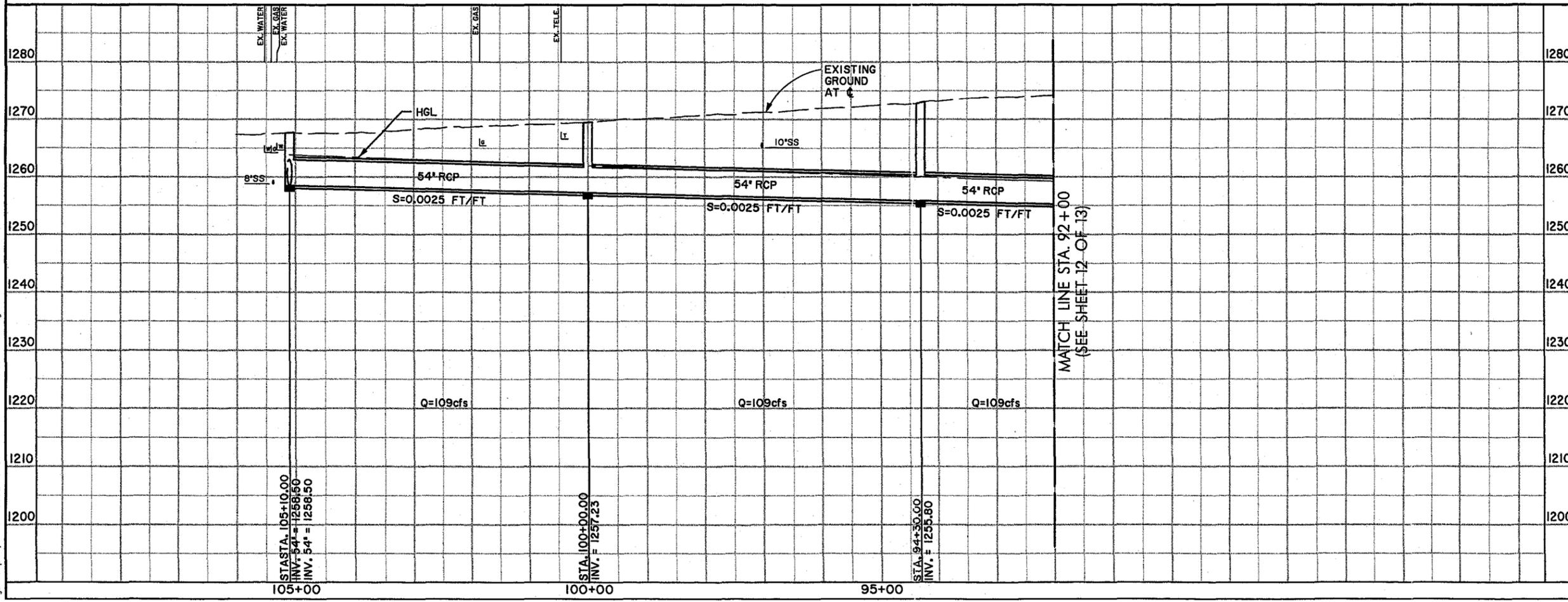
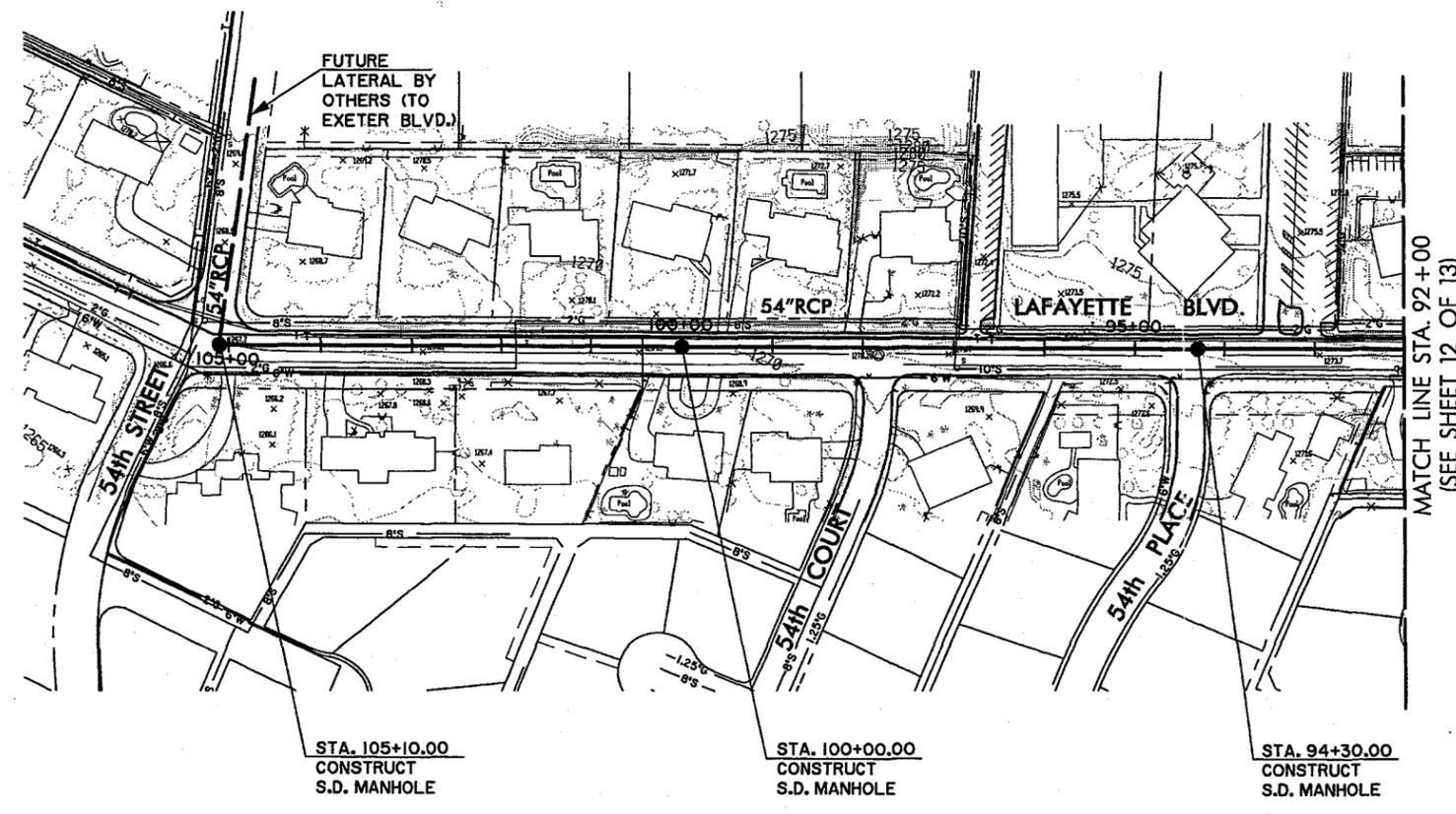
NOTE: UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY</b> ENGINEERING DIVISION <b>ARCADIA AREA DRAINAGE STUDY</b> PROJECT NO. 94-21			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. MCK.	03-97
	CHECKED	R. WISE	03-97
	<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85016-2029</small> <small>(602) 381-0125 FAX (602) 381-8053</small>		
ALTERNATE 3 OSBORN - 56th ST. - LAFAYETTE			SHEET 12 OF 13

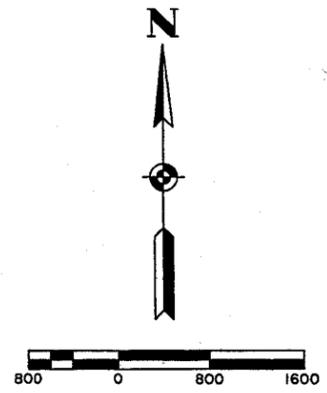
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NOTE : UTILITIES SHOWN IN PROFILE AREA WITH AN ASTERISK WERE NOT ABLE TO BE LOCATED VERTICALLY.  
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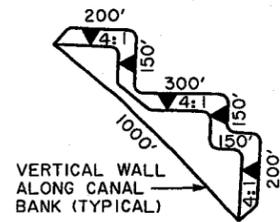
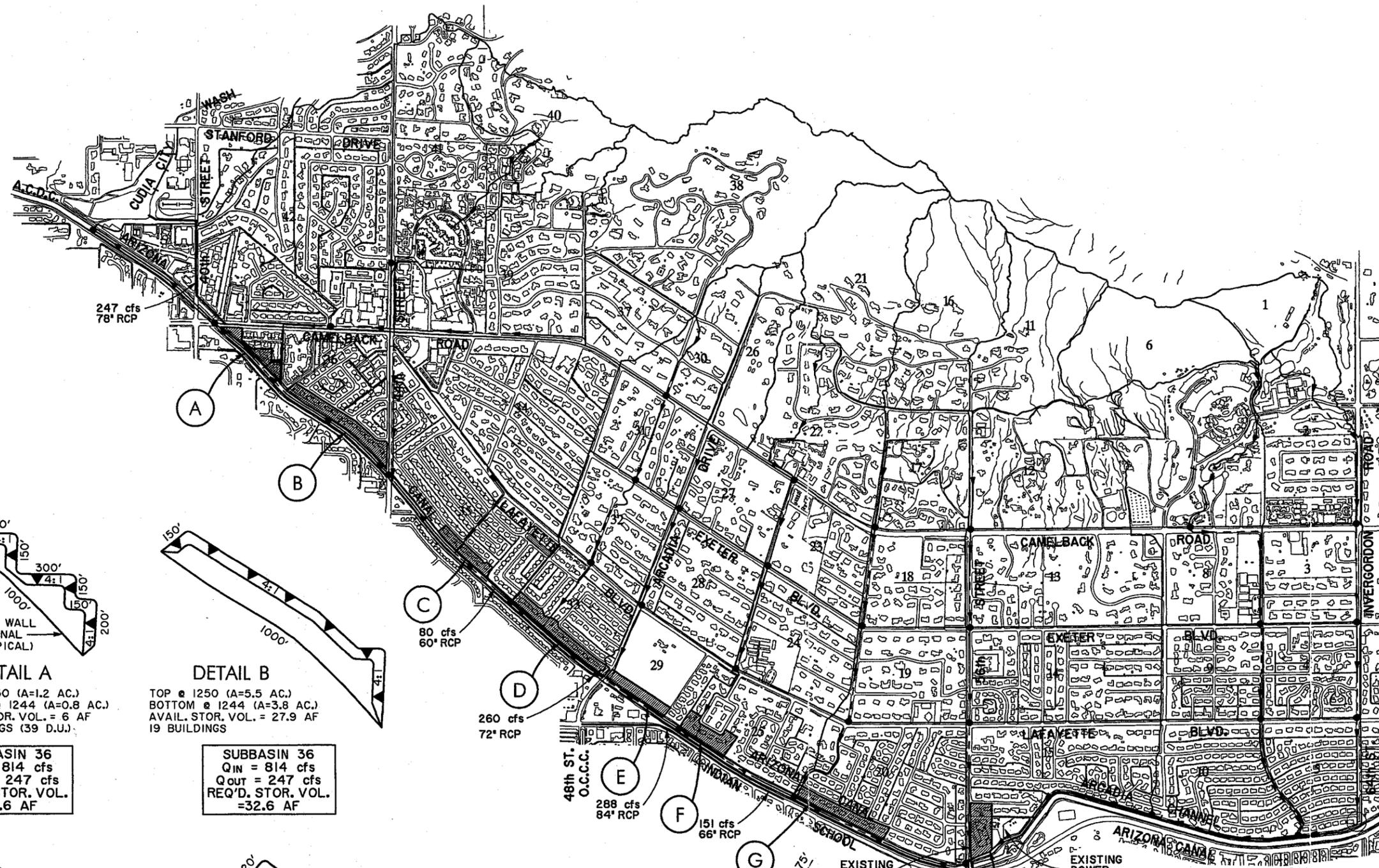
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NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION</b>			
<b>ARCADIA AREA DRAINAGE STUDY PROJECT NO. 94-21</b>			
	DESIGNED	J. GIRAND	03-97
	DRAWN	B. McK.	03-97
	CHECKED	R. WISE	03-97
<b>HUITT - ZOLLARS</b> <small>6245 N. 24th PARWAY / SUITE 102 / PHOENIX, ARIZONA 85016-2029 (602) 381-0125 FAX (602) 381-8053</small>			
ALTERNATE 3			SHEET <b>13 OF 13</b>

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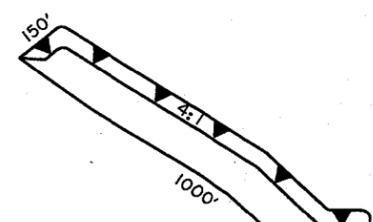
**LEGEND**

- WATERSHED BOUNDARY
- SUBBASIN BOUNDARY
- ROUTING REACH
- 2 SUBBASIN IDENTIFICATION NUMBER
- CONCENTRATION POINT
- DETENTION BASIN
- (X) BASIN DETAIL
- cfs 100-YEAR DISCHARGE



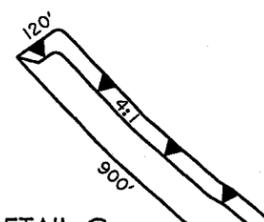
**DETAIL A**  
 TOP @ 1250 (A=1.2 AC.)  
 BOTTOM @ 1244 (A=0.8 AC.)  
 AVAIL. STOR. VOL. = 6 AF  
 7 BUILDINGS (39 D.U.)

**SUBBASIN 36**  
 Q<sub>IN</sub> = 814 cfs  
 Q<sub>OUT</sub> = 247 cfs  
 REQ'D. STOR. VOL. = 32.6 AF



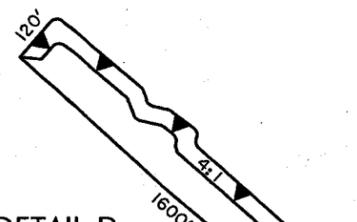
**DETAIL B**  
 TOP @ 1250 (A=5.5 AC.)  
 BOTTOM @ 1244 (A=3.8 AC.)  
 AVAIL. STOR. VOL. = 27.9 AF  
 19 BUILDINGS

**SUBBASIN 36**  
 Q<sub>IN</sub> = 814 cfs  
 Q<sub>OUT</sub> = 247 cfs  
 REQ'D. STOR. VOL. = 32.6 AF



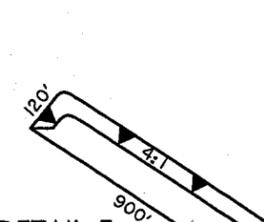
**DETAIL C**  
 TOP @ 1251 (A=2.5 AC.)  
 BOTTOM @ 1245 (A=1.5 AC.)  
 AVAIL. STOR. VOL. = 12 AF  
 9 BUILDINGS

**SUBBASIN 35**  
 Q<sub>IN</sub> = 316 cfs  
 Q<sub>OUT</sub> = 80 cfs  
 REQ'D. STOR. VOL. = 11.3 AF



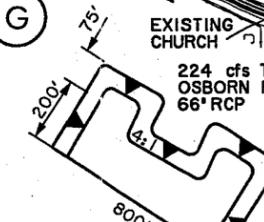
**DETAIL D**  
 TOP @ 1252 (A=4.4 AC.)  
 BOTTOM @ 1246 (A=2.8 AC.)  
 AVAIL. STOR. VOL. = 21.6 AF  
 17 BUILDINGS

**SUBBASIN 33**  
 Q<sub>IN</sub> = 519 cfs  
 Q<sub>OUT</sub> = 150 cfs  
 REQ'D. STOR. VOL. = 20.6 AF



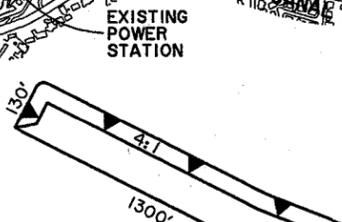
**DETAIL E**  
 TOP @ 1254 (A=2.5 AC.)  
 BOTTOM @ 1248 (A=1.5 AC.)  
 AVAIL. STOR. VOL. = 12 AF  
 0 BUILDINGS

**SUBBASIN 29**  
 Q<sub>IN</sub> = 241 cfs  
 Q<sub>OUT</sub> = 29 cfs  
 REQ'D. STOR. VOL. = 9.8 AF



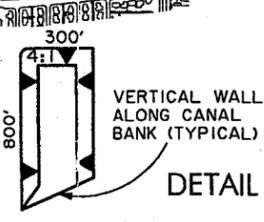
**DETAIL F**  
 TOP @ 1254 (A=4.2 AC.)  
 BOTTOM @ 1248 (A=2.8 AC.)  
 AVAIL. STOR. VOL. = 21 AF  
 6 BUILDINGS

**SUBBASIN 25**  
 Q<sub>IN</sub> = 494 cfs  
 Q<sub>OUT</sub> = 137 cfs  
 REQ'D. STOR. VOL. = 17.8 AF



**DETAIL G**  
 TOP @ 1253 (A=3.9 AC.)  
 BOTTOM @ 1247 (A=2.5 AC.)  
 AVAIL. STOR. VOL. = 19.2 AF  
 12 BUILDINGS

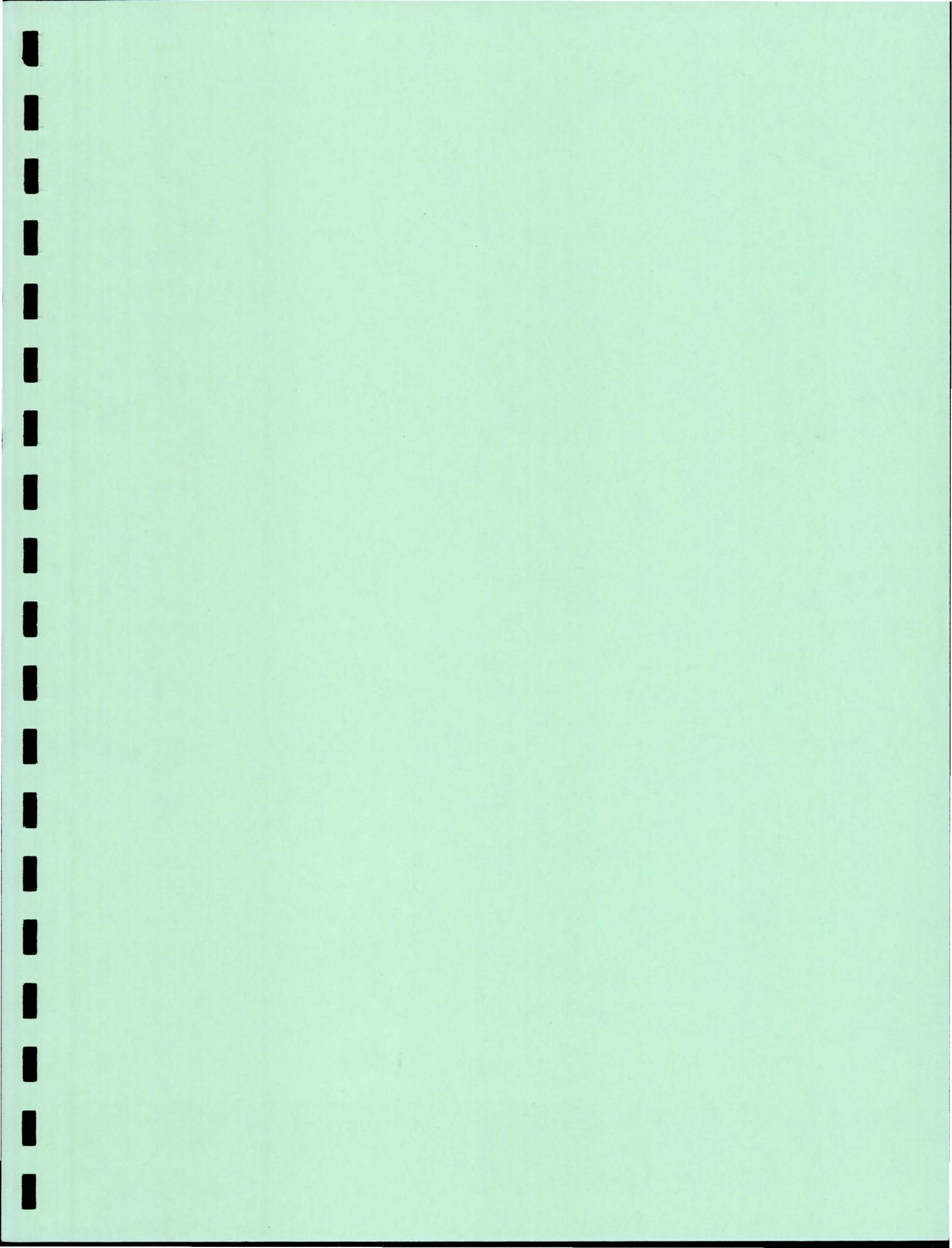
**SUBBASIN 20**  
 Q<sub>IN</sub> = 538 cfs  
 Q<sub>OUT</sub> = 151 cfs  
 REQ'D. STOR. VOL. = 19.0 AF



**DETAIL H**  
 TOP @ 1258 (A=5.5 AC.)  
 BOTTOM @ 1252 (A=4.5 AC.)  
 AVAIL. STOR. VOL. = 30.0 AF  
 CHURCH & 2 BUILDINGS  
 OPTION : USE ARCADIA PARK @ N.W. CORNER OF 56TH AND OSBORN ROAD (A=5 AC. D=4.8')

**SUBBASIN 15**  
 Q<sub>IN</sub> = 696 cfs  
 Q<sub>OUT</sub> = 224 cfs  
 REQ'D. STOR. VOL. = 23.8 AF

3			
2			
1			
NO.	REVISION	BY	DATE
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY</b> <b>ENGINEERING DIVISION</b> <b>ARCADIA AREA DRAINAGE STUDY</b> <b>PROJECT NO. 94-21</b>			
		BY	DATE
	DESIGNED	J. GIRAND	03-97
	DRAWN	MCK.	03-97
	CHECKED	R. WISE	03-97
		<b>HUITT - ZOLLARS</b> <small>1245 N. 24th PARKWAY / SUITE 102 / PHOENIX, ARIZONA 85016-202</small> <small>(602) 381-0125 FAX (602) 381-9053</small>	
ALTERNATE 4			SHEET OF 1 1



**APPENDIX D**  
**DETAILED COST ESTIMATES**

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CLIENT: FLOOD CONTROL DIST. - MARICOPA COUNTY

DATE

03/05/97

PROJECT: ARCADIA AREA DRAINAGE PROJECT FDC 94-21

BY: MRA/HUITT-ZOLLARS, INC

OPINION OF PROBABLE CONSTRUCTION COST

UNIT COSTS USED FOR ALTERNATES

ITEM PIPE SIZE (in.)	UNIT COST	COST \$/UNIT
24	LF	\$40.78
30	LF	\$49.06
36	LF	\$62.96
42	LF	\$78.52
48	LF	\$96.58
54	LF	\$116.15
60	LF	\$155.00
66	LF	\$170.00
72	LF	\$190.00
78	LF	\$213.00
84	LF	\$236.00
90	LF	\$260.00
96	LF	\$285.00
10' X 8' RCB	LF	\$400.00
12' X 10' RCB	LF	\$500.00
STORM DRAIN MANHOLE	EA	\$4,698.00
TRENCH PROTECTION (PIPE)	LF	\$25.00
TRENCH PROTECTION (BOX)	LF	\$50.00
PAVEMENT REPLACEMENT	SY	\$39.50
SAWCUT PAVEMENT	LF	\$2.38
SAWCUT EXIST. CONCRETE SPILLWAY	LF	\$2.38
TYPE "XX" INLETS (W/LATERALS)	LF	\$430.65
CANAL CROSSING (24" TO 30" PIPE)	LS	\$50,000.00
CANAL CROSSING (54" TO 66" PIPE)	LS	\$80,000.00
CANAL CROSSING (72" TO 90" PIPE)	LS	\$100,000.00
EXCAVATION (DETENTION BASIN ALT. 4)	CY	\$4.00
EXCAVATION (DETENTION BASIN ALT. 5)	CY	\$5.00
CHANNEL EXCAVATION	CY	\$2.00
RIGHT OF WAY ACQUISITION (CONDOS)	DU	\$80,000.00
" (SINGLE FAMILY)	DU	\$250,000.00
" (CHURCH)	AC	\$500,000.00
RIGHT OF WAY EASEMENT	AC	\$50,000.00
6' - 8' RETAINING WALL (ALT 4)	LF	\$125.00
UTILITY SUPPORT / RELOCATION	LS	\$700,000.00
DAM/GATE STRUCTURE (ALT 5)	LS	\$750,000.00
WEIR STRUCTURE	EA	\$2,500.00
CONCRETE LINING	CY	\$400.00
SANITARY SEWER RELOCATION	LS	\$250,000.00
INLET/OUTLET STRUCTURES (ALT 5)	EA	\$2,000,000.00
COFFER DAMS/SHEET PILE (ALT 5)	LF	\$100.00
SRP WATER QUALITY STATION (ALT 5)	LS	\$100,000.00
MEASURING BRIDGE (ALT 5)	LS	\$150,000.00
RCB FLOW METER (ALT 5)	LS	\$100,000.00
HYDROGENERATION LOSS (ALT 5)	LS	\$600,000.00
AESTHETIC FEATURES (ALT 5)	LS	\$1,000,000.00
RIGHT OF WAY RENTAL (SRP)	LS	\$200,000.00
6' WROUGHT IRON FENCE (OCCC)	LF	\$35.00
REPLACE CONCRETE SPILLWAY	CY	\$400.00

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CLIENT: FLOOD CONTROL DIST. - MARICOPA COUNTY

DATE 03/12/97

PROJECT: ARCADIA AREA DRAINAGE PROJECT FDC 94-21

BY: MRA/HUITT-ZOLLARS, INC

OPINION OF PROBABLE CONSTRUCTION COST

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
ALTERNATE 1					
CCWSB EAST TO 40TH ST.					
	48" CLASS III RCP	1,160	LF	\$96.58	\$112,033
	90" CLASS III RCP	670	LF	\$260.00	\$174,200
	STORM DRAIN MANHOLE	3	EA	\$4,698.00	\$14,094
	SAWCUT EXIST. CONCRETE SPILLWAY	700	LF	\$2.38	\$1,666
	REPLACE CONCRETE SPILLWAY	40	CY	\$400.00	\$16,000
	RIGHT-OF-WAY EASEMENT	0.5	LF	\$60,000.00	\$30,000
	TRENCH PROTECTION	1,830	LF	\$25.00	\$45,750
SUBTOTAL					\$393,743
40TH ST. SOUTH TO CANAL					
	90" CLASS III RCP	1,025	LF	\$260.00	\$266,500
	STORM DRAIN MANHOLE	3	EA	\$4,698.00	\$14,094
	PAVEMENT REPLACEMENT	1,140	SY	\$39.50	\$45,030
	SAWCUT PAVEMENT	2,050	LF	\$2.38	\$4,879
	TYPE "XX" INLETS W/LATERALS	112	LF	\$430.65	\$48,233
	TRENCH PROTECTION	1,025	LF	\$25.00	\$25,625
SUBTOTAL					\$404,361
CANAL - 40TH ST. TO CAMELBACK					
	90" CLASS III RCP	561	LF	\$260.00	\$145,860
	PAVEMENT REPLACEMENT	624	SY	\$39.50	\$24,648
	SAWCUT PAVEMENT	1,122	LF	\$2.38	\$2,670
	TRENCH PROTECTION	561	LF	\$25.00	\$14,025
SUBTOTAL					\$187,203
CAMELBACK - CANAL EAST TO EXISTING PIPE					
	60" CLASS III RCP	1,596	LF	\$155.00	\$247,380
	90" CLASS III RCP	295	LF	\$260.00	\$76,700
	STORM DRAIN MANHOLE	5	EA	\$4,698.00	\$23,490
	PAVEMENT REPLACEMENT	1,658	SY	\$39.50	\$65,491
	SAWCUT PAVEMENT	3,942	LF	\$2.38	\$9,382
	TYPE "XX" INLETS W/LATERALS	172	LF	\$430.65	\$74,072
	TRENCH PROTECTION	1,971	LF	\$25.00	\$49,275
	RELOCATE 8" SANITARY SEWER	1	LS	\$250,000.00	\$250,000
SUBTOTAL					\$795,790
CAMELBACK - CASTILLE CONDO. TO EXISTING PIPE					
	36" CLASS III RCP	1,300	LF	\$62.96	\$81,848
	STORM DRAIN MANHOLE	2	EA	\$4,698.00	\$9,396
	PAVEMENT REPLACEMENT	722	SY	\$39.50	\$28,519
	SAWCUT PAVEMENT	2,600	LF	\$2.38	\$6,188
	TYPE "XX" INLETS W/LATERALS	10	LF	\$430.65	\$4,307
	TRENCH PROTECTION	1300	LF	\$25.00	\$32,500
SUBTOTAL					\$162,758
ALTERNATE 1 SUBTOTAL					\$1,943,854
25% CONTINGENCY					\$485,964
SUBTOTAL					\$2,429,818
10% ENGINEERING & SURVEY					\$242,982
ALTERNATE 1 TOTAL					\$2,672,800

CLIENT: FLOOD CONTROL DIST. - MARICOPA COUNTY

DATE

03/12/97

PROJECT: ARCADIA AREA DRAINAGE PROJECT FDC 94-21

BY: MRA/HUITT-ZOLLARS, INC

OPINION OF PROBABLE CONSTRUCTION COST

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
ALTERNATE 2					
CCWSB EAST TO 40TH STREET					
	48" CLASS III RCP	1,160	LF	\$96.58	\$112,033
	66" CLASS III RCP	670	LF	\$170.00	\$113,900
	STORM DRAIN MANHOLE	3	EA	\$4,698.00	\$14,094
	SAWCUT EXIST. CONCRETE SPILLWAY	700	LF	\$2.38	\$1,666
	REPLACE CONCRETE SPILLWAY	40	CY	\$400.00	\$16,000
	TRENCH PROTECTION	1830	LF	\$25.00	\$45,750
	RIGHT-OF-WAY EASEMENT	0.50	LF	\$60,000.00	\$30,000
SUBTOTAL					\$333,443
40TH ST. SOUTH TO CANAL					
	66" CLASS III RCP	1,025	LF	\$170.00	\$174,250
	STORM DRAIN MANHOLE	3	EA	\$4,698.00	\$14,094
	PAVEMENT REPLACEMENT	836	SY	\$39.50	\$33,022
	SAWCUT PAVEMENT	2,050	LF	\$2.38	\$4,879
	TYPE "XX" INLET W/LATERALS	110	LF	\$430.65	\$47,372
	TRENCH PROTECTION	1,025	LF	\$25.00	\$25,625
SUBTOTAL					\$299,242
CANAL - 40TH ST TO CAMELBACK					
	66" CLASS III RCP	561	LF	\$170.00	\$95,370
	PAVEMENT REPLACEMENT	374	SY	\$39.50	\$14,773
	SAWCUT PAVEMENT	1,122	LF	\$2.38	\$2,670
	TRENCH PROTECTION	561	LF	\$25.00	\$14,025
SUBTOTAL					\$126,838
CAMELBACK - CANAL EAST TO EXISTING PIPE					
	66" CLASS III RCP	295	LF	\$170.00	\$50,150
	STORM DRAIN MANHOLE	2	EA	\$4,698.00	\$9,396
	PAVEMENT REPLACEMENT	292	SY	\$39.50	\$11,534
	SAWCUT PAVEMENT	590	LF	\$2.38	\$1,404
	TYPE "XX" INLETS W/LATERALS	90	LF	\$430.65	\$38,759
	TRENCH PROTECTION	295	LF	\$25.00	\$7,375
	RELOCATE 8" SANITARY SEWER	1	LS	\$250,000.00	\$250,000
SUBTOTAL					\$368,618
CAMELBACK - CASTILLE CONDO. TO EXISTING PIPE					
	36" CLASS III RCP	1,300	LF	\$62.96	\$81,848
	STORM DRAIN MANHOLE	2	EA	\$4,698.00	\$9,396
	PAVEMENT REPLACEMENT	722	SY	\$39.50	\$28,519
	SAWCUT PAVEMENT	2,600	LF	\$2.38	\$6,188
	TYPE "XX" INLETS W/LATERALS	10	LF	\$430.65	\$4,307
	TRENCH PROTECTION	1300	LF	\$25.00	\$32,500
SUBTOTAL					\$162,758

CLIENT: FLOOD CONTROL DIST. - MARICOPA COUNTY

DATE 03/12/97

PROJECT: ARCADIA AREA DRAINAGE PROJECT FDC 94-21

BY: MRA/HUITT-ZOLLARS, INC

OPINION OF PROBABLE CONSTRUCTION COST

NO.	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
ALTERNATE 2 (CONT'D)					
ARCADIA - OCCC TO CAMELBACK					
	78" CLASS III RCP	2,659	LF	\$213.00	\$566,367
	96" CLASS III RCP	1,366	LF	\$285.00	\$389,310
	CANAL CROSSING (90" PIPE)	1	LS	\$100,000.00	\$100,000
	STORM DRAIN MANHOLE	9	EA	\$4,698.00	\$42,282
	PAVEMENT REPLACEMENT	3,480	SY	\$39.50	\$137,460
	SAWCUT PAVEMENT	7,255	LF	\$2.38	\$17,267
	TYPE "XX" INLETS W/LATERALS	31	LF	\$430.65	\$13,350
	TRENCH PROTECTION	4,025	LF	\$25.00	\$100,625
	RIGHT-OF-WAY EASEMENT	0.1	AC	\$50,000.00	\$5,000
SUBTOTAL					\$1,371,661
CAMELBACK - ARCADIA TO 56TH ST EAST TO END					
	78" CLASS III RCP	1,897	LF	\$213.00	\$404,061
	72" CLASS III RCP	796	LF	\$190.00	\$151,240
	54" CLASS III RCP	1,323	LF	\$116.15	\$153,666
	36" CLASS III RCP	1,725	LF	\$62.96	\$108,606
	STORM DRAIN MANHOLE	13	EA	\$4,698.00	\$61,074
	PAVEMENT REPLACEMENT	4,412	SY	\$39.50	\$174,274
	SAWCUT PAVEMENT	11,484	LF	\$2.38	\$27,332
	TYPE "XX" INLETS W/LATERALS	500	LF	\$430.65	\$215,325
	TRENCH PROTECTION	5,742	LF	\$25.00	\$143,550
	RELOCATE 8" SANITARY SEWER	1	LS	\$250,000.00	\$250,000
SUBTOTAL					\$1,689,128
CAMELBACK - ARCADIA WEST TO END					
	42" CLASS III RCP	692	LF	\$78.52	\$54,336
	STORM DRAIN MANHOLE	3	EA	\$4,698.00	\$14,094
	PAVEMENT REPLACEMENT	423	SY	\$39.50	\$16,709
	SAWCUT PAVEMENT	1,384	LF	\$2.38	\$3,294
	TRENCH PROTECTION	692	LF	\$25.00	\$17,300
SUBTOTAL					\$105,732
LAFAYETTE - 44TH ST TO ARCADIA					
	78" CLASS III RCP	5,013	LF	\$213.00	\$1,067,769
	STORM DRAIN MANHOLE	9	EA	\$4,698.00	\$42,282
	PAVEMENT REPLACEMENT	4,734	SY	\$39.50	\$186,993
	SAWCUT PAVEMENT	10,025	LF	\$2.38	\$23,860
	TYPE "XX" INLETS W/LATERALS	56	LF	\$430.65	\$24,116
	TRENCH PROTECTION	5,013	LF	\$25.00	\$125,325
	RELOCATE 8" SANITARY SEWER	1	LS	\$250,000.00	\$250,000
SUBTOTAL					\$1,720,345

CLIENT: FLOOD CONTROL DIST. - MARICOPA COUNTY

DATE

03/12/97

PROJECT: ARCADIA AREA DRAINAGE PROJECT FDC 94-21

BY: MRA/HUITT-ZOLLARS, INC

OPINION OF PROBABLE CONSTRUCTION COST

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
ALTERNATE 2 (CONT'D)					
44TH ST - LAFAYETTE NORTH TO END					
	48" CLASS III RCP	1,157	LF	\$96.58	\$111,743
	STORM DRAIN MANHOLE	3	EA	\$4,698.00	\$14,094
	PAVEMENT REPLACEMENT	772	SY	\$39.50	\$30,494
	SAWCUT PAVEMENT	2,314	LF	\$2.38	\$5,507
	TYPE "XX" INLETS W/LATERALS	180	LF	\$430.65	\$77,517
	TRENCH PROTECTION	1,157	LF	\$25.00	\$28,925
SUBTOTAL					\$268,280
INVERGORDON - LAFAYETTE TO CAMELBACK					
	48" CLASS III RCP	2,552	LF	\$96.58	\$246,472
	STORM DRAIN MANHOLE	4	EA	\$4,698.00	\$18,792
	PAVEMENT REPLACEMENT	1,701	SY	\$39.50	\$67,190
	SAWCUT PAVEMENT	5,103	LF	\$2.38	\$12,145
	TRENCH PROTECTION	2,552	LF	\$25.00	\$63,800
SUBTOTAL					\$408,399
CAMELBACK - INVERGORDON WEST TO THE END					
	48" CLASS III RCP	2,632	LF	\$96.58	\$254,199
	STORM DRAIN MANHOLE	4	EA	\$4,698.00	\$18,792
	PAVEMENT REPLACEMENT	1,755	SY	\$39.50	\$69,323
	SAWCUT PAVEMENT	5,263	LF	\$2.38	\$12,526
	TYPE "XX" INLETS W/LATERALS	30	LF	\$430.65	\$12,920
	TRENCH PROTECTION	2,632	LF	\$25.00	\$65,800
SUBTOTAL					\$433,559
ALTERNATE 2 SUBTOTAL					\$7,288,002
25% CONTINGENCY					\$1,822,001
SUBTOTAL					\$9,110,003
10% ENGINEERING & SURVEY					\$911,000
ALTERNATE 2 TOTAL					\$10,021,003

CLIENT: FLOOD CONTROL DIST. - MARICOPA COUNTY

DATE 03/12/97

PROJECT: ARCADIA AREA DRAINAGE PROJECT FDC 94-21

BY: MRA/HUITT-ZOLLARS, INC

OPINION OF PROBABLE CONSTRUCTION COST

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
ALTERNATE 3					
CCWSB EAST TO 40TH ST					
	48" CLASS III RCP	1,160	LF	\$96.58	\$112,033
	66" CLASS III RCP	670	LF	\$170.00	\$113,900
	STORM DRAIN MANHOLE	3	EA	\$4,698.00	\$14,094
	SAWCUT EXIST. CONCRETE SPILLWAY	700	LF	\$2.38	\$1,666
	REPLACE CONCRETE SPILLWAY	40	CY	\$400.00	\$16,000
	TRENCH PROTECTION	1,830	LF	\$25.00	\$45,750
	RIGHT-OF-WAY EASEMENT	0.50	LF	\$60,000.00	\$30,000
SUBTOTAL					\$333,443
40TH ST SOUTH TO CANAL					
	66" CLASS III RCP	1,025	LF	\$170.00	\$174,250
	STORM DRAIN MANHOLE	3	EA	\$4,698.00	\$14,094
	PAVEMENT REPLACEMENT	836	SY	\$39.50	\$33,022
	SAWCUT PAVEMENT	2,150	LF	\$2.38	\$5,117
	TYPE "XX" INLETS W/INLETS	110	LF	\$430.65	\$47,372
	TRENCH PROTECTION	1,025	LF	\$25.00	\$25,625
SUBTOTAL					\$299,480
CANAL - 40TH ST TO CAMELBACK					
	66" CLASS III RCP	561	LF	\$170.00	\$95,370
	PAVEMENT REPLACEMENT	374	SY	\$39.50	\$14,773
	SAWCUT PAVEMENT	1,122	LF	\$2.38	\$2,670
	TRENCH PROTECTION	561	LF	\$25.00	\$14,025
SUBTOTAL					\$126,838
CAMELBACK - CANAL EAST TO EXISTING PIPE					
	66" CLASS III RCP	295	LF	\$170.00	\$50,150
	STORM DRAIN MANHOLE	2	EA	\$4,698.00	\$9,396
	PAVEMENT REPLACEMENT	292	SY	\$39.50	\$11,534
	SAWCUT PAVEMENT	590	LF	\$2.38	\$1,404
	TYPE "XX" INLETS W/LATERALS	90	LF	\$430.65	\$38,759
	TRENCH PROTECTION	295	LF	\$25.00	\$7,375
	RELOCATE 8" SANITARY SEWER	1	LS	\$250,000.00	\$250,000
SUBTOTAL					\$368,618
CAMELBACK - CASTILLE CONDO. TO EXISTING PIPE					
	36" CLASS III RCP	1,300	LF	\$62.96	\$81,848
	STORM DRAIN MANHOLE	2	EA	\$4,698.00	\$9,396
	PAVEMENT REPLACEMENT	722	SY	\$39.50	\$28,519
	SAWCUT PAVEMENT	2,600	LF	\$2.38	\$6,188
	TYPE "XX" INLETS W/LATERALS	10	LF	\$430.65	\$4,307
	TRENCH PROTECTION	1300	LF	\$25.00	\$32,500
SUBTOTAL					\$162,758
ARCADIA - CANAL TO LAFAYETTE					
	CANAL CROSSING (84" PIPE)	1	LS	\$100,000.00	\$100,000
	84" CLASS III RCP	1,365	LF	\$236.00	\$322,140
	STORM DRAIN MANHOLE	4	EA	\$4,698.00	\$18,792
	PAVEMENT REPLACEMENT	970	SY	\$39.50	\$38,315
	SAWCUT PAVEMENT	1,939	LF	\$2.38	\$4,615
	TRENCH PROTECTION	1,365	LF	\$25.00	\$34,125
SUBTOTAL					\$517,987

CLIENT: FLOOD CONTROL DIST. - MARICOPA COUNTY

DATE

03/12/97

PROJECT: ARCADIA AREA DRAINAGE PROJECT FDC 94-21

BY: MRA/HUITT-ZOLLARS, INC

OPINION OF PROBABLE CONSTRUCTION COST

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
ALTERNATE 3 (CONT'D)					
LAFAYETTE - ARCADIA TO 44TH ST					
	84" CLASS III RCP	1,320	LF	\$236.00	\$311,520
	78" CLASS III RCP	3,693	LF	\$213.00	\$786,609
	STORM DRAIN MANHOLE	8	EA	\$4,698.00	\$37,584
	PAVEMENT REPLACEMENT	4,864	SY	\$39.50	\$192,128
	SAWCUT PAVEMENT	10,025	LF	\$2.38	\$23,860
	TYPE "XX" INLETS W/LATERALS	244	LF	\$430.65	\$105,079
	TRENCH PROTECTION	5,013	LF	\$25.00	\$125,325
	RELOCATE 8" SANITARY SEWER	1	LS	\$250,000.00	\$250,000
				SUBTOTAL	\$1,832,104
44TH ST - LAFAYETTE NORTH TO END					
	48" CLASS III RCP	1,157	LF	\$96.58	\$111,743
	STORM DRAIN MANHOLE	3	EA	\$4,698.00	\$14,094
	PAVEMENT REPLACEMENT	772	SY	\$39.50	\$30,494
	SAWCUT PAVEMENT	2,314	LF	\$2.38	\$5,507
	TYPE "XX" INLETS W/LATERALS	180	LF	\$430.65	\$77,517
	TRENCH PROTECTION	1,157	LF	\$25.00	\$28,925
				SUBTOTAL	\$268,280
INDIAN SCHOOL ROAD - OCCC EAST TO END					
	CANAL CROSSING (24" PIPE)	2	EA	\$50,000.00	\$100,000
	CANAL CROSSING (30" PIPE)	1	EA	\$50,000.00	\$50,000
	54" CLASS III RCP	1,320	LF	\$116.15	\$153,318
	42" CLASS III RCP	772	LF	\$78.52	\$60,617
	30" CLASS III RCP	1,299	LF	\$49.06	\$63,729
	24" CLASS III RCP	650	LF	\$40.78	\$26,507
	STORM DRAIN MANHOLE	8	EA	\$4,698.00	\$37,584
	PAVEMENT REPLACEMENT	1,890	SY	\$39.50	\$74,655
	SAWCUT PAVEMENT	6,100	LF	\$2.38	\$14,518
	TRENCH PROTECTION	4,041	LF	\$25.00	\$101,025
				SUBTOTAL	\$681,953
OSBORN ROAD - OCCC TO 56TH ST					
	78" CLASS III RCP	5,277	LF	\$213.00	\$1,124,001
	STORM DRAIN MANHOLE	9	EA	\$4,698.00	\$42,282
	PAVEMENT REPLACEMENT	4,983	SY	\$39.50	\$196,829
	SAWCUT PAVEMENT	10,553	LF	\$2.38	\$25,116
	TRENCH PROTECTION	5,277	LF	\$25.00	\$131,925
				SUBTOTAL	\$1,520,153

CLIENT: FLOOD CONTROL DIST. - MARICOPA COUNTY

DATE

03/12/97

PROJECT: ARCADIA AREA DRAINAGE PROJECT FDC 94-21

BY: MRA/HUITT-ZOLLARS, INC

OPINION OF PROBABLE CONSTRUCTION COST

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
ALTERNATE 3 (CONT'D)					
56TH STREET - OSBORN ROAD TO LAFAYETTE					
	CANAL CROSSING (78" PIPE)	1	LS	\$100,000.00	\$100,000
	78" CLASS III RCP	2,596	LF	\$213.00	\$552,948
	48" CLASS III RCP	80	LF	\$96.58	\$7,726
	STORM DRAIN MANHOLE	5	EA	\$4,698.00	\$23,490
	PAVEMENT REPLACEMENT	2,485	SY	\$39.50	\$98,158
	SAWCUT PAVEMENT	5,292	LF	\$2.38	\$12,595
	TYPE "XX" INLETS W/LATERALS	280	LF	\$430.65	\$120,582
	TRENCH PROTECTION	2,596	LF	\$25.00	\$64,900
					-----
				SUBTOTAL	\$980,399
LAFAYETTE - 56TH ST WEST TO END					
	54" CLASS III RCP	1,637	LF	\$116.15	\$190,138
	STORM DRAIN MANHOLE	3	EA	\$4,698.00	\$14,094
	PAVEMENT REPLACEMENT	1,182	SY	\$39.50	\$46,689
	SAWCUT PAVEMENT	3,274	LF	\$2.38	\$7,792
	TYPE "XX" INLETS W/LATERALS	200	LF	\$430.65	\$86,130
	TRENCH PROTECTION	1,637	LF	\$25.00	\$40,925
					-----
				SUBTOTAL	\$385,768
				ALTERNATE 3 SUBTOTAL	----- \$7,477,780
				25% CONTINGENCY	----- \$1,869,445
				SUBTOTAL	----- \$9,347,225
				10% ENGINEERING & SURVEY	----- \$934,722
				ALTERNATE 3 TOTAL	----- \$10,281,947

CLIENT: FLOOD CONTROL DIST. - MARICOPA COUNTY

DATE 03/12/97

PROJECT: ARCADIA AREA DRAINAGE PROJECT FDC 94-21

BY: MRA/HUITT-ZOLLARS, INC

OPINION OF PROBABLE CONSTRUCTION COST

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
ALTERNATE 4					
	CCWSB EAST TO 40TH ST				
	78" CLASS III RCP	670	LF	\$213.00	\$142,710
	STORM DRAIN MANHOLE	1	EA	\$4,698.00	\$4,698
	TRENCH PROTECTION	670	LF	\$25.00	\$16,750
				SUBTOTAL	\$164,158
	40TH ST SOUTH TO CANAL				
	78" CLASS III RCP	1,025	LF	\$213.00	\$218,325
	STORM DRAIN MANHOLE	2	EA	\$4,698.00	\$9,396
	PAVEMENT REPLACEMENT	969	SY	\$39.50	\$38,276
	SAWCUT PAVEMENT	2,150	LF	\$2.38	\$5,117
	TRENCH PROTECTION	1,025	LF	\$25.00	\$25,625
				SUBTOTAL	\$296,739
	CANAL - 40TH ST TO SUBBASIN 36A				
	78" CLASS III RCP	500	LF	\$213.00	\$106,500
	STORM DRAIN MANHOLE	1	EA	\$4,698.00	\$4,698
	TRENCH PROTECTION	500	LF	\$25.00	\$12,500
				SUBTOTAL	\$123,698
	SUBBASIN 36A				
	RIGHT-OF-WAY ACQUISTION (CONDOS)	39	DU	\$80,000.00	\$3,120,000
	EXCAVATION	9,680	CY	\$4.00	\$38,720
	6'-8' RETAINING WALL	1,000	LF	\$125.00	\$125,000
				SUBTOTAL	\$3,283,720
	SUBBASIN 36B				
	RIGHT-OF-WAY ACQUISTION (SF)	19	DU	\$250,000.00	\$4,750,000
	EXCAVATION	45,012	CY	\$4.00	\$180,048
	6'-8' RETAINING WALL	1,000	LF	\$125.00	\$125,000
				SUBTOTAL	\$5,055,048
	SUBBASIN 35				
	RIGHT-OF-WAY ACQUISTION (SF)	9	DU	\$250,000.00	\$2,250,000
	EXCAVATION	19,360	CY	\$4.00	\$77,440
	6'-8' RETAINING WALL	900	LF	\$125.00	\$112,500
				SUBTOTAL	\$2,439,940

CLIENT: FLOOD CONTROL DIST. - MARICOPA COUNTY

DATE 03/12/97

PROJECT: ARCADIA AREA DRAINAGE PROJECT FDC 94-21

BY: MRA/HUITT-ZOLLARS, INC

OPINION OF PROBABLE CONSTRUCTION COST

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
ALTERNATE 4 (CONT'D)					
CANAL - OCCC WEST TO SUBBASIN 35					
	CANAL CROSSING (72" PIPE)	1	LS	\$100,000.00	\$100,000
	60" CLASS III RCP	2,000	LF	\$155.00	\$310,000
	72" CLASS III RCP	200	LF	\$190.00	\$38,000
	STORM DRAIN MANHOLE	4	EA	\$4,698.00	\$18,792
	TRENCH PROTECTION	2,200	SF	\$25.00	\$55,000
SUBTOTAL					\$521,792
SUBBASIN 33					
	RIGHT-OF-WAY ACQUISITION (SF)	17	DU	\$250,000.00	\$4,250,000
	EXCAVATION	34,850	CY	\$4.00	\$139,400
	6'-8' RETAINING WALL	1,600	LF	\$125.00	\$200,000
SUBTOTAL					\$4,589,400
SUBBASIN 29					
	RIGHT-OF-WAY EASEMENT	2.5	AC	\$50,000.00	\$125,000
	EXCAVATION	19,360	CY	\$4.00	\$77,440
	6'-8' RETAINING WALL	900	LF	\$125.00	\$112,500
SUBTOTAL					\$314,940
INDIAN SCHOOL ROAD - OCCC EAST TO SUBBASIN 20					
	CANAL CROSSING (54" PIPE)	1	LS	\$80,000.00	\$80,000
	CANAL CROSSING (66" PIPE)	1	LS	\$80,000.00	\$80,000
	54" CLASS III RCP	380	LF	\$116.15	\$44,137
	66" CLASS III RCP	1,700	LF	\$170.00	\$289,000
	84" CLASS III RCP	1,320	LF	\$236.00	\$311,520
	STORM DRAIN MANHOLE	8	EA	\$4,698.00	\$37,584
	TRENCH PROTECTION	3,020	SF	\$25.00	\$75,500
SUBTOTAL					\$917,741
SUBBASIN 25					
	RIGHT-OF-WAY ACQUISITION (SF)	6	DU	\$250,000.00	\$1,500,000
	EXCAVATION	33,880	CY	\$4.00	\$135,520
	6'-8' RETAINING WALL	800	LF	\$125.00	\$100,000
SUBTOTAL					\$1,735,520

CLIENT: FLOOD CONTROL DIST. - MARICOPA COUNTY

DATE

03/12/97

PROJECT: ARCADIA AREA DRAINAGE PROJECT FDC 94-21

BY: MRA/HUITT-ZOLLARS, INC

OPINION OF PROBABLE CONSTRUCTION COST

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
ALTERNATE 4 (CONT'D)					
SUBBASIN 20					
	RIGHT-OF-WAY ACQUISTION (SF)	12	DU	\$250,000.00	\$3,000,000
	EXCAVATION	30,980	CY	\$4.00	\$123,920
	6'-8' RETAINING WALL	1,300	LF	\$125.00	\$162,500
				<b>SUBTOTAL</b>	<b>\$3,286,420</b>
OSBORN ROAD - OCCC TO 56TH ST					
	66" CLASS III RCP	5,276	LF	\$170.00	\$896,920
	STORM DRAIN MANHOLE	10	EA	\$4,698.00	\$46,980
	TRENCH PROTECTION	5,276	LF	\$25.00	\$131,900
				<b>SUBTOTAL</b>	<b>\$1,075,800</b>
56TH ST - OSBORN ROAD TO SUBBASIN 15					
	CANAL CROSSING (66" PIPE)	1	LS	\$80,000.00	\$80,000
	66" CLASS III RCP	1,000	LF	\$170.00	\$170,000
	STORM DRAIN MANHOLE	3	EA	\$4,698.00	\$14,094
	TRENCH PROTECTION	1,000	LF	\$25.00	\$25,000
				<b>SUBTOTAL</b>	<b>\$289,094</b>
SUBBASIN 15					
	RIGHT-OF-WAY ACQUISTION (CHURCH)	2.75	AC	\$500,000.00	\$1,375,000
	RIGHT-OF-WAY ACQUISTION (SF)	2	DU	\$250,000.00	\$500,000
	EXCAVATION	49,370	CY	\$4.00	\$197,480
	6'-8' RETAINING WALL	300	LF	\$125.00	\$37,500
				<b>SUBTOTAL</b>	<b>\$2,109,980</b>
				<b>ALTERNATE 4 SUBTOTAL</b>	<b>\$26,203,990</b>
				<b>25% CONTINGENCY</b>	<b>\$6,550,997</b>
				<b>SUBTOTAL</b>	<b>\$32,754,987</b>
				<b>10% ENGINEERING &amp; SURVEY</b>	<b>\$3,275,499</b>
				<b>ALTERNATE 4 TOTAL</b>	<b>\$36,030,486</b>

CLIENT: FLOOD CONTROL DIST. - MARICOPA COUNTY

DATE

03/12/97

PROJECT: ARCADIA AREA DRAINAGE PROJECT FDC 94-21

BY: MRA/HUITT-ZOLLARS, INC

OPINION OF PROBABLE CONSTRUCTION COST

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
<b>ALTERNATE 5</b>					
<b>CANAL BYPASS FACILITY</b>					
	12' X 10' RCB	15,850	LF	\$500.00	\$7,925,000
	10' X 8' RCB (TO OCCC)	7,000	LF	\$400.00	\$2,800,000
	TRENCH PROTECTION	15,850	LF	\$50.00	\$792,500
	UTILITY POLE SUPPORT/RELOCATION	1	LS	\$700,000.00	\$700,000
	72" CLASS III RCP (TO OCCC)	100	LF	\$190.00	\$19,000
	INLET/OUTLET STRUCTURES	2	EA	\$2,000,000.00	\$4,000,000
	COFFER DAMS/SHEET PILE	15,850	LF	\$100.00	\$1,585,000
	SRP WATER QUALITY STATION	1	LS	\$100,000.00	\$100,000
	MEASURING BRIDGE	1	LS	\$150,000.00	\$150,000
	RCB FLOW METER	1	LS	\$100,000.00	\$100,000
	HYDROGENERATION LOSS	1	LS	\$600,000.00	\$600,000
	SEDIMENTATION BASIN	1	LS	\$2,000,000.00	\$2,000,000
				<b>SUBTOTAL</b>	<b>\$20,771,500</b>
<b>CANAL/BASIN</b>					
	EXCAVATION	120,000	CY	\$5.00	\$600,000
	DAM/GATE STRUCTURE	1	LS	\$750,000.00	\$750,000
	WEIR STRUCTURE	3	EA	\$2,500.00	\$7,500
	AESTHETIC FEATURES	1	LS	\$1,000,000.00	\$1,000,000
	RIGHT-OF-WAY RENTAL	1	LS	\$200,000.00	\$200,000
	2-YEAR FIRST-FLUSH INTERCEPT	1	LS	\$6,500,000.00	\$6,500,000
				<b>SUBTOTAL</b>	<b>\$9,057,500</b>
<b>WEST" CAMELBACK FACILITY (PER ALT. 1)</b>					
		1	LS	\$1,780,000.00	\$1,780,000
				<b>SUBTOTAL</b>	<b>\$1,780,000</b>
				<b>ALTERNATE 5 SUBTOTAL</b>	<b>\$31,609,000</b>
				30% CONTINGENCY	\$9,482,700
				<b>SUBTOTAL</b>	<b>\$41,091,700</b>
				10% ENGINEERING & SURVEY	\$4,109,170
				<b>ALTERNATE 5 TOTAL</b>	<b>\$45,200,870</b>

NOTE: COSTS FOR THE 2 YEAR "FIRST FLUSH" INTERCEPT FACILITIES WERE PROVIDED BY COP MEMO FROM CHARLES CONNETT TO RAYMOND ACUNA DATED 9/16/96.

CLIENT: FLOOD CONTROL DIST. - MARICOPA COUNTY

DATE

03/12/97

PROJECT: ARCADIA AREA DRAINAGE PROJECT FDC 94-21

BY: MRA/HUITT-ZOLLARS, INC

OPINION OF PROBABLE CONSTRUCTION COST

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COST SUMMATION OF FOUR ALTERNATES:

ALTERNATE 1 TOTAL	\$2,672,800
ALTERNATE 2 TOTAL	\$10,021,003
ALTERNATE 3 TOTAL	\$10,281,947
ALTERNATE 4 TOTAL	\$36,030,486
ALTERNATE 5 TOTAL	\$45,200,870

CLIENT: FLOOD CONTROL DIST. - MARICOPA COUNTY

DATE 03/05/97

PROJECT: ARCADIA AREA DRAINAGE PROJECT FDC 94-21

BY: MRA/HUITT-ZOLLARS, INC

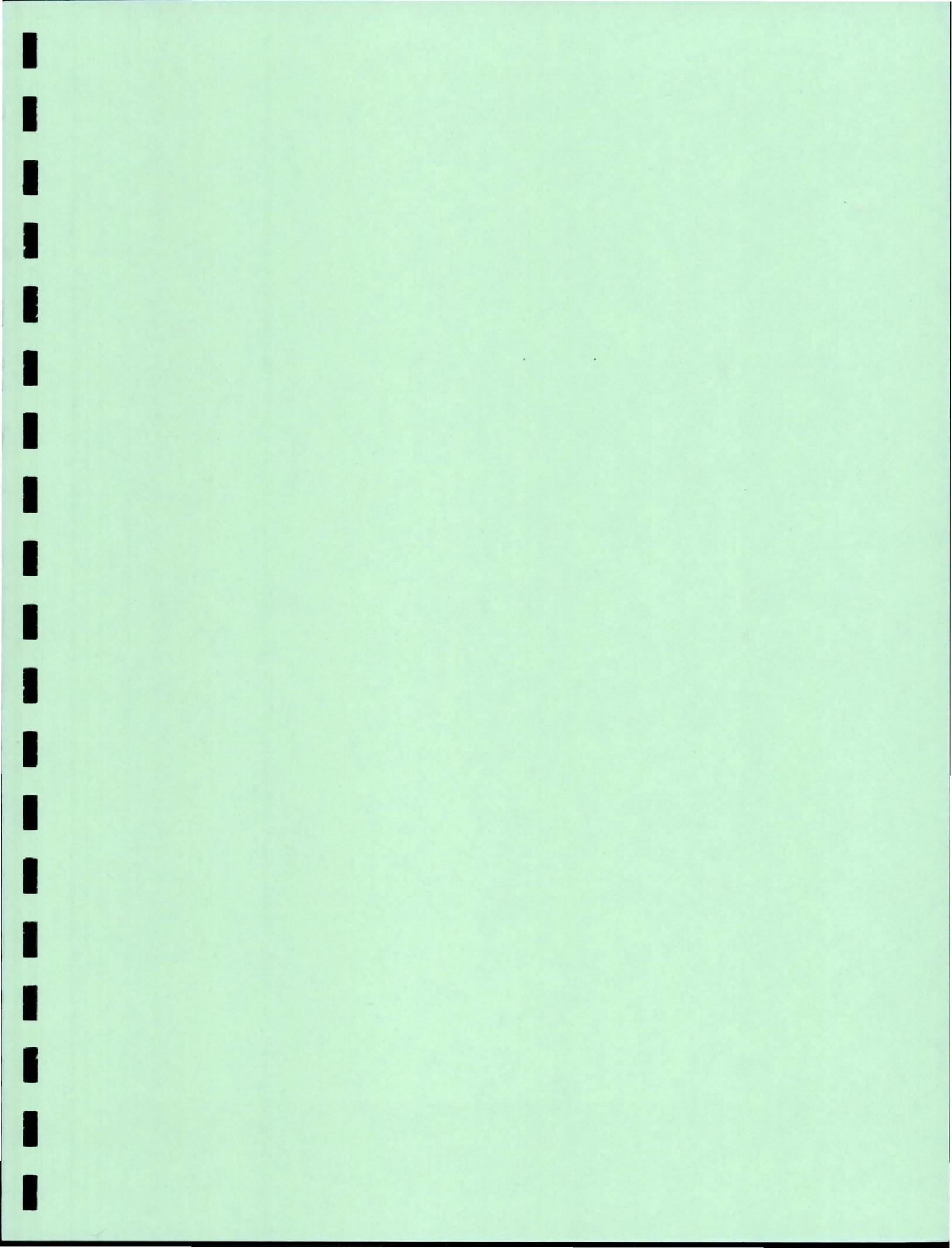
OPINION OF PROBABLE CONSTRUCTION COST

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
OLD CROSS CUT CANAL EXTENSION					
INDIAN SCHOOL ROAD TO ARIZONA CANAL GATE STRUCTURE					
	CHANNEL EXCAVATION	3,560	CY	\$2.00	\$7,120
	CONCRETE LINING	1,285	CY	\$400.00	\$514,000
	ACCESS ROAD PAVING	475	SY	\$39.50	\$18,763
	6' WROUGHT IRON FENCE	465	LF	\$35.00	\$16,275
	TRENCH PROT. - CHANNEL	465	LF	\$100.00	\$46,500
SUBTOTAL					\$602,658
25% CONTINGENCY					\$150,664
SUBTOTAL					\$753,322
10% ENGINEERING & SURVEY					\$75,332
OLD CROSS CUT CANAL EXTENSION TOTAL					\$828,654

OPTION WITH DOUBLE 10' X 10' RCB EXTENDED 235 FEET

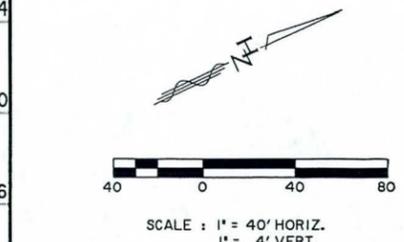
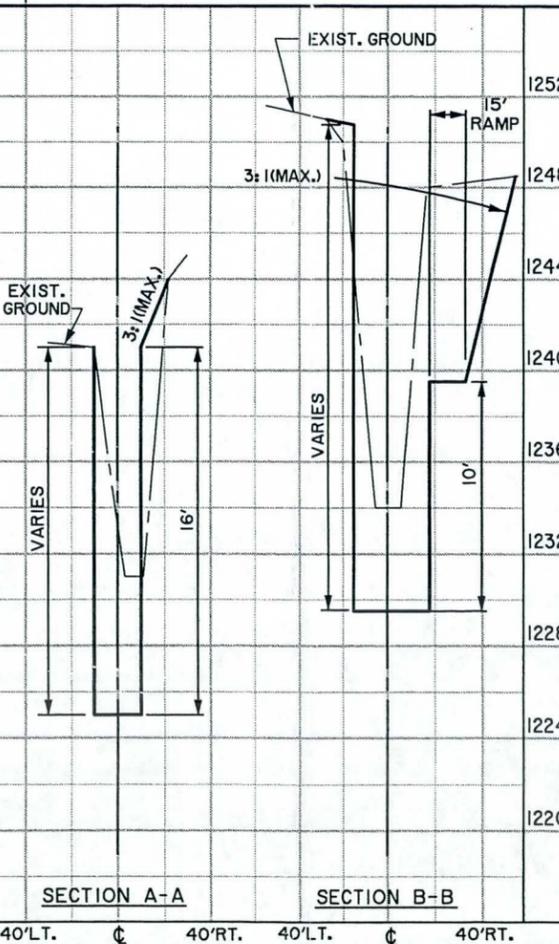
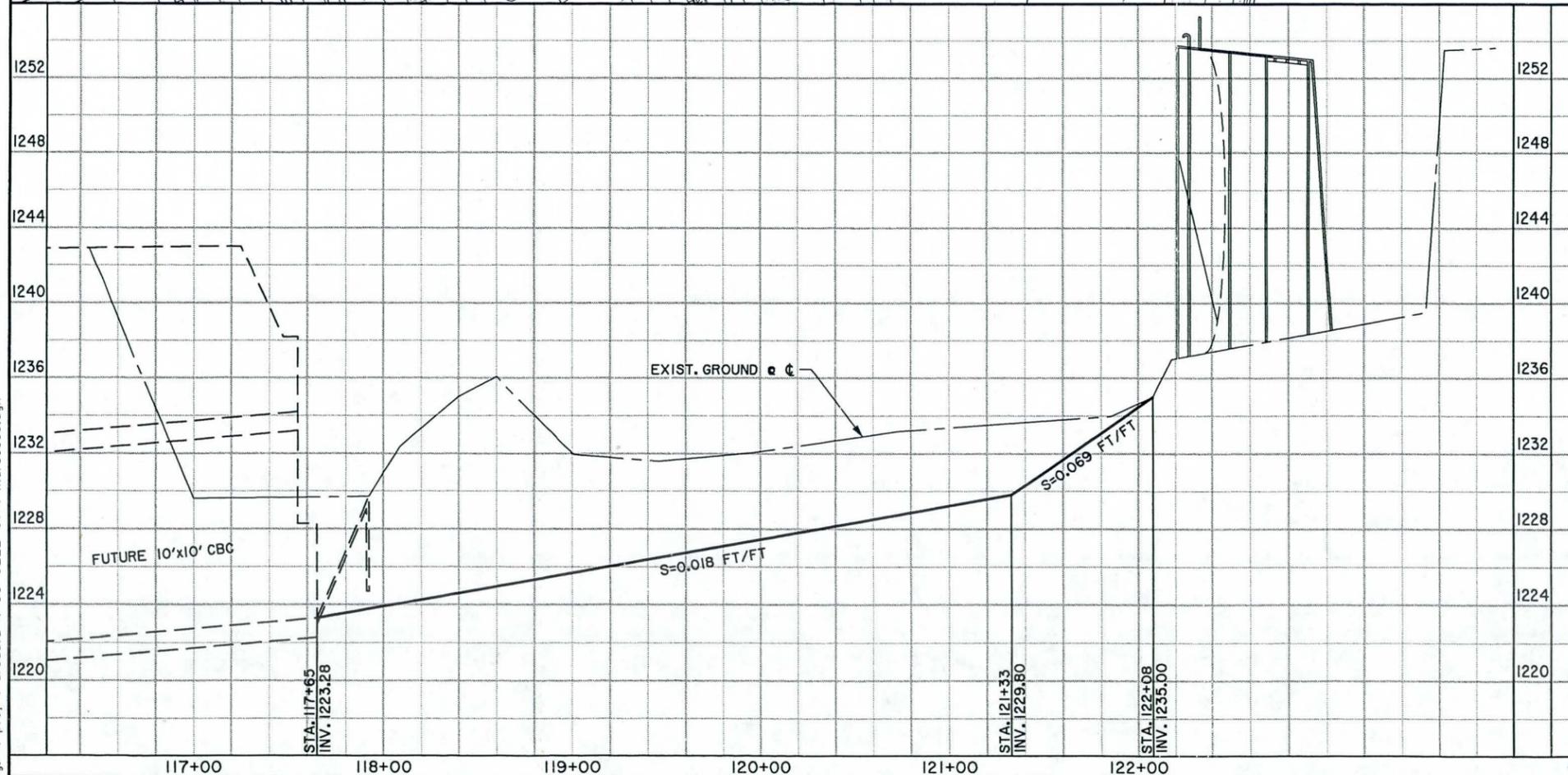
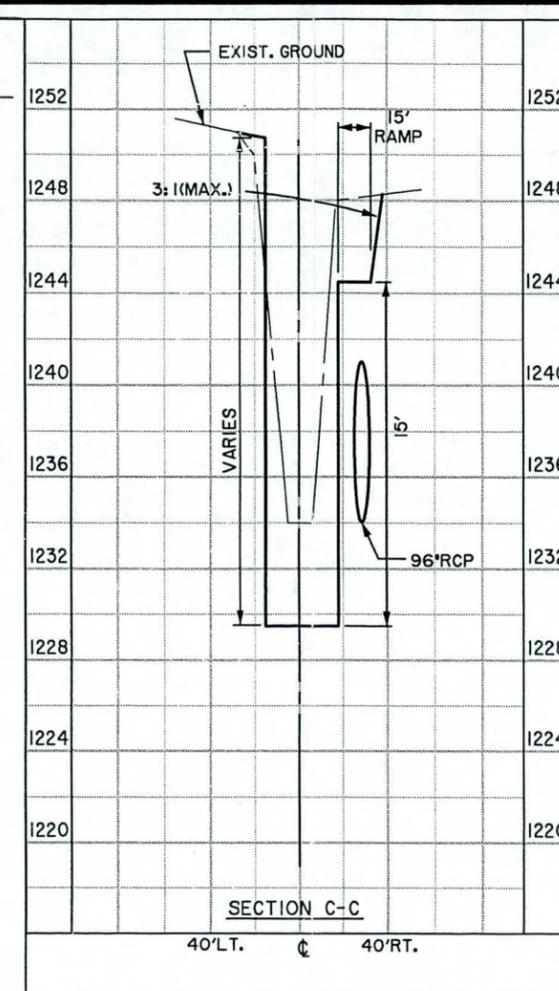
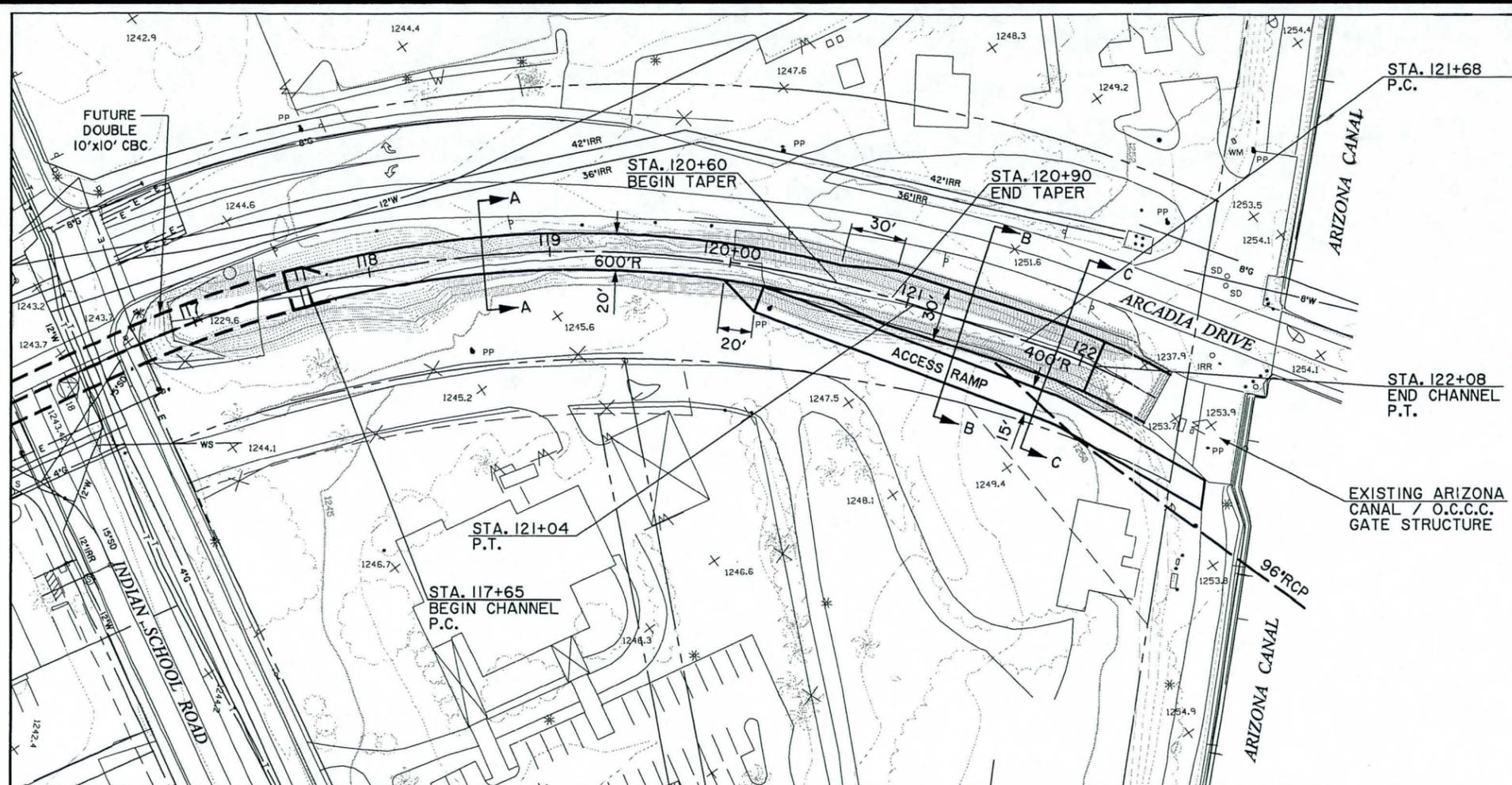
	2 - 10' X 10' RCB	235	LF	\$900.00	\$211,500
	CHANNEL EXCAVATION	1780	CY	\$2.00	\$3,560
	CONCRETE LINING	645	CY	\$400.00	\$258,000
	ACCESS ROAD PAVING	475	SY	\$39.50	\$18,763
	6' WROUGHT IRON FENCE	230	LF	\$35.00	\$8,050
	TRENCH PROTECTION - CHANNEL	230	LF	\$100.00	\$23,000
SUBTOTAL					\$522,873
25% CONTINGENCY					\$130,718
SUBTOTAL					\$653,591
10% ENGINEERING & SURVEY					\$65,359
OPTION WITH DOUBLE 10' X 10' RCB EXTENDED 235 FEET					\$718,950

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**APPENDIX E**  
**OCCC CHANNEL PLAN AND PROFILE**

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NO.	REVISION	BY	DATE
3			
2			
1			
<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY</b> ENGINEERING DIVISION <b>ARCADIA AREA DRAINAGE STUDY</b> <b>PROJECT NO. 94-21</b>			
		BY	DATE
		J. GIRAND	03-97
		B. McK.	03-97
		R. WISE	03-97
<b>HUITT-ZOLLARS</b> <small>6245 N. 24th PARKWAY SUITE 102 PHOENIX, ARIZONA 85016-2079</small> <small>(602) 381-0225 FAX (602) 381-8053</small>			
OLD CROSS CUT CANAL			SHEET <b>1 OF 1</b>

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