PRICE ROAD DRAIN

LOCATION STUDY
AND
PRELIMINARY DESIGN

BY

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
PHOENIX, ARIZONA

WITH
BOYLE ENGINEERING CORP.
SAN DIEGO, CALIFORNIA

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LOCATION STUDY
AND
PRELIMINARY DESIGN

PRICE ROAD DRAIN

Submitted to
Flood Control District of Maricopa County
3335 West Durango Street
Phoenix, Arizona 85009

&

committee members

City of Mesa
City of Chandler
Town of Gilbert
City of Tempe
City of Phoenix
Salt River Project
Arizona Department of Transportation

By

Dibble & Associates Consulting Engineers
2627 East Thomas Road
Phoenix, Arizona 85016
(602) 955-5310

with

Boyle Engineering Corporation
7807 Convoy Court, Suite 200
San Diego, California 92111
(619) 268-8080

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PROPOSED

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I. EXECUTIVE SUMMARY

Beginning as early as the late 60's and early 70's the Corps of Engineers and the Soil Conservation Service together with the Flood Control District of Maricopa County had investigated flood water management plans for the area encompassed in the Gila River Basin. In 1978 the Flood Control District of Maricopa County authorized the preparation of preliminary design and right-of-way determination for the "Gila Drain Project", an East Valley storm water management plan. Due to the complexities of the many agencies involved, the project was never finalized. In 1983 a Task Force of local city agencies, was formed to investigate alternatives to the 1979 Gila Drain Project. The Task Force concluded that alternatives to earlier investigations existed, but a more detailed study must be compiled. In 1984 the Flood Control District commissioned a study, known as the "Gila Drain Alternative Study" to investigate alternative outlets for storm water in the East Valley cities of Tempe, Mesa, Chandler and Gilbert. The conclusion of this investigation was to abandon the Gila Drain concept and utilize the Salt River as an outlet for the collected storm waters.

This location and preliminary design report, know as the "Price Road Drain", is the culmination of the twenty years of effort to resolve the ever increasing storm water management problem for the East Valley Cities of Maricopa County. This report contains a preliminary design for combining the various municipalities stored storm water and routes this accumulated water North along Price Road from the Western Canal to the Salt River within the corridor dedicated for the Outer Loop Freeway. The Design/Location tasks were broken into two (2) separate areas. The East Branch which conveys stored storm water from Gilbert and the North Branch which brings the combined capacities from Gilbert, Chandler and Mesa (230 cfs) to a proposed A.D.O.T. facility at the Superstition Freeway.

The East Branch contains a 60-66 inch gravity drain with a capacity of one hundred (100) cfs. This drain would deliver flow from Cooper Road in Gilbert to Price Road in Tempe (approximately five miles) west along the south bank of the Salt River Projects' Lateral 9.5 (Western Canal). The storm water would exit into the existing Carriage Lane Retention Basin (located on the northeast corner of Price Road and Lateral 9.5) where it would combine with storm water from Chandler and Mesa.

The North Branch begins with a pump station which lifts the combined waters of the municipalities into an eighty four (84) inch force main having a capacity of two hundred and thirty (230) cfs. It delivers storm water from Mesa, Chandler and Gilbert from the Carriage Lane Retention Facility along the East side of the Mesa Drain Ditch to a proposed A.D.O.T. Retention Facility (approximately 2 miles north) located on the south side of State Route 360 (Superstition Freeway) and Price Road.

Enclosed in this report are the results of topographic mapping, survey, right-of-way, utility investigations, geotechnical investigations, pump station design, operation and maintenance conditions for both the North and East reaches. The preliminary costs and cost allocation results of the preferred alternatives are summarized as follows:

I. EXECUTIVE SUMMARY Continued)

The preliminary costs for both capital outlay and annual operation and maintenance expenditures are all expressed in 1987 dollars. The cost allocations were devised from a formula based on a percentage of peak flow and total flow combined.

OVERALL SUMMARY OF PRELIMINARY COSTS
(230 CFS SYSTEM)

Description	1000's of $ Cost
EAST BRANCH	
Pipeline	(Gilbert)
Alt 3	5,843
Metering Facilities	(Chandler)
Alt 3	129
	6,018
Common Facilities	(Chandler & Gilbert)
Junction Structure and Inlet to Carriage Lane Retention Basin	
Alt 3	46
NORTH BRANCH	(Chandler, Gilbert and Mesa)
Pipeline	
Alt 1	4,564
Common Facilities	(Chandler & Gilbert)
230 cfs Pump Station	2,000
Supervisory Control & Telemetry System	48
GRAND TOTAL - PREFERRED PLAN	12,630

II. INTRODUCTION

A. Background

The Flood Control District of Maricopa County has authorized Dibble & Associates Consulting Engineers with Boyle Engineering Corporation to prepare a location study and preliminary designs for the Price Road Drain, generally conforming to Alternate 6 defined in the report entitled Gila Drain Western Canal Alternatives Conceptual Design Study, dated May 31, 1985, prepared by the previously mentioned firms. Refer to Figure 1.

Since the study has commenced, planning development by ADOT and their various consultants working on the Price Road/Outer Loop Freeway corridor have delayed study of the north branch, that section of the Price Road Drain extending from the Carriage Lane Retention Basin at Price Road and the Western Canal to the Superstition Freeway. In order to minimize the delay to the overall study schedule, the east branch portion of the assignment, that stretch from Cooper Road to Price Road generally following the Western Canal (Lateral 9.5) alignment, has been studied separately with enough attention to the north branch to allow making a preliminary assessment of pipeline size, pump station siting and power requirements, and possible meter station size and approximate location at the Superstition retention basin site.

B. Purpose of Study

The purpose of this study is to determine the preferred pipeline alignments for both branches of the Price Road Drain System to develop preliminary designs for major facilities, recommend the system for final design, define and recommend operational and maintenance procedures, and develop sufficient hydraulic parameters to allow the Town of Gilbert and the City of Chandler to design their respective connecting facilities.

III. STORM WATER CONTRIBUTIONS

A. City of Mesa

The City of Mesa has determined that its capacity in the Price Road Drain will be 30 cfs maximum flow, introduced into the system at the proposed pump station to be located at the existing Carriage Lane Retention Basin. Refer to Figure 1 in Appendix A. No new City-constructed facilities are required. It is understood that present drainage in the Mesa Drain Ditch will be diverted near the Superstition Freeway.

B. City of Chandler

The City of Chandler has determined that its capacity in the Price Road Drain will be 100 cfs maximum flow, introduced into the system at the proposed 8-foot Parshall Flume structure to be located adjacent to the Carriage Lane Retention Basin. Refer to Figure 1 in Appendix A. The City will design and construct a new retention basin in the vicinity of Pecos Road and Price Road, a 100 cfs pump station, and a pressure pipeline to the point of connection. A conceptual design of these facilities has been prepared for the City by Camp Dresser & McKee Inc. The draft report is dated May 1986.

C. Town of Gilbert

The Town of Gilbert has determined that its capacity in the Price Road Drain will be 100 cfs maximum flow, introduced into the system at the proposed 8-foot Parshall Flume structure to be located just west of Cooper Road at the end of the East Branch. Refer to Figure 1 in Appendix A. The town will design and construct a new retention basin about 0.7 miles east of Cooper Road, a 100 cfs pump station, and an outfall pipeline to the point of connection.

D. Combined Flows to Superstition Retention Basin

The maximum flow to be pumped from Carriage Lane Retention Basin to the Superstition Retention Basin will be the sum of the maximum flows for the three participants, 230 cfs.

E. Hydrology

Appendix C to this report is a description of the derivation of the hydrology assumed in this study. Figure C-1 in that Appendix shows graphically and pictorially how the flows from Mesa, Chandler, and Gilbert are expected to be introduced into the system over the storm period, how the Carriage Lane Detention Basin could be emptied, and how the flows would arrive at the Superstition Retention Basin.

III. STORM WATER CONTRIBUTIONS Continued

The following are 100-year storm water volumes for the respective communities:

City of Mesa:	240 acre-feet
City of Chandler:	300 acre-feet
Town of Gilbert:	300 acre-feet
Total:	840 acre-feet

Approximately 120 acre-feet of storage will be needed in the Carriage Lane Retention Basin. (Refer to Appendix C). This would result in a high water surface elevation of about 1187 based on capacity versus depth information on the Carriage Lane and Palo Verde Park combined facilities obtained from the City of Mesa.

IV. DESIGN CRITERIA

A. Hydraulic Grade Line Profiles

The hydraulic grade line profiles for the pipelines are based on a computer program LAWPSGF prepared by the Los Angeles County Flood District (LACFCD) in 1979 and converted for use on a Hewlett-Packard HP 3000 computer in November 1981. The program determines water surface and pressure gradient elevations in both open channels and closed pressurized conduits. Adjustments to program input were made to increase the standard LA County manhole headloss from 0.05 $\frac{V^2}{2g}$ to 0.25 $\frac{V^2}{2g}$ better reprsent the Maricopa Association of Government (MAG) Standard Detail 521 manhole hydraulic characteristics.

Controlling water surface levels for determination of hydraulic grade line profiles were assumed as follows:

East Branch - Carriage Lane Retention Basin Normal High Water Level 1185.

North Branch - Superstition Retention Basin High Water Level 1198.5. Allowing free flow through the 12-foot Parshall Flume at design flow, the energy level at the upstream entrance to the flume was determined to be elevation 1203.04.

B. Pipe Characteristics

- Gravity Drains - low head reinforced concrete pipe (RCP) conforming to ASTM C 76 and MAG Section 735.
- Pressure Pipe - Low head reinforced concrete pipe (RCPP) conforming to ASTM C 361. Special fittings would be cement mortar lined and coated steel pipe conforming to AWWA C 200, C 205, and C 208.
- Pipes to flow full when carrying the design flow. (The maximum storm water flow in the pipe.).
- Manning coefficient: 0.012.
- Minimum velocity when pipe is flowing full: 3.0 fps.
- Minimum velocity in gravity draining pipes when depth ratio is 0.20: 3.0 fps.
- Pipe Length: 8 feet for both RCP and RCPP.
- Horizontal curves: 5^o bevel joints, R=100'.
- Pipe joints to be rubber gasket type for both RCP and RCPP.

C. External Loads and Pipe Trench Configurations

Trench cross sections and external loads on pipes are based on the findings in the preliminary geotechnical investigation bound in Appendix D of this report.

Selection of D-loads for RCP is based on the theories and methods developed by Spangler and Marston as presented by Ameron in their publication entitled Engineering Library No. 1-2.

Most of the pipeline alignments lie in clayey materials which are cohesive in nature. For open cut trenches, it was assumed that in the lower 6 feet of the trench, the trench cross section will conform to MAG Specifications Table 601-1, and that above that elevation, the trench walls will be sloped at 1/2 horizontal to 1 vertical. Where space limitations require steeper trench walls, vertical walls and brace-type shoring were assumed.

Between Price Road and Alma School Road, north of the lateral 9.5 canal (Alternative 1) and between Station 26 + 00 and Alma School Road, south of the lateral 9.5 canal (Alternatives 2 and 3), a 3 to 4-foot sand layer was encountered about 9 feet below the top of the canal back. For open cut trenches, the trench walls above the bottom of the sand layer elevation were assumed to be cut to a slope of 1 horizontal to 1 vertical. Where steeper trench walls are required due to space limitations, vertical walls and continuous sheeting-type shoring were assumed. Such shored sheeting may be accomplished by a movable box shield with jacks to spread the shield walls against the trench walls.

The bedding conditions assumed for determining the D-load of the pipe are those specified in MAG Specifications Section 601 for water and sewer pipe, a compacted granular material, 4 to 7 inches thick directly under the pipe barrel. The resulting load factor was assumed to be 1.9.

The geotechnical investigation also recommended that for pipe D-load determinations, the following factors be used:

- ku' = 0.158 for excavated native materials used for trench backfill.
- The unit weight of moist native soils used for trench backfill = 128 pcf.

Live loads for D-load determination will be assumed to be AASHTO H-20, S-16 wheel loads.

For pipelines passing under the Southern Pacific Railroad, Class V (3000-0) pipe will be assumed appropriate, as specified in MAG Specifications Sub-Section 618.3

IV. DESIGN CRITERIA Continued

D. Manholes and Special Structures

- Manhole and Side Access Manhole Spacing: Approximately 1/4-mile intervals.
- Standard Manholes: MAG Standard Details 522 and 523 (riser portion) and 521 (base portion), modified with special air vent ducts.
- Air Release Structures: Approximately 1/2-mile intervals in RCPP and at all closed high points.
- Blow-Off Structures: At all low points in RCPP.
- Special Structures: Use MAG Details where possible. Special design will be required for all other special structures.

E. Parshall Flume Design

Design of Parshall flow measurement flumes was performed using the guidelines published in the manual entitled Design and Calibration of Submerged Open Channel Flow Measurement Structures, Part 2 - Parshall Flumes, dated March 1967, compiled by the Utah Water Research Laboratory, Utah State University, Logan, Utah. Design was based on free flow conditions for the design flows and hydraulic grade lines. Free flow allows use of only one gage to measure flow, where submerged flow requires the use of two gages and the interpretation of the differences in water surface elevations at more cost and lower reliability.

The LACFCD program LAWPSGF was used to confirm free outflow conditions in the flume for the crest elevation selected. Water surface profile through the meter station was based on the Parshall Flume data published by Utah State University, an empirical approach.

F. Pump Station Design

Pump station rated capacity must be sufficient to deliver the maximum Combined Flows of the three participating municipalities, 230 cfs to the Superstition Retention Basin, with the water level in the Carriage Lane Retention assumed to be at the mid-point between a low level (elevation 1172) and the design normal high level of 1185, which is elevation 1178.5.

Based on a preliminary layout of the headworks at the Superstition Retention Basin as shown on Exhibit 7-N in Appendix F, and assuming an 84-inch pressure pipeline will deliver the storm water from the pump station to the Superstition Retention Basin, a pump head of approximately 37 feet will be required at rated capacity of the pump station.

Generally, the least expensive storm water pump stations have been found to be those with the fewest pumps. In this case, three engine-driven, right-angle drive, mixed flow vertical pumps are considered appropriate (one being a redundant unit). Utility company electrical power is considered unreliable during storm conditions, with the result that local agencies such as ADOT will not permit utility company power to be the primary source of power to drive the main pumps. However, utility power is considered appropriate to operate all non-essential electrical loads including battery chargers, ventilation system, and the very important sump pump. This pump may actually deliver more water over an average year than any of the primary engine-driven pumps.

The sump pump should be capable of handling some dirt, debris, and stringy matter. Its capacity should equal the largest non-storm nuisance flow which any one municipality might introduce into the system. Because the pump stations associated with Town of Gilbert and the City of Chandler systems have not been designed, it is assumed that 10 cfs is appropriate. A submersible centrifugal non-clog type storm water/sewage pump is recommended.

Pump Station operation should be as independent of the Carriage Lane Retention Basin as possible, so that a minimum of the potential volume of the Basin is lost to pump control.

Wet well and associated lake-side entrance area facilities should be sized to allow for a 3-minute warm-up period for the lead engine and to limit cycling pumps under adverse flow conditions to 5 cycles per hour per unit. The redundant unit can be used in meeting this requirement.

Net inflow to pump station during 3-minute warm-up: Effective pump flow (100 cfs) less sump pump flow (10 cfs) = 90 cfs. Required volume = 16,200 CF.

Water Level	Step: Rising	Step: Dropping	Function	Remarks
High	6		o High Water Alarm	Alarm only
	5		o Start Lag Pump	
	4		o Start Lead Pump	
	3		o Start Remaining Engines	
		7	o Stop Lead Pump, operate alternator, and continue to step pumps off (or on) the line as needed by water level (and alternator)	Engines to run until all pumps have shut down for 10 minutes
		8	o Low suction pressure	Alarm/Control
	2		o Start Lead Engine	
	1		o Start Sump Pump	
		9	o Stop Sump Pump	
Low		10	o Low Water Signal	Status Only

IV. DESIGN CRITERIA Continued

Interlocks should be provided to prohibit the redundant pumping unit from operating simultaneously with all of the other prime pumps. Otherwise a greater flow than the agreed maximum 230 cfs could be delivered to the Superstition Retention Basin. This presumably would be in violation of the agreement with the participants in the downstream facilities between the Basin to the Salt River.

If either pump fails to deliver when called for, the redundant pump would replace the failed pump and the failed pump would be locked off the line and an alarm initiated.

Engines should be 1200 rpm maximum, continuous-duty rated, naturally aspirated, designed for operation on liquid petroleum gas (propane) fueled.

V. SURVEY AND TOPOGRAPHIC MAPPING

A. Control

The control for this project is provided from survey data collected by Dibble and Associates, Phoenix, Arizona.

Horizontal control has been established by use of an arbitrary coordinate system. The coordinate origin is located at the West Quarter corner of Section 7, Township 1 South, Range 5 East (Price Road and Western Canal). Assigned coordinate values shall be nothing - 50,000.00 easting - 50,000.00. The basis of bearing is the line from the East Quarter corner of Section 11, Township 1 South, Range 5 East to the East Quarter corner of Section 10, Township 1 South, Range 5 East (Cooper Road to McQueen Road). The bearing is assumed to be due west.

Vertical control has been obtained from the Geodetic Section of the Arizona Department of Transportation (A.D.O.T.). The vertical control for the east branch is found 368.2 feet north of and 76.2 feet west of the intersection of State Route 360 and Stapley Drive in Mesa, Arizona. The elevation of the A.D.O.T. aluminum cap number 360.-X is 1220.87 feet. Vertical control for the north reach is obtained on the northeast corner of the Price Road overpass at the Superstition Freeway, 107.4' north of S.R. 360 centerline and 54.5' east of Price Road centerline, 2.4' south of the expansion joint. The cap in the bridge sidewalk is stamped 360-E with an elevation of 1194.293.

B. TOPOGRAPHIC MAPPING

Kenney Aerial Mapping, Inc., of Phoenix, Arizona, provided the photogrammetric services for this project, including all contours, spot elevations and topographic features.

From the horizontal and vertical control provided, Kenney Aerial Mapping has provided one-foot contour intervals, accurate to within one-half a contour interval and spot elevations accurate to within one-quarter of a contour interval.

VI. RIGHT-OF-WAY REQUIREMENTS

A. General

Location of the right-of-way (R/W) for the east branch of this project falls completely within land held in fee by the Salt River Project.

The east branch lies adjacent to the midsection line of Sections 7 to 11, Township 1 South, Range 5 East (Price Road to Cooper Road) and basically parallels the Salt River Projects' Western Canal Lateral 9.5. Within the right-of-way area shown in Exhibits 1-E through 18-E in Appendix E there exists two separate right-of-ways. The northern half ownership is the Salt River Project Water Users Association, with the southern half of the right-of-way also being Salt River Project, but the Power Division. All of the alternates are located within this right-of-way.

The north branch lies east along the range line (4E and 5E) approximately paralleling the Mesa Drain Ditch. This property is presently owned and maintained by the City of Mesa, and parallels the right-of-way for the Salt River Projects' Tempe Canal, however, it is expected this property will be acquired by A.D.O.T. for the Proposed Price Road Expressway and the traffic interchange with the Superstition Freeway.

B. RIGHT-OF-WAY DEFINITION

The existing Salt River Project right-of-way for the Western Canal Lateral 9.5 (East Branch of the Price Road Drain) approximately follows the Mid-Section line between Guadalupe Road and Elliot Road from Price Road to Cooper Road. The canal meanders slightly therefore the existing right-of-way is not exactly parallel to the mid-section line. The East Branch location drawings indicate the limits of the right-of-way, but no dimensions are shown as the right-of-way is not parallel to the mid-section line.

The following list of survey plats, recorded at the Maricopa County Recorders' (MCR) office will help the reader to identify the exact location of the existing right-of-way lines for locating the East Branch of the project:

Subdivision or Description	Book	Page
Salt River Valley Water Users Association		
(SRVWUA) Sec. 7, T15, R5E	166	22
(SRVWUA) Sec. 12, T15, R4E	181	14
(SRVWUA) Sec. 8, T15, R5E	181	10
(SRVWUA) Sec. 9, T15, R5E	181	11
(SRVWUA) Sec. 10, T15, R5E	179	11
(SRVWUA) Sec. 11, T15, R5E	180	31
(SRVWUA) Sec. 12, T15, R5E	185	48
Carriage Lane	198	23

VI. RIGHT-OF-WAY REQUIREMENTS Continued

Subdivision or Description	Book	Page
Carriage Lane II	173	28
Carriage Lane VII	193	7
Knoell East Unit IV	194	17
Knoell East Unit VI	219	44
Woodglen Unit IV	204	30
Parkview Unit II	191	33
North Forty Unit III	204	21
Parkwood Estates 4	116	3
Marlboro Mesa Unit I	194	20
Sunridge Townhomes	184	28
Mission Valley II	231	7
Dave Brown Unit I	194	22
New Horizons Phase III	216	1
Sunset Commerces	100	27
Dobson Business Park	216	25
Termaine Park	116	36

The existing Salt River Project right-of-way for the Tempe Canal and the existing City of Mesa right-of-way for the Mesa Drain Ditch approximately follow the Range line between R.4E. and R.5E. from the Western Canal to the Superstition Freeway. The right-of-way is not exactly parallel to the Section line.

The following list of survey plats recorded at the Maricopa County Recorder's office (MCR) will help identify descriptions for the existing right-of-way available for the North Branch of the project:

Subdivision or Description	Book	Page
Carriage Lane	198	23
Saratoga Lakes	166	3
Villa Chica Plaza	187	46
Don Carlos Plaza	187	47
Los Altos Amended	167	27
Saratoga Lakes Unit Two	172	50
Saratoga Lakes Unit Three	184	41
Saratoga Lakes Unit Four	186	41

C. PUBLIC UTILITY EASEMENTS (P.U.E.)

For the purposes of maintenance, a P.U.E. will need to be granted. The management agency that is to ultimately maintain the storm drain facility will need the right of permanent access for periodic inspections and routine maintenance.

VI. RIGHT-OF-WAY REQUIREMENTS Continued

A thirty foot P.U.E., fifteen feet each side of the centerline of the final pipe alignment is recommended as a minimum requirement.

Temporary Construction Easements (T.C.E.) will be contingent upon final location and profile of the storm drain. The minimum requirements will be an additional twenty feet each side of the P.U.E. or access to both sides of Lateral 9.5, as necessary. No T.C.E. will be necessary at the major arterial street intersections if construction is performed within the existing street right-of-way.

VII. UTILITIES

A. General

Letters requesting information regarding approximate location of existing and proposed facilities were sent to the following utilities, agencies and municipalities for the subject area:

Town of Gilbert
City of Chandler
City of Mesa
City of Tempe
Salt River Project
Arizona Department of Transportation
Times Mirror Cable Company
Southern Pacific Railroad
El Paso Natural Gas Company
Southwest Gas Corporation
Mountain Bell

Every utility listed responded in a timely fashion and the facilities are located graphically per the information supplied.

These utilities located on the Exhibits 1E - 18E in Appendix E and Exhibits 1-N - 7-N in Appendix F should be field verified for actual location and depth before any trenching commences in the immediate area.

B. UTILITIES

The numerous utility crossings that exist within the various alternative alignments and profiles will be identified in the preliminary cost estimates included in Appendices E and F.

1. EAST BRANCH

UTILITY	NO. OF FACILITIES (BURIED OR PARALLEL)
ALTERNATES 1A AND 1B	
Buried Electrical	5
Telephone	5, 1- Running Parallel 2600'
Irrigation	2 - 12" 3 - 18" 1 - 48"
	5 - 24" 1 - 15" 1 - 30"
	5400', 5' Conc. Lined Ditch Running Parallel
Pole Bracing	37 each
Gas	1 - 2" 1 - 4-1/2" G
Water	1 - 6" 1 - 12" Proposed
Sewer	1 - 18"
TV	1 - Running Parallel 5500'

VII. UTILITIES Continued

ALTERNATE 2

Buried Electrical	6
Telephone	4
Irrigation	3 - 12" 1 - 30"
	2300', 5' Conc. Lined Ditch Running Parallel
Gas	1 - 2" 1 - 4-1/2" G
Water	1 - 6" 1 - 12" proposed
Sewer	1 - 18"

ALTERNATE 3

Buried Electrical	6
Telephone	4
Irrigation	1 - 12" 1 - 30" 1 - 18"
Gas	1 - 2" 1 - 4-1/2" G
Water	1 - 6"W 1 - 12" Proposed
Sewer	1 - 18"

2. NORTH BRANCH

UTILITY	NO. OF FACILITIES (BURIED OR PARALLEL)
Buried Electrical	1
Cable Television	1
Telephone	1
Gas	1 - 4" 1 - 6" 1 - 16" (H.P.)
Sewer	1 - 33" VCP
	1 - 54" RCP

Cable television and telephone facilities are also buried paralleling the eastern bank of the Mesa Drain Ditch.

For the East Branch (Western Canal) portion of the project the proposed pipe is sufficiently deep to allow existing crossing utilities to remain in their present location crossing over the top of the storm drain. At a few locations the trenching operations will require supporting, protecting or removing and replacing, in an acceptable manner, some irrigation ditches, power poles, transmission towers, or pipelines.

One specific location requiring extensive work will be the relocating of an 18-inch sanitary sewer line from Station 264+ to Station 265+.

VII. UTILITIES Continued

Notes have been added to the location concept drawings (Exhibits 1-E through 18-E) to point out where the potential for major utility conflict exists. These notes are added only for the preferred alignment, Alternate 3.

For the North Branch (Tempe Canal) portion of the project the proposed pipe is a pressure pipeline and is much shallower than the East Branch pipeline. However, most major utilities do not cross the alignment because the pipeline is located within the City of Mesas' Drain Ditch Right-of-Way and the corridor has been avoided as a utility corridor.

Conflicts exist with an underground telephone line in the vicinity of Station 56+20, a 24-inch drain pipe at Baseline Road, in the vicinity of Station 80+10, and a 16-inch gas line at Baseline Road, in the vicinity of Station 79+70. Each of these utilities should be reconstructed to clear the proposed storm drain pipe.

Notes have been added to the location concept drawings (Exhibits 1-N through 7-N) to indicate where the potential for major utility conflict exists.

VIII. GEOTECHNICAL INVESTIGATION

A. General

Thomas-Hartig and Associates, Inc., Chandler, Arizona provided the geotechnical investigation for this project.

The scope of their investigation was to perform soil borings at quarter (1/4) mile intervals, on alternating sides of Lateral 9.5 along the East Branch and at one-half (1/2) mile intervals along the North Branch. From these borings, soil samples were removed and the following tests performed;

Dry Density - Optimum Moisture Content (ASTM D-698-A)
Direct Shear Test
Sieve Analysis ASTM D-422
Plastic Limit ASTM D-424
Soluble Chlorides
Soluble Sulfates
pH

The findings and results are located in this report in Appendix D. The following trench excavation recommendation from the geotechnical engineer is repeated in this section for convenience of the reader.

B. TRENCH EXCAVATION RECOMMENDATION

1. Temporary unbraced excavations into the clay subgrade soils should be no steeper than 0.5 horizontal to 1.0 vertical. Slopes should be flattened to at least where clayey sandy soils are encountered. Flatter slopes may be required where clean sand layers or utility line fill are encountered.

2. All existing utilities should be located on the excavation plans to evaluate the effect of existing trenches and backfill material on the excavation slopes. Flatter slopes and seepage control measures may be required in the vicinity of the existing utility lines and backfill material. Any existing utilities near the excavation to remain in-place should be adequately supported to prevent movements of the utility line.

3. Open excavations should not be used in areas where the crest of the slope will fall within 15 feet of the canal or any above-grade structures.

4. No surface water should be allowed to pond within 20 feet of the crest of the excavation or should any surface water drain over the top of the crest and down the excavation slope. Precautions should be taken to help prevent erosion of the excavation slopes. No surface water should be allowed to pond within the limits of the excavation.

5. No soil or construction materials should be stored within 20 feet of the crest, and no construction equipment should be operated within 15 feet of the crest.

All excavation plans and designs (including bracing systems) should be reviewed by a qualified geotechnical engineer. Periodic observation should be made by the reviewing geotechnical engineer during excavations and after completion of the excavation to evaluate site conditions and to determine if any modifications are necessary. Some surface raveling and caving should be expected in unbraced excavations unless measures are taken to stabilize the exposed cut surface.

IX. EAST BRANCH ALTERNATIVES

A. General Discussion

Three alternative horizontal alignments were selected for study along the East Branch. These have been identified as Alternatives 1, 2, and 3 and generally consist of 60 and 66-inch diameter RCP. The expectation is that the costs of construction could be significantly different, although not obvious without detailed study. Also, each will have advantages and disadvantages when compared with the others. Evaluation of these tangible and intangible factors should lead to a sound recommendation for the preferred plan.

In addition to these alternatives, other possibilities exist which may prove worthy of detailed study. Recently, the SRP has suggested that they might go along with a conduit project which would utilize their Lateral 9.5 canal as the trench. The terms have not yet been defined, but the concept(s) are discussed later in this section.

All three alternatives include non-pressure, open channel type flow meters at points of connection to the Price Road Drain System. Refer to Exhibits 1-E and 18-E in Appendix E. It is assumed that the Town of Gilbert will construct a planned retention basin and pump station about 3800 feet east of Cooper Road. It is further assumed that pump station will pump into an open headworks which in turn will deliver up to 100 cfs through a 54-inch pipeline constructed by the Town of Gilbert and connected to the Price Road Drain System just west of Cooper Road at a 100 cfs Parshall Flume Structure as shown on Figure 2 in Appendix A. The City of Chandler is proposing to construct a retention basin and pumping station near the intersection of Price Road and Pecos Road. Up to a maximum of 100 cfs would be pumped through a 72-inch pressure pipeline located in the Price Road right-of-way to the Carriage Lane Retention Basin, where the pipe would connect to a 100 cfs Parshall Flume Structure as indicated in Exhibit 1-E in Appendix E and Figure 2 in Appendix A.

B. Alternative 1 (East Branch)

Exhibits 1-E through 18-E in Appendix E show the Alternative 1 alignment, located along the northerly levee of the SRP Lateral 9.5, a dirt access road. Alternative 1 has two different profile options. Alternative 1A is generally deeper than Alternative 1B due to dropping down to clear and then maintain minimum pipeline invert grades after passing under existing major gravity drain pipelines near Alma School Road. Refer to Exhibits 8-E and 9-E. Alternative 1B uses a double barrel 42-inch inverted siphon to accomplish the drop without generally lowering the pipeline profile.

Due to restricted working area, especially toward Price Road, where the pipe will require a deep trench, supporting and/or replacement of nearby improvements will be required. Handling of excavated earth will also present construction difficulties in limited space. It is assumed that earth as it is excavated will have to be transferred across Lateral 9.5

canal by conveyor for stockpiling. The reverse procedure will be necessary for track backfilling.

An overhead electrical power/telephone pole line will be almost directly overhead between Price Road and McQueen Road (21,200 feet).

The entire alignment fails in the SRP (water division) owned right-of-way. An easement could probably be obtained at minimal cost. Crossing of the major roads may require jacking of the pipeline if open cutting of the roads with associated traffic control and public inconvenience is not feasible. The Southern Pacific Railroad will require jacking the pipeline. Open cut trench will probably be permitted at McQueen Road.

C. Alternative 2 (East Branch)

Exhibits 1-E through 18-E in Appendix E also show the Alternative 2 alignment, which is generally located south of the southerly levee of the SRP Lateral 9.5, centered along the SRP Steel electrical power towers. The Alternative 2 pipeline generally has significantly less earthen cover than Alternative 1 and with the exception of the steel tower locations at about 885 - foot intervals, more open space is available for trenchwork and storage of excavated materials.

The most significant problem with this alignment will be the need to jack the pipeline under the SRP steel truss towers to avoid disturbing the four pedestal foundations at each tower.

The proximity of the overhead electrical cables over the entire alignment will present construction clearance problems, except where the pipe is jacked.

The right-of-way is owned by SRP (power division) and therefore an easement can probably be obtained at minimal cost. Jacking the pipeline under crossing roads and the open cut at McQueen Road will be similar to Alternative 1. An additional section of jacked pipe may be required under the Lateral 9.5 canal near the Carriage Lane Retention Basin inlet.

D. Alternative 3 (East Branch)

Exhibits 1-E through 18-E in Appendix E show the Alternative 3 alignment, which generally lies south of Alternative 2, close to a SRP steel pole line. East of the Southern Pacific Railroad crossing (Exhibits 13-E and 14-E) the horizontal alignment coincides with Alternative 2 to avoid a sewage pumping station. Also, near Cooper Road (Exhibit 18-E) the horizontal alignment coincides with Alternative 2, to avoid a sewer main which skews across the SRP right-of-way.

This alignment passes through a number of depressed areas serving as retention basins for the residential developments adjacent to the SRP southerly right-of-way. The depths of cover over the pipe would be significantly less than for Alternative 1 and slightly less than Alternative 2. Special supporting of the trench walls will be required wherever the pipeline passes an SRP steel pole (about every 885 feet). Since the ground surface is low, periodically the HGL will be above the ground surface where manholes are planned. These manholes will have to be of a pressure type as shown on MAG Standard Detail No. 523.

The proximity of the overhead electrical cables over most of the entire alignment will present construction clearance problems.

Since all of the pipeline alignment lies within SRP-owned rights-of-way, an easement could probably be obtained at minimum cost.

Jacking the pipeline under crossing roads and the open cut at McQueen Road will be similar to Alternative 1. An additional section of jacked pipe may be required under the Lateral 9.5 canal near the Carriage Lane Retention Basin inlet.

E. Other Alternatives

In the original scope of this project using Lateral 9.5 was not considered as a viable option due to Salt River Project policy against storm water outfalls into their canal system in the Phoenix Metropolitan Area. However, the SRP has recently suggested consideration be given to two other alternatives which would involve. not only the Town of Gilbert as is basically the case with East Branch Alternatives 1, 2, and 3, but also the SRP and, in a way, the Cities of Mesa and Chandler. These alternatives are not directly comparable to Alternatives 1, 2, and 3 because another purpose for the project is an important factor. This is the backfilling of the SRP Lateral 9.5 and the creation of a common strip of park land along the old Lateral 9.5 between Price Road and Cooper Road.

At present the water allocations for commercial and private users for Lateral 9.5 have been greatly reduced due to the rapid development of this area away from agriculture. The present capacity of the existing lateral channel is no longer being fully utilized. Salt River Project has tentatively agreed to support the concept of placing a closed conduit (square or circular) in the Lateral 9.5 channel. The Salt River Project would require that any existing irrigation commitments and inter-canal storm water transfers be maintained, but otherwise the facility could be utilized by the Town of Gilbert for their storm water outfall to the Carriage Lane Retention Basin.

By removing the obvious liability caused by Lateral 9.5, the linear park concepts, consisting of common detention areas, pocket parks, equestrian/bike paths could become a multi-city recreation facility. Though no actual dedicated parks or park sites exist at present, but the concept of placing the East Branch of the Price Road Drain into the invert of Lateral 9.5 would dovetail with the linear park concept adopted by the various communities.

The proposed profile and alignment, engineering responsibilities, details of ownership, operation, delivery schedules, maintenance costs, financial participation, interagency agreements have not been addressed. Invert grades would probably be different than the present channel invert grades in order to allow the conduit to drain at reasonable water velocities to the Carriage Lane Retention Basin and to keep the pipe flowing full under maximum design flow conditions.

Alternative SRP 1 would be to size the pipeline to simultaneously carry 100 cfs from the Town of Gilbert and 100 cfs of storm water flow from SRP's Consolidated Canal. Through a diversion facility, the two flows would be separated at Price Road, 100 cfs going to the Carriage Lane Retention Basin (on the behalf of Gilbert), and 100 cfs going to the SRP Western Canal, west of Price Road (on behalf of the SRP). Under this alternative, SRP would retain the right to use the pipeline to carry irrigation flows of up to 50 cfs, except when storm water must be transmitted.

Alternative SRP 2 would be to size the pipeline for 100 cfs and to provide additional retention basin volume in the Town of Gilbert to store Gilbert's 100 cfs flow until the SRP had finished delivering its 100 cfs of storm water flow from the Consolidated Canal. Under this alternative, a manually operated diversion facility at Price Road would allow delivering SRP's flows to the Western Canal, west of Price Road, or Gilbert's flow to the Carriage Lane Retention Basin. As with Alternative SRP 1, SRP would retain the right to use the pipeline to carry irrigation flows of up to 50 cfs, except when storm water must be transmitted.

Evaluation of these alternatives is beyond the scope of this study, however for this study, may be worthwhile. In order to make such an evaluation, the following problems must be addressed:

- A comprehensive basis of comparison of alternatives should be developed to include a valuation of park aspects of the SRP alternatives vs the no park aspects of the other alternatives.

- If the pipeline is full of irrigation water when a storm begins, the time of concentration of the 100 cfs from Gilbert at Carriage Lane Retention Basin would be significantly reduced.

- If the Gilbert 100 cfs storm flow is retained until after the SRP storm flow is passed on to the Western Canal west of Price Road, the Carriage Lane Retention Basin would be filled more slowly. This might be good. However, if the filling time is spread out too long, it is possible that a second storm might impact the area and the Gilbert Retention Basin may not have been evacuated in time to receive all of the next storm's flow.

- How long would SRP need to transfer storm water from the Consolidated Canal to Price Road at 100 cfs?

- The impacts of changed hydrology on downstream facilities leading to the Salt River should be evaluated and included in the comparisons.

- How would flows into the pipeline be measured and controlled?

- What does SRP propose to do about the numerous drain lines which presently discharge into the Lateral 9.5 channel? Are these flows part of the SRP 100 cfs capacity? How would they be controlled?

- The pipeline would discharge against significantly different HGL's at Price Road. Since the Western Canal water surface probably will be higher than the 1185 level assumed for the design water surface elevation at the Carriage Lane Retention Basin used for pipeline sizing, the SRP 100 cfs flow will require a larger pipe diameter than the Gilbert 100 cfs flow would require. How would this affect participation (allocation of costs) by the Town of Gilbert?

- Since the value of parks to the communities is a factor, allocation of costs should include these factors. What is SRP's contribution? The right-of-way? If so, this should be established at the onset of the study.

X. NORTH BRANCH ALTERNATIVES

A. General Discussion

A single alignment was selected for study along the North Branch, since highway planning for the Price Road corridor eliminates a practical alignment at virtually all points, except as far east of the existing Mesa Ditch channel bottom as possible, while staying inside the existing right-of-way for that ditch.

In addition to the North Branch as presented in this study, ADOT has recently proposed two alternatives of more regional usage. These alternatives are not directly comparable to the North Branch, but are discussed later in this section.

B. NORTH BRANCH ALTERNATIVE 1 (230 CFS SYSTEM)

Exhibits 1-N through 7-N in Appendix F show the alignment of the 84-inch RCPP, generally located east of the channel bottom and 25 to 35 feet west of the easterly right-of-way line of the Mesa Drain Ditch.

The location of the pipeline was selected in part so that the trench bottom would clear a limiting ground stability plane which passes through the ground surface 3 feet west of the easterly right-of-way line and slopes at 1 horizontal to 1 vertical downward and westward therefrom. This would allow excavating the pipeline trench without interfering with the stability of earthen materials which might underly fences, walls, and structures located along or close to the right-of-way.

Major crossing utilities exist primarily in and near Baseline Road. Reinforced concrete box bridge structures exist at both Guadalupe and Baseline Roads. Due to heavy vehicular traffic on these two streets, it is assumed that open cut trenchwork will not be permitted where the North Branch crosses these streets. RCPP can be directly jacked without need for a bulky casing, however local practice is to jack a pipe casing filling the void between the drain pipe and the casing with sand or grout after the drain pipe has been installed.

The strength of pipe must include an allowance for external loads. In determining these loads, it has been assumed that someday, an embankment will be placed over the pipeline, to accommodate a future frontage road required by the ADOT Price Road highway plans. The frontage road surface could approximate the existing ground elevations along the easterly right-of-way line of the Mesa Ditch.

Since the North Branch is a pressure pipeline, special consideration must be given to appurtenances which will assist in its proper maintenance and operation. As the pipeline fills with water, air will be displaced and must be allowed to escape. Air release valves should be placed at 1/2-mile intervals and at closed high points. Some sandy materials may find their way into the pipeline through the pump station. Access manholes and cleanout structures will allow moving deposited debris to low points for removal.

The cost of right-of-way should be minimal due to the fact that the proposed alignment lines within the existing Mesa Drain Ditch right-of-way, owned by the City of Mesa.

C. OTHER ALTERNATIVES (285 CFS SYSTEMS)

ADOT and their consultant HNTB have recently proposed two alternatives to the principal plan investigated under the study. The report is entitled Outer Loop Highway SR360 Interchange Alternatives Analysis, October 1986. These alternatives may be worthy of additional detailed investigation, but are beyond the scope of this study. Both would drain the Carriage Lane Retention Basin by gravity to the vicinity of the Superstition Freeway. One would use a depressed retention basin at that point, and a major pump station which would pump storm waters under the freeway, discharging them into a chain of reinforced concrete boxes buried at moderate depths of cover and leading to the Salt River. The second would allow flows to drop into a deep tunnel which would be an inverted siphon, leading to the Salt River. Other flows would be directed into the tunnel at periodic drop shafts.

These alternatives are not directly comparable to the principal plan presented in this study for several reasons. The flows delivered to the downstream system include ADOT intercepted flows of 55 cfs. The high water level in the Carriage lane Retention Basin was assumed to be about elevation 1192, where 1185 was assumed safer in this study. The ADOT alternatives show outfall pipe invert elevations about 5 feet above the present bottom of the Carriage Lane Retention Basin, so additional pumping would be required to completely dewater the Basin. The ADOT alternatives would take much longer to empty the Carriage Lane Retention Basin after a major storm, or a larger drainage system would have to be built.

In addition, with a higher water surface in the Carriage Lane Retention Basin to discharge against, the East Branch pipeline sizes of Alternatives 1, 2, and 3 would need to be increased.

One serious potential problem which the ADOT alternatives will create is due to the fact that Carriage Lane Retention Basin is located at the far upstream (southerly) end of the ADOT outfall system to the Salt River. Many of the downstream input flows have the potential of higher HGL's than the Carriage Lane Retention Basin operating water levels. Without a major pumping station at the Carriage Lane facility to over-power these HGL's, the communities of Mesa, Gilbert, and Chandler will be at the mercy of the downstream users.

X. NORTH BRANCH ALTERNATIVES Continued

The result would probably be that the Carriage Lane Retention Basin could fail to be evacuated before the next storm arrives. Several low residential houses then could be flooded, since they are lower in elevation than the land around the basin.

Refer to the discussing on impact of the ADOT tunnel project in Section XVII.

XI. 230 CFS PUMP STATION

Figure 4 in Appendix A shows a preliminary layout of a 230 cfs pump station which would be of sufficient capacity to handle the combined maximum flows of the three participants, Mesa, Chandler, and Gilbert. Based on the hydraulic profile and the headworks at the Superstition Retention Basin as shown on Exhibits 1-N through 9-N in Appendix F, three 440 rpm Cascade 42-inch mixed flow vertical pumps will be required, including one redundant unit. Maximum horsepower required by each pump will be about 565 HP in the normal operating range. Each would be capable of delivering 115 cfs at 37 feet of head. Each pump would be driven by a 800 HP Waukesha L 5790 G propane gas fueled 1100 rpm, continuous duty-rated engine through a right-angle drive, Amarillo Model 1800, 2.5 ratio.

The motor control and engine room would be located high enough to avoid flooding in the Carriage Lane Retention Basin. The basement level where the pump discharge head elbow is located has a potential for being flooded, if the retaining walls surrounding the access stairway is not water tight. Such flooding probably would not cause serious problems, just a cleanup nuisance.

Flap gates would be provided on the individual pump discharges to prevent reverse flow through the pumps from the discharge manifold, should a pump not be running while one or more others are.

A 74 HP Flygt Model 14" CP-3355 submersible sump pump would deliver 10 cfs at a pump head of about 40 feet. Electrical power would be provided by the utility company. During a power failure, the pump would not be needed, because an engine-driven pump could be started.

In order to minimize the use of storage in the existing Carriage Lane Retention Basin to control pumps, an inlet apron is proposed to receive flows from Chandler and Gilbert and direct them to the pump station wet well. Refer to Exhibit 1-E in Appendix E and Figure 4 in Appendix A.

Since the pump station is discharging into a long pressure pipeline, a potential exists for hydraulic surges to occur as pumps start and stop. Surges could damage the pipeline. A 72-inch diameter standpipe at the pump station site is suggested as a possible solution to this problem. Refer to Figure 4 in Appendix A. A splash apron at its base would allow spilled water to return to the Carriage Lane Retention Basin. The standpipe also could serve as a relief to restrict the maximum flow being delivered to the Superstition Retention Basin to about 10 percent in excess of the agreed maximum flow for 230 cfs.

Special consideration must be given to the design of the pump station to ensure that it cannot become bouyant as the water level in the Carriage Lane Retention Basin rises to its highest possible level.

XI. <u>230 CFS PUMP STATION</u> <u>Continued</u>

Access to the 10 ton engines for replacement is proposed by mobile crane through removable skylight in the building roof. A second possibility would be by horizontal movement through the building wall by removing the engine ventilation louver system and shrouds.

Access to pumping units also would be through removable skylights in the building roof.

Propane tank fuel storage will be required at a safe distance away from the pump station structure.

XII. OPERATIONAL LOGIC (230 CFS SYSTEM)

The concept of operation of the principal storm drain facilities studied is as follows:

Storm water flows entering the Carriage Lane Retention Basin (HGL 1185) from the communities of Chandler and Gilbert will be controlled to effectively restrict each agency's flow to a maximum of 100 cfs. The management agency would continuously monitor flows through telemetered data measured at the two 100 cfs Parshall Flume Structures. (Refer to Exhibits 1-E and 18-E in Appendix E.) Should the telemetered flow data indicate that the flow from one community has exceeded 100 cfs, a supervisory instruction will be sent to the respective community's outflow pump station control panel, causing pumps to stop and/or slow down until the flow drops to 100 cfs. Should the flow drop below 100 cfs, the supervisory control system will allow pumps to increase output to 100 cfs, until an overriding local signal steps pumps off the line due to low water level in the community's nearby retention basin.

Storm water flows leaving the Carriage Lane Retention Basin and entering the Superstition Retention Basin (HWL 1198.5) will be controlled to effectively restrict the combined flows to 230 cfs. The management agency would continuously monitor the flow through telemetered data measured at the 230 cfs Parshall Flume Structure. (Refer to Exhibit 7-N in Appendix F.) Should the telemetered flow data indicate that the flow has exceeded 230 cfs, a supervisory instruction will be sent to the 230 cfs Pump Station at the Carriage Lane Retention Basin. (Refer to Exhibit 1-E in Appendix E.) Supervisory control of pumps and/or pump speed will be similiar to that described above for the pump stations belonging to the communities of Chandler and Gilbert.

After the bulk of the storm flow has passed through the system to the Superstition Retention Basin, low flows may continue to enter the system. As long as flows do not exceed about 75% of the respective community's agreed capacity, local pump control (by the community) would be permitted by the management agency's supervisory control system.

It is envisioned that the management agency would maintain a headquarters for receiving and analyzing all status and alarm information, and for sending all supervisory control commands, through telemetry using telephone company leased circuit(s).

XIII. FLOW MEASURING STATIONS (230 CFS SYSTEM)

Figures 2 and 3 in Appendix A show 100 and 230 cfs Parshall Flume Structures.

The 100 cfs stations are typical for Chandler and Gilbert input flows as shown on Exhibits 1-E and 18-E in Appendix E. Both are envisioned as reinforced concrete structures with sectionalized removable concrete covers. The Chandler flow measuring facility is slightly longer than the Gilbert Structure due to the larger entry pipe requiring a longer inlet transition. The Parshall Flume throat will be 8 feet wide, measured across the channel.

The 230 cfs station located at the Superstition Retention Basin measures flows entering that basin, as shown on Exhibit 7-N in Appendix F. The throat will be 12-feet wide. This station could possibly be open at the top. A chain link fence would deter unauthorized access by people and animals.

Each station would include a manhole vault located alongside the main structure which will house the flow measuring and telemetering equipment. Flow data would be sent to the management agency's headquarters where it would be analyzed and used to control flow rates. Both 120 volt single phase electrical power service and telephone service will be needed at each flow measuring station.

XIV. MAINTENANCE REQUIREMENTS

A. General

The storm drain system must be maintained in a routine manner under an adequate budget so that the system will be ready to operate properly when the storms arrive.

Maintenance of the Superstition Retention Basin and downstream facilities leading to the Salt River are beyond the scope of this study.

B. Access

Access roads must be maintained to allow maintenance personnel and vehicles to reach the major elements and appurtenances of the system. The level of maintenance should be sufficient to allow vehicular traffic to reach the pump station and Parshall Flume structures at all times. Access to standard manholes, side-access manholes, siphon terminal structures, and air release structures should be available as soon as the storm passes. Refer to Exhibit 5 in Appendix A and Exhibits 1-N thru 7-N in Appendix F. Stable access to periodically flooded structures such as pressure manholes and blow-off structures should be available as soon as the storm waters recede.

C. GRAVITY DRAINING PIPELINES

The East Branch pipelines are set at sufficiently steep invert grades, that they should tend to be self-cleaning. An annual inspection at random manholes should assist in establishing a cleaning schedule. Generally, dislodged, silt, sand, and debris should be washed to downstream manholes for interception and lift-out-or allowed to pass on to the Carriage Lane Retention Basin.

If the inverted siphon alternative (1B) is built, the downstream terminal structure is expected to require considerable maintenance. After every storm, the structure should be checked and cleaned of accumulated debris. Also, to avoid a potential public health nuisance, the inverted siphon pipe should be dewatered by use of portable pumps within seven days after each storm, unless that time is extended by the advent of a new storm pushing the stagnating water on through the system.

D. PARSHALL FLUME STRUCTURES

Parshall Flume Structures should be visited routinely on a weekly basis and cleaned as necessary to ensure that the metering element, the sensor pipe, and the float well in the instrument manhole are free of accumulated debris. Refer to Figures 2 and 3 in Appendix A. During each visit, the flow transmitter should be checked for proper operation and calibration by comparing the signal being received at headquarters with the water level in the float well. A fresh water supply and a control valve in the flume sensor line will permit filling the float well sufficiently to represent a significant flow of about 75 to 100 percent of the rated flow for the station. After the test, the control valve should be opened and left open.

E. PRESSURE PIPELINES

Unfortunately, the pressure pipeline contemplated for the North Branch Alternative 1 cannot be practically designed to allow flushing with adequate velocities and low flows as is possible with the East Branch gravity draining pipelines. Fortunately, however, the sediment load should be light due to the fact that much of the sand and debris already should have been separated at the 230 cfs pump station and at the Carriage Lane Retention Basin. Periodic cleaning is expected to be necessary. Initially the pipeline should be checked after every storm to learn what a reasonable cleaning schedule might be. The preliminary design anticipates that two levels of cleaning will be employed. The first and simplest is to operate the blow-off structures planned for the bottom of the Carriage Lane Retention Basin and the Mesa Ditch near the Superstition Retention Basin, using the full static head available after the storm, and as soon as the water level in the basin and ditch is lowered sufficiently to allow access to the manually operated blow-off control valves. The second level of cleaning will require dewatering the pipeline, entering the side-access manholes planned about every quarter mile along the pipeline, and using fire hydrants and hoses to help blast the debris from and along the pipeline invert to the closest blow-off structure. At the blow-off, the debris would be forced through the blow-off piping, initially by the head available in the main pipeline, and later by using portable pumps lowered into the vertical riser at the blow-off structure to pump out the slurry. Ultimately, the removed sand and debris should be loaded onto trucks and removed from the project, to avoid the possibility of re-entry into the pipeline via the pump station.

Air release vaults will require periodic checking to verify that the valve is operable and that no water or foreign objects have found their way into the vaults and particularly the vent lines. These must pass large volumes of air over short periods of time, or the pipeline capacity will be adversely affected. Rodent screens should be checked for condition and replaced when found deteriorating.

F. DRAINING FLOODED STRUCTURES

Structures which do not directly drain into gravity draining pipes may be subject to periodic flooding. Most susceptible will be the side-access manholes along the pressure pipeline (North Branch Alternative 1), especially while the Mesa Ditch is still in use. An effort should be made to maintain these structures as water-tight vaults. However, the potential exists for groundwater to find its way into the structures. Pump out will probably be necessary to allow accessing the pipeline.

XIV. MAINTENANCE REQUIREMENTS Continued

The instrument manholes associated with the Parshall Flumes and the air release vaults along the pressure pipelines could also be flooded or partially flooded. Periodic checks should be made to ensure that they do not remain flooded for extensive periods of time.

G. PUMP STATIONS

Pump stations require significant maintenance in order that they be available when needed. This is especially true of stations with engines as the sole means of pump drive, either directly through right-angle drives, or indirectly by way of generators and motor drivers.

Each engine should be started and run for at least 15 minutes every week, using manual controls. Since normally there will be no significant amount of stored water to pump, it will not be practical to engage the pumps, so these runs will confirm the ability of the batteries and starting system to start the engines and exercise the units to keep moving parts and the cooling system operative. Routine engine/cooling system maintenance and service should be as recommended by the engine and right-angle drive manufacturers and worked into the weekly start-up program on a modular basis.

At least annually in May or June, automatic starting, sequencing, and stopping of the prime pumps and their engine drives should be checked by simulating water levels and allowing the control system to operate automatically. If sufficient amounts of water are available, full simulation may not be necessary. Should simulation be required, then steps must be taken to prevent the engine clutch from actually engaging the input shaft to the right angle drive unit, since the pumps must not be run in a dry condition or with insufficient net positive suction head (HPSH). Experience might suggest that more frequent checkouts of the automatic control system are needed to obtain a reliable system, ready to receive and pump flood waters, when they come.

Some sand and debris will find its way into the wet well. The inlet apron and the pump station bar screen should be cleaned as soon as the storm waters recede after every storm. Sand, silt, and other debris should be scooped up and removed from the Carriage Lane Retention Basin area, and not allowed to move on into the wet well. This is because removal after passing through the sump pump will be more difficult and most probably still necessary, since most of the material will ultimately have to be removed through the blow-off structures, rather than passing on to the Superstition Retention Basin.

The sump pump most likely will receive the heaviest duty service when compared to the other pumps. The sump pumps should therefore receive the most frequent maintenance checks, suggested weekly until a more realistic schedule can be established through experience.

XIV. MAINTENANCE REQUIREMENTS Continued

All of the pumps discharge against individual flap gates which are intended to operate as check valves, so that water being pumped does not short circuit pumps which are not operating, flowing back into the wet well. These gates should be checked and serviced annually in May or June in preparation for the next storm season. Access to the valves should normally be through the surge tower adjacent to the pump station.

The propane fuel storage area will require routine maintenance to ensure that weeds are controlled and that local code requirements are met.

H. RETENTION BASINS

Where the basin is serving a dual purpose as a park, lawns, plantings, and the irrigation system must be maintained in cooperation with the storm drain system facilities. Water levels of ornamental ponds must be maintained to avoid interference with the pump station inlet apron area or the silt basin associated with the blow-off structure in the Carriage Lane Retention Basin. The turf area between the end of the formal access road to the blow-off structure silt basin (shown on Exhibit 1-N in Appendix F) and the pump station should be kept dry enough to support the occasional loaded maintenance vehicle which has serviced the pump station wet well and inlet apron. It is believed that the existing grass area can be maintained to meet this requirement without having to provide a paved access road across the bottom of the basin.

I. SUPERVISORY CONTROL AND TELEMETRY SYSTEM

Proper operation of the entire storm drain system is dependent upon the faithful and accurate performance by the supervisory control and telemetry system. The maintenance recommendations of the supervisory control system should be adopted and closely followed. Field-mounted equipment such as that at the Parshall Flume structures and the pump station should be checked weekly for signs of possible malfunction and serviced as needed. Through radio communication, simulated signals from the field should be verified at headquarters.

The management agency should maintain (through written agreement) a working relationship with the operators of the two pumping stations (Chandler and Gilbert) which must accurately and quickly respond to supervisory control signals from the management agency's control system. Initially, it is recommended that tests be made every 6 months on a cooperative basis. With some operating experience, the schedule could be finalized as mutually agreed.

XV. CAPITAL COSTS

A. General

The methodology utilized in the capital cost analysis and comparison of alternatives was to identify and quantify the various cost parameters in sufficient number to allow pricing the major features which might tend to separate the alternatives. The following is a list of the more significant parameters considered.

1. Storm drain pipe installed costs are based on pipe material, pipe size, and pipe strength requirements, together with the costs related to trench cross section and shoring, if any, and jacking.

2. Structure costs are based on types of structures, and where significant, the depths of the structures.

3. Earthwork costs are for pipes and structures and reflect the type of trench cross section needed to fit with the available work area and the stability of the existing ground, all in accordance with the recommendations contained in preliminary geotechnical investigation report included in Appendix D to this study. Due to limited safe working space along the north side of Lateral 9.5, it was assumed that excavated material taken from the trenches for East Branch Alternatives 1A and 1B will have to be transferred by conveyor to the south side of Lateral 9.5 for storage until the pipe has been placed and then loaded onto the conveyor and returned to the north side as part of the trench backfilling operation.

4. Costs of protecting and/or replacing adjacent or crossing improvements are based on individual assessments of cost by utility or other category. These costs are generally small with the notable exception of the SRP 80-foot 230 volt electrical power tubular steel towers which are located adjacent to the East Branch Alternative J. The cost of protecting these towers was assumed to be about 80 percent of the cost to jack the pipeline past the tower foundation, where the length of jacking would have been twice the average trench depth at that point. This should produce enough money to allow the contractor to use his own method, provided it is acceptable to the SRP.

Costs are expressed in 1986 dollars for the Phoenix metropolitan area and can be related to the Engineering News Record magazine 20-Cities Construction Cost Index of about 4400. As time passes, these costs should be escalated in proportion to the change in that index.

Table 1 in Appendix B is an overall summary of preliminary costs by branches and facilities.

XV. CAPITAL COSTS Continued

B. EAST BRANCH

Three horizontal alignment structures were studied in the SRP right-of-way between the Carriage Lane Retention Basin near Price Road and the easterly point of connection to the Town of Gilbert's system at Cooper Road. The East Branch would convey storm water originating in the Town of Gilbert to the Carriage Lane Facility. Detailed cost breakdowns are included in Appendix E and a summary of the preliminary pipeline costs of these alternatives will be found in Table 19-E. Alternative 3 appears to be preferred on a capital cost basis.

Alternative 1, which would lie along the north side of SRP Lateral 9.5, was studied for two separate profiles over a significant portion of the project. This was due to the possibility of using an inverted siphon at Alma School Road compared with placing the pipeline deeper. (Refer to Exhibit 8-E in Appendix E.) Alternative 1A is the deep pipeline. Alternative 1B includes the inverted siphon. It will be noted in Table 19-E that Alternative 1B requires slightly less initial expense than Alternative 1A (and also Alternative 2.) However, these costs do not include the additional maintenance cost of pumping out the inverted siphon with portable equipment as recommended in subsection XIV C, Gravity Draining Pipelines.

Alternative 2 would follow an alignment just south of Lateral 9.5, passing directly under the SRP steel truss towers via jacked casings. This alternative appears to be the most expensive in terms of capital costs.

Alternative 3 was assumed to lie eight to ten feet south of the SRP tubular steel towers which lie south of their steel truss towers. Due to shallower trenches resulting from passing through various retention basins along the SRP right-of-way, Alternative 3 appears to require the least capital to construct while also providing a gravity draining pipeline which should require less in the way of maintenance than Alternative 1B with its inverted siphon.

Tables 20-E and 21-E in Appendix E show the expected capital costs for certain facilities which are related to the East Branch, but serve more than just the Town of Gilbert. They are the Parshall Flume Structure which would receive flow from the City of Chandler and a common junction structure and short 84-inch outfall pipe which will convey the combined storm flows from the communities of Gilbert and Chandler into the Carriage Lane Retention Basin.

The East Branch capital costs are summarized in Appendix B, Table 1.

C. NORTH BRANCH

The North Branch Alternative 1 would convey storm water generated by the three communities (Chandler, Gilbert, and Mesa) from the Carriage Lane Retention Basin through a 230 cfs pump station and an 84-inch pressure pipeline to the Superstition Retention Basin. At the basin, flow would be measured by a 230 cfs Parshall Flume. Detailed cost breakdowns are included in Appendix F and a summary of the preliminary pipeline costs will be found in Table 8-N. Table 9-N is a breakdown of the costs related to the 230 cfs pump station and the supervisory control and telemetry system required to operate the system.

The North Branch capital costs are summarized in Appendix B, Table 1.

XVI. COST ALLOCATIONS AMONG USERS (230 CFS SYSTEM)

A. General

The three communities do not share equally in the capacities of the various elements of the Price Road Drain. Therefore equitable bases for financial participation in capital and maintenance and operation costs must be found and agreed to by the three communities. These probably are not exact formulas.

B. CAPITAL COSTS

It appears that a fair approximation for determining participation in the initial capital costs would recognize the peak flow and the total storm flow input by each community into the pipelines, pump station, and appurtenant structures. Peak flow or total storm volume alone would not be entirely fair for several reasons. For example, if Mesa were to have a higher peak flow capacity in the North Branch, the water levels in the Carriage Lane Retention Basin could be maintained at a lower elevation. Therefore more head would be available to the Town of Gilbert for the East Branch pipeline. This would reduce the size and cost of that pipeline to Gilbert. At the same time the greater flow and higher lift would increase the cost of the North Branch, borne by all three communities. So a logical approach would simply consider equally both peak flow and total storm volume contributed by each community in each element of the Price Road Drain System.

From Section III STORM WATER CONTRIBUTIONS, the following data was taken:

	100-year Storm Data	
Community	Volume-AF	Peak Capacity-CFS
Mesa	240	30
Chandler	300	100
Gilbert	300	100

Participation in the initial capital costs would be as follows:

Gilbert alone: 100%
Chandler alone: 100%
Shared by Gilbert and Chandler:

$$\frac{50\% \times 300}{300 + 300} + \frac{50\% \times 100}{100 + 100}$$

$$= 25\% + 25\% = 50\%/\text{each}$$

XVI. COST ALLOCATIONS AMONG USERS (230 CFS SYSTEM) Continued

Shared by Mesa, Gilbert, and Chandler:

Mesa: $$\frac{50\% \times 240}{240 + 300 + 300} + \frac{50\% \times 30}{30 + 100 + 100}$$

$$= 14.3\% + 6.5\% = 20.8\%$$

Gilbert: $$\frac{50\% \times 300}{240 + 300 + 300} + \frac{50\% \times 100}{30 + 100 + 100}$$

$$= 17.9\% + 21.7\% = 39.6\%$$

Chandler: Same as Gilbert - = 39.6%

Total 100.0%

Table 2 in Appendix B shows the recommended allocation of initial capital costs among the three communities based on these percentages of participation.

C. OPERATION AND MAINTENANCE COSTS

Allocation of O & M costs is probably primarily a function of the total volume of water pumped each year. These volumes would be obtained from data generated at the three Parshall Flume Structures and compiled at the management agency's headquarters by use of telemetered information. The two 100 cfs structures would cover the Town of Gilbert and the City of Chandler. Mesa's contribution would be based on the difference between the 230 cfs Parshall Flume data and data for the two 100 cfs flumes. In terms of the basic elements of the Price Road Drain system, annual participation would be based on actual costs and the following:

Gilbert alone:	100%
Chandler alone:	100%
Shared by Gilbert and Chandler:	

$$\frac{100\% \times 300}{300 + 300} = 50\%/\text{each}$$

XVI. COST ALLOCATIONS AMONG USERS (230 CFS SYSTEM) Continued

Shared by Mesa, Gilbert, and Chandler:

Mesa:	$\frac{100\% \times 240}{240 + 300 + 300}$		= 28.6%
Gilbert:	$\frac{100\% \times 300}{240 + 300 + 300}$		= 35.7%
Chandler:	Same as Gilbert -		= 35.7%
		Total	100.0%

Table 3 in Appendix B is based on a hypothetically typical year and shows how the O & M cost allocations could fall among the three communities, using the percentages of participation developed above. The O & M costs shown in the table are not actual costs but estimates expressed in percentages of capital costs for the various elements of the project. These estimates have been taken from other studies and should be considered rough, but indicative of the magnitude of these costs.

Since the management agency probably will not find a convenient way to breakdown O & M costs by each of the elements of the system itemized in Table 3 in Appendix B, a simplification should be found and agreed upon by all three communities. To this end it is suggested that initially the actual total O & M cost be broken down into elements by the same percentages of total O & M cost as shown in Table 3. Then using the actual percentages of participation based on measured flows, calculated as above, the allocation method shown in Table 3 can be recalculated each year.

XVII. IMPACT OF POSSIBLE ADOT TUNNEL PROJECT

ADOT is proceeding with plans to build regional storm drainage facilities along their planned Outer Loop Highway (Price Road). Refer to the discussion of Other Alternatives in Section X North Branch Alternatives. The design of the section between the Superstition Freeway and the Salt River is based on an 18-foot diameter tunnel capable of conveying the anticipated 100-year storm flows to the Salt River where the water surface would be at the 10-year storm level in the river.

It is understood that ADOT is now considering storage of the 100-year storm water in the 18-foot diameter tunnel. This does not seem possible, if the hydrographs and tunnel profile presented in the design study prepared by HNTB in October 1986 are correct. The study, entitled Outer Loop Highway SR 360 Interchange Alternatives Analysis Offsite Drainage System and Outfall to Salt River, is based on conveyance of the projected storm flows to the Salt River. How can this pipe also store the same volume? Therefore the following discussion addresses only the conveyance alternative with the entire storm flow being discharged directly into the river.

Refer to Appendix G. The Tunnel Alternative Profile, Exhibit 2 to the HMTB report is reproduced for the reader's convenience. It will be noted that a 102-inch pipeline is shown connecting the Carriage Lane Retention Basin and a drop structure located just south of the Superstition Freeway. It will also be noted that the approximate HGL's working upstream from the Salt River climb in elevation from the 10-year storm high water level 1172± to about 1192 in the Carriage Lane Retention Basin. This means that the water level in Carriage Lane Retention Basin could be higher than elevation 1192. This is about the same as floor elevations of nearby houses and significantly higher than the maximum design water level of 1185 recommended for that Basin in this study.

The impact of the 102-inch gravity pipe would be to cause potential flooding of upstream facilities including the Carriage Lane Retention Basin and at various upstream points along the East Branch to the Town of Gilbert. The 102-inch pipe would not be able to completely drain the Carriage Lane Retention Basin, so pump-out facilities would still be required.

A review of the HGL's shown on the ADOT Tunnel Alternative Profile in Appendix G suggests that no gravity pipeline could safely serve teh Carriage Lane Retention Basin, if water surface in that Basin is held at elevation 1185.

This profile also shows 55 cfs of intercepted ADOT flows entering the 102-inch pipeline. This would also impact the proposed 84-inch North Branch pipeline and the Pump Station. Refer to the earlier discussion in Section X North Branch Alternatives.

XVII. IMPACT OF POSSIBLE ADOT TUNNEL PROJECT (continued)

The following is a brief list of tasks which would be required to more fully evaluate integration of the tunnel project with the Price Road Drain.

1. Determine the pertinent hydrograph for ADOT's drop structure just south of the Superstition Freeway, depending upon how the 18 foot tunnel is to discharge to the Salt River.

2. Verify that gravity flow from Carriage Lane Retention Basin (water level below 1185) cannot work.

3. Review and change sizes of North Branch Pump Station, pipeline, and meter structure to recognize 55 cfs ADOT input near Guadalupe Road as proposed by HMTB.

4. Design a pipeline from Guadalupe Road to the Carriage Lane Retention Basin to carry ADOT's 55 cfs.

5. Determine required capacity of a retention basin, if needed, just south of the Superstition Freeway.

6. Revise cost estimates.

XVIII. RECOMMENDATIONS

A. East Branch

The alignment shown in Exhibit E for Alternative 3 should be refined based upon the findings of this study. Included refinements would be possibly locating the pipeline farther away from the SRP 230 volt electrical power tubular steel towers. Protecting these poles could be very expensive. Moving the alignment a few feet could significantly reduce this cost. Also, final layout could improve on the location of manholes so as to avoid having to use so many pressure type manholes in low-lying areas.

B. North Branch

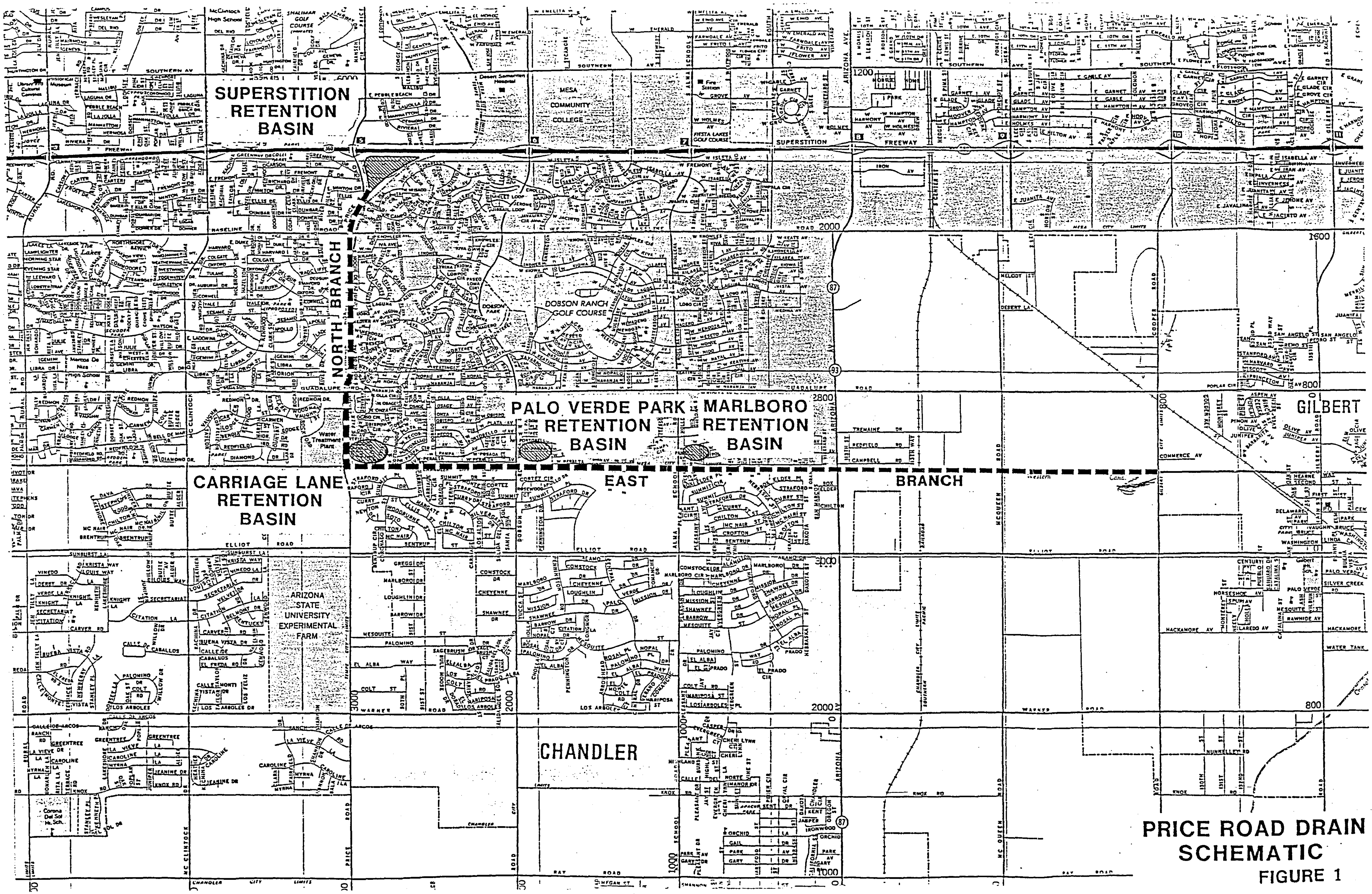
The alignment shown in Appendix F could be refined based on the findings of this study or revised to accommodate ADOT's plans for major regional storm drainage facilities along their Outer Loop Highway (Price Road) to the Salt River. It appears that the recommended concept of pumping storm flows from Carriage Lane Retention Basin to a retention basin (high water level 1198.5) just south of the Superstition Freeway is preferred to attempting to drain the Carriage Lane Retention Basin by gravity as proposed by the ADOT Tunnel plan. Design of the Superstition Retention Basin would have to be integrated with the ADOT tunnel project.

APPENDIX A

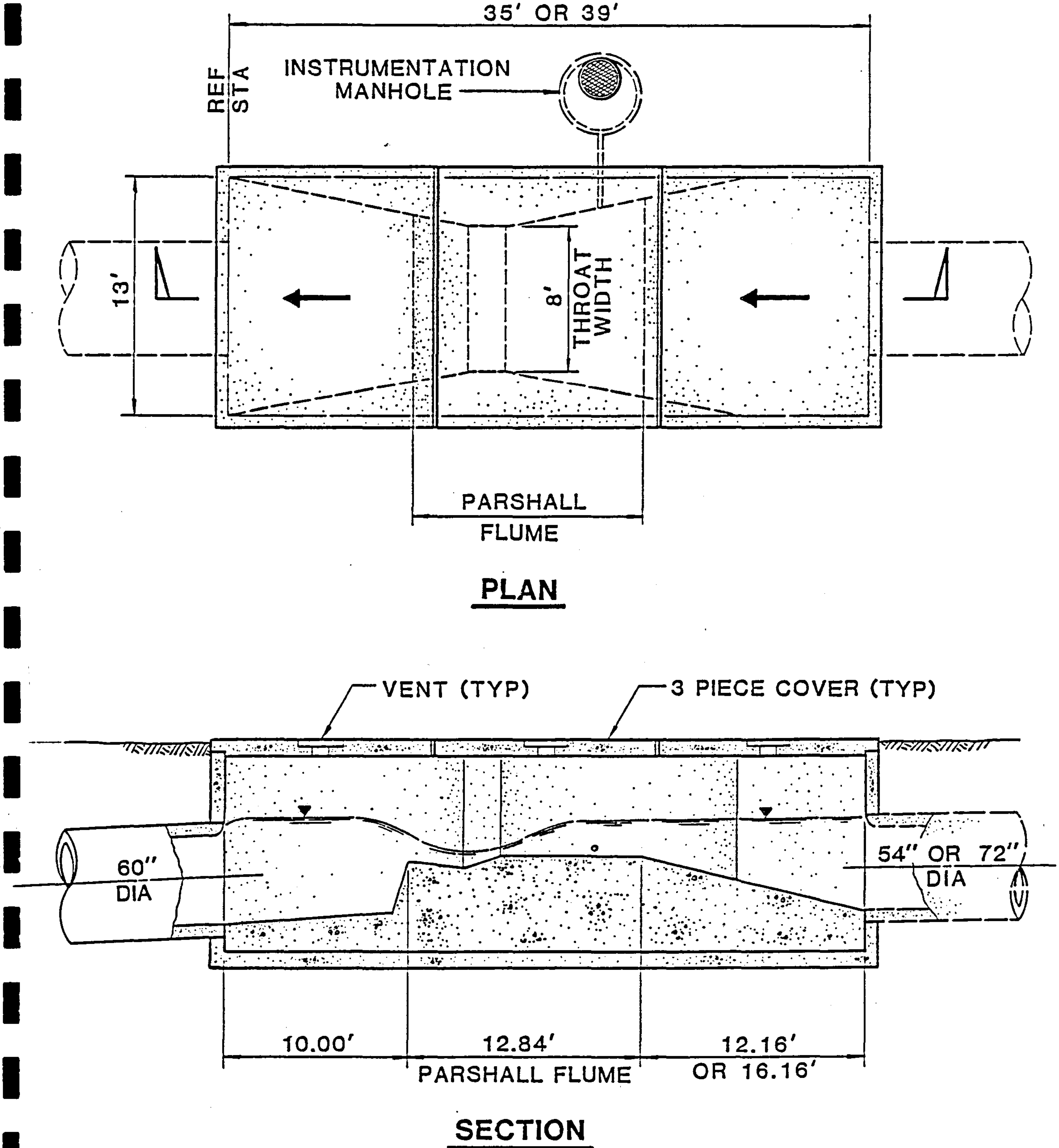
FIGURES

APPENDIX A

FIGURES

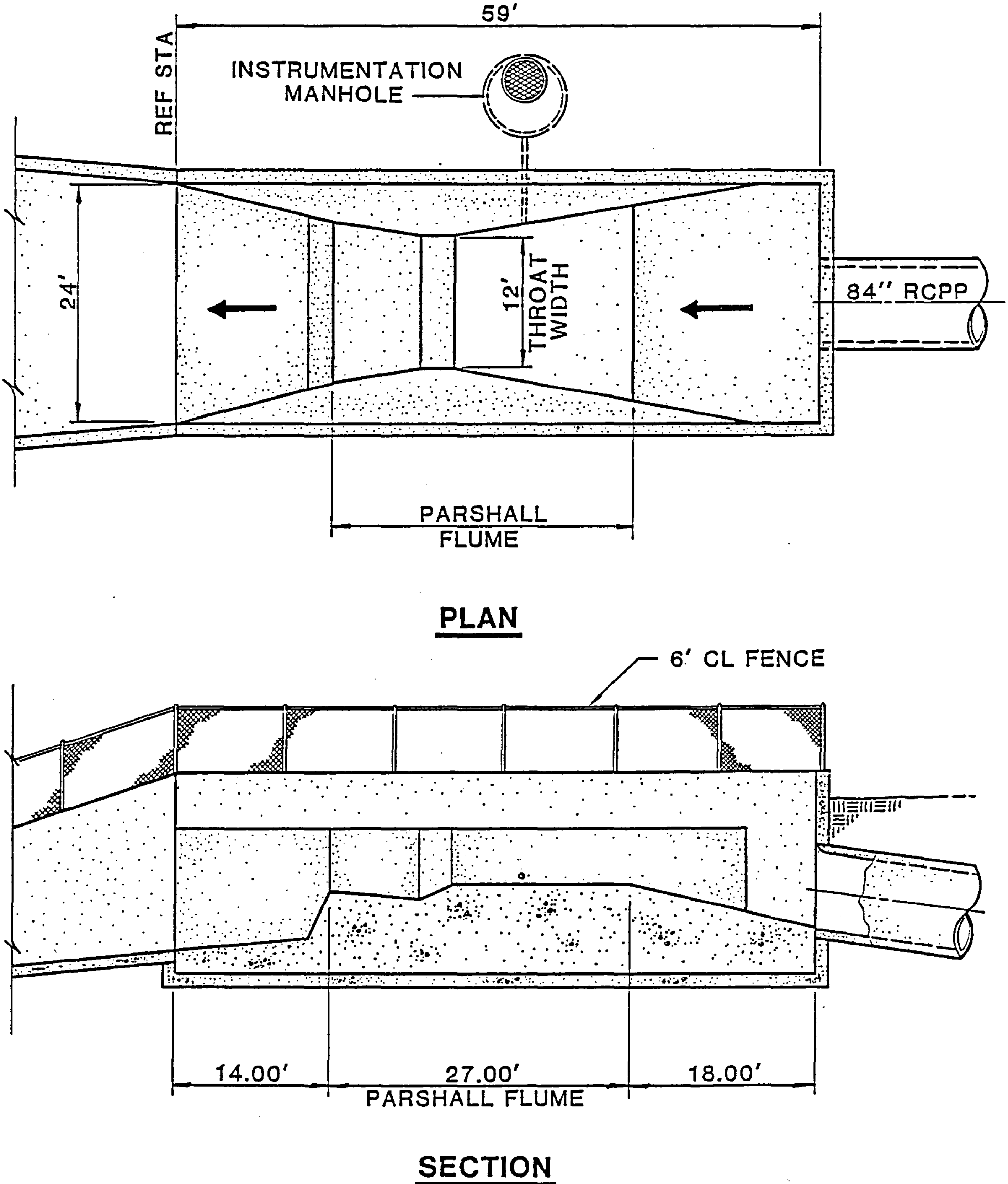


PRICE ROAD DRAIN SCHEMATIC
FIGURE 1



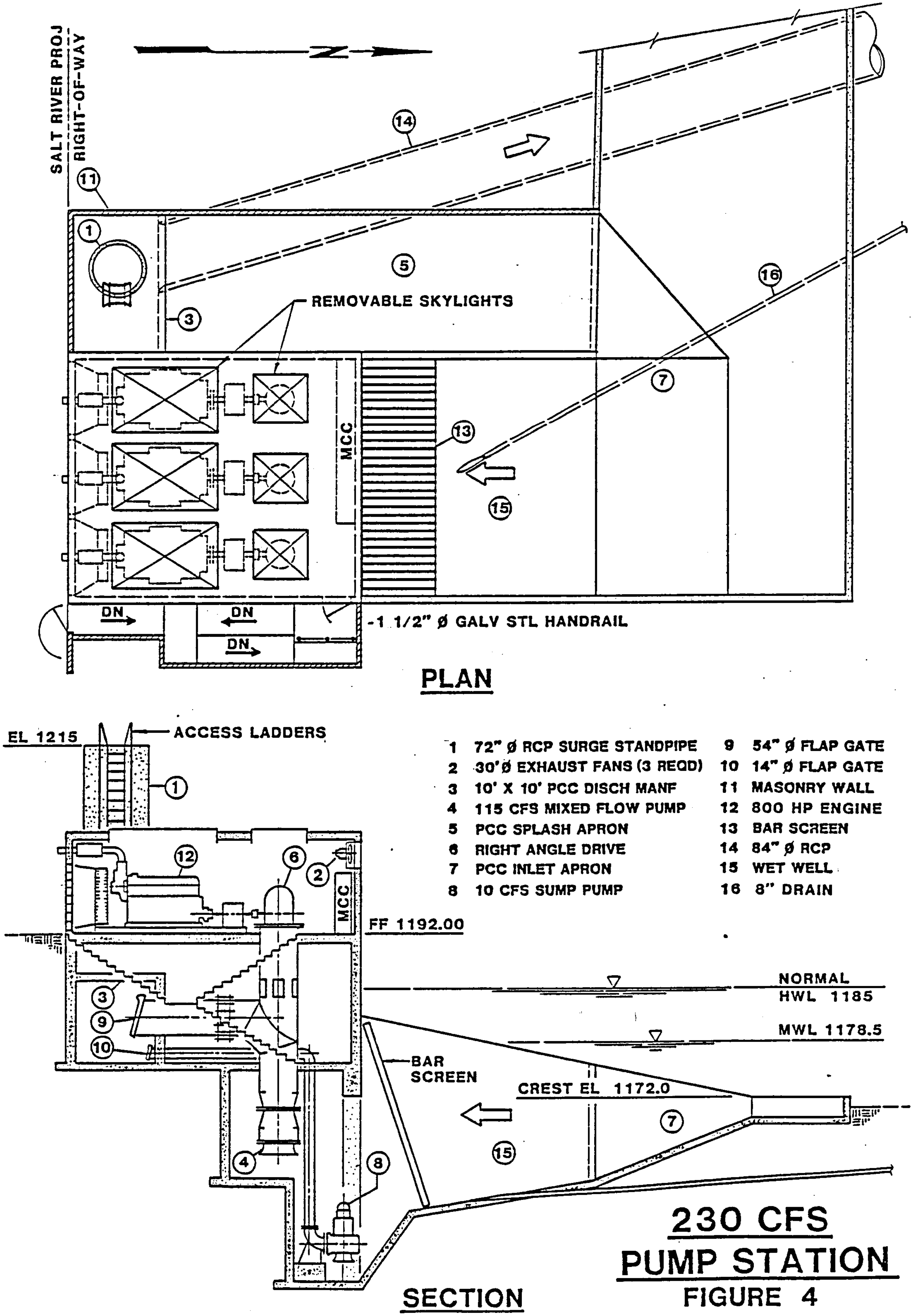
100 CFS PARSHALL FLUME STRUCTURE

FIGURE 2



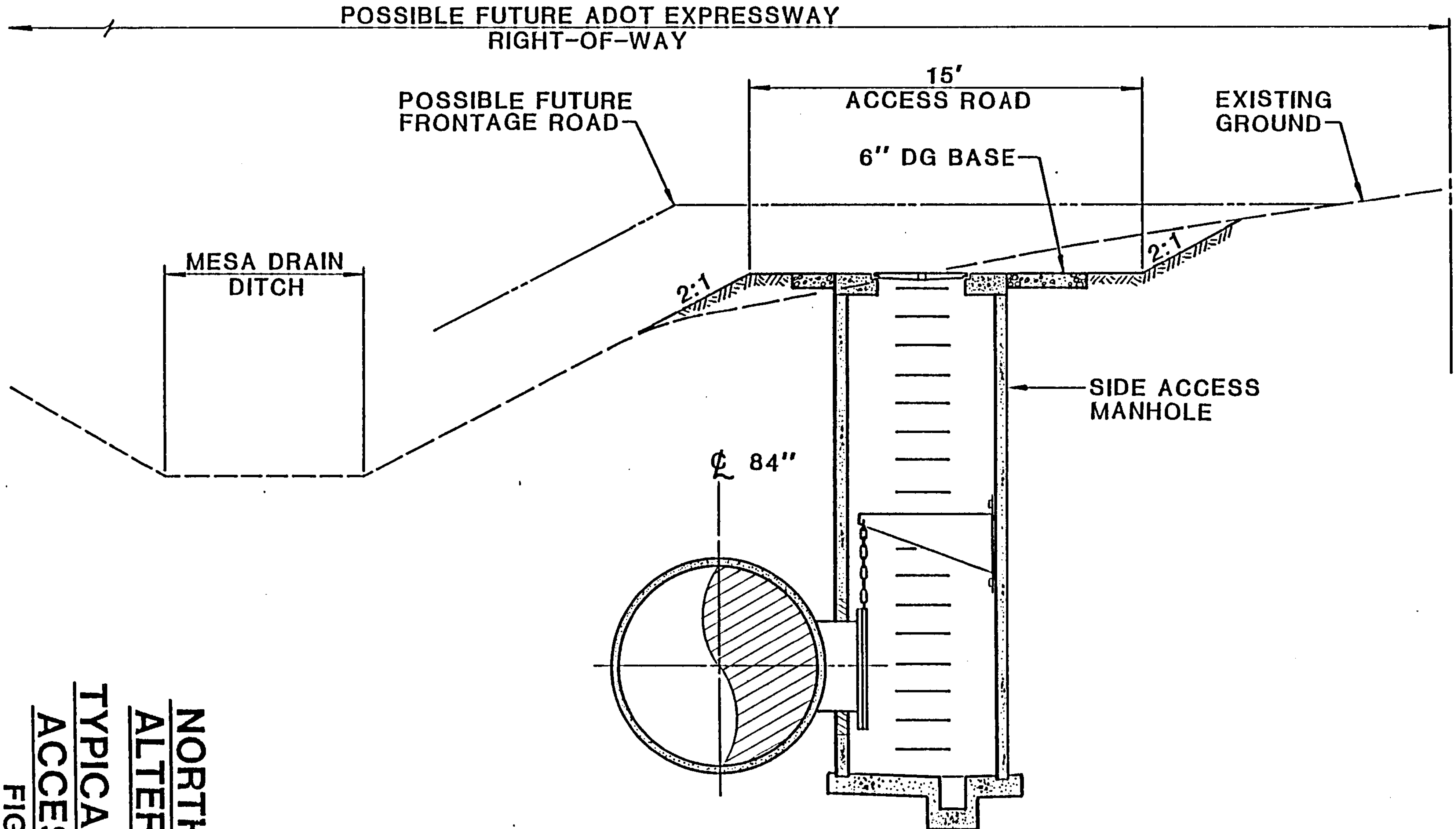
230 CFS PARSHALL FLUME STRUCTURE

FIGURE 3



230 CFS PUMP STATION

FIGURE 4



NORTH BRANCH
ALTERNATIVE 1
TYPICAL SECTION
ACCESS ROAD

FIGURE 5

APPENDIX B

TABLES

APPENDIX B

TABLES

OVERALL SUMMARY OF PRELIMINARY COSTS
(230 CFS SYSTEM)

TABLE 1

Description	1000's of $ Cost	Preferred Alternative Ident.	Preferred Alternative Cost-1000's of $
EAST BRANCH			
Pipeline	(Gilbert) See Appendix E Table 19-E		
Alt 1A	6440		-
Alt 1B	6160		-
Alt 2	6457		-
Alt 3	5843	Alt 3	5843
Metering Facilities	(Chandler) See Appendix E Table 20-E		
All Alternatives	129	Alt 3	129
Common Facilities	(Chandler & Gilbert) See Appendix E Table 21-E		
Junction Structure and Inlet to Carriage Lane Retention Basin			
Alt 1A	45		
Alt 1B	44		
Alt 2	45		
Alt 3	46	Alt 3	46
NORTH BRANCH	(Chandler, Gilbert, and Mesa)		
Pipeline	See Appendix F Table 8-N		
Alt 1	4564		4564
Common Facilities	See Appendix F Table 9-N		
230 cfs Pump Station	2000		2000
Supervisory Control & Telemetry System	48		48
GRAND TOTAL - PREFERRED PLAN			12,630

RECOMMENDED CAPITAL
COST ALLOCATIONS AMONG USERS
(230 CFS SYSTEM)

TABLE 2

Element Description	Preferred Alt. Cost*	Mesa		Chandler		Gilbert	
		%	Cost*	%	Cost*	%	Cost*
EAST BRANCH							
Pipeline	5843	0	0	0	0	100	5843
Metering Facilities - Chandler	129	0	0	100	129	0	0
Common Facilities - Chandler & Gilbert	46	0	0	50	23	50	23
Subtotals - East Branch	6018		0		152		5866
NORTH BRANCH							
Pipeline	4564	20.8	950	39.6	1807	39.6	5866
Common Facilities	2048	20.8	426	39.6	811	39.6	811
Subtotals - North Branch	6612		1376		2618		2618
GRAND TOTAL CAPITAL COSTS*	12,630		1376		2770		8484

* 1000'S of 1986 Dollars

Percent

TYPICAL O & M COST ALLOCATIONS
AMOUNG USERS (230 CFS SYSTEM)

TABLE 3

Element Description	Capital Cost*	Annual O & M % Cap.	Annual O & M Cost*	Annual O & M % Tot	Mesa %	Mesa Cost*	Chandler %	Chandler Cost*	Gilbert %	Gilbert Cost*
EAST BRANCH										
Pipeline	5843	0.3	17.5	91	0	0	0	0	100	17.5
Metering Fac. - Chandler	129	1.0	1.3	7	0	0	100	1.3	0	0
Common Fac. - Chandler & Gilbert	46	1.0	0.4	2	0	0	50	0.2	50	0.2
Subtotals - East Branch	6018		19.2	100		0		1.5		17.7
NORTH BRANCH										
Pipeline	4564	0.5	22.8	34	28.6	6.5	35.7	8.1	35.7	8.1
Common Fac.	2048	2.2	45.1	66	28.6	12.9	35.7	16.1	35.7	16.1
Subtotals - North Branch	6612		67.9	100		19.4		24.2		24.2
GRAND TOTAL TYPICAL O & M COSTS*			87.1			19.4		25.7		41.9
TYPICAL OVERALL PARTICIPATION-%			100			22		30		48

*1000'S of 1986 Dollars

APPENDIX C

HYDROLOGY

APPENDIX C

HYDROLOGY

Initial hydrologic analysis conducted in July 1986 was rough due to the lack of specific information from the cities of Chandler, Gilbert, and Mesa. Flows reaching Carriage Lane Retention Basin were assumed to be regulated by retention basins in these communities. Preliminary information indicated flows from Chandler and Gilbert would be pumped to Carriage Lane at 100 cfs, and approximately 30 cfs would be contributed by Mesa. Lag times for flows from Chandler and Gilbert were estimated as time of travel in 72-inch diameter pipelines with average velocities of 3.5 ft/sec. The resulting lag times were approximately 2 hours for flows from each community. Flows from Mesa were assumed to reach Carriage Lane at the beginning of the storm. The peak of the simplified hydrograph constructed from these assumptions was 230 cfs. Time to peak was two hours, and duration of this peak flow was not known.

Recently, drainage studies for the cities of Chandler and Mesa have been completed, making available more detailed hydrologic information. Runoff from the 100-year design storm will be pumped from Chandler's retention basin to Carriage Lane at 100 cfs. Pumping will begin 2 hours after the design storm starts and will continue for 36 hours. The total volume of water pumped at 100 cfs for 36 hours is almost 300 acre-ft. The pumped flows will travel about 4.5 miles in a 72-inch diameter pipe at a velocity of about 3.5 ft/sec, reaching Carriage Lane approximately 2 hours after pumping begins.

The firm of Howard Needles Tammen and Bergendoff (HNTB) has analyzed flows from a large area as part of their desgin work for the Outer Loop Highway SR 360 Interchange. Their study area included the drainage area for the Carriage Lane Retention Basin. Mesa's contributions to basin inflow include direct runoff and outflow from the Palo Verde Park basin, a total of about 240 acre-ft. for the 100-year storm.

Pumped flows from Gilbert were assumed to have the same hydrograph as Chandler's flows, as detailed information on storm volume and retention basin operation was not available. The flows will travel approximately 5 miles in 60- and 66-inch diameter pipes at an average velocity of about 4.6 ft/sec, reaching Carriage Lane about 1.5 hours after pumping begins.

In HNTB's analysis, the peak flow from Mesa's 100-year, 24-hour design storm, including the 200 cfs pumped from Chandler and Gilbert, was estimated as 546 cfs, and time to peak was 13 hours. Flows from Chandler and Gilbert were added into the Carriage Lane hydrograph beginning at hour 13 of the 24-hour storm. The entire hydrograph lasts 49 hours, but flows are negligible until approximately 12 hours after the beginning of the 24-hour storm. HNTB estimated the total volume of the 100-year, 24-hour storm as 840 acre-ft.

Hydrographs compiled from the above information are shown on Figure C-1, which also illustrates the outflow hydrograph from Carriage Lane and the inflow hydrograph to Superstition Retention Basin.

HNTB's analysis shows maximum storage of approximately 120 acre-ft will be needed in Carriage Lane Retention Basin, assuming a maximum possible outflow of 230 cfs. Capacity curves from the City of Mesa indicate there will be sufficient storage in the Carriage Lane basin to contain this volume of water, with water surface below elevation 1187.

APPENDIX D

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT

Dibble and Associates
3625 North 16th Street
Phoenix, Arizona

16 October 1986

Attention: Kent Dibble, P.E.

Project: Price Road Storm Drain
M.C.F.C.D. Project No: 86-8
Western Canal Between Price Road & Cooper Road
Chandler, Gilbert, & Mesa, Arizona

Project No: 86-991

In accordance with your authorization, test borings were drilled and soil resistivity measurements were made at 20 locations along the proposed alignments for the new storm drain. We understand the storm drain will be 57 to 90 inches in diameter and installed approximately 10 to 20 feet below existing ground surface. The test locations are shown on the attached site plan and the results of all testing are attached.

The test borings were drilled to various depths from 15 to 25 feet. The subsurface soil profile along the proposed alignment varied somewhat. The surficial soils at the test boring locations were predominantly composed of silty-sandy clay and sandy clay. These soils generally exhibited stiff to hard consistency, medium to high plasticity, and variable weak to moderate cementation with localized zones of strong cementation. These surficial clay soils were underlain by stratified deposits of clayey sand, sandy clay, silty sand, and sandy silt/silty sand. The attached boring logs present detailed descriptions of these soils and the predominant soil types encountered at each test boring. Soil moisture contents were generally described as damp to moist, and no groundwater was encountered in any of the test borings during drilling.

Representative soil samples were obtained during the drilling. Eight (8) samples were selected for sieve and plasticity index analyses; eight (8) samples were selected for pH, chloride, and sulfate analyses; seven (7) samples were selected for maximum dry density-optimum moisture content determination (ASTM D698-A); and two (2) samples were selected for direct shear tests.

The soil resistivity was measured using a 4-terminal "Vibroground Model 263" resistivity meter. The resistivity tests were conducted using three different electrode spacings to indicate the variation in soil resistance with depth. The resistivity readings were influenced by the underground pipes, canal, metal fences, and overhead high-voltage electric lines in the immediate vicinity of the tests. Efforts were made to try to minimize outside interference; however, it is unknown how much effect the surrounding development had on the tests. The resistivity values ranged from about 1200 to 37300 ohm-cm.

The following recommendations are based upon the results of the field and laboratory testing which are attached. The following parameters are recommended for design purposes:

Natural In-Place Soils:

- moist density (γm) = 128 pcf
- Rankine's active earth pressure coefficient (K) = 0.405
- coefficient of friction (μ) = 0.466
- load factor ($K\mu$) = 0.189

Fill Materials Utilizing Natural Soils:

- at 100% ASTM D698 - moist density (γm) = 125 pcf
- at 95% ASTM D698 - moist density (γm) = 120 pcf
- Rankine's active earth pressure coefficient (K) = 0.589
- coefficient of friction (μ) = 0.268
- load factor ($K\mu$) = 0.158

Saturated unit weights should be used if the natural soils or backfill materials are subjected to inundation.

The following recommendations are presented to aid in the development of excavation plans:

1. Temporary unbraced excavations into the clay subgrade soils should be no steeper than 0.5H:1V. Slopes should be flattened to at least 1H:1V where clayey sand soils are encountered. Flatter slopes may be required where clean sand layers or utility line fill are encountered.

2. All existing utilities should be located on the excavation plans to evaluate the effect of existing trenches and backfill material on the excavation slopes. Flatter slopes and seepage control measures may be required in the vicinity of the existing utility lines and backfill material. Any existing utilities near the excavation to remain in-place should be adequately supported to prevent movements of the utility line.

3. Open excavations should not be used in areas where the crest of the slope will fall within 15 feet of the canal or any above-grade structures.

4. No surface water should be allowed to pond within 20 feet of the crest of the excavation nor should any surface water drain over the top of the crest and down the excavation slope. Precautions should be taken to help prevent erosion of the excavation slopes. No surface water should be allowed to pond within the limits of the excavation.

5. No soil or construction materials should be stored within 20 feet of the crest, and no construction equipment should operate within 15 feet of the crest.

All excavation plans and designs (including bracing systems) should be reviewed by a qualified geotechnical engineer. Periodic observation should be made by the reviewing geotechnical engineer during excavating and after completion of the excavation to evaluate site conditions and to determine if any modifications are necessary. Some surface raveling and caving should be expected in unbraced excavations unless measures are taken to stabilize the exposed cut surface.

Please do not hesitate to call if you have any questions or if we can be of further assistance.

Respectfully submitted,

THOMAS-HARTIG & ASSOCIATES, INC.

By: ______________________ Reviewed by: ______________________

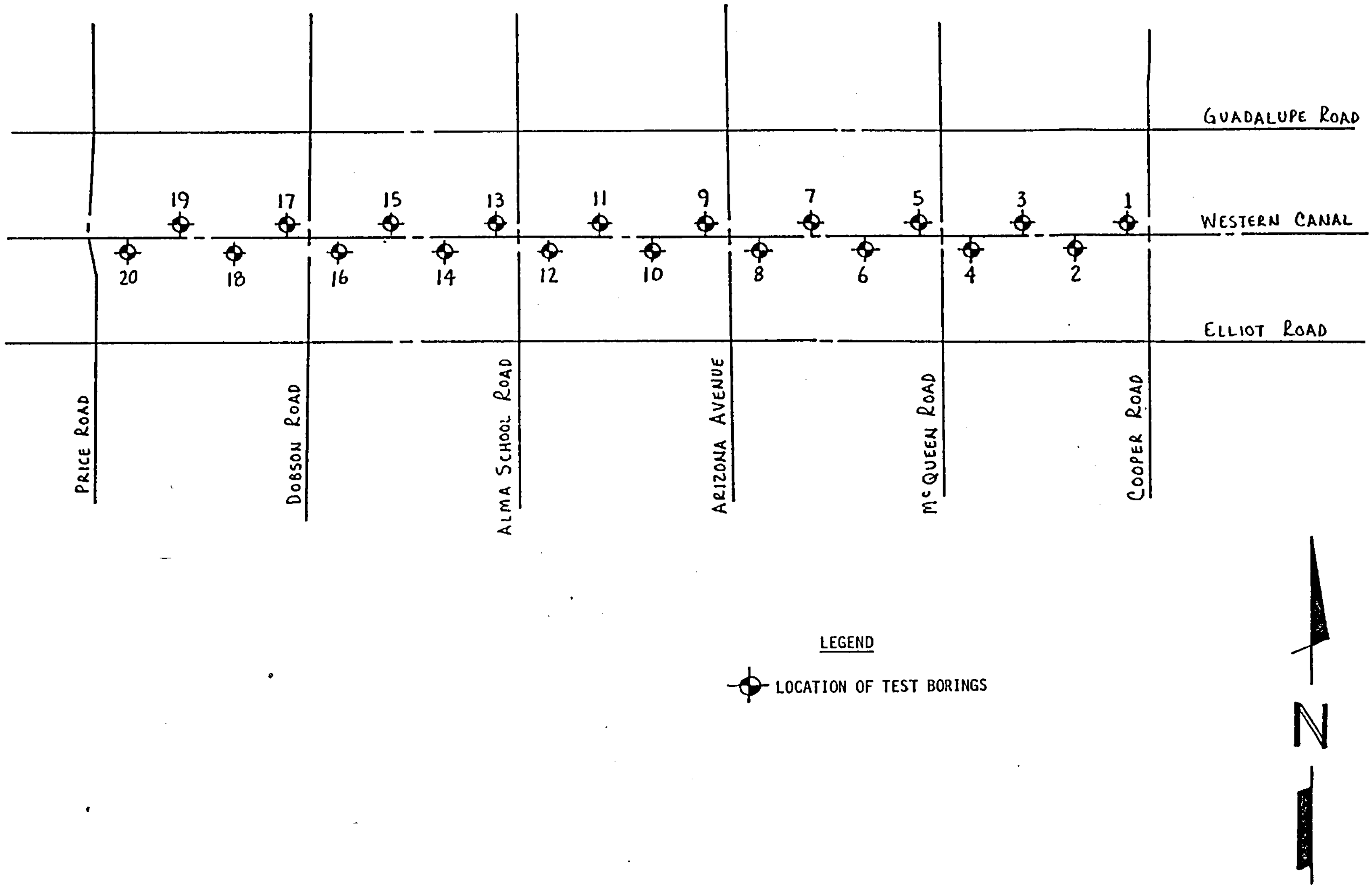
Chet L. Pearson, P.E. Glen K. Copeland, P.E.

/cmm

Copies to: Addressee (5)

APPENDIX A

FIELD RESULTS



THOMAS-HARTIG & ASSOCIATES, INC.
Project No: 86-991

APPROXIMATE LOCATION OF TEST BORINGS

Test Boring	Station, ft.	Offset from centerline of canal	Surface Elevation, ft.
1	263+50	40'N	1220.7
2	250+20	45'S	1217.9
3	237+10	40'N	1217.5
4	223+60	50'S	1216.0
5	210+50	30'N	1214.5
6	197+20	80'S	1211.6
7	184+60	20'N	1210.7
8	170+30	15'S	1208.5
9	157+20	25'N	1207.0
10	144+00	80'S	1199.0
11	130+80	25'N	1205.5
12	117+70	60'S	1197.0
13	104+50	30'N	1202.5
14	91+20	80'S	1195.0
15	78+00	30'N	1200.5
16	64+50	85'S	1191.0
17	51+30	45'N	1196.3
18	38+30	70'S	1194.2
19	24+80	40'N	1193.7
20	11+70	90'S	1185.5

LEGEND

SOIL CLASSIFICATION ASTM: D2487

COARSE-GRAINED SOIL

MORE THAN 50% LARGER THAN 200 SIEVE SIZE

Symbol	Letter	DESCRIPTION	MAJOR DIVISIONS
	GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - 200 FINES	GRAVELS More than half of coarse fraction is larger than No 4 Sieve size
	GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - 200 FINES	
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% - 200 FINES	
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, MORE THAN 12% - 200 FINES	
	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - 200 FINES	SANDS More than half of coarse fraction is smaller than No 4 sieve size
	SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - 200 FINES	
	SM	SILTY SANDS, SAND-SILT MIXTURES MORE THAN 12% - 200 FINES	
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES MORE THAN 12% - 200 FINES	

FINE-GRAINED SOIL

MORE THAN 50% SMALLER THAN 200 SIEVE SIZE

Symbol	Letter	DESCRIPTION	MAJOR DIVISIONS
	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	SILTS AND CLAYS Liquid limit less than 50
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
	OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY	
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS, ELASTIC SILTS	SILTS AND CLAYS Liquid limit greater than 50
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	

log denotes visual approximation unless accompanied by mechanical analysis and Atterberg limits.

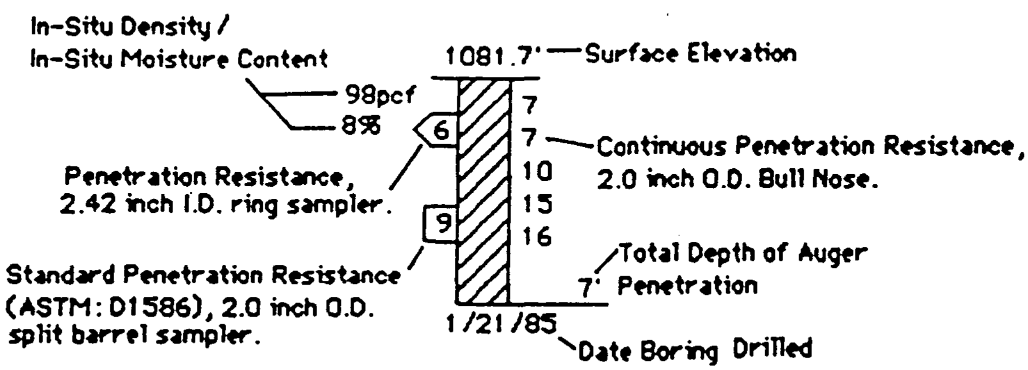
GRAIN SIZES

U.S. STANDARD SERIES SIEVE — CLEAR SQUARE SIEVE OPENINGS

	200	50	16	4	¾"	3"	6"
SILTS & CLAYS DISTINGUISHED ON BASIS OF PLASTICITY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

MOISTURE CONDITION (INCREASING MOISTURE ——→)

DRY	SLIGHTLY DAMP	DAMP	MOIST	VERY MOIST	WET (SATURATED)
		(PL)			(LL)



PENETRATION RESISTANCE:
Blows per foot using 140 lb. hammer
with 30 inch free fall unless otherwise noted.

CONSISTENCY			RELATIVE DENSITY	
CLAYS & SILTS	BLOWS/FOOT*	STRENGTH‡	SANDS & GRAVELS	BLOWS/FOOT*
VERY SOFT	0-2	0-¼	VERY LOOSE	0-4
SOFT	2-4	¼-½	LOOSE	4-10
FIRM	4-8	½-1	MEDIUM DENSE	10-30
STIFF	8-16	1-2	DENSE	30-50
VERY STIFF	16-32	2-4	VERY DENSE	OVER 50
HARD	OVER 32	OVER 4		

* Number of blows of 140 pound hammer falling 30 inches to drive a 2 inch O.D. (1-⅜ inch I.D.) split spoon (ASTM D-1586).

‡ Unconfined compressive strength in tons/sq. ft. Read from a pocket penetrometer

Project No. 86-991

THOMAS-HARTIG & ASSOCIATES, INC.

LEGEND OF SOIL TYPES

SILTY-SANDY CLAY (CL-CH); brown; stiff to hard; medium to high plasticity; variable weak to strong cementation; damp.

SANDY CLAY (CL); brown and light brown; stiff to hard; medium plasticity; variable weak to strong cementation; damp.

SILTY CLAY (CL); brown; firm to stiff; medium plasticity; weak cementation; moist.

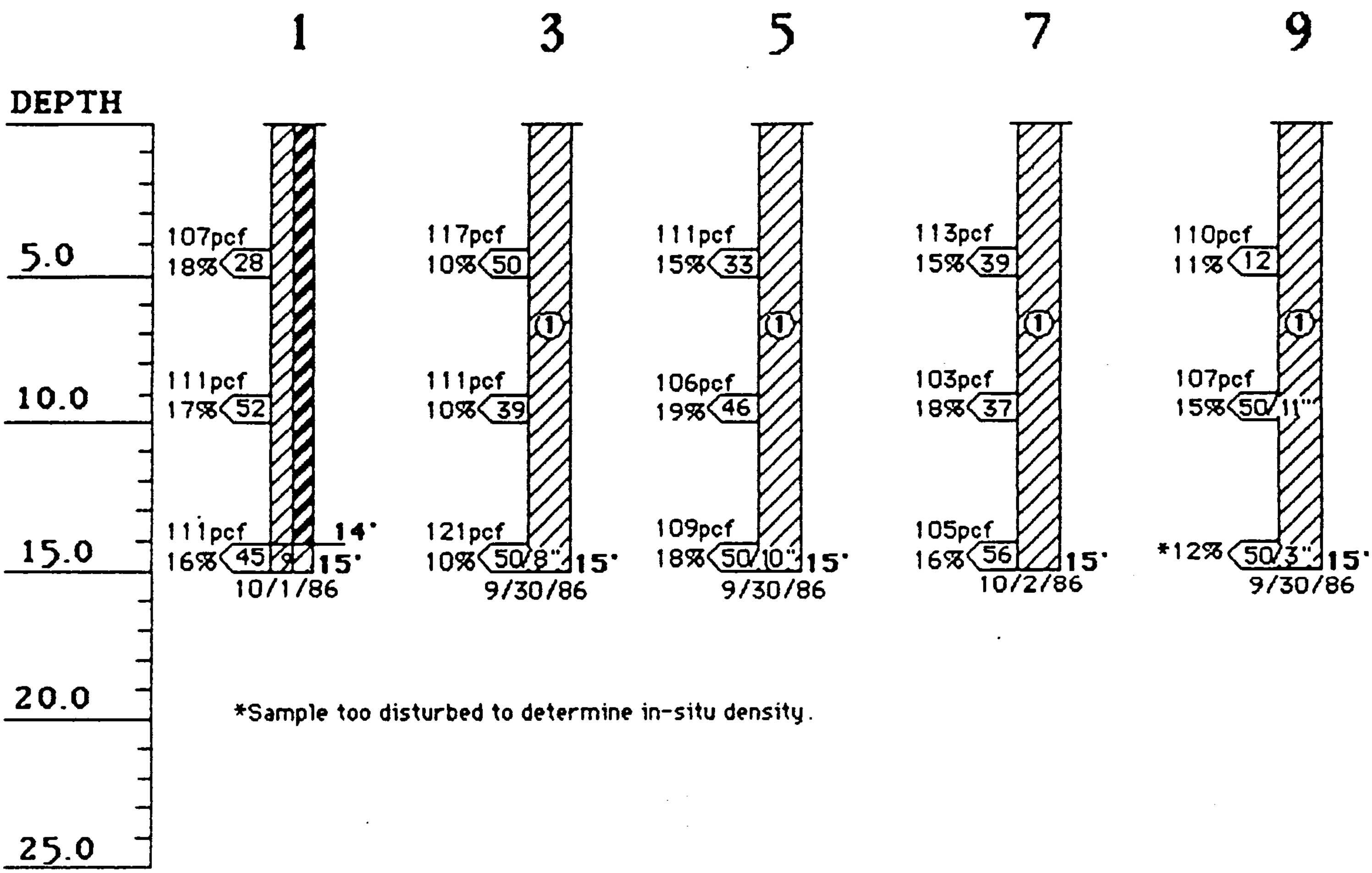
CLAYEY SAND/SANDY CLAY (SC/CL); brown and light brown; medium dense; medium plasticity; variable weak to strong cementation; damp.

CLAYEY SAND (SC); brown and light brown; medium dense to dense; medium plasticity; variable weak to moderate cementation; contains some gravel; damp.

SILTY SAND/SANDY SILT (SM/ML); light brown; medium dense; low plasticity; weak cementation; damp.

Project No. 86-991
Thomas - Hartig & Associates

NOTE: The data presented on the boring logs represents subsurface conditions only at the specific locations and at the time designated. This data may not represent conditions at other locations and/or times. Contacts between soil strata are approximate and changes between soil types may be gradual rather than abrupt. This boring data was compiled primarily for design purposes and should not be construed as part of the plans governing construction or defining construction techniques. Bidders are fully responsible for interpretations or conclusions they draw from the boring log.



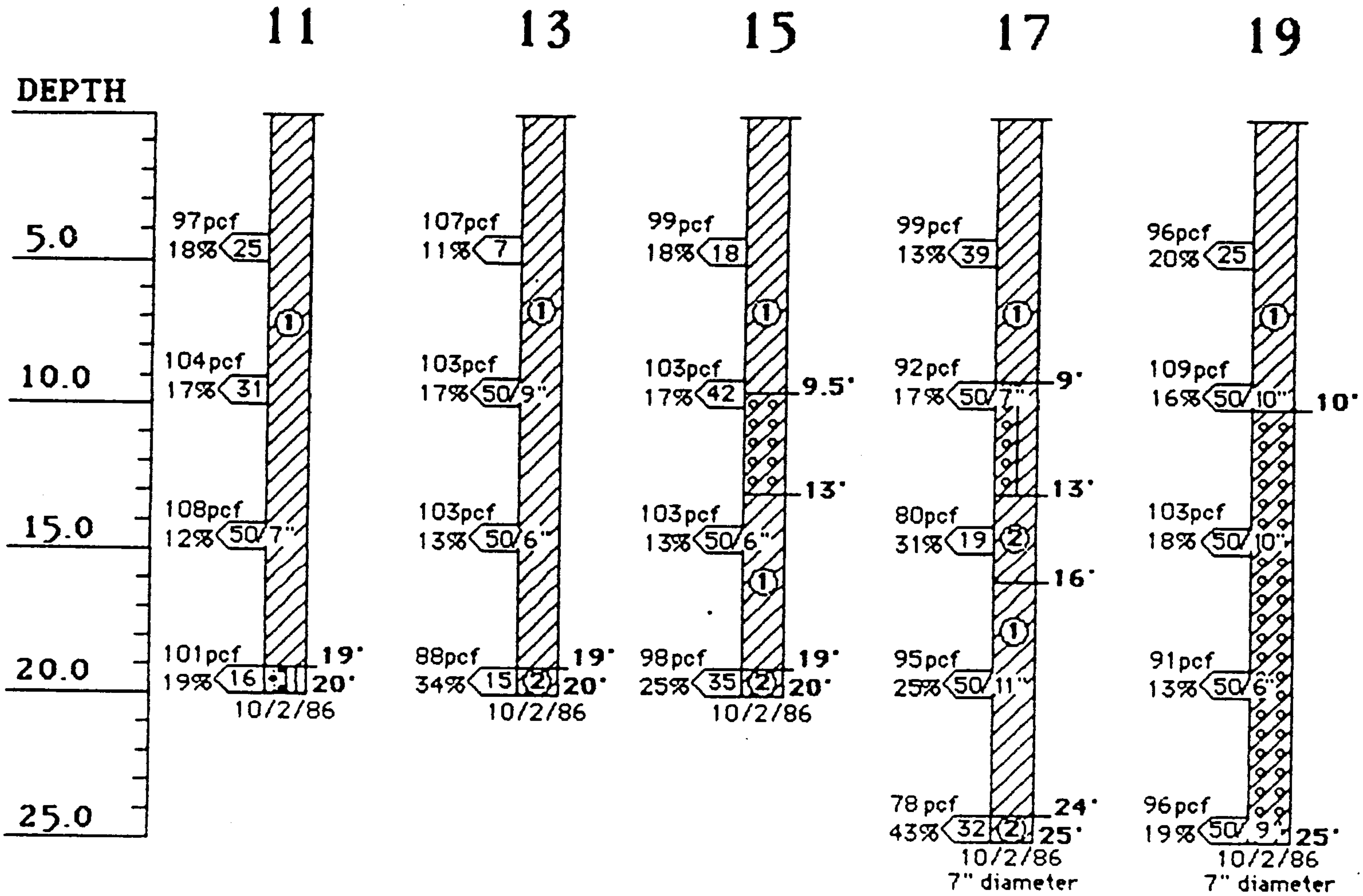
*Sample too disturbed to determine in-situ density.

No free groundwater was encountered in any of the borings during drilling.

All borings drilled with 4" diameter continuous flight auger unless otherwise noted.

Project No. 86-991
Thomas - Hartig & Associates

NOTE: The data presented on the boring logs represents subsurface conditions only at the specific locations and at the time designated. This data may not represent conditions at other locations and/or times. Contacts between soil strata are approximate and changes between soil types may be gradual rather than abrupt. This boring data was compiled primarily for design purposes and should not be construed as part of the plans governing construction or defining construction techniques. Bidders are fully responsible for interpretations or conclusions they draw from the boring log.

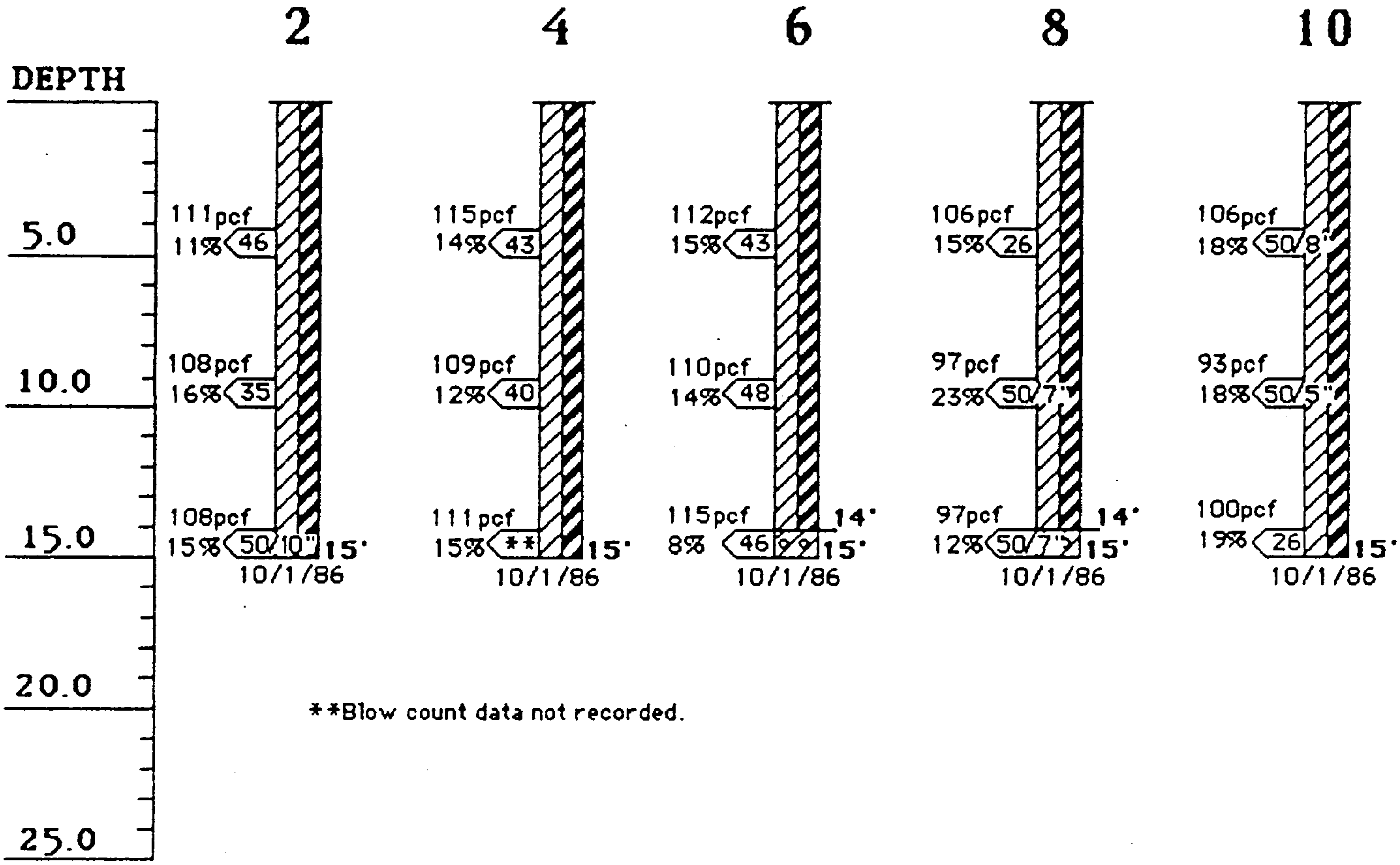


No free groundwater was encountered in any of the borings during drilling.

All borings drilled with 4" diameter continuous flight auger unless otherwise noted.

Project No. 86-991
Thomas - Hartig & Associates

NOTE: The data presented on the boring logs represents subsurface conditions only at the specific locations and at the time designated. This data may not represent conditions at other locations and/or times. Contacts between soil strata are approximate and changes between soil types may be gradual rather than abrupt. This boring data was compiled primarily for design purposes and should not be construed as part of the plans governing construction or defining construction techniques. Bidders are fully responsible for interpretations or conclusions they draw from the boring log.



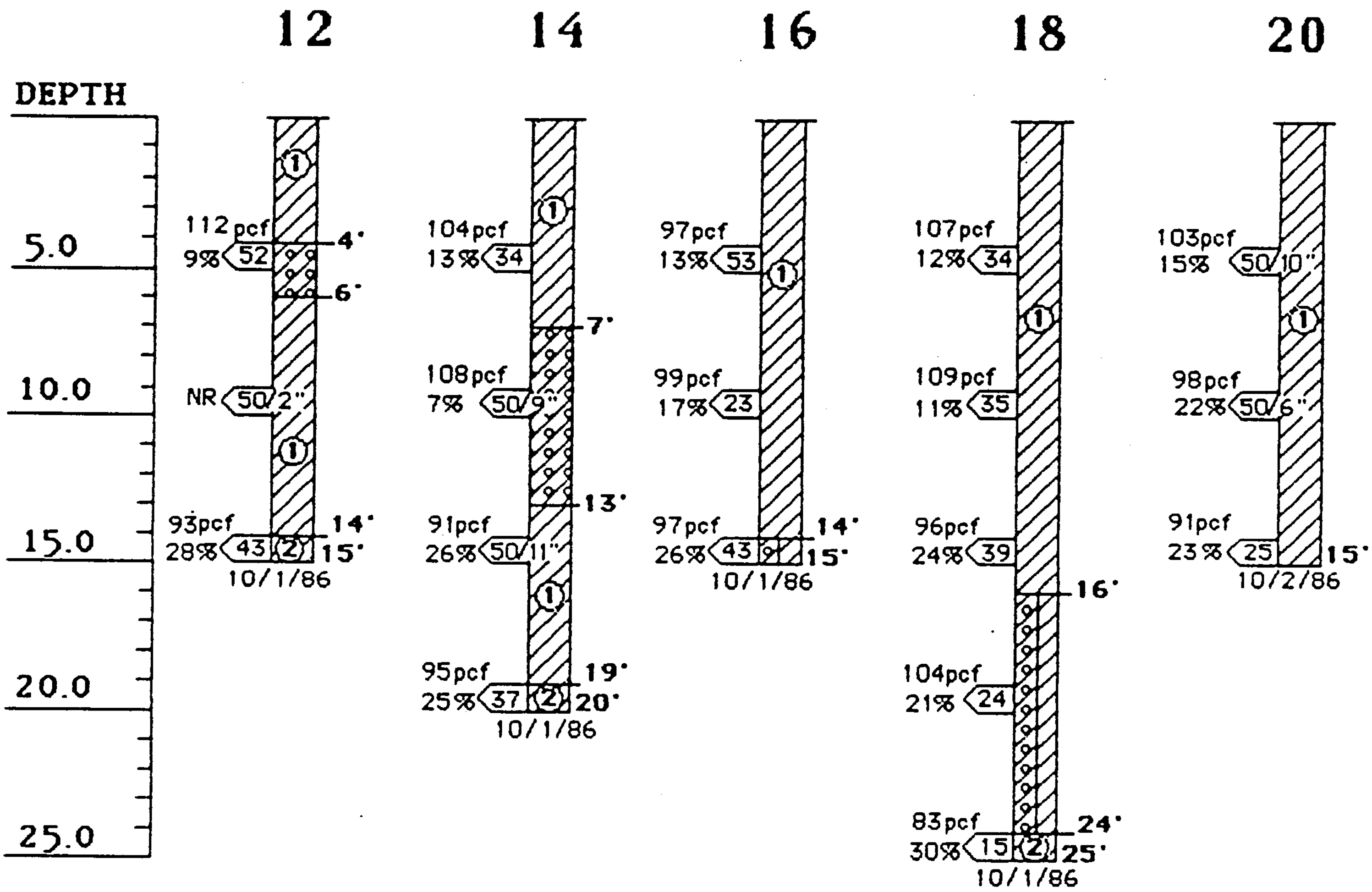
**Blow count data not recorded.

No free groundwater was encountered in any of the borings during drilling.

All borings drilled with 4" diameter continuous flight auger unless otherwise noted.

Project No. 86-991
Thomas - Hartig & Associates

NOTE: The data presented on the boring logs represents subsurface conditions only at the specific locations and at the time designated. This data may not represent conditions at other locations and/or times. Contacts between soil strata are approximate and changes between soil types may be gradual rather than abrupt. This boring data was compiled primarily for design purposes and should not be construed as part of the plans governing construction or defining construction techniques. Bidders are fully responsible for interpretations or conclusions they draw from the boring log.



No free groundwater was encountered in any of the borings during drilling.

All borings drilled with 4" diameter continuous flight auger unless otherwise noted.

Project No. 86-991
Thomas - Hartig & Associates

NOTE: The data presented on the boring logs represents subsurface conditions only at the specific locations and at the time designated. This data may not represent conditions at other locations and/or times. Contacts between soil strata are approximate and changes between soil types may be gradual rather than abrupt. This boring data was compiled primarily for design purposes and should not be construed as part of the plans governing construction or defining construction techniques. Bidders are fully responsible for interpretations or conclusions they draw from the boring log.

REPORT ON FIELD TESTS

DESCRIPTION:

Location: Noted below

Material: Native soils

Performed by: TH/Ethington

TESTED:

Resistivity tests measured by the 4-probe method

RESULTS:

Location	Electrode Spacing (ft.)	Depth of Measurement (ft.)	Soil Resistivity (ohm-cm)
1	5	0 - 5	2200
	10	0 - 10	2700
	15	0 - 15	2100
2	5	0 - 5	1600
	10	0 - 10	1300
	15	0 - 15	1600
3	5	0 - 5	2000
	10	0 - 10	1700
	15	0 - 15	2500
4	5	0 - 5	2100
	10	0 - 10	1700
	15	0 - 15	1900
5	5	0 - 5	1200
	10	0 - 10	1500
	15	0 - 15	2100
6	5	0 - 5	1700
	10	0 - 10	1500
	15	0 - 15	1300
7	5	0 - 5	1800
	10	0 - 10	1600
	15	0 - 15	2100
8	5	0 - 5	1800
	10	0 - 10	1300
	15	0 - 15	1600
9	5	0 - 5	3400
	10	0 - 10	2700
	15	0 - 15	2700

REPORT ON FIELD TESTS
(CONTINUED)

DESCRIPTION:
Location: Noted below
Material: Native soils
Performed by: TH/Ethington

TESTED:
Resistivity tests measured by the 4-probe method

RESULTS:

Location	Electrode Spacing (ft.)	Depth of Measurement (ft.)	Soil Resistivity (ohm-cm)
10	5	0 - 5	2900
	10	0 - 10	2500
	15	0 - 15	1700
11	5	0 - 5	1200
	10	0 - 10	1200
	15	0 - 15	1700
12	5	0 - 5	2500
	10	0 - 10	3100
	15	0 - 15	2500
13	5	0 - 5	4900
	10	0 - 10	2100
	15	0 - 15	37300
14	5	0 - 5	2200
	10	0 - 10	3100
	15	0 - 15	2800
15	5	0 - 5	2100
	10	0 - 10	3100
	15	0 - 15	2600
16	5	0 - 5	2100
	10	0 - 10	2700
	15	0 - 15	2000
17	5	0 - 5	2900
	10	0 - 10	3600
	15	0 - 15	4300
18	5	0 - 5	1800
	10	0 - 10	1600
	15	0 - 15	2100
19	5	0 - 5	1700
	10	0 - 10	1900
	15	0 - 15	2200
20	5	0 - 5	3500
	10	0 - 10	3600
	15	0 - 15	2700

APPENDIX B

LABORATORY RESULTS

REPORT ON LABORATORY TESTS

SAMPLE: Date 10/15/86

Source Test boring 18; 14 - 15'

Type Driven ring sample; 96 pcf dry density; 24% field moisture

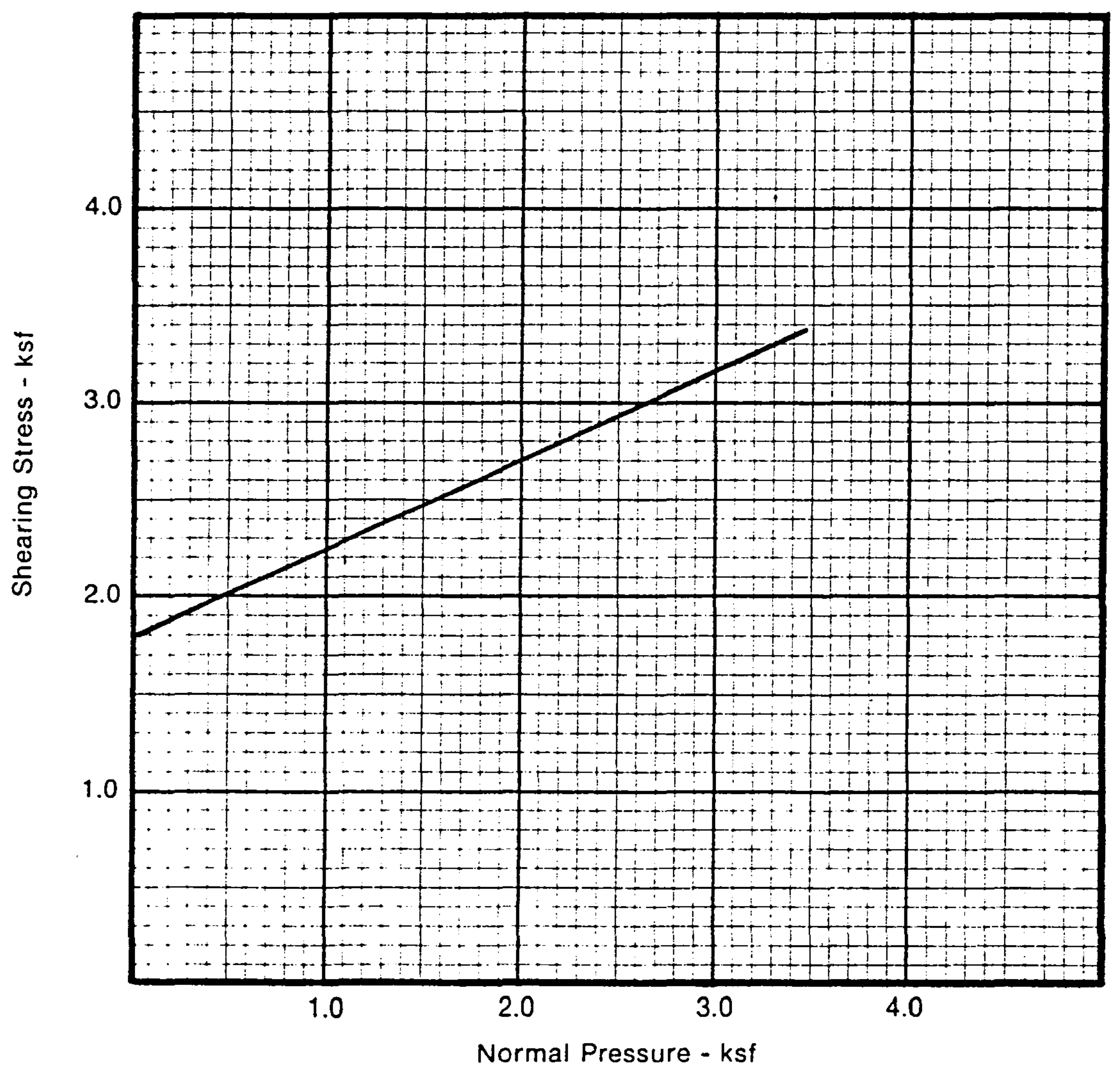
Material Sandy Clay (CL)

Sampled By TH/Thompson

TESTED: Direct Shear; sample tested at in-situ moisture content

RESULTS:

Friction Angle (Ø) = 25° Cohesion (c) = 1.8 ksf



Project No. 86-991

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 10/15/86

Source Test boring 18; 24 - 25'

Type Driven ring sample; 83 pcf dry density; 30% field moisture

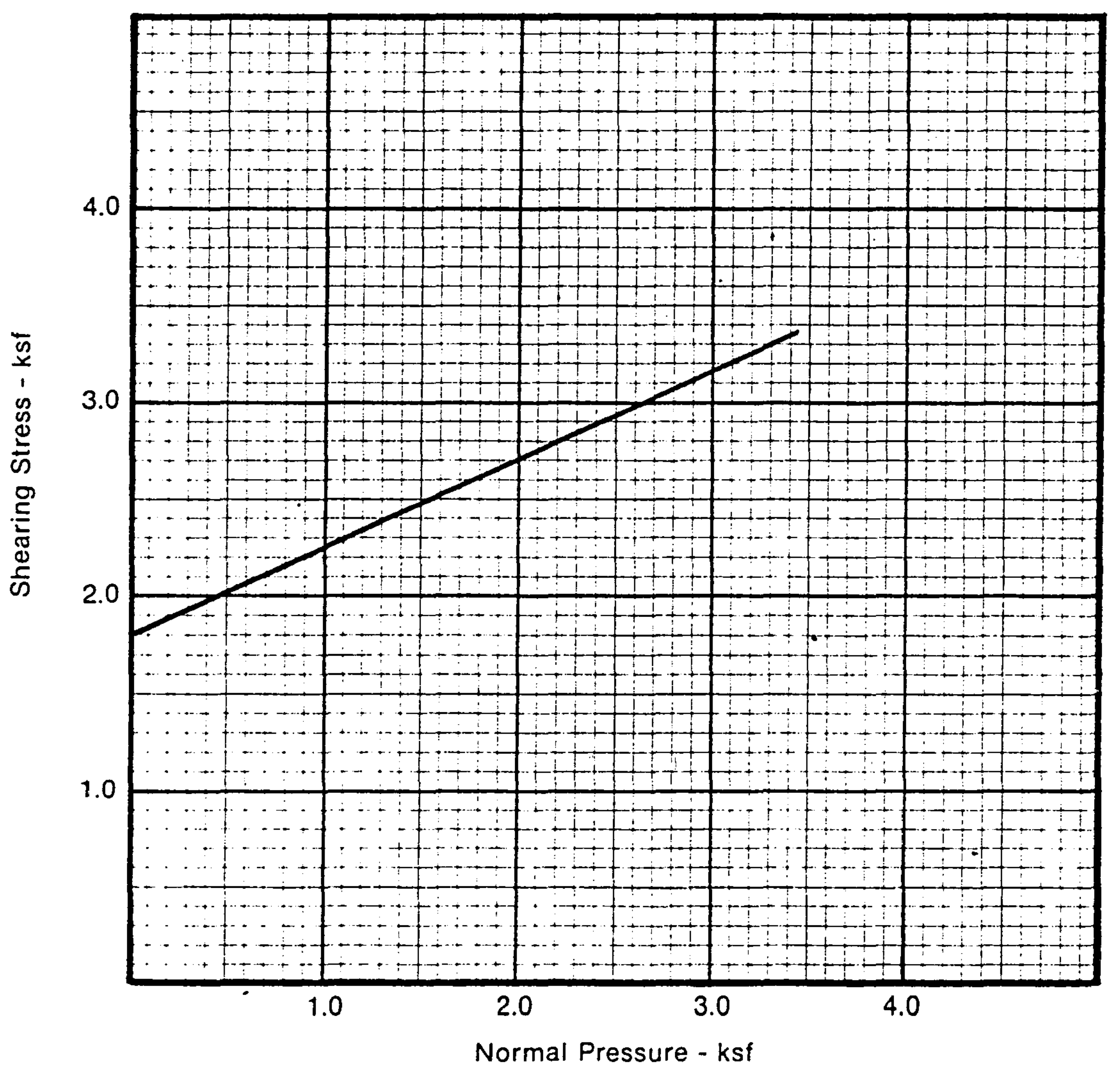
Material Silty Clay (CL)

Sampled By TH/Thompson

TESTED: Direct Shear; sample tested at in-situ moisture content

RESULTS:

Friction Angle (Ø) = 25° Cohesion (c) = 1.8 ksf



Project No. 86-991

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 10/15/86

Source Noted below

Type Grab samples

Material Noted below

Sampled By TH/Thompson

TESTED: Sieve analysis and plasticity index

RESULTS:

Sample	LL	PI	Sieve Size - 200	100	50	30	16	Accum. % Passing 8	4	3/4"	1"	2"	3"	* Class
1; 2 - 14'	53	35	67	75	92	97	99	100						CH
4; 2 - 14'	54	33	63	68	86	95	98	99	100					CH
7; 2 - 14'	44	23	74	83	93	96	98	99	100					CL
10; 2 - 14'	54	30	67	71	82	88	93	97	99	100				CH
13; 2 - 19'	38	20	58	68	78	82	84	87	90	100				CL
16; 2 - 14'	43	21	59	64	77	83	89	94	98	100				CL
19; 2 - 10'	47	27	71	79	86	89	91	94	97	100				CL
19; 10 - 18'	59	35	42	48	53	57	62	69	80	100				SC

* Unified Soil Classification

Project No. 86-991

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

DESCRIPTION:
Location: Noted below
Sample Type: Grab sample
Material: Surface and subsurface soils
Sampled by: TH/Ethington

TESTED:
pH and soluble sulfates and chlorides concentrations

RESULTS:

Sample	pH	Soluble Sulfates	Soluble Chlorides
1; 9 - 10'	8.6	0.0091%	0.013%
4; 9 - 10'	8.8	0.013%	0.013%
7; 9 - 10'	8.6	0.0093%	0.015%
10; 9 - 10'	8.7	0.0073%	0.014%
13; 14 - 15'	8.7	0.0043%	0.011%
16; 9 - 10'	8.7	0.0021%	0.014%
17; 14 - 15'	8.2	0.010%	0.041%
20; 9 - 10'	8.9	0.019%	0.023%

REPORT ON LABORATORY TESTS

SAMPLE: Date 10/15/86

Source Test boring 1; 2 - 14'

Type Bulk sample

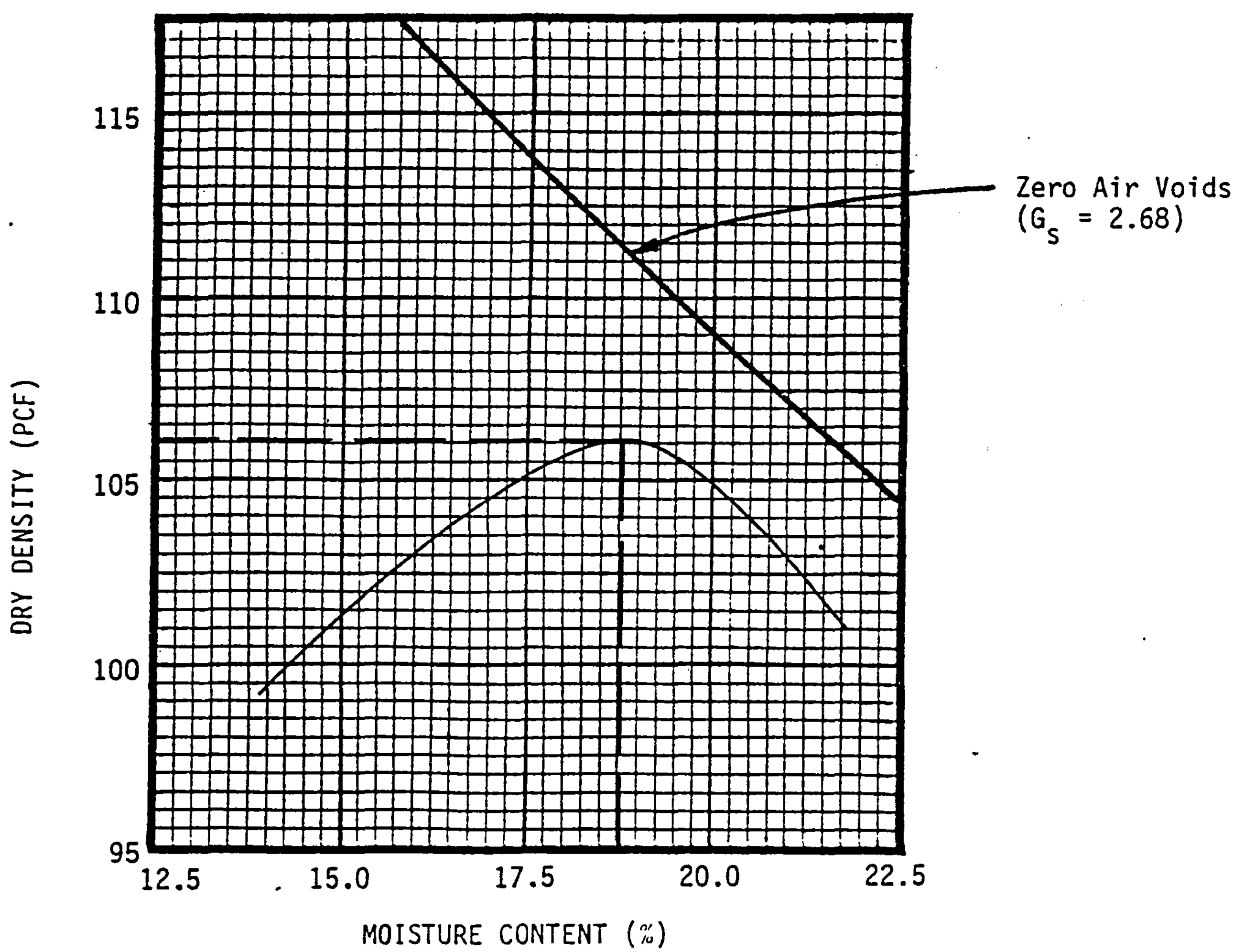
Material Silty-Sandy Clay (CL)

Sampled By TH/Thompson

TESTED: ASTM D698 Method A

RESULTS:

Max. Dry Density (pcf) 106.1 Optimum Moisture Content (%) 18.8



Project No. 86-991

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 10/15/86

Source Test boring 4; 2 - 14'

Type Bulk sample

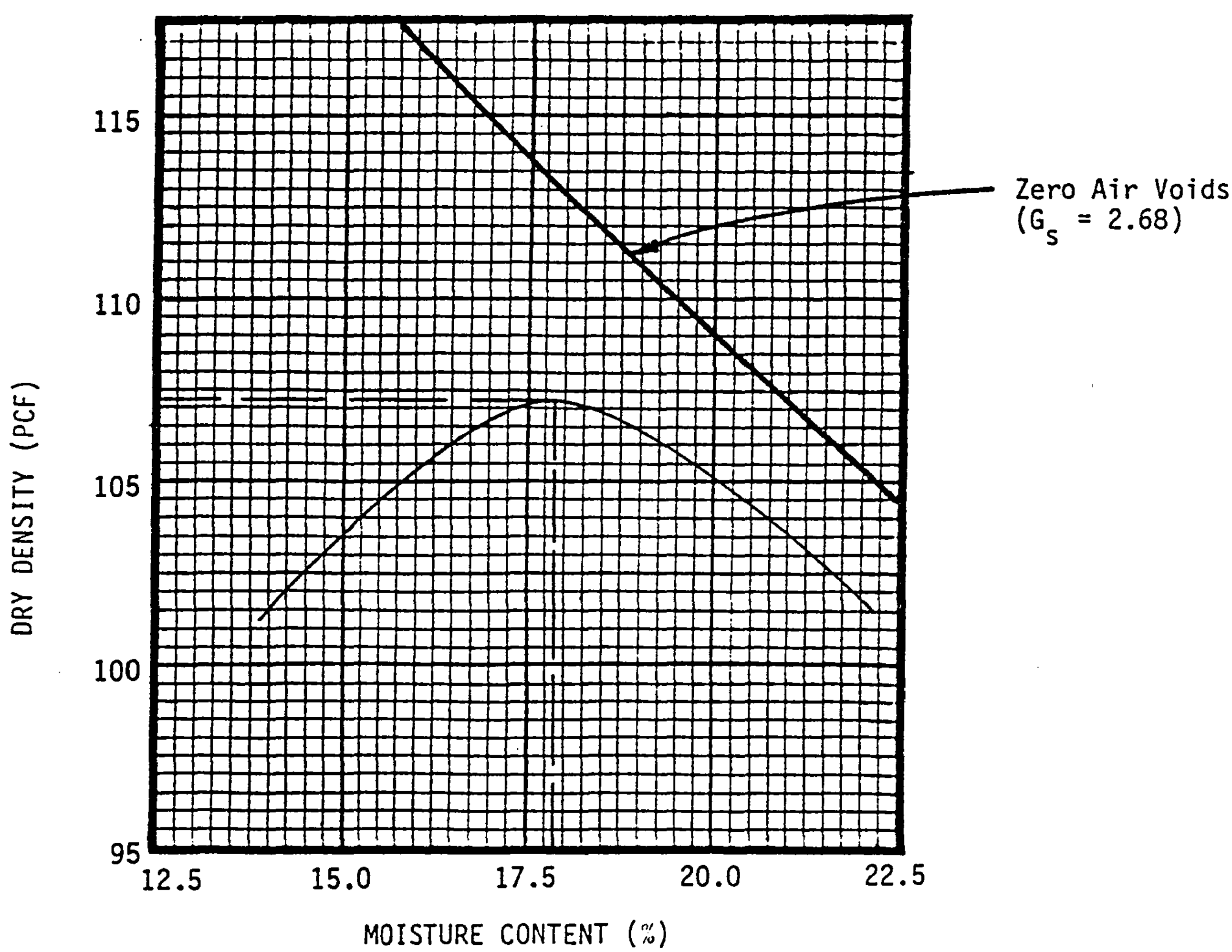
Material Silty-Sandy Clay (CL)

Sampled By TH/Thompson

TESTED: ASTM D698 Method A

RESULTS:

Max. Dry Density (pcf) 107.2 Optimum Moisture Content (%) 17.8



Project No. 86-991

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 10/15/86

Source Test boring 7; 2 - 14'

Type Bulk sample

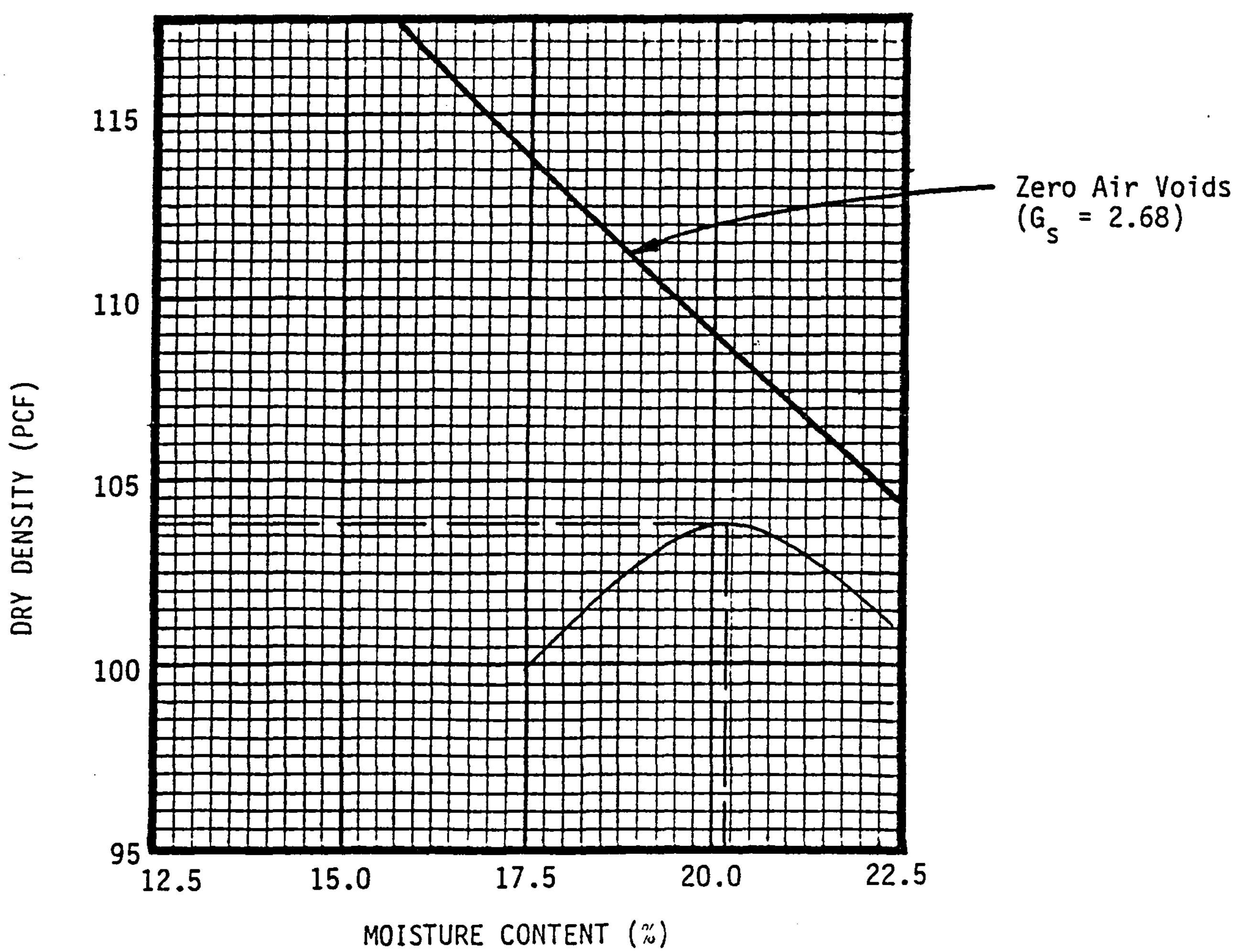
Material Sandy Clay (CL)

Sampled By TH/Thompson

TESTED: ASTM D698 Method A

RESULTS:

Max. Dry Density (pcf) 103.8 Optimum Moisture Content (%) 20.2



Project No. 86-991

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 10/15/86

Source Test boring 10; 2 - 14'

Type Bulk sample

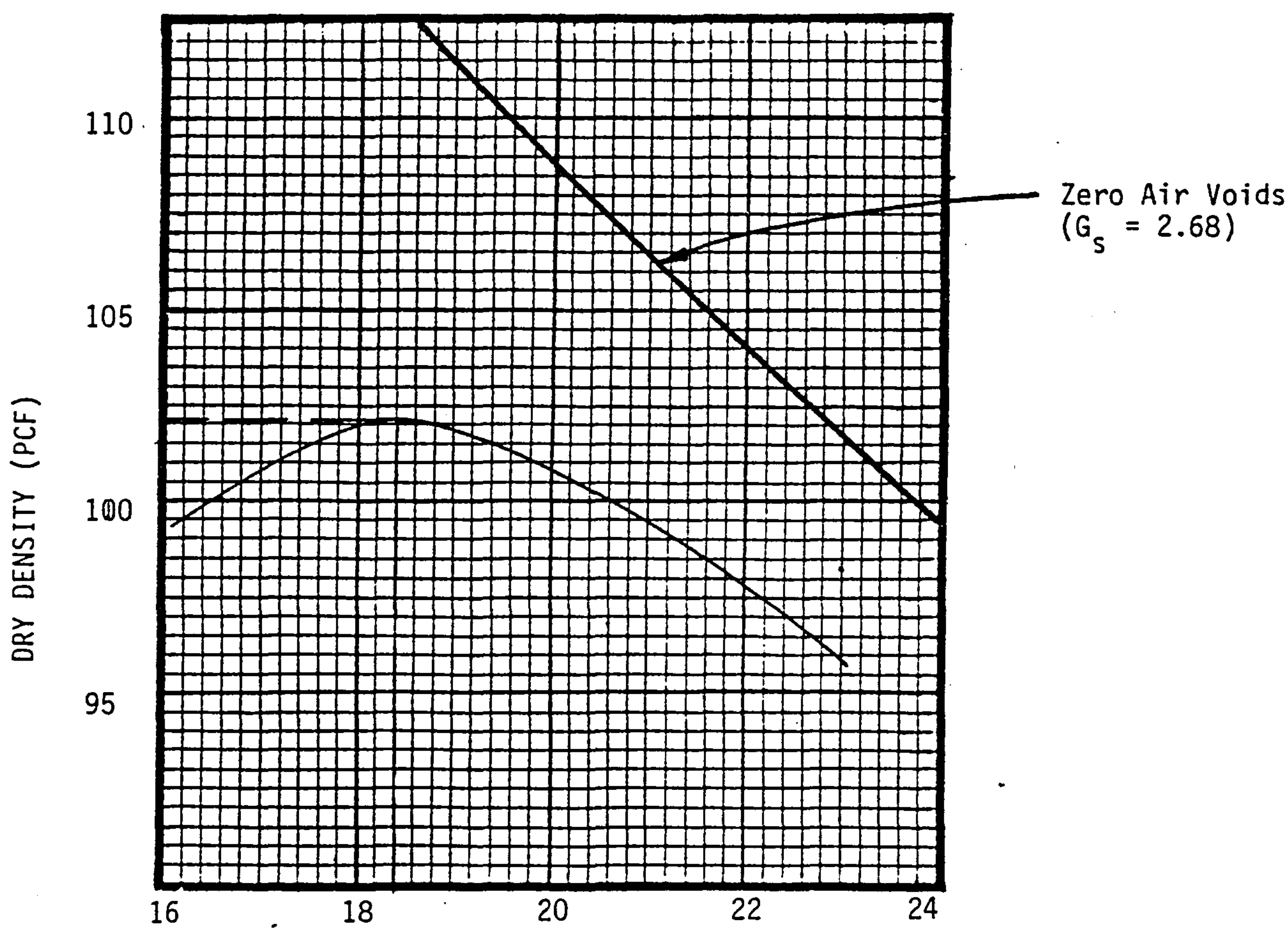
Material Silty-Sandy Clay (CL)

Sampled By TH/Thompson

TESTED: ASTM D698 Method A

RESULTS:

Max. Dry Density (pcf) 102.1 Optimum Moisture Content (%) 18.4



Project No. 86-991

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 10/15/86

Source Test boring 13; 2 - 9'

Type Bulk sample

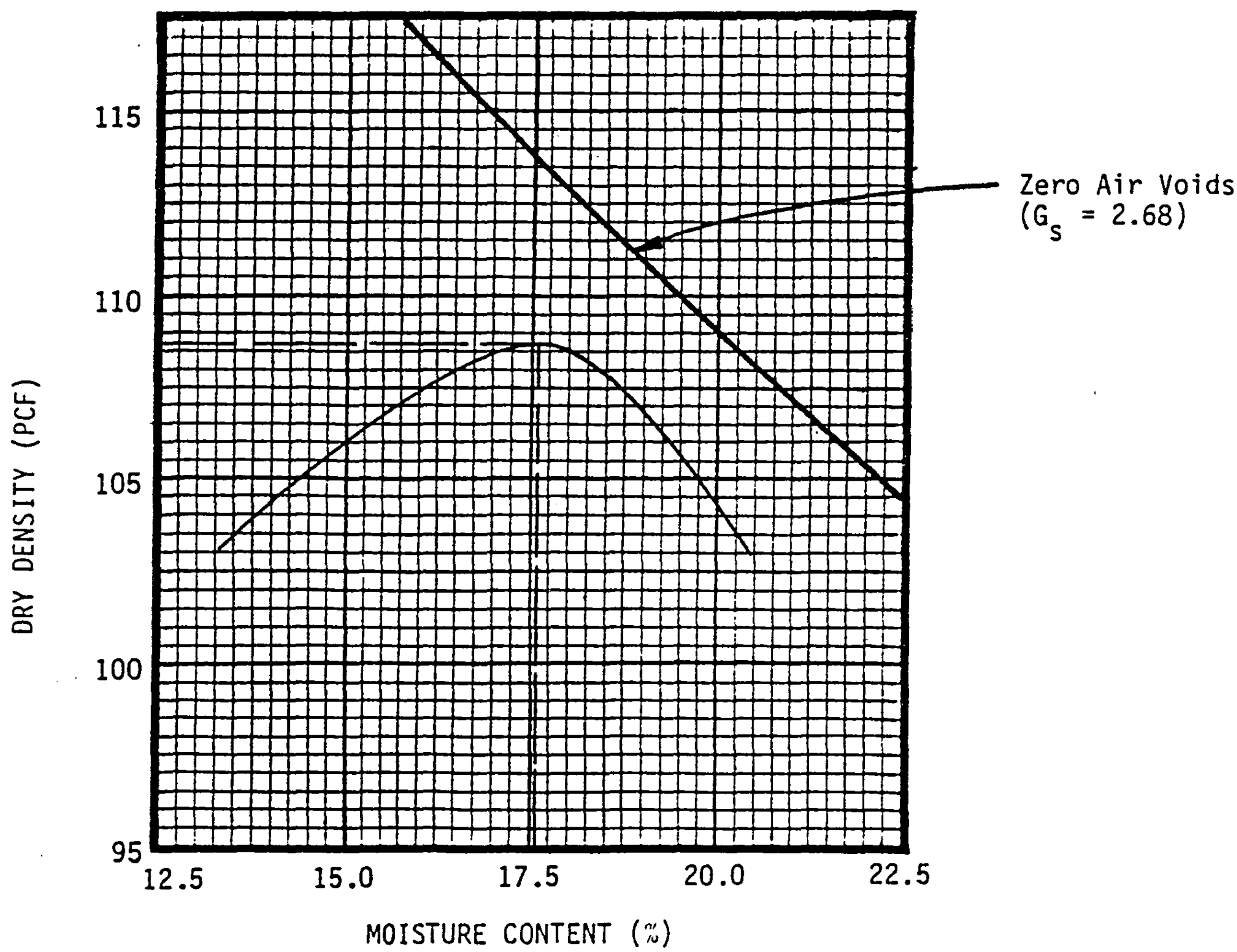
Material Sandy Clay (CL)

Sampled By TH/Thompson

TESTED: ASTM D698 Method A

RESULTS:

Max. Dry Density (pcf) 108.7 Optimum Moisture Content (%) 17.6



Project No. 86-991

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 10/15/86

Source Test boring 16; 2 - 14'

Type Bulk sample

Material Sandy Clay (CL)

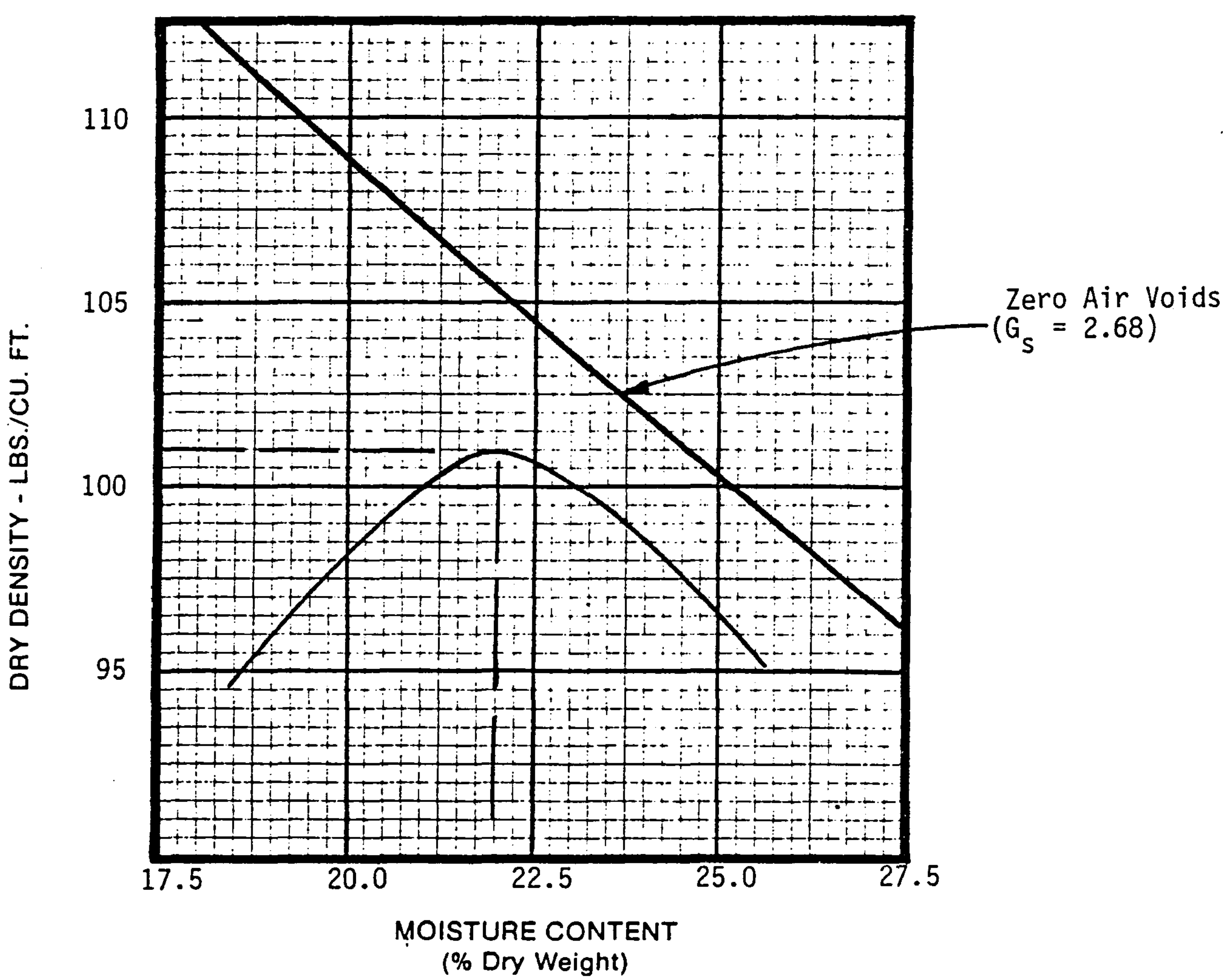
Sampled By TH/Thompson

TESTED: ASTM D698 Method A

RESULTS:

Max. Dry Density, lbs./cu. ft. 101.0

Optimum Moisture Content, % 22.1



Project No. 86-991

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 10/15/86

Source Test boring 19; 10 - 18'

Type Bulk sample

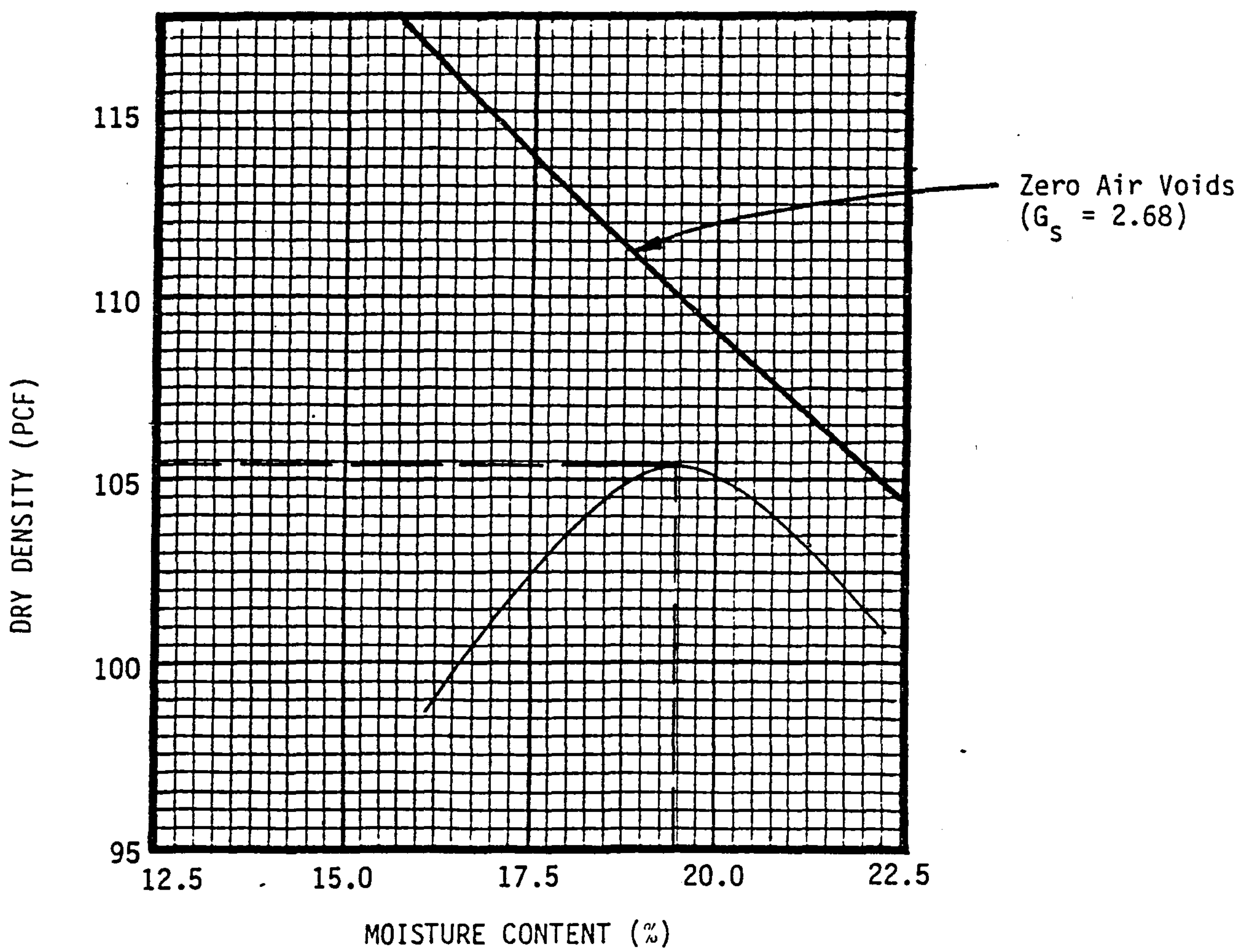
Material Clayey Sand (SC)

Sampled By TH/Thompson

TESTED: ASTM D698 Method A

RESULTS:

Max. Dry Density (pcf) 105.4 Optimum Moisture Content (%) 19.4



Project No. 86-991

THOMAS-HARTIG & ASSOCIATES, INC.

THOMAS-HARTIG & ASSOCIATES, INC.

TOM W. THOMAS, P.E. · HARRY E. HARTIG, P.E.

Soil and Foundation Engineering · Materials Testing

7031 West Oakland Street Chandler, Arizona 85226 (602) 961-1169

James R. Morrow		Roger A. Brewer, P.E.
John P. Boyd, P.E.	Glen K. Copeland, P.E.	Steven A. Hart, P.E.
Charles H. Atkinson, P.E.	James M. Willson, P.E.	Chet L. Pearson, P.E.
Donald J. Spadola, P.E.	Frank M. Guerra, P.E.	Kenneth L. Ricker, P.E.

JAN 27 1987

Dibble and Associates
3625 North 16th Street
Phoenix, Arizona

26 January 1987

Attention: Kent Dibble

Project: Price Road Storm Drain
M.C.F.C.D. Project No. 86-8
Price Road from Western Canal to
Superstition Freeway
Chandler, Gilbert, & Mesa, Arizona

Project No: 86-991
Supplement No. 1

In accordance with your authorization, test borings were drilled and soil resistivity measurements were made at six (6) more locations along the proposed alignment for the new storm drain. We understand that the storm drain will be 57 to 90 inches in diameter and installed approximately 10 to 20 feet below the existing ground surface. The test locations are shown on the attached site plan, and the results of all testing are attached.

All 6 test borings were drilled to a depth of 19 feet. Fill was encountered in each of the test borings to various depths from 1 to 7 feet. The fill materials were predominantly composed of clayey sand of medium plasticity. The natural soils beneath the fill were predominantly composed of sandy clay which exhibited firm to stiff consistency, medium plasticity, light cementation below about 7 feet, and variable moderate to heavy cementation below about 12 feet. A 5-foot layer of clayey sand was encountered in Test Boring 25 at a depth of 7 feet. This clayey sand was medium dense to dense and exhibited medium plasticity and variable light to moderate cementation. Soil moisture contents were generally described as being slightly damp to damp. No groundwater was encountered in any of the test borings during the drilling operations; however, zones of perched groundwater may occur when there is water in the Tempe Canal and the Mesa Drainage Channel.

Representative samples were obtained during the test drilling. Three samples were selected for sieve and plasticity index analyses; 2 samples were selected for pH, chloride, and sulfate analyses; and 2 samples were selected for maximum dry density-optimum moisture content determination (ASTM D698).

The soil resistivity was measured using a 4-terminal "Vibroground Model 263" resistivity meter. The resistivity tests were conducted using 3 different electrode spacings to indicate the variation in soil resistance with depth. The resistivity readings were influenced by underground pipes, canal, metal fences, and overhead electric lines in the immediate vicinity of the tests. Efforts were made to minimize outside interference; however, it is unknown how much effect the surrounding development had on the tests. The resistivity values ranged from about 1600 to 16,300 ohm-cm. Low resistivity values were encountered near Test Boring 21, so 2 additional soil resistivity readings were made at a distance of 100 feet north and south of Test Boring 21.

The recommendations presented in our previous report (Thomas-Hartig & Associates, Inc., Project No: 86-991) for the first portion of this project are applicable to this second portion of the project. The existing fill materials were predominantly composed of clayey sand soils, and the recommendations presented in our previous report for clayey sand soils are applicable to the fill materials.

This supplement shall be attached to the original report and shall become a part thereof. Please do not hesitate to call if you have any questions or if we may be of further assistance.

Respectfully submitted,

THOMAS-HARTIG & ASSOCIATES, INC.

Registered Professional Engineer (Civil) CERTIFICATE NO. 19709 CHET L. PEARSON Signed ARIZONA, U.S.A.

By: ______________________ Reviewed by: ______________________

Chet L. Pearson, P.E.

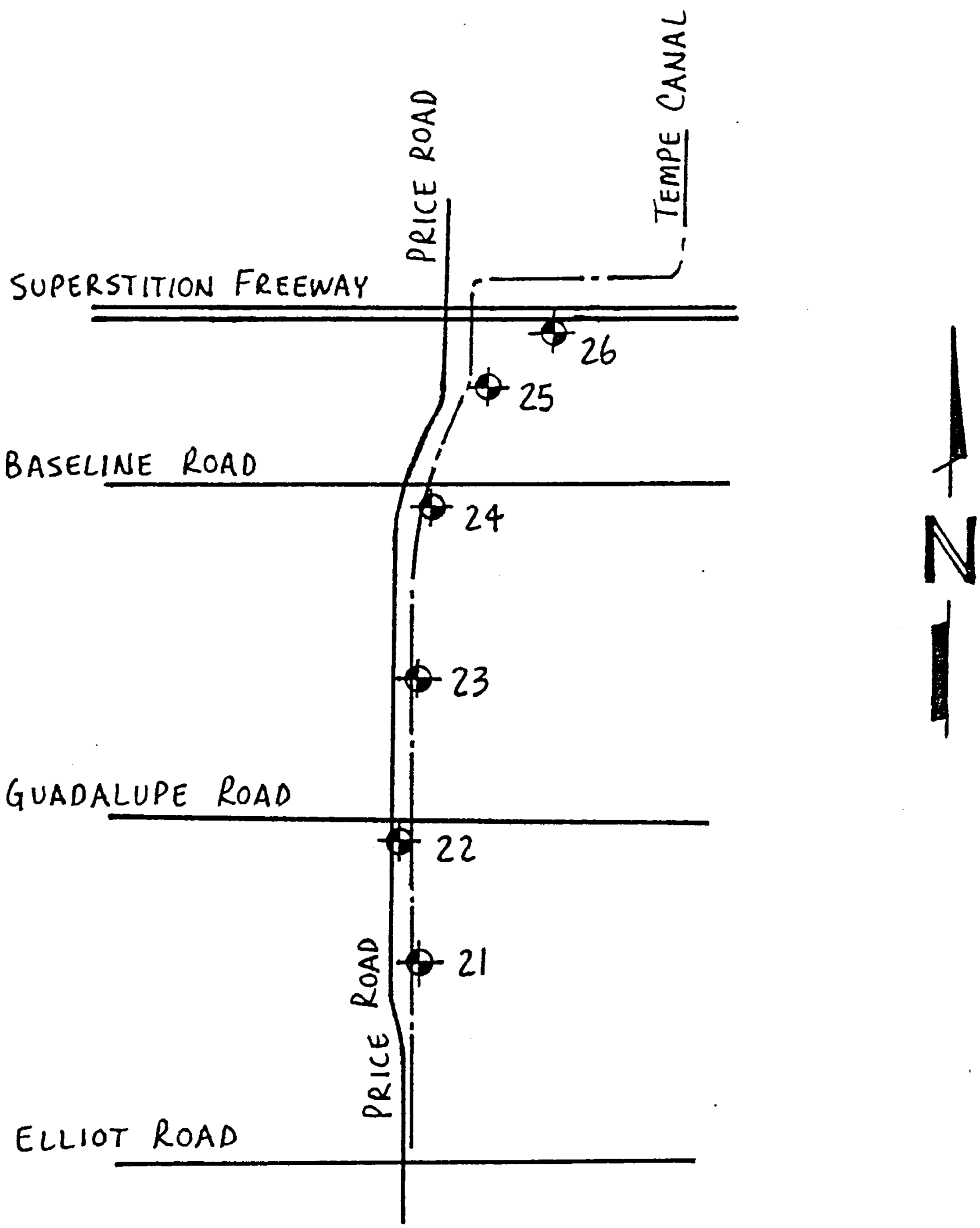
Registered Professional Engineer (Civil) CERTIFICATE NO. 6858 GLEN K. COPELAND Signed ARIZONA, U.S.A.

Glen K. Copeland, P.E.

/cmm

Copies to: Addressee (5)

FIELD AND LABORATORY RESULTS



LEGEND

Location of test borings

LEGEND

SOIL CLASSIFICATION ASTM: D2487

COARSE-GRAINED SOIL

MORE THAN 50% LARGER THAN 200 SIEVE SIZE

Symbol	Letter	DESCRIPTION	MAJOR DIVISIONS
	GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - 200 FINES	GRAVELS More than half of coarse fraction is larger than No 4 Sieve size
	GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - 200 FINES	
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% - 200 FINES	
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, MORE THAN 12% - 200 FINES	
	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - 200 FINES	SANDS More than half of coarse fraction is smaller than No 4 sieve size
	SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - 200 FINES	
	SM	SILTY SANDS, SAND-SILT MIXTURES MORE THAN 12% - 200 FINES	
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES MORE THAN 12% - 200 FINES	

FINE-GRAINED SOIL

MORE THAN 50% SMALLER THAN 200 SIEVE SIZE

Symbol	Letter	DESCRIPTION	MAJOR DIVISIONS
	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	SILTS AND CLAYS Liquid limit less than 50
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
	OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY	
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS, ELASTIC SILTS	SILTS AND CLAYS Liquid limit greater than 50
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	

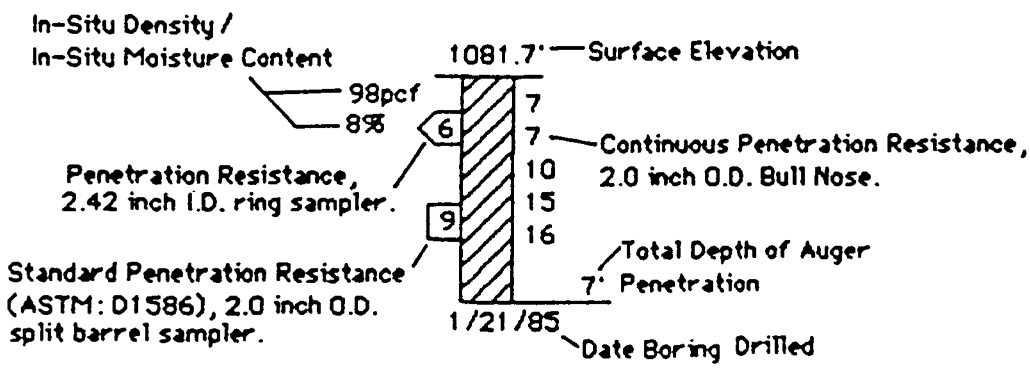
log denotes visual approximation unless accompanied by mechanical analysis and Atterberg limits.

GRAIN SIZES

	U.S. STANDARD SERIES SIEVE 200	50	16	4	CLEAR SQUARE SIEVE OPENINGS ¾"	3"	6"
SILTS & CLAYS DISTINGUISHED ON BASIS OF PLASTICITY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

MOISTURE CONDITION (INCREASING MOISTURE ⟶)

DRY	SLIGHTLY DAMP	DAMP	MOIST	VERY MOIST	WET (SATURATED)
		(PL)			(LL)



PENETRATION RESISTANCE:
Blows per foot using 140 lb. hammer
with 30 inch free fall unless otherwise noted.

CONSISTENCY			RELATIVE DENSITY	
CLAYS & SILTS	BLOWS/FOOT*	STRENGTH‡	SANDS & GRAVELS	BLOWS/FOOT*
VERY SOFT	0-2	0-¼	VERY LOOSE	0-4
SOFT	2-4	¼-½	LOOSE	4-10
FIRM	4-8	½-1	MEDIUM DENSE	10-30
STIFF	8-16	1-2	DENSE	30-50
VERY STIFF	16-32	2-4	VERY DENSE	OVER 50
HARD	OVER 32	OVER 4		

* Number of blows of 140 pound hammer falling 30 inches to drive a 2 inch O.D. (1-⅜ inch I.D.) split spoon (ASTM D-1586).

‡ Unconfined compressive strength in tons/sq. ft. Read from a pocket penetrometer

Project No. 86-991.1

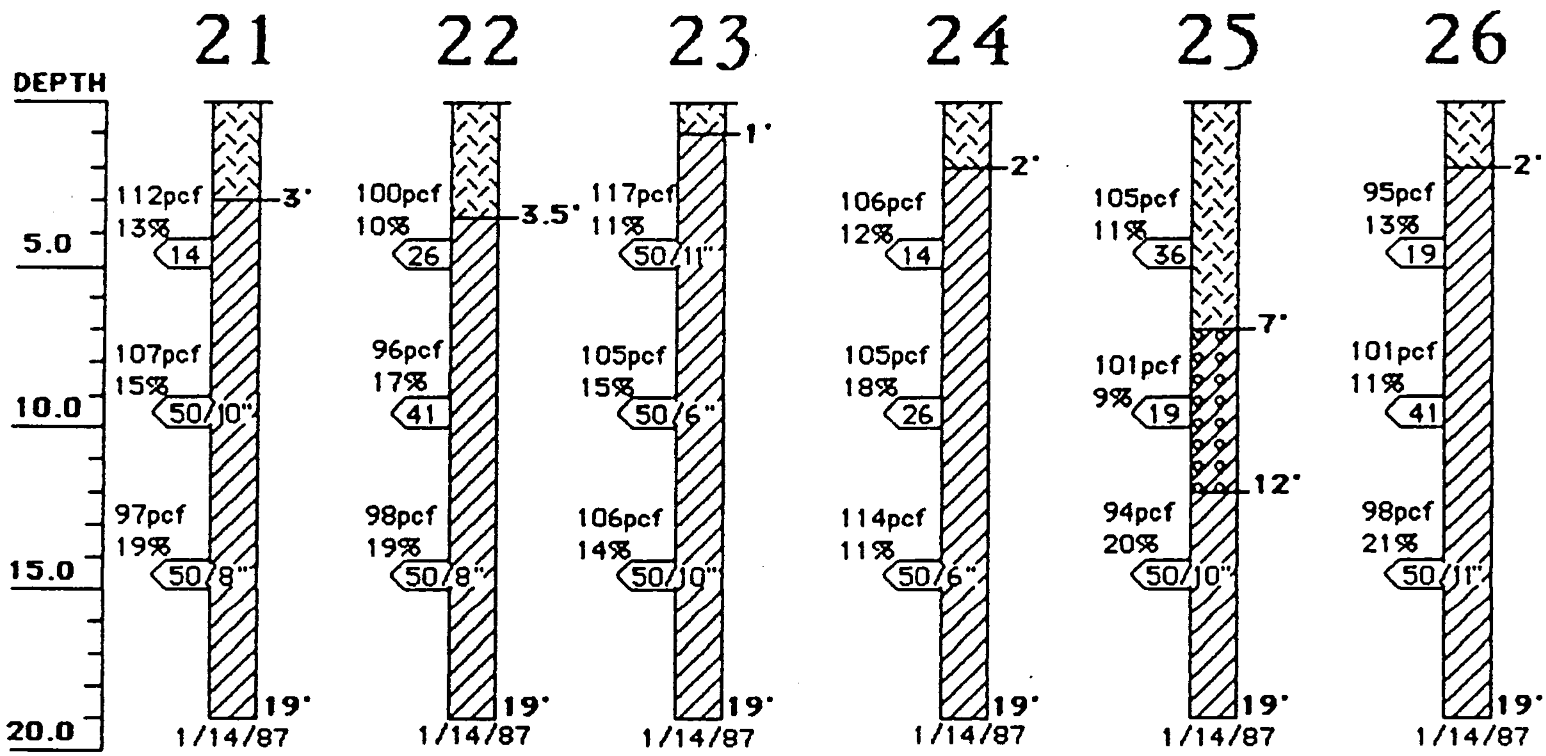
THOMAS-HARTIG & ASSOCIATES, INC.

APPROXIMATE LOCATIONS OF TEST BORINGS

Test Boring	Station (ft)	Offset from Centerline of Tempe Canal	*Surface Elevation (ft)
21	2 + 50	70'E	1195.6
22	24 + 00	115'W	1196.0
23	50 + 00	120'E	1192.6
24	78 + 00	160'E	1196.5
25	104 + 00	**0	1200.0
26	122 + 00	**33'N	1199.2

*Elevation based on topography shown on plans by Dibble and Associates.

**Distance from control line on Dibble and Associates plans.



LEGEND OF SOIL TYPES

FILL MATERIAL: CLAYEY SAND (SC); tan; medium plasticity; slightly damp.

SANDY CLAY (CL); brown; firm to very stiff; medium plasticity; light cementation below 7 feet; variable moderate to heavy cementation below 12 feet; damp.

CLAYEY SAND (SC); brown; medium dense to dense; medium plasticity; variable light to moderate cementation; damp.

No free groundwater was encountered in any of the borings during drilling.

All borings drilled with 7" diameter hollow-stem auger unless otherwise noted.

Project No. 86-991.1

Thomas - Hartig & Associates

NOTE: The data presented on the boring logs represents subsurface conditions only at the specific locations and at the time designated. This data may not represent conditions at other locations and/or times. Contacts between soil strata are approximate and changes between soil types may be gradual rather than abrupt. This boring data was compiled primarily for design purposes and should not be construed as part of the plans governing construction or defining construction techniques. Bidders are fully responsible for interpretations or conclusions they draw from the boring log.

REPORT ON FIELD TESTS

DESCRIPTION:

Location: Noted below
Material: Native soils
Performed by: TH/D. Thomas
Date: 23 January 1987

TESTED:

Resistivity tests measured by the 4-probe method

RESULTS:

Location	Electrode Spacing	Depth of Measurement	Soil Resistivity (ohm-cm)
21	5'	0 - 5'	1700
	10'	0 - 10'	1600
	15'	0 - 15'	1800
21A (100'N of 21)	5'	0 - 5'	4800
	10'	0 - 10'	4400
	15'	0 - 15'	4000
21B (100'S of 21)	5'	0 - 5'	2300
	10'	0 - 10'	3300
	15'	0 - 15'	2600
22	5'	0 - 5'	6000
	10'	0 - 10'	3400
	15'	0 - 15'	2200
23	5'	0 - 5'	6000
	10'	0 - 10'	5200
	15'	0 - 15'	4900
24	5'	0 - 5'	4800
	10'	0 - 10'	5400
	15'	0 - 15'	5500
25	5'	0 - 5'	16300
	10'	0 - 10'	5400
	15'	0 - 15'	2700
26	5'	0 - 5'	9300
	10'	0 - 10'	2700
	15'	0 - 15'	6000

REPORT ON LABORATORY TESTS

SAMPLE: Date 1/23/87

Source Noted below

Type Grab samples

Material Surface and subsurface soil

Sampled By TH/Thompson

TESTED: Sieve analysis and plasticity index

RESULTS:

Sample	LL	PI	Sieve Size - 200	100	50	30	16	Accum. % Passing 8	4	3/4"	1"	2"	3"	* Class
21; 2 - 9'	37	17	69	79	87	90	92	94	96	100				CL
23; 10 - 19'	48	22	43	50	56	62	69	78	89	100				SC
26; 2 - 10'	35	16	64	74	84	91	94	96	98	100				CL

* Unified Soil Classification

Project No. 86-991.1

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 1/26/87

Source: Noted below

Type: Grab samples

Material: Surface and subsurface soil

Sampled By: TH/Thompson

TESTED: pH, Chlorides, and Sulfates

RESULTS:

Sample	pH	Soluble Chlorides	Soluble Sulfates
21; 3 - 9'	8.8	0.042%	0.094%
25; 10 - 20'	9.0	0.008%	0.024%

Project No. 86-991.1

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 1/23/87

Source Test boring 22; 3.5 - 12'

Type Grab sample

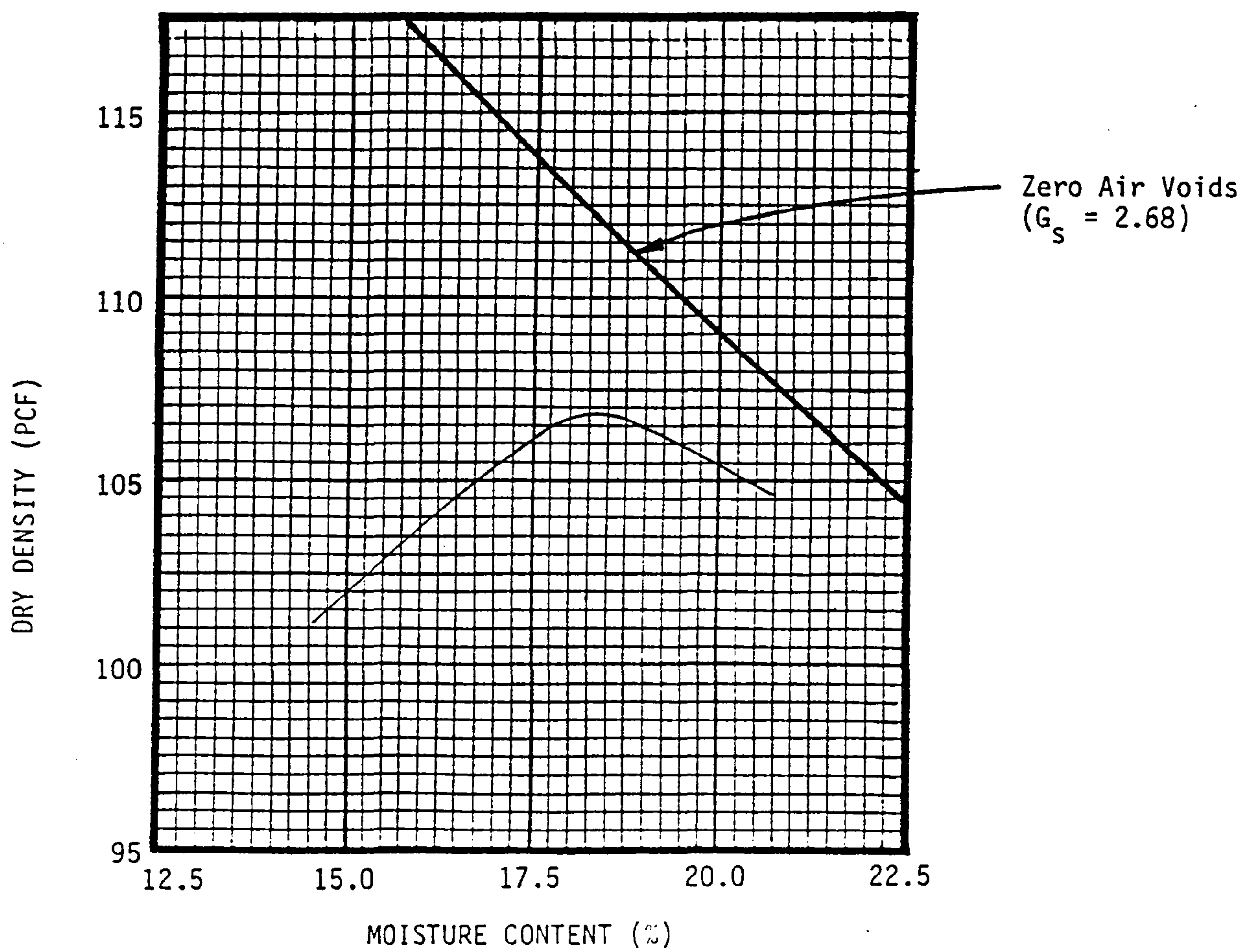
Material Surface and subsurface soil

Sampled By TH/Thompson

TESTED: ASTM D698 Method A

RESULTS:

Max. Dry Density (pcf) 106.8 Optimum Moisture Content (%) 18.3



Project No. 86-991.1

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 1/23/87

Source: Test boring 24; 2 - 6' and 6 - 14'

Type: Composite grab sample

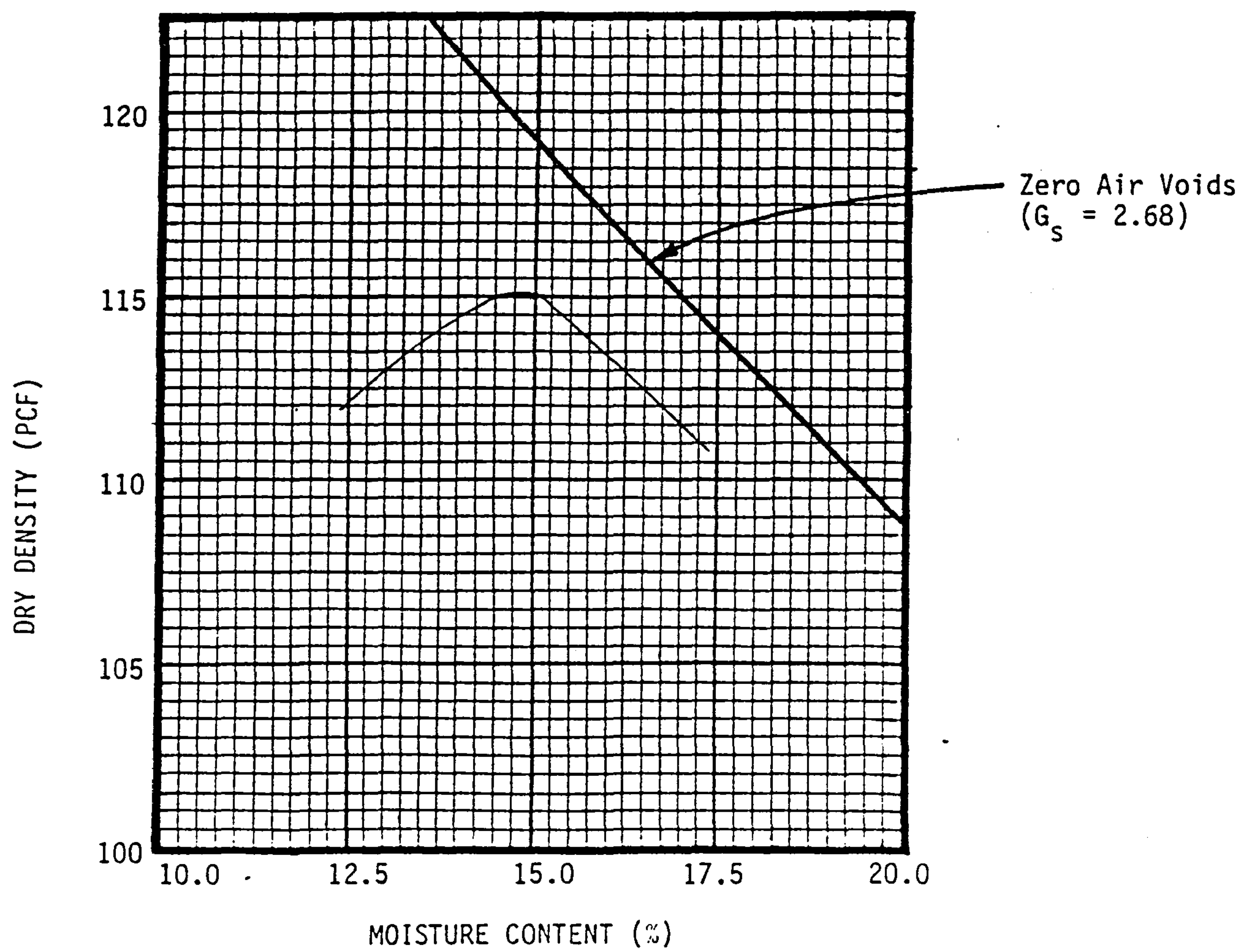
Material: Surface and subsurface soil

Sampled By: TH/Thompson

TESTED: ASTM D698 Method A

RESULTS:

Max. Dry Density (pcf) 115.1 Optimum Moisture Content (%) 14.8



Project No. 86-991.1

THOMAS-HARTIG & ASSOCIATES, INC.

APPENDIX E

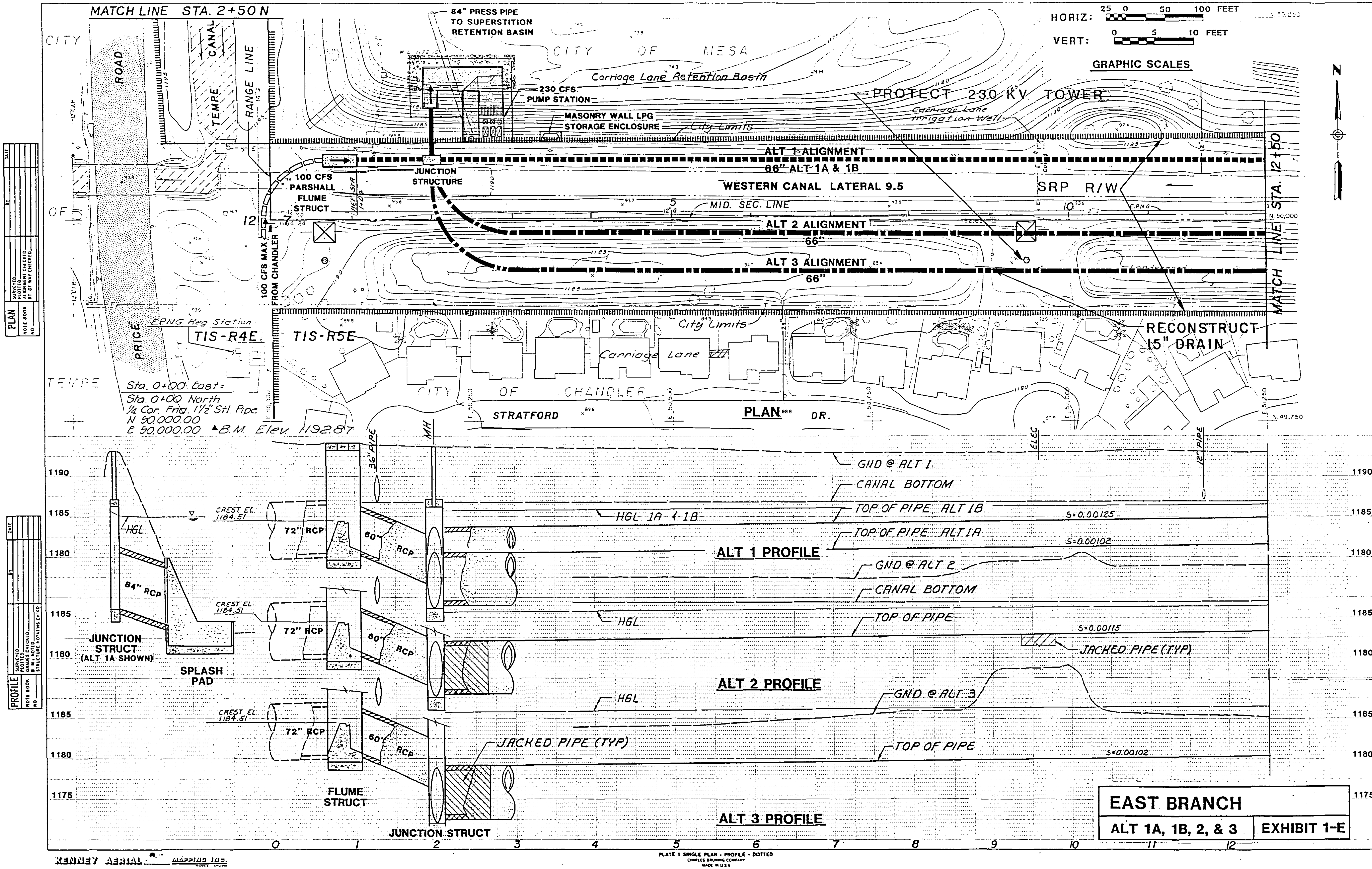
PLAN AND PROFILE SHEETS AND PRELIMINARY COSTS
FOR EAST BRANCH ALTERNATIVES 1, 2 AND 3

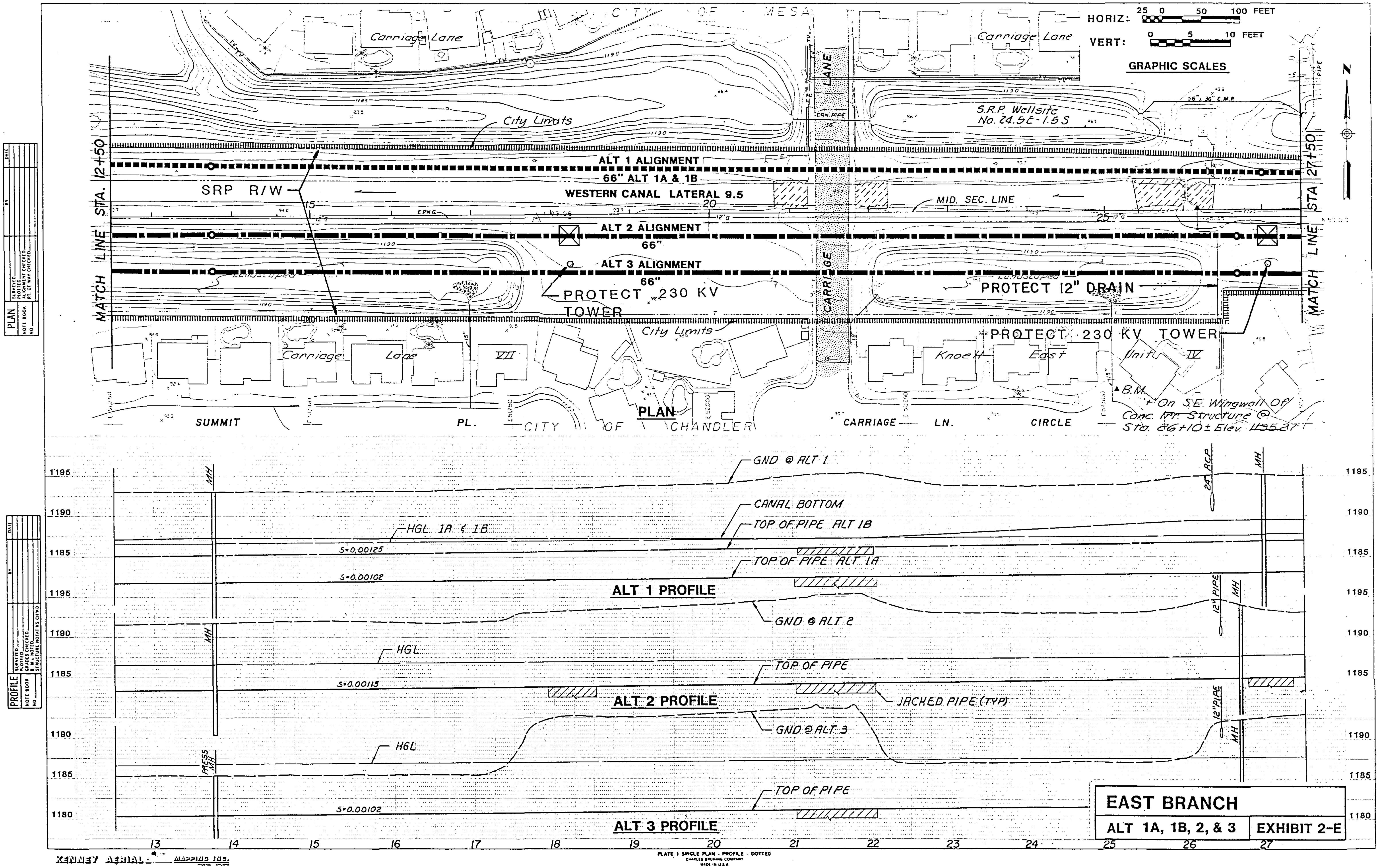
TABLES

APPENDIX E

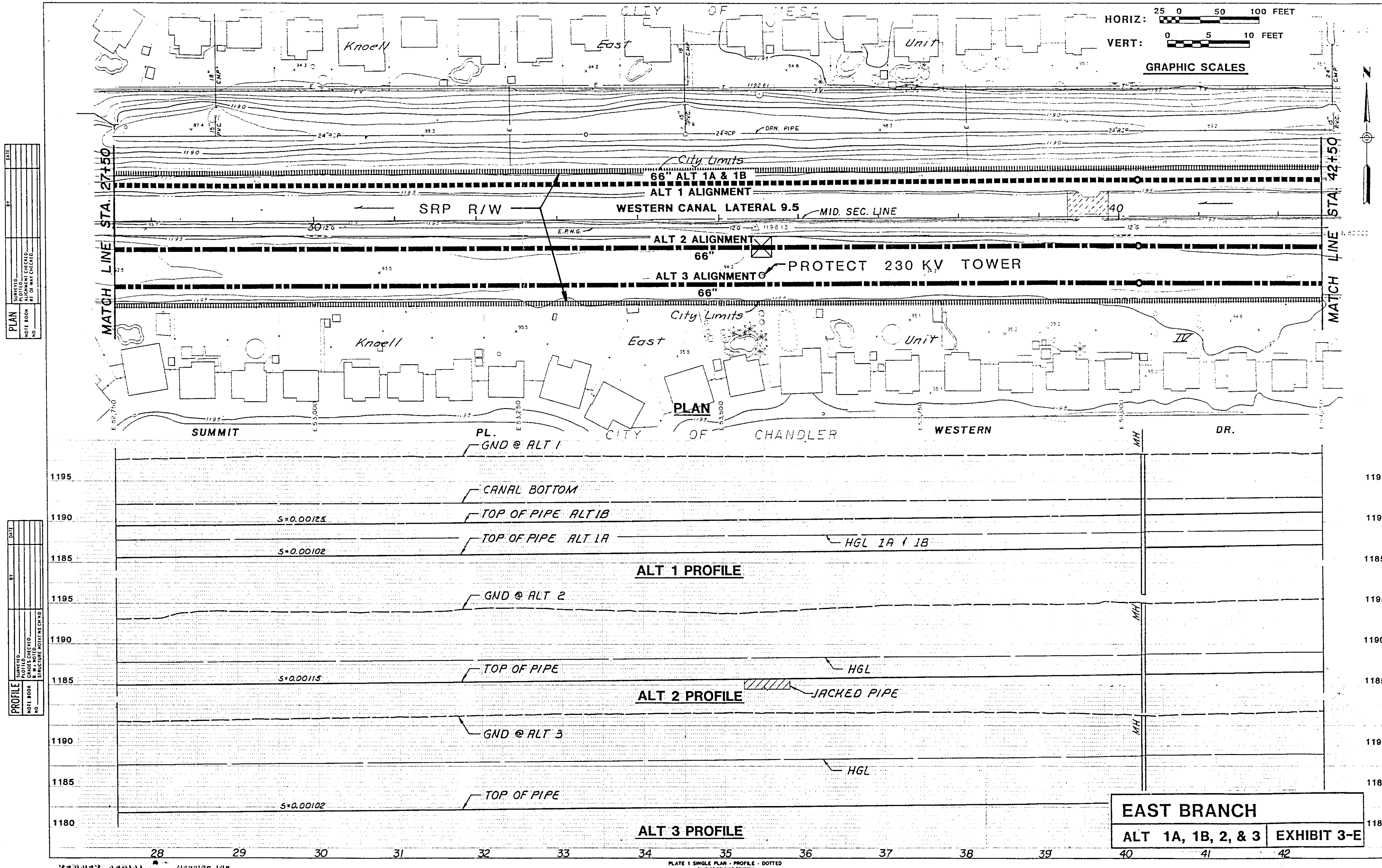
EXHIBITS

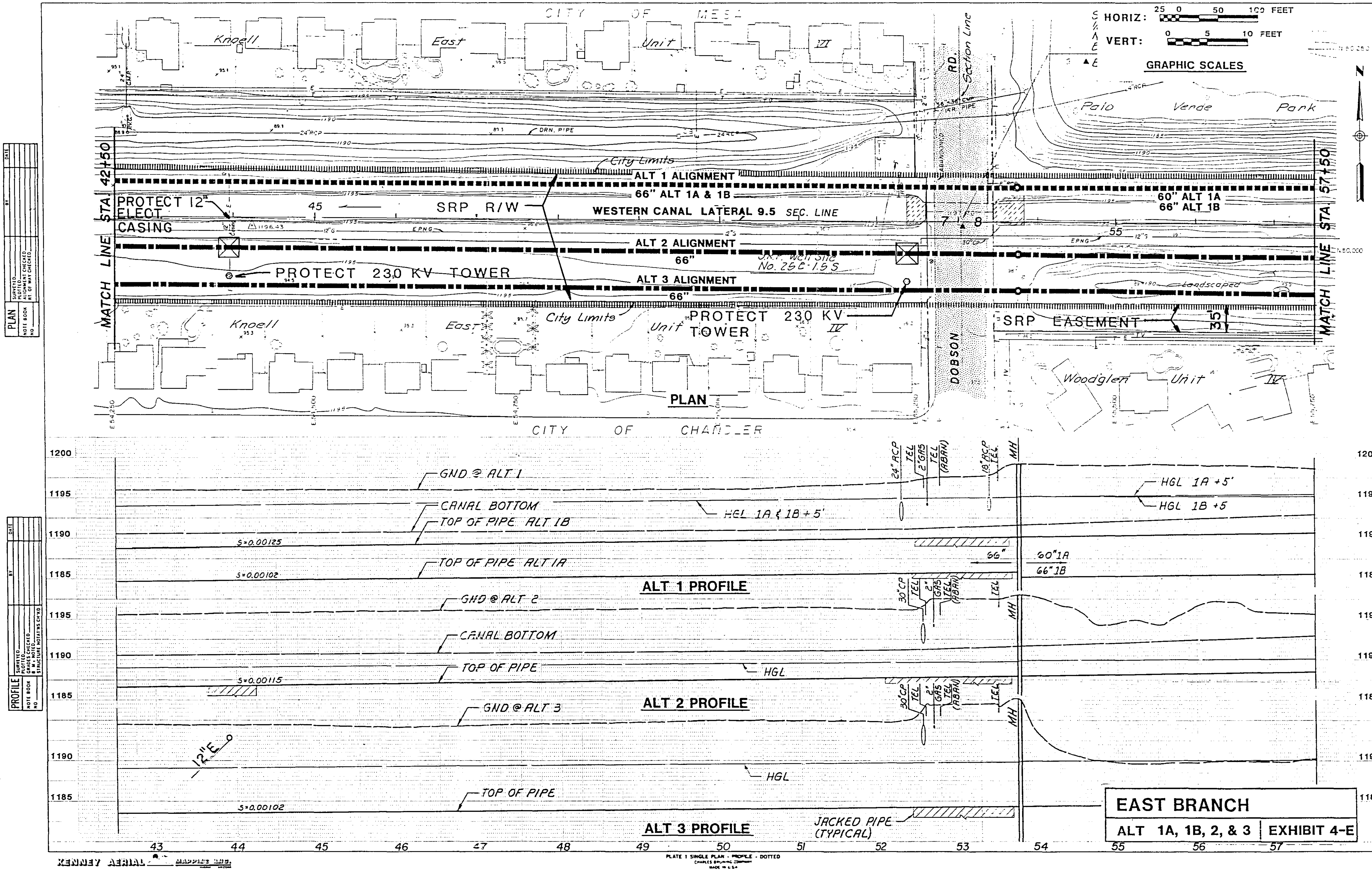
EXHIBIT NO.	TITLE	
1-E	Price Road Drain--East Branch Alternatives 1,2 & 3 (Gilbert) Comparison of Preliminary Costs	
2-E	"	"
3-E	"	"
4-E	"	"
5-E	"	"
6-E	"	"
7-E	"	"
8-E	"	"
9-E	"	"
10-E	"	"
11-E	"	"
12-E	"	"
13-E	"	"
14-E	"	"
15-E	"	"
16-E	"	"
17-E	"	"
18-E	"	"

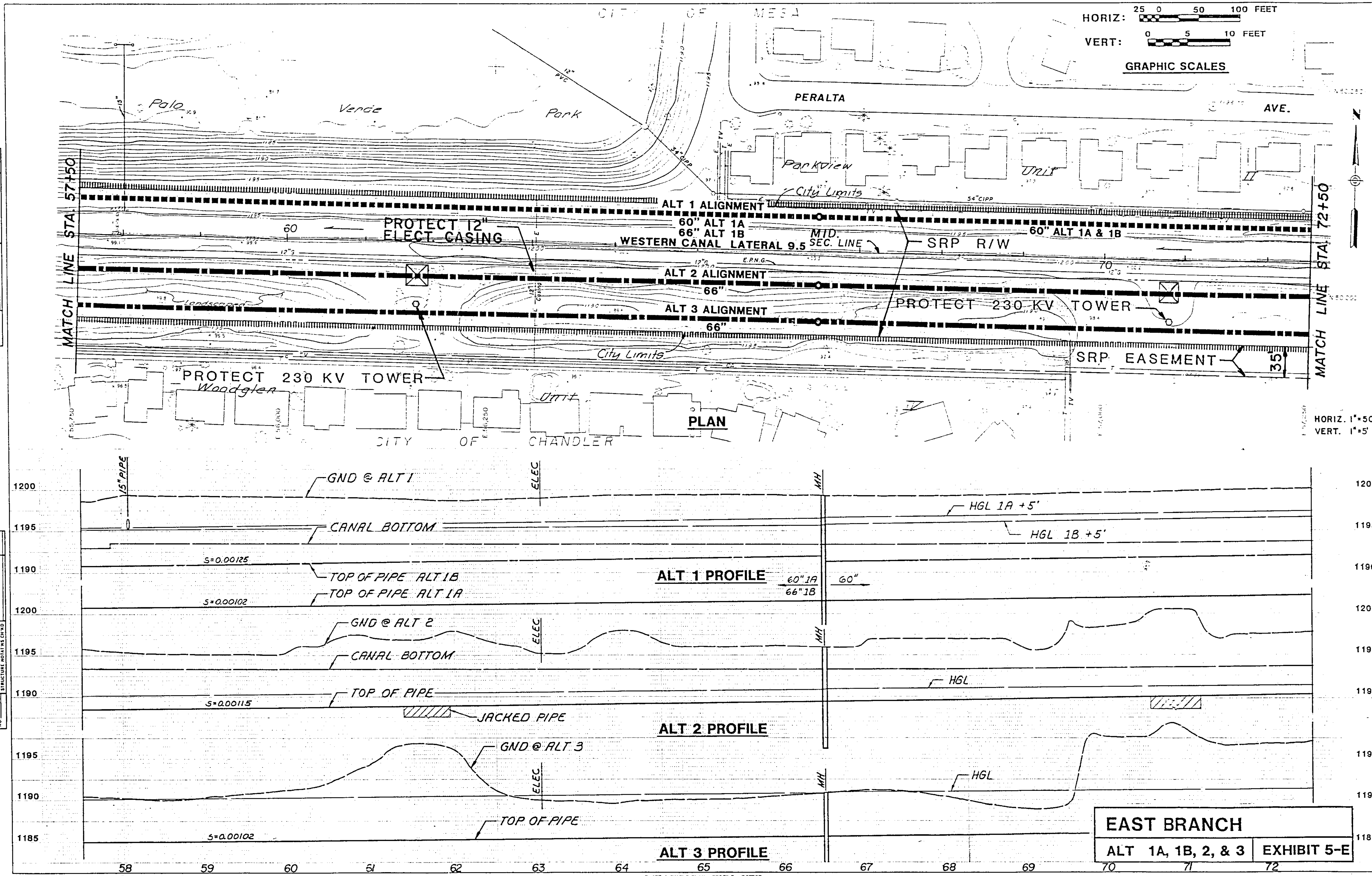

MATCH LINE STA. 2+50 N
84" PRESS PIPE TO SUPERSTITION RETENTION BASIN
CITY OF MESA
Carriage Lane Retention Basin
230 CFS PUMP STATION
MASONRY WALL LPG STORAGE ENCLOSURE
City Limits
PROTECT 230 KV TOWER
Carriage Lane Irrigation Well
HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
N
ROAD
CANAL
TEMPE
RANGE LINE
CITY OF
ALT 1 ALIGNMENT
66" ALT 1A & 1B
JUNCTION STRUCTURE
100 CFS PARSHALL FLUME STRUCT
WESTERN CANAL LATERAL 9.5
SRP R/W
MID. SEC. LINE
ALT 2 ALIGNMENT
66"
ALT 3 ALIGNMENT
66"
100 CFS MAX FROM CHANDLER
MATCH LINE STA. 12+50
N. 50,000
EPNG Reg Station
TIS-R4E
TIS-R5E
City Limits
RECONSTRUCT 15" DRAIN
Carriage Lane
PRICE
TEMPE
CITY OF CHANDLER
STRATFORD
PLAN
DR.
Sta. 0+00 East= Sta. 0+00 North
1/4 Cor. Fnd. 1 1/2" Stl. Pipe
N 50,000.00
E 50,000.00
B.M. Elev. 1192.87
N. 49,750
36" PIPE
MH
ELEC
12" PIPE
GND @ ALT 1
CANAL BOTTOM
HGL 1A & 1B
TOP OF PIPE ALT 1B
S=0.00125
TOP OF PIPE ALT 1A
S=0.00102
ALT 1 PROFILE
CREST EL 1184.51
HGL
72" RCP
60" RCP
84" RCP
GND @ ALT 2
CANAL BOTTOM
HGL
TOP OF PIPE
S=0.00115
JACKED PIPE (TYP)
JUNCTION STRUCT (ALT 1A SHOWN)
SPLASH PAD
ALT 2 PROFILE
GND @ ALT 3
JACKED PIPE (TYP)
TOP OF PIPE
S=0.00102
FLUME STRUCT
JUNCTION STRUCT
ALT 3 PROFILE
1190
1185
1180
1175
0 1 2 3 4 5 6 7 8 9 10 11 12
EAST BRANCH
ALT 1A, 1B, 2, & 3
EXHIBIT 1-E
PLAN
PROFILE
KENNEY AERIAL MAPPING INC.
PLATE 1 SINGLE PLAN - PROFILE - DOTTED



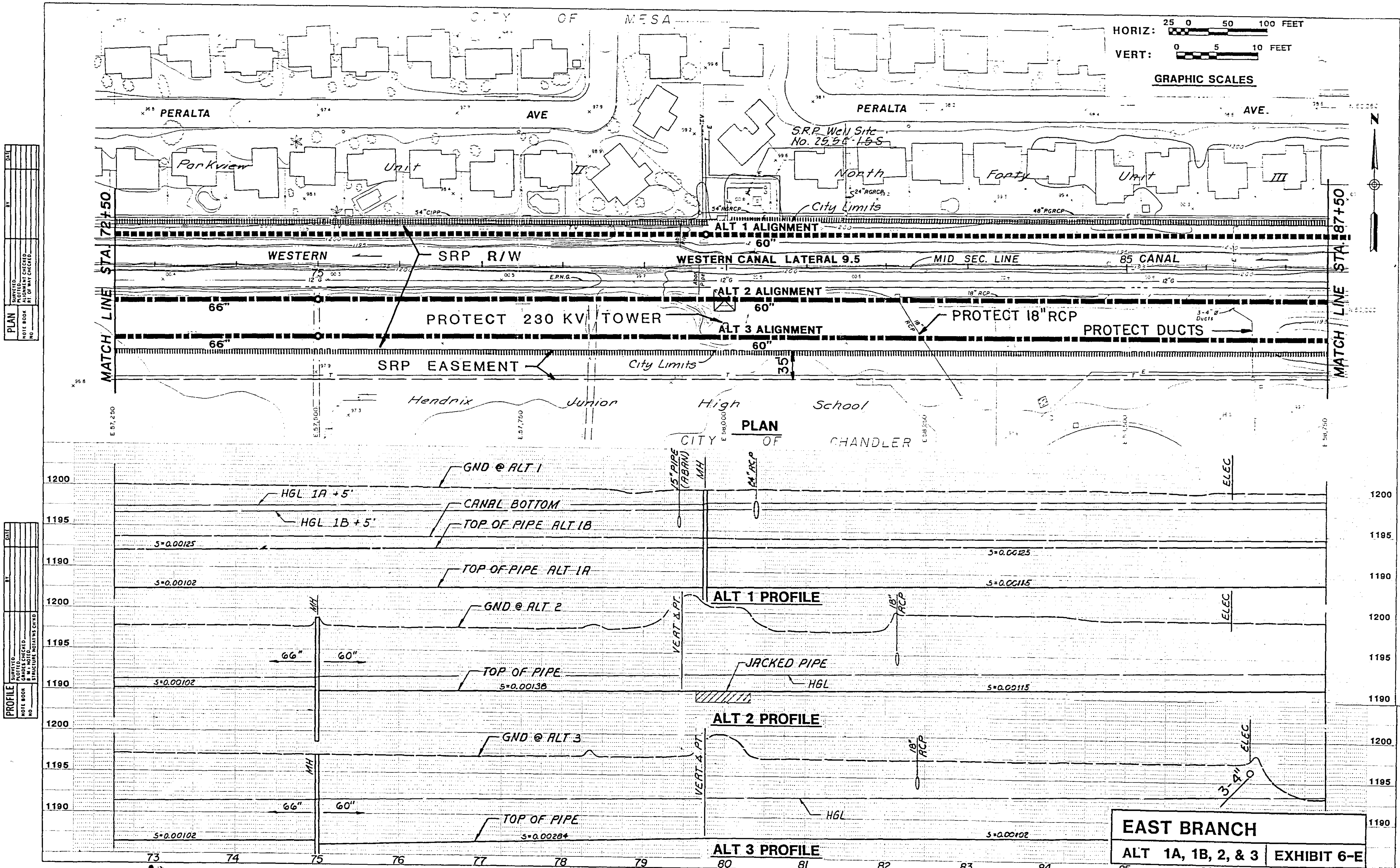
CITY OF MESA
Carriage Lane
HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
City Limits
S.R.P. Wellsite No. 24.5E-1.5S
ALT 1 ALIGNMENT
66" ALT 1A & 1B
SRP R/W
WESTERN CANAL LATERAL 9.5
MID. SEC. LINE
ALT 2 ALIGNMENT
66"
ALT 3 ALIGNMENT
66"
PROTECT 230 KV TOWER
PROTECT 12" DRAIN
PROTECT 230 KV TOWER
MATCH LINE STA. 12+50
MATCH LINE STA 27+50
CARRIAGE LANE
Carriage Lane VII
Knoell East Unit IV
B.M. + On S.E. Wingwall Of Conc. Irr. Structure @ Sta. 26+10± Elev. 1195.27
SUMMIT PL.
CITY OF CHANDLER
PLAN
CARRIAGE LN. CIRCLE
GND @ ALT 1
CANAL BOTTOM
TOP OF PIPE ALT 1B
HGL 1A & 1B
S=0.00125
TOP OF PIPE ALT 1A
S=0.00102
ALT 1 PROFILE
GND @ ALT 2
HGL
TOP OF PIPE
S=0.00115
ALT 2 PROFILE
JACKED PIPE (TYP)
GND @ ALT 3
HGL
PRESS MH
TOP OF PIPE
S=0.00102
ALT 3 PROFILE
MH
24" RCP
12" PIPE
1195
1190
1185
1180
13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
EAST BRANCH
ALT 1A, 1B, 2, & 3
EXHIBIT 2-E
KENNEY AERIAL MAPPING INC.
PLATE 1 SINGLE PLAN - PROFILE - DOTTED


CITY OF MESA
Knoell East Unit
HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
MATCH LINE STA. 27+50
MATCH LINE STA. 42+50
City Limits
66" ALT 1A & 1B
ALT 1 ALIGNMENT
SRP R/W
WESTERN CANAL LATERAL 9.5
MID. SEC. LINE
ALT 2 ALIGNMENT
66"
PROTECT 230 KV TOWER
ALT 3 ALIGNMENT
66"
City Limits
Knoell East Unit IV
PLAN
SUMMIT PL.
CITY OF CHANDLER
WESTERN DR.
GND @ ALT 1
CANAL BOTTOM
TOP OF PIPE ALT 1B
S=0.00125
TOP OF PIPE ALT 1A
S=0.00102
HGL 1A & 1B
ALT 1 PROFILE
GND @ ALT 2
HGL
TOP OF PIPE
S=0.00115
JACKED PIPE
ALT 2 PROFILE
GND @ ALT 3
HGL
TOP OF PIPE
S=0.00102
ALT 3 PROFILE
MH
EAST BRANCH
ALT 1A, 1B, 2, & 3
EXHIBIT 3-E
KENNEY AERIAL MAPPING INC.
PLATE 1 SINGLE PLAN - PROFILE - DOTTED


CITY OF MESA
Knoell East Unit VI
HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
Palo Verde Park
DOBSON RD.
Section Line
City Limits
ALT 1 ALIGNMENT
66" ALT 1A & 1B
60" ALT 1A
66" ALT 1B
PROTECT 12" ELECT. CASING
SRP R/W
WESTERN CANAL LATERAL 9.5 SEC. LINE
ALT 2 ALIGNMENT
66"
PROTECT 230 KV TOWER
ALT 3 ALIGNMENT
66"
MATCH LINE STA. 42+50
MATCH LINE STA. 57+50
Knoell East Unit IV
PROTECT 230 KV TOWER
SRP EASEMENT
35'
Woodglen Unit IV
PLAN
CITY OF CHANDLER
GND @ ALT 1
CANAL BOTTOM
TOP OF PIPE ALT 1B
HGL 1A & 1B + 5'
HGL 1A +5'
HGL 1B +5
S=0.00125
TOP OF PIPE ALT 1A
S=0.00102
60"1A
66"1B
ALT 1 PROFILE
GND @ ALT 2
CANAL BOTTOM
TOP OF PIPE
HGL
S=0.00115
ALT 2 PROFILE
GND @ ALT 3
12"E
HGL
TOP OF PIPE
S=0.00102
JACKED PIPE (TYPICAL)
ALT 3 PROFILE
24" RCP
TEL
2" GAS
TEL (ABAN)
18" RCP
30" CP
MH
EAST BRANCH
ALT 1A, 1B, 2, & 3
EXHIBIT 4-E
43 44 45 46 47 48 49 50 51 52 53 54 55 56 57
KENNEY AERIAL MAPPING INC.

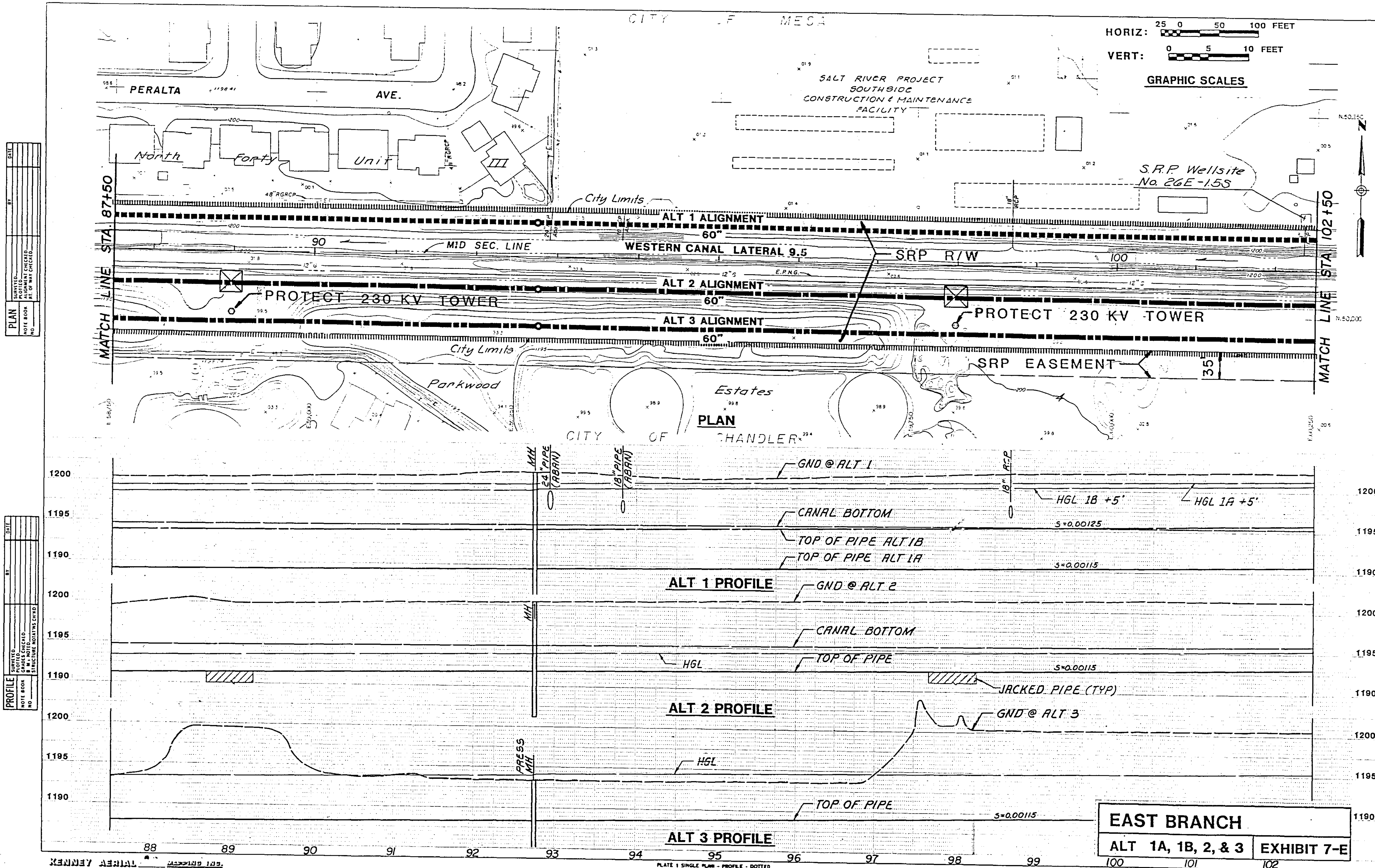


CITY OF MESA
HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
PERALTA AVE.
Palo Verde Park
Parkview Unit II
City Limits
MATCH LINE STA. 57+50
MATCH LINE STA. 72+50
ALT 1 ALIGNMENT
60" ALT 1A
66" ALT 1B
60" ALT 1A & 1B
PROTECT 12" ELECT. CASING
WESTERN CANAL LATERAL 9.5
MID. SEC. LINE
SRP R/W
ALT 2 ALIGNMENT
66"
ALT 3 ALIGNMENT
66"
PROTECT 230 KV TOWER
PROTECT 230 KV TOWER
SRP EASEMENT
35'
Woodglen Unit
PLAN
CITY OF CHANDLER
HORIZ. 1"=50'
VERT. 1"=5'
15" PIPE
GND @ ALT 1
ELEC
MH
HGL 1A +5'
CANAL BOTTOM
HGL 1B +5'
S=0.00125
TOP OF PIPE ALT 1B
ALT 1 PROFILE
60" 1A
66" 1B
60"
S=0.00102
TOP OF PIPE ALT 1A
GND @ ALT 2
CANAL BOTTOM
HGL
S=0.00115
TOP OF PIPE
JACKED PIPE
ALT 2 PROFILE
GND @ ALT 3
HGL
TOP OF PIPE
S=0.00102
ALT 3 PROFILE
1200
1195
1190
1185
58 59 60 61 62 63 64 65 66 67 68 69 70 71 72
EAST BRANCH
ALT 1A, 1B, 2, & 3
EXHIBIT 5-E
KENNEY AERIAL MAPPING INC.
PLATE 1 SINGLE PLAN - PROFILE - DOTTED

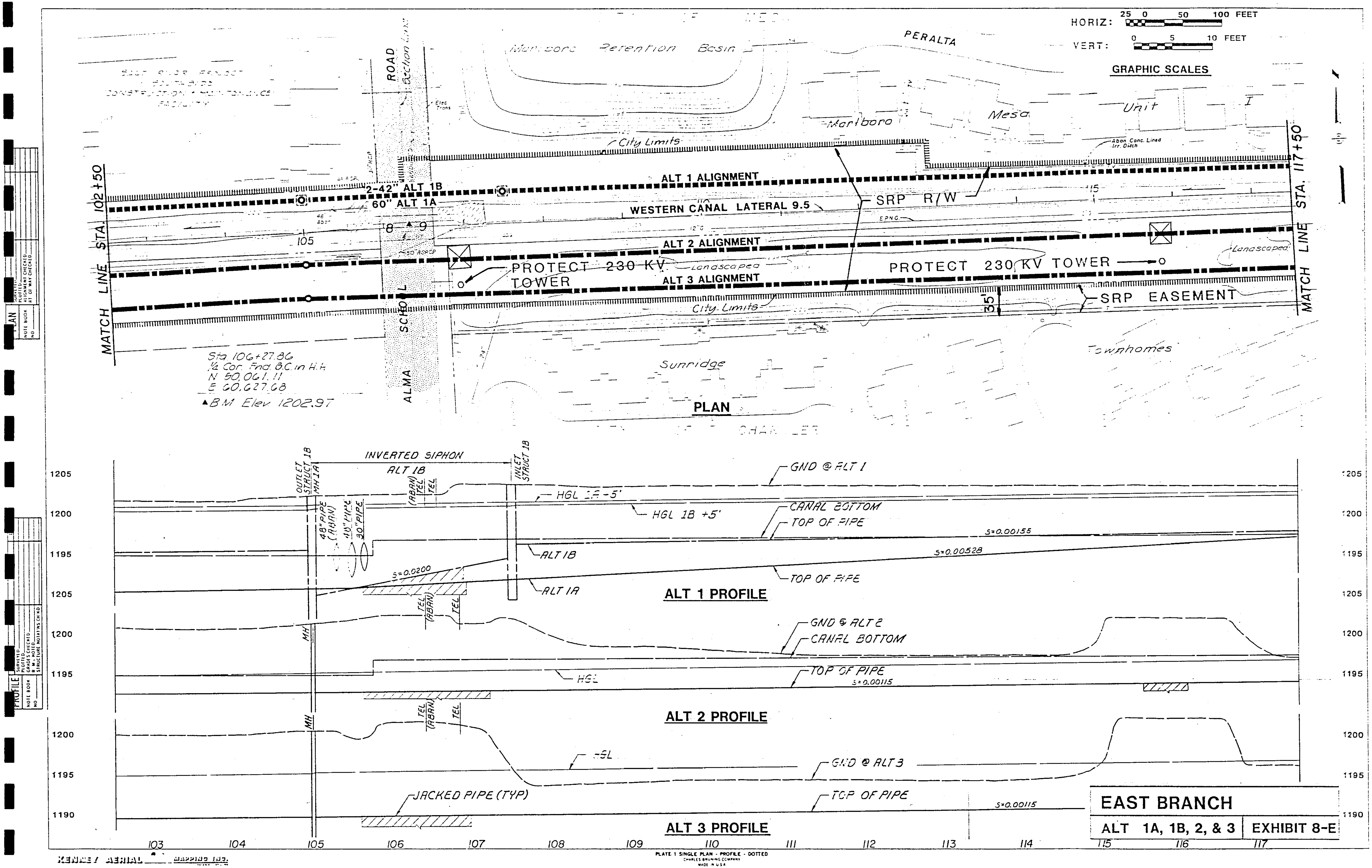


EAST BRANCH

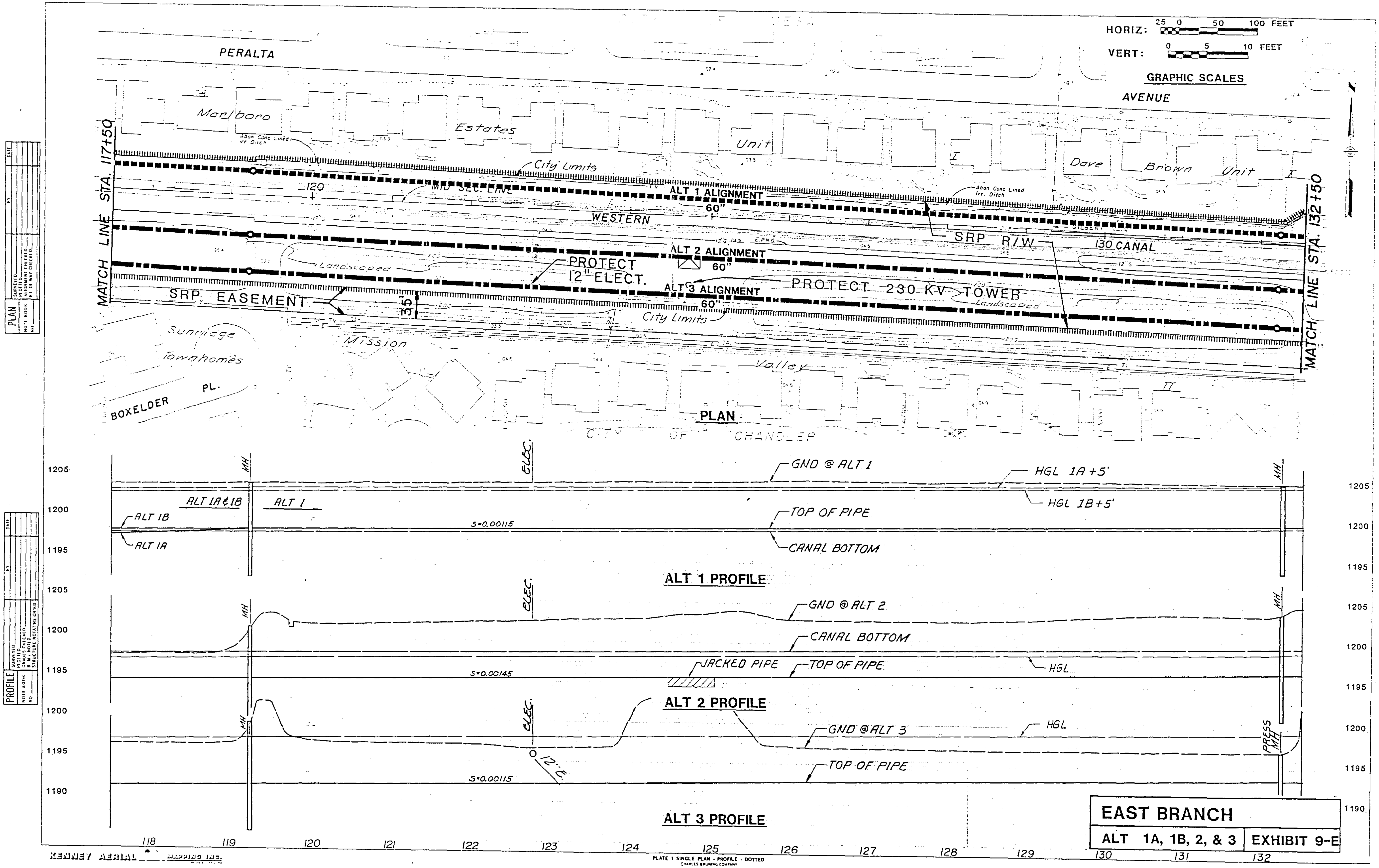
ALT 1A, 1B, 2, & 3 | EXHIBIT 6-E



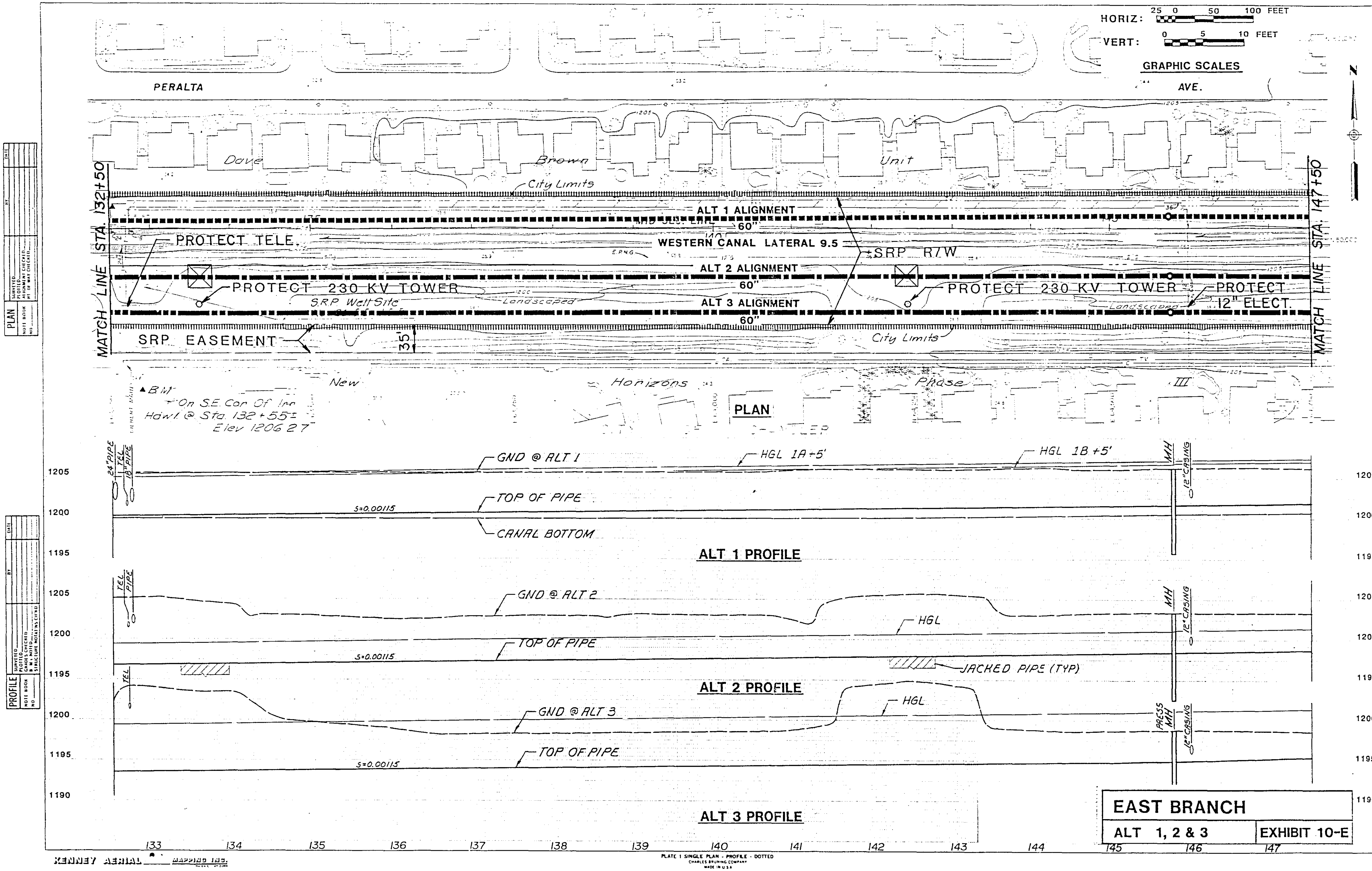
CITY OF MESA
HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
PERALTA AVE.
SALT RIVER PROJECT SOUTHSIDE CONSTRUCTION & MAINTENANCE FACILITY
North Forty Unit III
48" RGRCP
S.R.P. Wellsite No. 26E-1.5S
City Limits
MATCH LINE STA. 87+50
MATCH LINE STA. 102+50
ALT 1 ALIGNMENT
60"
90
MID SEC. LINE
WESTERN CANAL LATERAL 9.5
SRP R/W
100
ALT 2 ALIGNMENT
60"
PROTECT 230 KV TOWER
PROTECT 230 KV TOWER
ALT 3 ALIGNMENT
60"
City Limits
SRP EASEMENT
35
Parkwood Estates
PLAN
CITY OF CHANDLER
MH
24" PIPE (ABAN)
18" PIPE (ABAN)
18" RCP
GND @ ALT 1
HGL 1B +5'
HGL 1A +5'
CANAL BOTTOM
S=0.00125
TOP OF PIPE ALT 1B
TOP OF PIPE ALT 1A
S=0.00115
ALT 1 PROFILE
GND @ ALT 2
CANAL BOTTOM
HGL
TOP OF PIPE
S=0.00115
JACKED PIPE (TYP)
ALT 2 PROFILE
GND @ ALT 3
PRESS MH
HGL
TOP OF PIPE
S=0.00115
ALT 3 PROFILE
1200
1195
1190
88 89 90 91 92 93 94 95 96 97 98 99 100 101 102
EAST BRANCH
ALT 1A, 1B, 2, & 3
EXHIBIT 7-E
PLAN
PROFILE
KENNEY AERIAL MAPPING INC.



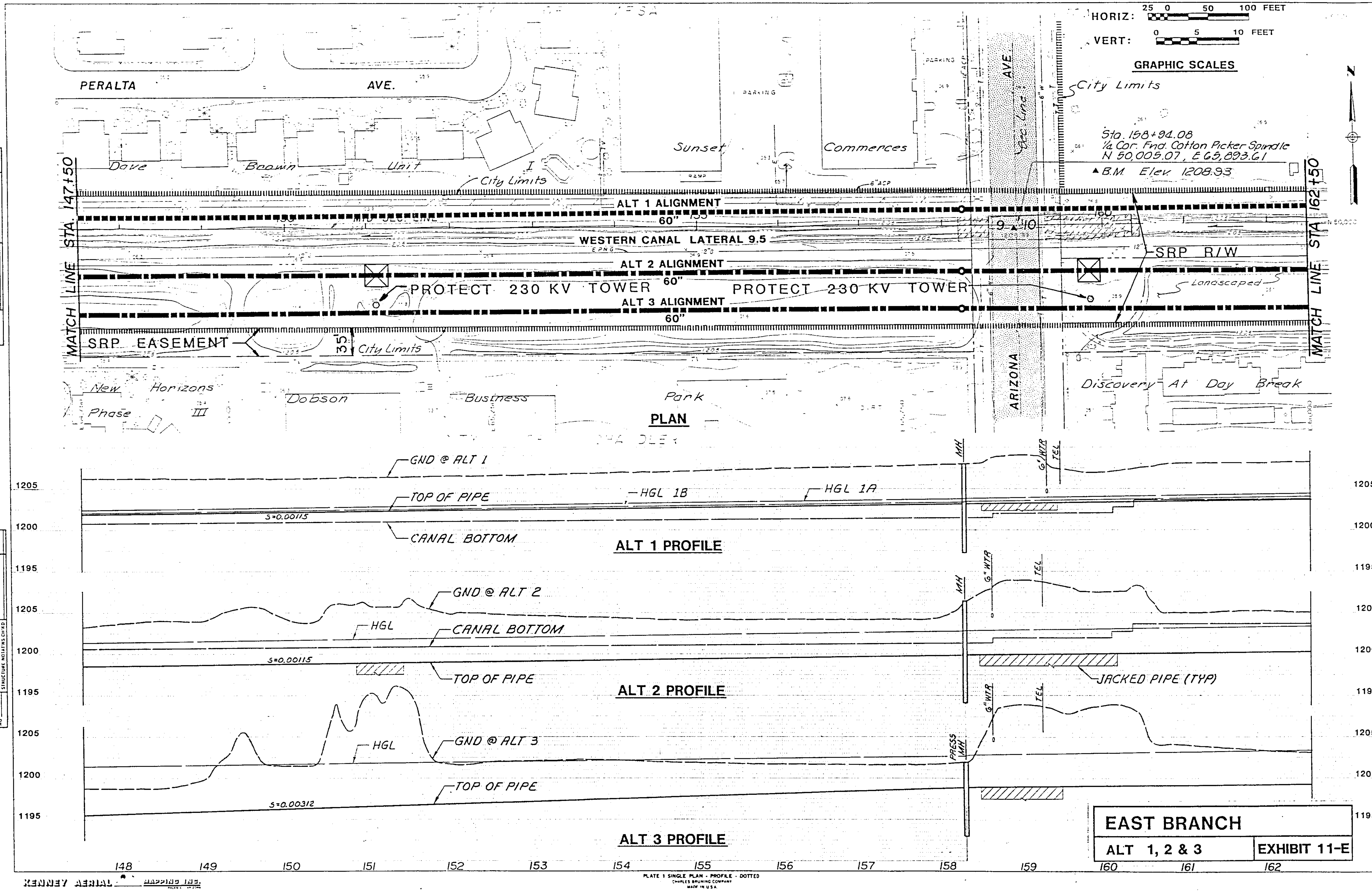
HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
PERALTA
Marlboro Retention Basin
Marlboro Mesa Unit I
City Limits
ALT 1 ALIGNMENT
2-42" ALT 1B
60" ALT 1A
WESTERN CANAL LATERAL 9.5
SRP R/W
ALT 2 ALIGNMENT
PROTECT 230 KV TOWER
PROTECT 230 KV TOWER
ALT 3 ALIGNMENT
SRP EASEMENT
35'
MATCH LINE STA. 102+50
MATCH LINE STA. 117+50
ALMA SCHOOL ROAD
Sta 106+27.86
1/4 Cor. Fnd. B.C. in H.H.
N 50,061.11
E 60,627.68
▲B.M. Elev 1202.97
Sunridge
Townhomes
PLAN
INVERTED SIPHON
ALT 1B
OUTLET STRUCT 1B
INLET STRUCT 1B
MH 1A
GND @ ALT 1
HGL 1A -5'
HGL 1B +5'
CANAL BOTTOM
TOP OF PIPE
ALT 1B
ALT 1A
S=0.00155
S=0.00528
S=0.0200
48" PIPE (ABAN)
30" PIPE
TEL
TOP OF PIPE
ALT 1 PROFILE
GND @ ALT 2
CANAL BOTTOM
HGL
TOP OF PIPE
S=0.00115
ALT 2 PROFILE
MH
GND @ ALT 3
HGL
JACKED PIPE (TYP)
TOP OF PIPE
S=0.00115
ALT 3 PROFILE
1205
1200
1195
1190
103 104 105 106 107 108 109 110 111 112 113 114 115 116 117
EAST BRANCH
ALT 1A, 1B, 2, & 3
EXHIBIT 8-E
KENNEY AERIAL MAPPING INC.
PLATE 1 SINGLE PLAN - PROFILE - DOTTED

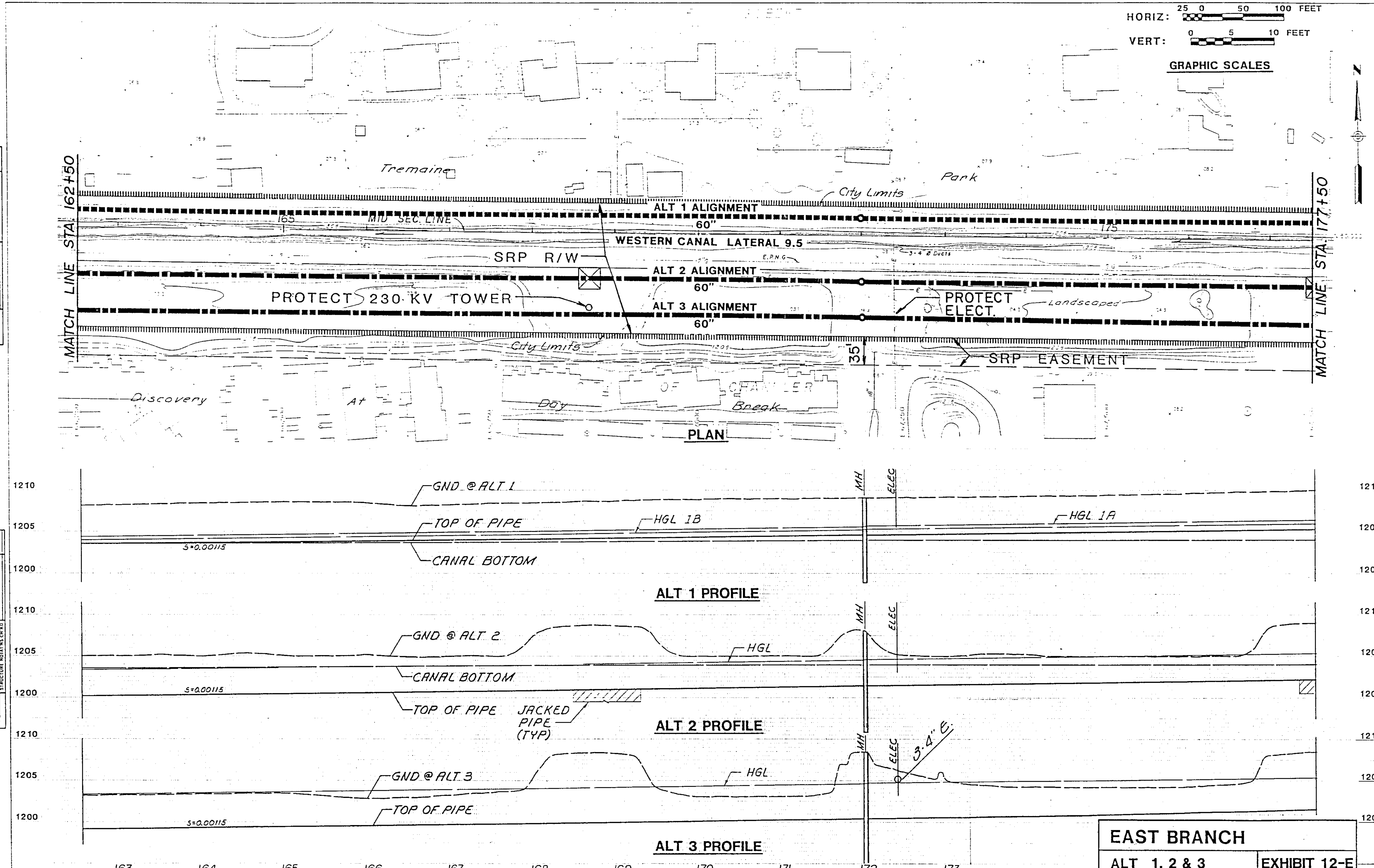


HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
PERALTA
AVENUE
Marlboro Estates Unit I
Dave Brown Unit I
City Limits
MID SEC. LINE
ALT 1 ALIGNMENT
60"
WESTERN
SRP R/W
130 CANAL
ALT 2 ALIGNMENT
60"
PROTECT 12" ELECT.
ALT 3 ALIGNMENT
60"
PROTECT 230 KV TOWER
Landscaped
SRP EASEMENT
35'
City Limits
Sunridge Townhomes
Mission Valley
BOXELDER PL.
MATCH LINE STA. 117+50
MATCH LINE STA. 132+50
PLAN
CITY OF CHANDLER
MH
ELEC.
GND @ ALT 1
HGL 1A +5'
HGL 1B+5'
ALT 1A & 1B
ALT 1
ALT 1B
ALT 1A
S=0.00115
TOP OF PIPE
CANAL BOTTOM
ALT 1 PROFILE
GND @ ALT 2
CANAL BOTTOM
JACKED PIPE
TOP OF PIPE
HGL
S=0.00145
ALT 2 PROFILE
GND @ ALT 3
HGL
12" E.
TOP OF PIPE
S=0.00115
PRESS MH
ALT 3 PROFILE
1205 1200 1195 1205 1200 1195 1200 1195 1190
118 119 120 121 122 123 124 125 126 127 128 129 130 131 132
EAST BRANCH
ALT 1A, 1B, 2, & 3
EXHIBIT 9-E
KENNEY AERIAL MAPPING INC.
PLATE 1 SINGLE PLAN - PROFILE - DOTTED
CHARLES BRUNING COMPANY



HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
PERALTA
AVE.
Dave Brown Unit I
City Limits
MATCH LINE STA. 132+50
MATCH LINE STA. 147+50
ALT 1 ALIGNMENT
60"
WESTERN CANAL LATERAL 9.5
PROTECT TELE.
SRP R/W
ALT 2 ALIGNMENT
PROTECT 230 KV TOWER
PROTECT 12" ELECT.
S.R.P. Well Site
Landscaped
ALT 3 ALIGNMENT
SRP EASEMENT
35'
New Horizons Phase III
PLAN
▲B.M. On S.E. Cor Of Irr Hdwl @ Sta. 132+55± Elev 1206.27
24" PIPE
TEL
18" PIPE
GND @ ALT 1
HGL 1A+5'
HGL 1B+5'
MH
12" CASING
TOP OF PIPE
S=0.00115
CANAL BOTTOM
ALT 1 PROFILE
GND @ ALT 2
HGL
JACKED PIPE (TYP)
ALT 2 PROFILE
GND @ ALT 3
PRESS MH
ALT 3 PROFILE
1205
1200
1195
1190
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
EAST BRANCH
ALT 1, 2 & 3
EXHIBIT 10-E
KENNEY AERIAL MAPPING INC.
PLATE 1 SINGLE PLAN - PROFILE - DOTTED
CHARLES BRUNING COMPANY
MADE IN U.S.A.


HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
PERALTA
AVE.
Dave Brown Unit I
City Limits
Sunset
Commerces
PARKING
AVE.
ARIZONA
Sta. 158+94.08
1/4 Cor. Fnd. Cotton Picker Spindle
N 50,005.07, E 65,893.61
B.M. Elev. 1208.93
MATCH LINE STA. 147+50
MATCH LINE STA. 162+50
ALT 1 ALIGNMENT
60"
WESTERN CANAL LATERAL 9.5
ALT 2 ALIGNMENT
SRP R/W
PROTECT 230 KV TOWER
PROTECT 230 KV TOWER
Landscaped
ALT 3 ALIGNMENT
SRP EASEMENT
35'
New Horizons Phase III
Dobson Business Park
Discovery At Day Break
PLAN
MH
6" WTR
TEL
GND @ ALT 1
TOP OF PIPE
HGL 1B
HGL 1A
S=0.00115
CANAL BOTTOM
ALT 1 PROFILE
GND @ ALT 2
HGL
CANAL BOTTOM
S=0.00115
TOP OF PIPE
JACKED PIPE (TYP)
ALT 2 PROFILE
GND @ ALT 3
HGL
PRESS MH
TOP OF PIPE
S=0.00312
ALT 3 PROFILE
1205
1200
1195
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
EAST BRANCH
ALT 1, 2 & 3
EXHIBIT 11-E
KENNEY AERIAL MAPPING INC.
PLATE 1 SINGLE PLAN - PROFILE - DOTTED
CHARLES BRUNING COMPANY
MADE IN U.S.A.

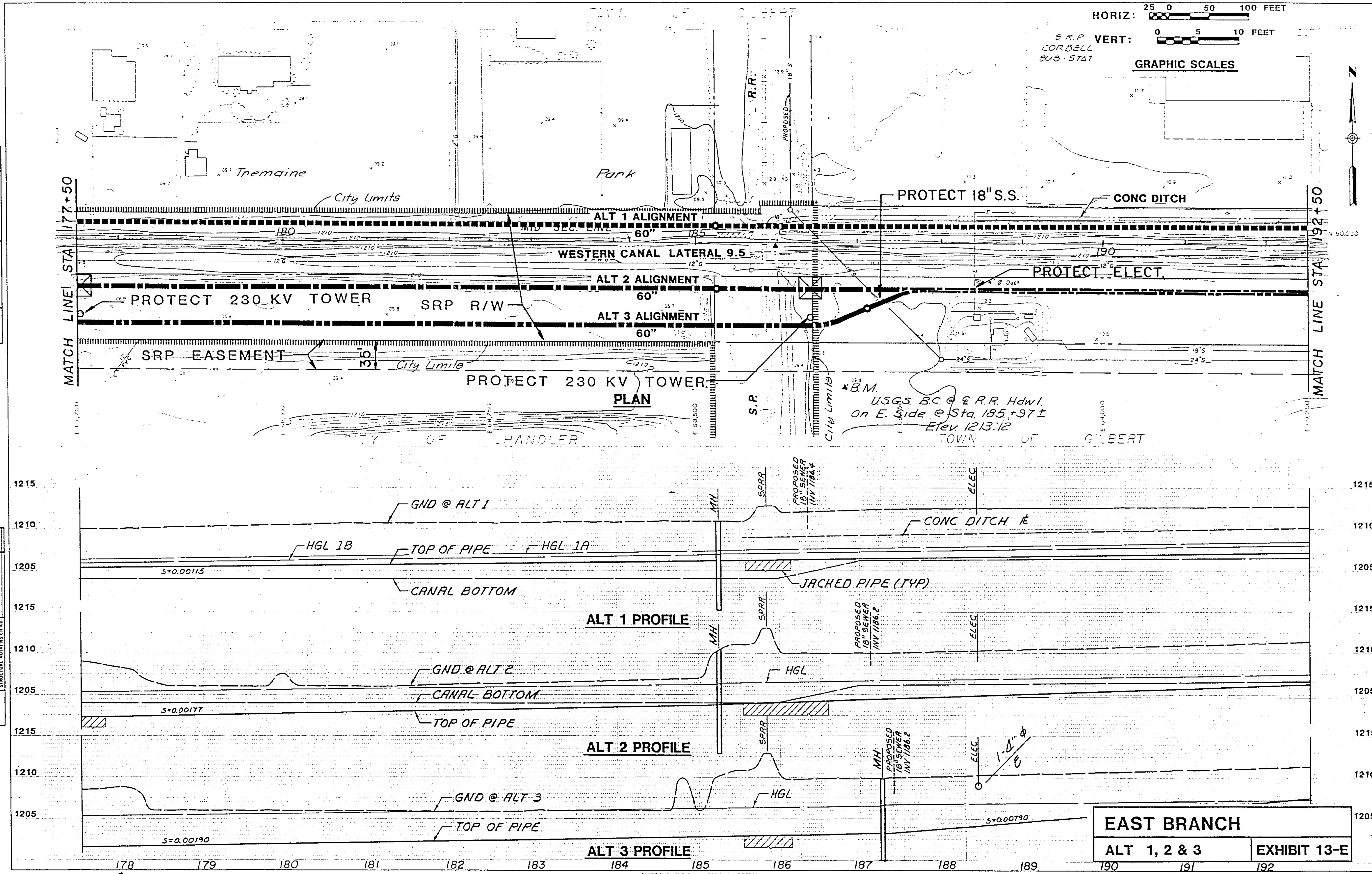


EAST BRANCH

ALT 1, 2 & 3 | EXHIBIT 12-E

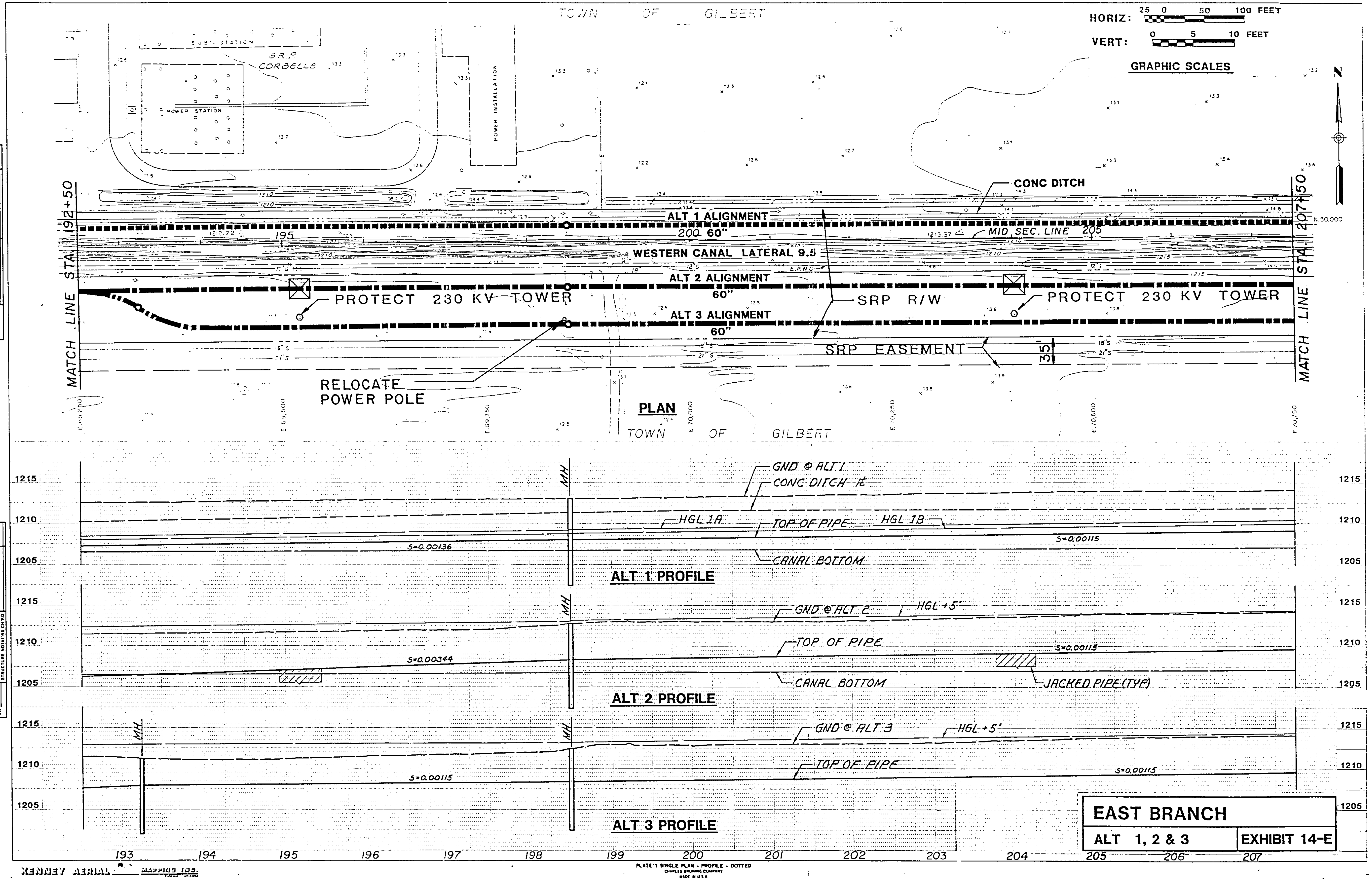
KENNEY AERIAL MAPPING INC.

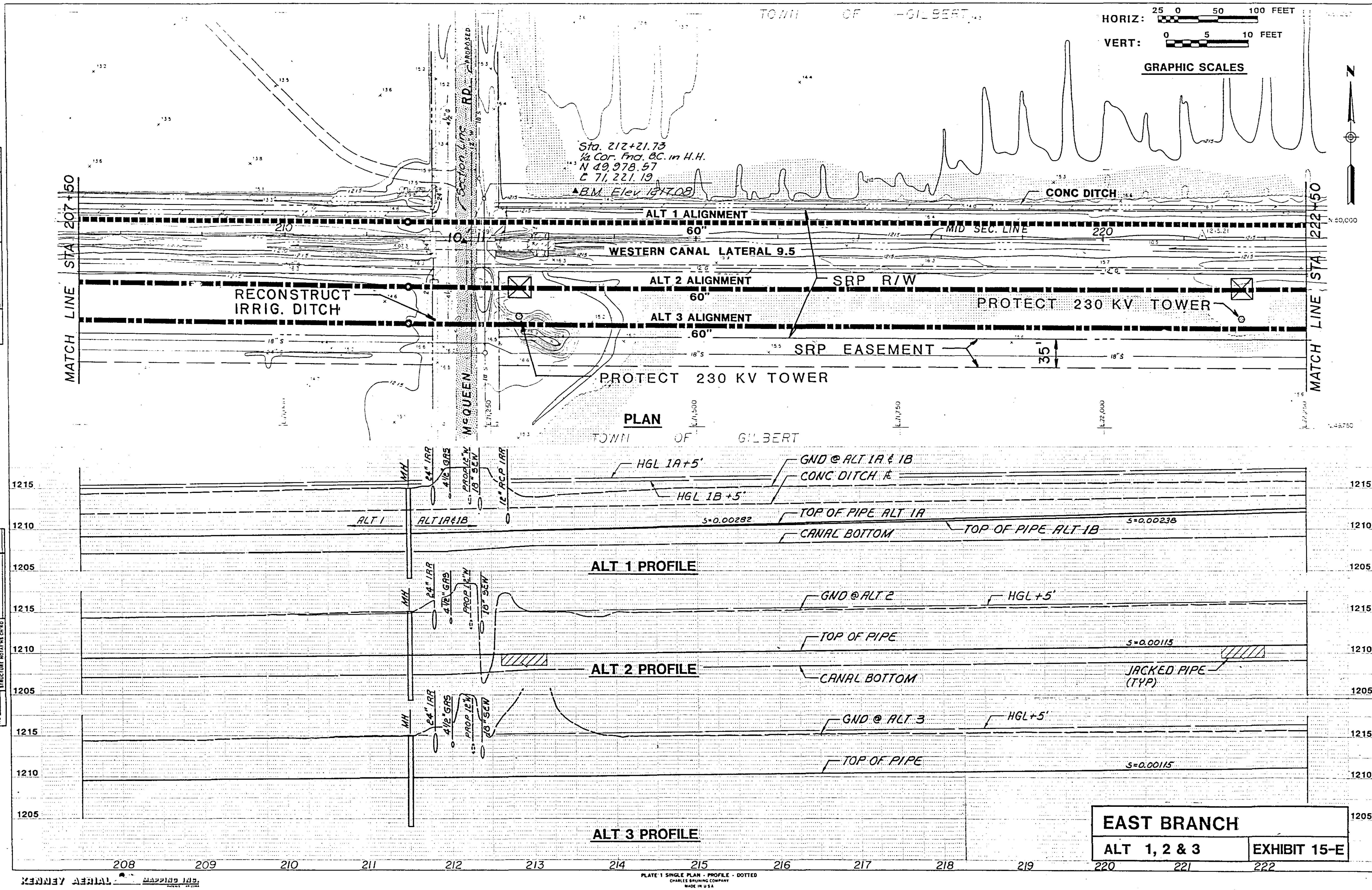
PLATE 1 SINGLE PLAN - PROFILE - DOTTED
CHARLES BRUNING COMPANY
MADE IN U.S.A.



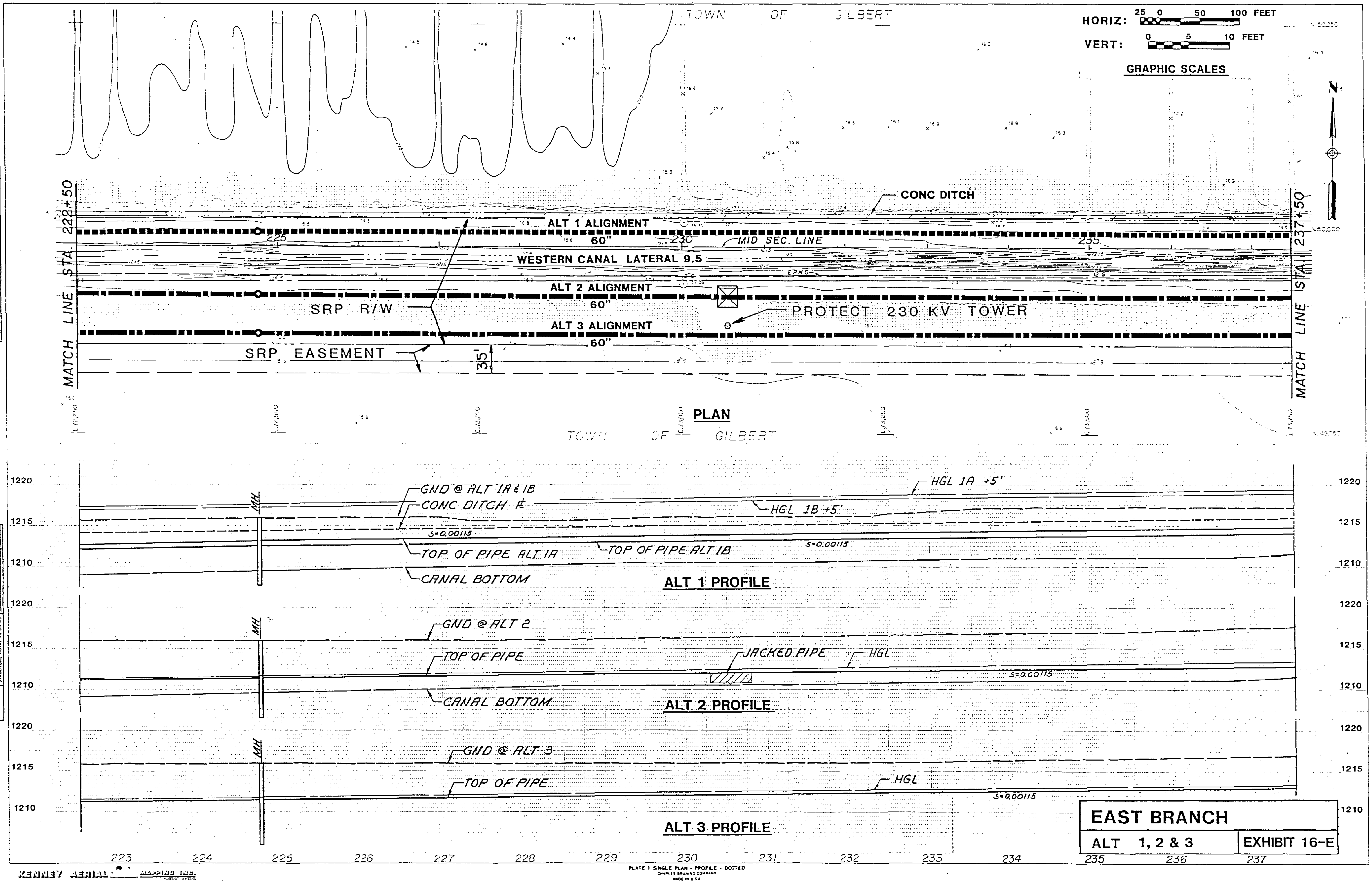
KENNEY AERIAL MAPPING INC.

PLATE 1 SINGLE PLAN - PROFILE - DOTTED
CHARLES BRUNING COMPANY
MADE IN U.S.A.

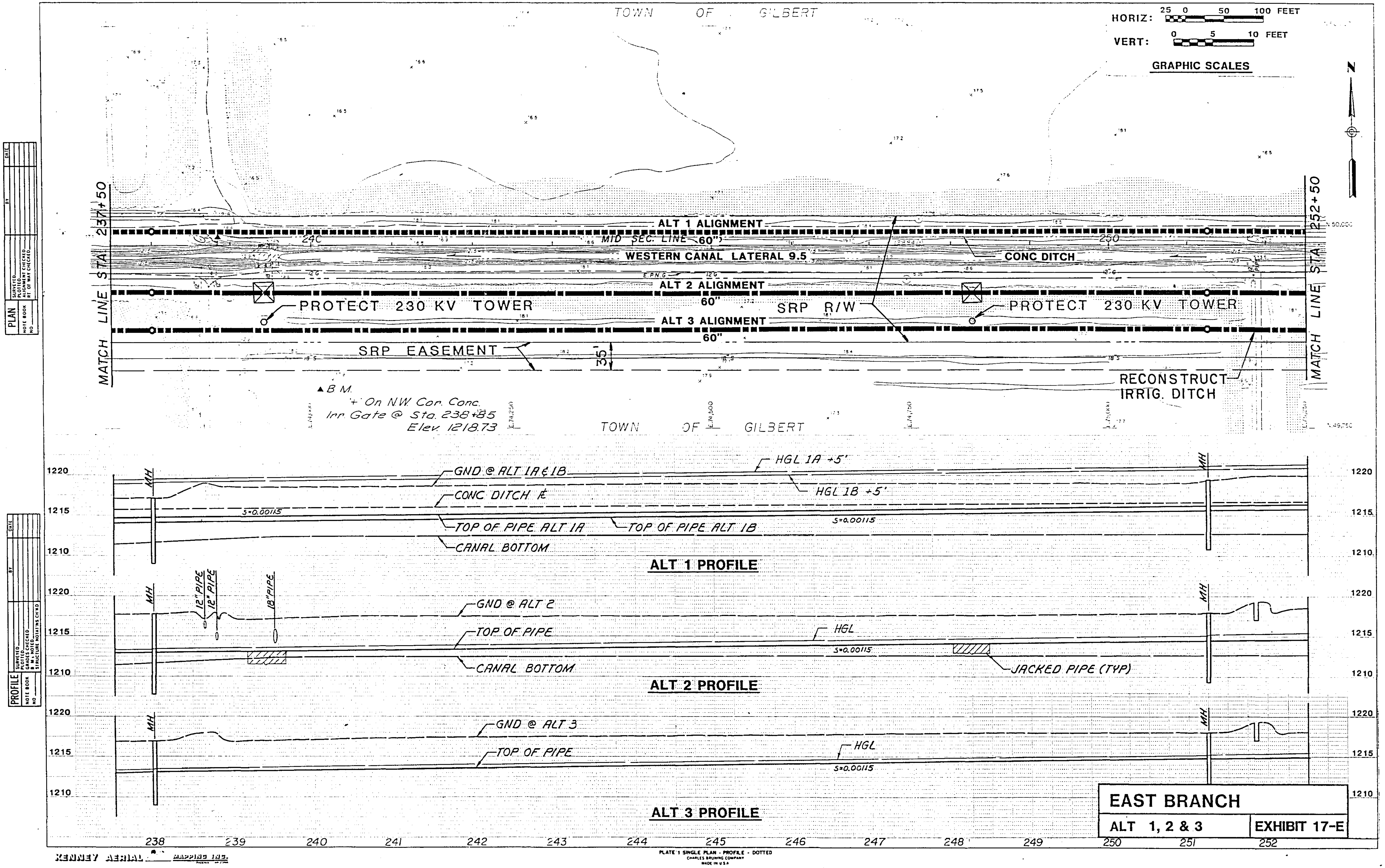

TOWN OF GILBERT
HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
S.R.P. CORBELLE
POWER STATION
POWER INSTALLATION
CONC DITCH
ALT 1 ALIGNMENT
200 60"
MID SEC. LINE 205
WESTERN CANAL LATERAL 9.5
ALT 2 ALIGNMENT
60"
PROTECT 230 KV TOWER
SRP R/W
PROTECT 230 KV TOWER
ALT 3 ALIGNMENT
60"
SRP EASEMENT
35'
RELOCATE POWER POLE
MATCH LINE STA. 192+50
MATCH LINE STA. 207+50
PLAN
TOWN OF GILBERT
GND @ ALT 1
CONC DITCH ℄
HGL 1A
TOP OF PIPE
HGL 1B
S=0.00136
S=0.00115
CANAL BOTTOM
MH
ALT 1 PROFILE
GND @ ALT 2
HGL +5'
TOP OF PIPE
S=0.00344
S=0.00115
CANAL BOTTOM
JACKED PIPE (TYP)
ALT 2 PROFILE
GND @ ALT 3
HGL +5'
TOP OF PIPE
S=0.00115
S=0.00115
ALT 3 PROFILE
1215
1210
1205
193 194 195 196 197 198 199 200 201 202 203 204 205 206 207
EAST BRANCH
ALT 1, 2 & 3
EXHIBIT 14-E
KENNEY AERIAL MAPPING INC.

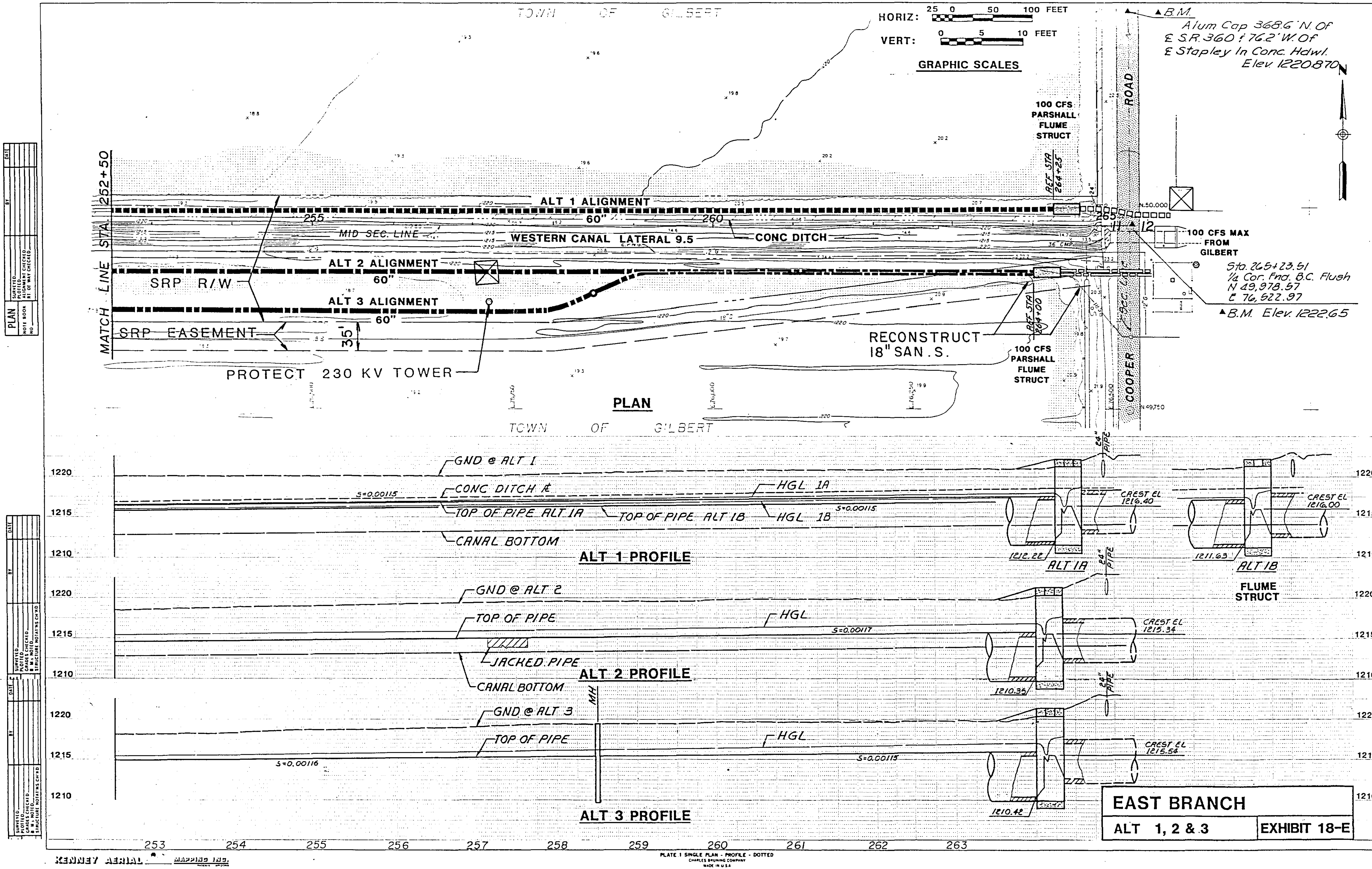


TOWN OF GILBERT
HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
N
Sta. 212+21.73
1/4 Cor. Fnd. BC. in H.H.
N 49,978.57
E 71,221.19
B.M. Elev 1217.08
Section Line
McQUEEN RD.
CONC DITCH
ALT 1 ALIGNMENT
60"
MID SEC. LINE
WESTERN CANAL LATERAL 9.5
ALT 2 ALIGNMENT
SRP R/W
RECONSTRUCT IRRIG. DITCH
PROTECT 230 KV TOWER
ALT 3 ALIGNMENT
SRP EASEMENT
35'
MATCH LINE STA 207+50
MATCH LINE STA 222+50
PLAN
HGL 1A+5'
GND @ ALT 1A & 1B
CONC DITCH ℄
HGL 1B+5'
TOP OF PIPE ALT 1A
TOP OF PIPE ALT 1B
CANAL BOTTOM
ALT 1
ALT 1A&1B
S=0.00282
S=0.00238
24" IRR
4 1/2" GAS
PROP 12"W
18" SEW
12" RCP IRR
MH
ALT 1 PROFILE
GND @ ALT 2
HGL+5'
TOP OF PIPE
S=0.00115
ALT 2 PROFILE
CANAL BOTTOM
JACKED PIPE (TYP)
GND @ ALT 3
HGL+5'
TOP OF PIPE
S=0.00115
ALT 3 PROFILE
1215
1210
1205
208 209 210 211 212 213 214 215 216 217 218 219 220 221 222
EAST BRANCH
ALT 1, 2 & 3
EXHIBIT 15-E
KENNEY AERIAL MAPPING INC.
PLAN
PROFILE



TOWN OF GILBERT
HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
CONC DITCH
ALT 1 ALIGNMENT
60"
MID SEC. LINE
WESTERN CANAL LATERAL 9.5
ALT 2 ALIGNMENT
60"
SRP R/W
PROTECT 230 KV TOWER
ALT 3 ALIGNMENT
60"
SRP EASEMENT
35'
MATCH LINE STA. 222+50
MATCH LINE STA. 237+50
PLAN
TOWN OF GILBERT
GND @ ALT 1A & 1B
CONC DITCH ℄
HGL 1A +5'
HGL 1B +5'
S=0.00115
TOP OF PIPE ALT 1A
TOP OF PIPE ALT 1B
CANAL BOTTOM
ALT 1 PROFILE
GND @ ALT 2
TOP OF PIPE
JACKED PIPE
HGL
S=0.00115
CANAL BOTTOM
ALT 2 PROFILE
GND @ ALT 3
TOP OF PIPE
HGL
S=0.00115
ALT 3 PROFILE
MH
1220
1215
1210
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
EAST BRANCH
ALT 1, 2 & 3
EXHIBIT 16-E
KENNEY AERIAL MAPPING INC.


TOWN OF GILBERT
HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
MATCH LINE STA 237+50
MATCH LINE STA 252+50
ALT 1 ALIGNMENT
MID SEC. LINE
60"
WESTERN CANAL LATERAL 9.5
CONC DITCH
ALT 2 ALIGNMENT
60"
PROTECT 230 KV TOWER
SRP R/W
PROTECT 230 KV TOWER
ALT 3 ALIGNMENT
60"
SRP EASEMENT
35'
RECONSTRUCT IRRIG. DITCH
B.M.
On N.W. Cor. Conc. Irr. Gate @ Sta. 238+85 Elev. 1218.73
TOWN OF GILBERT
MH
GND @ ALT 1A & 1B
HGL 1A +5'
HGL 1B +5'
CONC DITCH ℄
S=0.00115
TOP OF PIPE ALT 1A
TOP OF PIPE ALT 1B
CANAL BOTTOM
ALT 1 PROFILE
12" PIPE
12" PIPE
18" PIPE
GND @ ALT 2
TOP OF PIPE
HGL
CANAL BOTTOM
JACKED PIPE (TYP)
ALT 2 PROFILE
GND @ ALT 3
TOP OF PIPE
HGL
S=0.00115
ALT 3 PROFILE
1220
1215
1210
238 239 240 241 242 243 244 245 246 247 248 249 250 251 252
EAST BRANCH
ALT 1, 2 & 3
EXHIBIT 17-E
PLAN
PROFILE
KENNEY AERIAL MAPPING INC.
PLATE 1 SINGLE PLAN - PROFILE - DOTTED
CHARLES BRUNING COMPANY



TOWN OF GILBERT
HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
B.M.
Alum Cap 368.6' N. Of
℄ S.R. 360 & 76.2' W. Of
℄ Stapley In Conc. Hdwl.
Elev 1220.870
100 CFS PARSHALL FLUME STRUCT
REF. STA 264+25
ROAD
ALT 1 ALIGNMENT
60"
MID SEC. LINE
WESTERN CANAL LATERAL 9.5
CONC DITCH
100 CFS MAX FROM GILBERT
ALT 2 ALIGNMENT
SRP R/W
ALT 3 ALIGNMENT
Sta. 265+23.51
1/4 Cor. Fnd. B.C. Flush
N 49,978.57
E 76,922.97
B.M. Elev. 1222.65
MATCH LINE STA. 252+50
SRP EASEMENT
35'
RECONSTRUCT 18" SAN. S.
REF STA 264+00
COOPER
PROTECT 230 KV TOWER
PLAN
GND @ ALT 1
CONC DITCH ℄
HGL 1A
S=0.00115
TOP OF PIPE ALT 1A
TOP OF PIPE ALT 1B
HGL 1B
CANAL BOTTOM
CREST EL 1216.40
CREST EL 1216.00
1212.22
ALT 1A
1211.63
ALT 1B
ALT 1 PROFILE
24" PIPE
FLUME STRUCT
GND @ ALT 2
TOP OF PIPE
HGL
S=0.00117
JACKED PIPE
CANAL BOTTOM
CREST EL 1215.34
1210.35
ALT 2 PROFILE
GND @ ALT 3
MH
TOP OF PIPE
HGL
S=0.00116
S=0.00115
CREST EL 1215.54
1210.42
ALT 3 PROFILE
1220
1215
1210
253 254 255 256 257 258 259 260 261 262 263
EAST BRANCH
ALT 1, 2 & 3
EXHIBIT 18-E
KENNEY AERIAL MAPPING INC.
PLATE 1 SINGLE PLAN - PROFILE - DOTTED
CHARLES BRUNING COMPANY
MADE IN U.S.A.

APPENDIX E

TABLES

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 1-E)
TABLE 1-E

STORM DRAIN (RCP)

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)	UNIT COST	ALTERNATIVE 1A	1B	2	3
1A	1050	66	2000	VERTICAL	18.7	$236/LF	247,800			
1B	1050	"	1350	"	17.7	$218/LF		228,900		
2	850	"	1350	OPEN CUT	N/A	$165/LF			140,250	
2	54	"	1350	JACKED	"	$965/LF			52,110	
2	140	"	2000	OPEN CUT	"	$180/LF			25,200	
2	60	"	2000	JACKED	"	$980/LF			58,800	
3	1000	"	1350	OPEN CUT	"	$155/LF				155,000
3	56	"	1350	JACKED	"	$955/LF				53,480
3	150	"	2000	OPEN CUT	"	$180/LF				27,000

JUNCTION STRUCTURE

ALT	EACH	DEPTH (FT)	UNIT COST	1A	1B	2	3
1A	1	20	$20,000/EA	20,000			
1B	1	18	$19,000/EA		19,000		
2	1	19	$20,000/EA			20,000	
3	1	21	$21,000/EA				21,000

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	1A	1B	2	3
1A	12.0	1050	7,061	$10/CY	70,613			
1B	9.0	1050	6,684	$10/CY		66,837		
2	8.0	1050	4,425	$7/CY			30,978	
3	5.0	900	2,201					
3	11.0	475	3,001					
			5,202	$7/CY				36,412

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 1-E)
TABLE 1-E (CONTINUED)

MISCELLANEOUS

ALT	QTY	UNIT	DESCRIPTION		ALTERNATIVE 1A	1B	2	3
1A	5	EA	POWER POLE BRACING	$1,000/EA	5,000			
1B	5	EA	POWER POLE BRACING	$1,000/EA		5,000		
1A	2	EA	PROTECT 12"DRN & 12" ELEC CASING	$450/EA	900			
1B	2	EA	PROTECT 12"DRN & 12" ELEC CASING	$450/EA		900		
2	990	LF	LANDSCAPE RESTORATION	$15/LF			14,850	
3	1	EA	230 KV TOWER PROTECTION	$23,000/EA				23,000
3	140	LF	RECONSTRUCT 15" DRAIN	$40/LF				5,600
3	1000	LF	LANDSCAPE RESTORATION	$15/LF				15,000
ALL	1050	LF	R/W ACQUISITION	$0/LF	0	0	0	0
				SUBTOTAL	344,313	320,637	342,188	336,492
			MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	68,863	64,127	68,438	67,298
				TOTAL	413,176	384,765	410,625	403,791

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 2-E)
TABLE 2-E

STORM DRAIN (RCP)

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)	UNIT COST	ALTERNATIVE 1A	1B	2	3
1A	1375	66	2000	VERTICAL	18.2	$235/LF	323,125			
1A	20	"	3000	"	"	$262/LF	5,240			
1A	105	"	3000	JACKED	N/A	$1,007/LF	105,735			
1B	225	"	1350	VERTICAL	14.7	$209/LF		47,025		
1B	1179	"	2000	"	"	$224/LF		264,096		
1B	96	"	2000	JACKED	N/A	$980/LF		94,080		
2	700	"	1350	OPEN CUT	N/A	$165/LF			115,500	
2	642	"	2000	" "	"	$180/LF			115,560	
2	158	"	2000	JACKED	"	$980/LF			154,840	
3	875	"	1350	OPEN CUT	"	$165/LF				144,375
3	523	"	2000	" "	"	$180/LF				94,140
3	102	"	2000	JACKED	"	$980/LF				99,960

MANHOLES

ALT	EACH	DEPTH (FT)	UNIT COST	1A	1B	2	3
1A	2	19	$3,700/EA	7,400			
1B	2	15	$3,300/EA		6,600		
2	2	15	$3,300/EA			6,600	
3	2	15 (1 PRESSURE)	$3,500/EA				7,000

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	1A	1B	2	3
1A	11.5	1500	9,818	$10/CY	98,179			
1B	8.0	1500	7,930	$10/CY		79,298		
2	8.0	500	2,107					
2	10.0	500	2,790					
2	8.5	500	2,271					
			7,168	$7/CY			50,175	
3	5.0	475	1,162					
3	12.0	475	3,369					
3	5.5	400	1,087					
3	11.0	150	948					
			6,565	$7/CY				45,954

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 2-E)
TABLE 2-E (CONTINUED)

					ALTERNATIVE			
					1A	1B	2	3
MISCELLANEOUS								
ALT	QTY	UNIT	DESCRIPTION					
1A	5	EA	POWER POLE BRACING	$1,000/EA	5,000			
1B	5	EA	POWER POLE BRACING	$1,000/EA		5,000		
1A	1	EA	PROTECT 24" DRAIN	$450/EA	450			
1B	1	EA	PROTECT 24" DRAIN	$450/EA		450		
2	1300	LF	LANDSCAPE RESTORATION	$15/LF			19,500	
2	30	LF	RECONSTRUCT 12" DRAIN & 2 STRUCTS	$65/LF			1,950	
3	1	EA	PROTECT 12" DRAIN	$450/EA				450
3	1320	LF	LANDSCAPE RESTORATION	$15/LF				19,800
3	2	EA	230 KV TOWER PROTECTION	$24,000/EA				48,000
ALL	1500	LF	R/W ACQUISITION	$0/LF	0	0	0	0
				SUBTOTAL	545,129	496,549	464,125	459,679
MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES				20%	109,026	99,310	92,825	91,936
				TOTAL	654,155	595,859	556,950	551,615

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 3-E)
TABLE 3-E

						UNIT COST	ALTERNATIVE 1A	1B	2	3
STORM DRAIN (RCP)										
ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)					
1A	1500	66	3000	VERTICAL	18.7	$263/LF	394,500			
1B	225	"	1350	"	14.7	$209/LF		47,025		
1B	1275	"	2000	"	"	$224/LF		285,600		
2	193	"	1350	OPEN CUT	N/A 2.5*	$165/LF			31,845	
2	57	"	1350	JACKED	"	$965/LF			55,005	
2	1250	"	2000	OPEN CUT	"	$180/LF			225,000	
3	1500	"	2000	" "	" 0*	$180/LF				270,000
				* DIST FROM CLAYEY SAND-TOP PIPE (FT)						
MANHOLES										
ALT	EACH		DEPTH (FT)							
1A	1		18			$3,600/EA	3,600			
1B	1		14			$3,200/EA		3,200		
2	1		15			$3,300/EA			3,300	
3	1		17			$3,500/EA				3,500
EARTHWORK										
ALT	AVERAGE COVER (FT)		LENGTH (FT)	CUBIC YDS EXCAVATION						
1A	12.0		1500	10,088		$10/CY	100,876			
1B	8.0		1500	7,930		$10/CY		79,298		
2	9.0		1443	14,381		$7/CY			100,666	
3	11.0		1500	15,292		$7/CY				107,042
MISCELLANEOUS										
ALT	QTY UNIT		DESCRIPTION							
1A	5 EA		POWER POLE BRACING			$1,000/EA	5,000			
1B	5 EA		POWER POLE BRACING			$1,000/EA		5,000		
3	1 EA		230 KV TOWER PROTECTION			$24,000/EA				24,000
ALL	1500 LF		R/W ACQUISITION			$0/LF	0	0	0	0
						SUBTOTAL	503,976	420,123	415,816	404,542
MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES						20%	100,795	84,025	83,163	80,908
						TOTAL	604,771	504,148	498,979	485,450

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 4-E)
TABLE 4-E

STORM DRAIN (RCP)

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)		UNIT COST	ALTERNATIVE 1A	ALTERNATIVE 1B	ALTERNATIVE 2	ALTERNATIVE 3
1A	375	60	3000	VERTICAL	18.5		$190/LF	71,250			
1A	1000	66	2000	"	"		$236/LF	236,000			
1A	125	"	2000	JACKED	N/A		$980/LF	122,500			
1B	975	"	1350	VERTICAL	14.2		$208/LF		202,800		
1B	409	"	2000	"	"		$223/LF		91,207		
1B	116	"	2000	JACKED	N/A		$980/LF		113,680		
2	325	"	1350	OPEN CUT	N/A	3*	$165/LF			53,625	
2	961	"	2000	" "	"		$180/LF			172,980	
2	214	"	2000	JACKED	"		$980/LF			209,720	
3	350	66	1350	OPEN CUT	"	0*	$165/LF				57,750
3	1024	"	2000	" "	"		$180/LF				184,320
3	126	"	2000	JACKED	"		$980/LF				123,480

* DIST FROM CLAYEY SAND-TOP PIPE(FT)

MANHOLES

ALT	EACH	DEPTH (FT)	UNIT COST	1A	1B	2	3
1A	1	20	$3,800/EA	3,800			
1B	1	15	$3,300/EA		3,300		
2	1	17	$3,500/EA			3,500	
3	1	20	$3,800/EA				3,800

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	1A	1B	2	3
1A	14.0	375	2,343					
1A	11.0	1000	6,653					
			8,996	$10/CY	89,965			
1B	8.5	409	1,962					
1B	7.0	975	4,979					
			6,941	$10/CY		69,408		
2	9.0	986	10,255					
2	7.0	975	7,923					
			18,179	$7/CY			127,250	

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 4-E)
TABLE 4-E (CONTINUED)

					1A	1B	2	3
3	11.0	1049	10,102					
3	11.0	250	2,408					
			12,509	$7/CY				87,566

MISCELLANEOUS

ALT	QTY UNIT	DESCRIPTION		1A	1B	2	3
1A	5 EA	POWER POLE BRACING	$1,000/EA	5,000			
1B	5 EA	POWER POLE BRACING	$1,000/EA		5,000		
1A	1 EA	PROTECT 24" DRAIN	$450/EA	450			
1B	1 EA	PROTECT 24" DRAIN	$450/EA		450		
1A	1 EA	PROTECT 12" ELECT CASING	$450/EA	450			
1B	1 EA	PROTECT 12" ELECT CASING	$450/EA		450		
2	350 LF	LANDSCAPE RESTORATION	$15/LF			5,250	
2	1 EA	PROTECT 12" ELECT CASING	$450/EA			450	
3	1 EA	PROTECT 12" ELECT CASING	$450/EA				450
3	350 LF	LANDSCAPE RESTORATION	$15/LF				5,250
3	2 EA	230 KV TOWER PROTECTION	$23,000/EA				46,000
ALL	1500 LF	R/W ACQUISITION	$0/LF	0	0	0	0
			SUBTOTAL	529,415	486,295	572,775	508,616
		MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	105,883	97,259	114,555	101,723
			TOTAL	635,298	583,554	687,331	610,339

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 5-E)
TABLE 5-E

STORM DRAIN (RCP)

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)		UNIT COST	ALTERNATIVE 1A	ALTERNATIVE 1B	ALTERNATIVE 2	ALTERNATIVE 3
1A	1150	60	2000	VERTICAL	19.3		$190/LF	218,500			
1A	350	"	3000	"	"		$193/LF	67,550			
1B	600	"	1350	"	14.3		$167/LF		100,200		
1B	900	66	2000	"	"		$223/LF		200,700		
2	1200	"	1350	OPEN CUT	N/A	2.5*	$165/LF			198,000	
2	181	"	2000	" "	"		$180/LF			32,580	
2	119	"	2000	JACKED	"		$980/LF			116,620	
3	350	66	1000	OPEN CUT	"	0*	$155/LF				54,250
3	625	"	1350	" "	"		$165/LF				103,125
3	525	"	2000	" "	"		$180/LF				94,500

* DIST FROM CLAYEY SAND/SANDY CLAY-TOP PIPE (FT)

MANHOLES

ALT	EACH	DEPTH (FT)	UNIT COST	1A	1B	2	3
1A	1	19	$3,700	3,700			
1B	1	14	$3,200		3,200		
2	1	13	$3,100			3,100	
3	1	11	$2,900				2,900

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	1A	1B	2	3
1A	13.0	1500	9,779	$10/CY	97,787			
1B	8.0	600	3,086					
1B	8.0	900	4,628					
			7,714	$10/CY		77,141		
2	7.5	1500	11,699	$7/CY			81,896	
3	6.0	325	1,618					
3	10.5	150	1,362					
3	5.0	725	3,096					
3	11.0	300	2,889					
			8,965	$7/CY				62,754

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 5-E)
TABLE 5-E (CONTINUED)

MISCELLANEOUS

ALT	QTY	UNIT	DESCRIPTION	UNIT COST	ALTERNATIVE 1A	ALTERNATIVE 1B	ALTERNATIVE 2	ALTERNATIVE 3
1A	6	EA	POWER POLE BRACING	$1,000/EA	6,000			
1B	6	EA	POWER POLE BRACING	$1,000/EA		6,000		
1A	2	EA	PROTECT 15" DRN & 12" ELECT CASING	$450/EA	900			
1B	2	EA	PROTECT 15" DRN & 12" ELECT CASING	$450/EA		900		
2	1100	LF	LANDSCAPE RESTORATION	$15/LF			16,500	
2	1	EA	PROTECT 12" ELECT CASING	$450/EA			450	
3	1	EA	PROTECT 12" ELECT CASING	$450/EA				450
3	2	EA	230 KV TOWER PROTECTION	$24,000/EA				48,000
3	1200	LF	LANDSCAPE RESTORATION	$15/LF				18,000
ALL	1500	LF	R/W ACQUISITION	$0/LF	0	0	0	0
				SUBTOTAL	394,437	388,141	449,146	383,979
			MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINSTRATION & CONTINGENCIES	20%	78,887	77,628	89,829	76,796
				TOTAL	473,324	465,769	538,975	460,775

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 6-E)
TABLE 6-E

STORM DRAIN (RCP)

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)		UNIT COST	ALTERNATIVE 1A	ALTERNATIVE 1B	ALTERNATIVE 2	ALTERNATIVE 3
1A	1500	60	2000	VERTICAL	18.1		$186/LF	279,000			
1B	1150	"	1350	"	13.6		$165/LF		189,750		
1B	350	"	2000	"	"		$173/LF		60,550		
2	550	"	1350	OPEN CUT	N/A	4*	$124/LF			68,200	
2	634	"	2000	" "	"		$132/LF			83,688	
2	66	"	2000	JACKED	"		$882/LF			59,094	
2	250	66	2000	OPEN CUT	"		$180/LF			45,000	
3	75	60	1350	" "	"	1*	$124/LF				9,300
3	1175	"	2000	" "	"		$132/LF				155,100
3	250	66	2000	" "	"		$180/LF				45,000

* DIST FROM CLAYEY SAND-TOP PIPE (FT)

MANHOLES

ALT	EACH	DEPTH (FT)	UNIT COST	1A	1B	2	3
1A	1	18	$3,300/EA	3,300			
1B	1	13	$2,800/EA		2,800		
2	1	15	$3,300/EA			3,300	
3	1	17	$3,500/EA				3,500

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	1A	1B	2	3
1A	12.0	1500	9,171	$10/CY	91,707			
1B	7.5	1500	6,891	$10/CY		68,907		
2	8.5	1440	14,665					
2	8.0	250	2,395					
			17,059	$7/CY			119,416	
3	10.0	1250	11,662					
3	11.0	250	2,762					
			14,423	$7/CY				100,962

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 6-E)
TABLE 6-E (CONTINUED)

MISCELLANEOUS

ALT	QTY	UNIT	DESCRIPTION		ALTERNATIVE 1A	1B	2	3
1A	7	EA	POWER POLE BRACING	$1,000/EA	7,000			
1B	7	EA	POWER POLE BRACING	$1,000/EA		7,000		
1A	2	EA	PROTECT 24" DRN & 3-4" ELECT DUCTS	$600/EA	1,200			
1B	2	EA	PROTECT 24" DRN & 3-4" ELECT DUCTS	$600/EA		1,200		
2	1	EA	PROTECT 3-4" ELECT DUCTS	$600/EA			600	
2	300	LF	RECONSTRUCT 5'WIDE CONC IRRIG DITCH	$10/LF			3,000	
2	275	LF	RECONSTRUCT 18" RCP + IRRIG STRUCT	$40/LF			11,000	
3	2	EA	PROTECT 18" DRN & 3-4" ELECT DUCTS	$600/EA				1,200
3	1	EA	230 KV TOWER PROTECTION	$23,000/EA				23,000
ALL	1500	LF	R/W ACQUISITION	$0/LF	0	0	0	0
				SUBTOTAL	382,207	330,207	393,298	338,062
			MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATON & CONTINGENCIES	20%	76,441	66,041	78,660	67,612
				TOTAL	458,648	396,248	471,958	405,674

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 7-E)
TABLE 7-E

							UNIT COST	ALTERNATIVE 1A	1B	2	3
STORM DRAIN (RCP)											
ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)						
1A	1500	60	2000	VERTICAL	17.6		$185/LF	277,500			
1B	1500	"	1350	"	12.6		$162/LF		243,000		
2	1440	"	1350	OPEN CUT	N/A	2*	$124/LF			178,560	
2	60	"	1350	JACKED	"		$874/LF			52,440	
3	500	"	1000	OPEN CUT	"	1*	$120/LF				60,000
3	325	"	1350	" "	"		$124/LF				40,300
3	675	"	2000	" "	"		$132/LF				89,100

* DIST FROM CLAYEY SAND-TOP PIPE (FT)

			UNIT COST	1A	1B	2	3
MANHOLES							
ALT	EACH	DEPTH (FT)					
1A	1	18	$3,300/EA	3,300			
1B	1	13	$2,800/EA		2,800		
2	1	15	$3,000/EA			3,000	
3	1	12(PRESSURE)	$3,000/EA				3,000

				UNIT COST	1A	1B	2	3
EARTHWORK								
ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION					
1A	11.5	1500	8,917	$10/CY	89,173			
1B	6.5	1500	6,384	$10/CY		63,840		
2	8.5	1440	12,211	$7/CY			85,478	
3	4.5	875	3,775					
3	11.0	625	6,551					
			10,326	$7/CY				72,282

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 7-E)
TABLE 7-E (CONTINUED)

					ALTERNATIVE			
					1A	1B	2	3
MISCELLANEOUS								
ALT	QTY	UNIT	DESCRIPTION					
1A	3	EA	POWER POLE BRACING	$1,000/EA	3,000			
1B	3	EA	POWER POLE BRACING	$1,000/EA		3,000		
1A	2	EA	PROTECT 18" DRAINS	$450/EA	900			
1B	2	EA	PROTECT 18" DRAINS	$450/EA		900		
2	1500	LF	RECONSTRUCT 5' WIDE CONC IRRIG DITCH	$10/LF			15,000	
3	2	EA	230 KV TOWER RELOCATION	$23,000/EA				46,000
ALL	1500	LF	R/W ACQUISITION	$0/LF	0	0	0	0
				SUBTOTAL	373,873	313,540	334,478	310,682
MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES				20%	74,775	62,708	66,896	62,136
				TOTAL	448,648	376,248	401,374	372,818

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 8-E)
TABLE 8-E

STORM DRAIN (RCP)

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)	UNIT COST	ALTERNATIVE 1A	ALTERNATIVE 1B	ALTERNATIVE 2	ALTERNATIVE 3
1A	200	60	1350	BRACED	15.9	$148	29,600			
1A	1170	"	2000	"	"	$156	182,520			
1A	130	"	2000	JACKED	N/A	$882	114,660			
1B	1250	"	1350	BRACED	13.0	$144		180,000		
1B	124	42	2000	"	"	$86		10,664		
1B	126	"	2000	JACKED	N/A	$667		84,042		
1B	124	"	2000	BRACED	13.0	$86		10,664		
1B	126	"	2000	JACKED	N/A	$667		84,042		
2	500	60	1000	OPEN CUT	N/A	$120			60,000	
2	775	"	1350	" "	"	$124			96,100	
2	67	"	2000	" "	"	$132			8,844	
2	158	"	1350	JACKED	"	$874			138,092	
3	700	"	1000	OPEN CUT	"	$120				84,000
3	100	"	1350	" "	"	$124				12,400
3	564	"	2000	" "	"	$132				74,448
3	136	"	2000	JACKED	"	$882				119,952

MANHOLES

ALT	EACH	DEPTH (FT)	UNIT COST	1A	1B	2	3
1A	1	12	$2,700	2,700			
1B	1	14(INLET STRUCT)	$5,800		5,800		
1B	1	18(OUTLET STRUCT)	$6,600		6,600		
2	1	15	$3,000			3,000	
3	1	17	$3,200				3,200

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	1A	1B	2	3
1A	9.5	1070	5,747					
1A	11.0	300	1,611					
			7,358	$10/CY	73,578			
1B	6.5	1250	5,489					
1B	11.0	124	544					
			6,033	$10/CY		60,334		

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 8-E)
TABLE 8-E (CONTINUED)

					ALTERNATIVE 1A	ALTERNATIVE 1B	ALTERNATIVE 2	ALTERNATIVE 3
2	9.0	392	2,386					
2	8.0	175	957					
2	5.0	775	2,968					
			6,311	$7/CY			44,177	
3	4.0	825	2,770					
3	11.0	539	4,009					
			6,780	$7/CY				47,457

MISCELLANEOUS

ALT	QTY	UNIT	DESCRIPTION		1A	1B	2	3
1A	480	LF	RCNSTRCT PARALLEL ELEC-TELE &TV CNDT	$40/LF	19,200			
1B	480	LF	RCNSTRCT PARALLEL ELEC-TELE &TV CNDT	$40/LF		19,200		
1A	6	EA	POWER POLE BRACING	$1,000/EA	6,000			
1B	6	EA	POWER POLE BRACING	$1,000/EA		6,000		
1A	2	EA	PROTECT 30" & 48" DRAINS	$450/EA	900			
1B	2	EA	PROTECT 30" & 48" DRAINS	$450/EA		900		
2	850	LF	LANDSCAPE RESTORATION	$15/LF			12,750	
2	300	LF	RCNSTRCT 5' WIDE CONC IRRIG DITCH	$10/LF			3,000	
3	2	EA	230 KV TOWER PROTECTION	$23,000/EA				46,000
3	900	LF	LANDSCAPE RESTORATION	$15/LF				13,500
ALL	1500	LF	R/W ACQUISITION	$0/LF	0	0	0	0

		1A	1B	2	3
	SUBTOTAL	429,158	468,246	365,963	400,957
MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	85,832	93,649	73,193	80,191
	TOTAL	514,990	561,895	439,156	481,148

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 9-E)
TABLE 9-E

STORM DRAIN (RCP)

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)	UNIT COST	ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
1	1500	60	1350	BRACED	11.9	$142/LF	213,000			
2	150	"	1000	OPEN CUT	N/A	$120/LF			18,000	
2	1291	"	1350	" "	"	$124/LF			160,084	
2	59	"	1350	JACKED	"	$874/LF			51,566	
3	925	"	1000	OPEN CUT	"	$120/LF				111,000
3	375	"	1350	" "	"	$124/LF				46,500
3	200	"	2000	" "	"	$132/LF				26,400

MANHOLES

ALT	EACH	DEPTH (FT)	UNIT COST	ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
1	2	12	$2,700	5,400			
2	2	13	$2,800			5,600	
3	1	12	$2,700				2,700
3	1	12(PRESSURE)	$3,000				3,000

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
1	5.8	1500	6,029	$10/CY	60,293			
2	3.0	175	512					
2	7.0	1266	6,184					
			6,695	$7/CY			46,867	
3	5.5	625	2,550					
3	11.0	116	863					
3	4.0	700	2,350					
			5,763	$7/CY				40,341

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 9-E)
TABLE 9-E (CONTINUED)

MISCELLANEOUS

ALT	QTY	UNIT	DESCRIPTION		ALTERNATIVE 1		2	3
1	6	EA	POWER POLE BRACING	$1,000/EA	6,000			
1	1	EA	PROTECT 12" ELECTRIC	$450/EA	450			
1	200	LF	RCNSTRCT PRLLEL ELEC,TELE & TV CNDTS	$40/LF	8,000			
1	1	EA	PROTECT TEL CONDUIT	$450/EA	450			
2	1	EA	PROTECT 12" ELECTRIC	$450/EA			450	
2	950	LF	LANDSCAPE RESTORATION	$15/LF			14,250	
3	1	EA	PROTECT 12" ELECTRIC	$450/EA				450
3	1	EA	230 KV TOWER RESTORATION	$21,000/EA				21,000
3	1000	LF	LANDSCAPE RESTORATION	$15/LF				15,000
ALL	1500	LF	R/W ACQUISITION	$0/LF	0		0	0
				SUBTOTAL	293,593		296,817	266,391
			MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	58,719		59,363	53,278
				TOTAL	352,312		356,180	319,669

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 10-E)
TABLE 10-E

STORM DRAIN (RCP)

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)	UNIT COST	ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
1	1500	60	1350	BRACED	11.1	$141/LF	211,500			
2	375	"	1000	OPEN CUT	N/A	$120/LF			45,000	
2	920	"	1350	" "	"	$124/LF			114,080	
2	205	"	1350	JACKED	"	$874/LF			179,170	
3	900	"	1000	OPEN CUT	"	$120/LF				108,000
3	275	"	1350	" "	"	$124/LF				34,100
3	325	"	2000	" "	"	$132/LF				42,900

MANHOLES

ALT	EACH	DEPTH (FT)	UNIT COST	ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
1	1	11	$2,600/EA	2,600			
2	1	11	$2,600/EA			2,600	
3	1	10(PRESSURE)	$2,800/EA				2,800

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
1	5.0	1500	5,624	$10/CY	56,240			
2	7.5	400	2,069					
2	5.5	700	2,856					
2	5.0	400	1,532					
			6,456	$7/CY			45,192	
3	10.0	350	2,361					
3	5.5	200	816					
3	4.5	525	1,884					
3	4.0	425	1,427					
			6,488	$7/CY				45,414

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 10-E)
TABLE 10-E (CONTINUED)

MISCELLANEOUS

ALT	QTY	UNIT	DESCRIPTION	UNIT COST	ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
1	1460	LF	PROTECT CONC DITCH	$5/LF	7,300			
1	5	EA	POWER POLE BRACING	$1,000/EA	5,000			
1	1	EA	PROTECT 12" ELEC CASING	$450/EA	450			
1	60	LF	RECONSTRUCT 18" & 24" DRAINS	$55/LF	3,300			
2	1260	LF	LANDSCAPE RESTORATION	$15/LF			18,900	
2	1	EA	PROTECT 12" ELEC CASING	$450/EA			450	
3	1	EA	PROTECT 12" ELEC CASING	$450/EA				450
3	1	EA	PROTECT TELE CONDUIT	$450/EA				450
3	1260	LF	LANDSCAPE RESTORATION	$15/LF				18,900
3	2	EA	230 KV TOWER PROTECTION	$20,000/EA				40,000
ALL	1500	LF	R/W ACQUISITION	$0/LF	0		0	0
				SUBTOTAL	286,390		405,392	293,014
			MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	57,278		81,078	58,603
				TOTAL	343,668		486,470	351,617

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 11-E)
TABLE 11-E

STORM DRAIN (RCP)

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)	UNIT COST	ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
1	1406	60	1350	BRACED	10.6	$140/LF	196,840			
1	94	"	1350	JACKED	N/A	$874/LF	82,156			
2	600	"	1000	OPEN CUT	N/A	$120/LF			72,000	
2	730	"	1350	" "	"	$124/LF			90,520	
2	170	"	1350	JACKED	"	$874/LF			148,580	
3	575	"	1000	OPEN CUT	"	$120/LF				69,000
3	500	"	1350	" "	"	$124/LF				62,000
3	325	"	2000	" "	"	$132/LF				42,900
3	100	"	2000	JACKED	"	$882/LF				88,200

MANHOLES

ALT	EACH	DEPTH (FT)	UNIT COST	ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
1	1	11	$2,600/EA	2,600			
2	1	12	$2,700/EA			2,700	
3	1	9(PRESSURE)	$2,700/EA				2,700

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
1	4.5	1500	5,371	$10/CY	53,707			
2	5.0	775	2,968					
2	7.0	275	1,343					
2	8.0	250	1,367					
2	4.5	200	718					
			6,396	$7/CY			44,771	
3	3.5	500	1,568					
3	7.0	75	366					
3	5.5	75	306					
3	12.0	125	1,021					
3	4.7	325	1,197					
3	10.0	150	1,012					
3	4.5	250	897					
			6,368	$7/CY				44,574

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 11-E)
TABLE 11-E (CONTINUED)

MISCELLANEOUS

ALT	QTY	UNIT	DESCRIPTION		ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
1	1200	LF	PROTECT CONC DITCH	$5/LF	6,000			
1	1	EA	POWER POLE BRACING	$1,000/EA	1,000			
1	1	EA	POWER POLE RELOCATON	$10,000/EA	10,000			
2	500	LF	LANDSCAPE RESTORATION	$15/LF			7,500	
2	200	LF	RECONSTRUCT TELE CONDUIT	$20/EA			4,000	
3	2	EA	230 KV TOWER PROTECTION	$15,000/EA				30,000
3	500	LF	LANDSCAPE RESTORATION	$15/EA				7,500
ALL	1500	LF	R/W ACQUISITION	$0/LF	0		0	0
				SUBTOTAL	352,303		370,071	346,874
			MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	70,461		74,014	69,375
				TOTAL	422,763		444,085	416,248

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 12-E)
TABLE 12-E

STORM DRAIN (RCP)

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)	UNIT COST	ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
1	1500	60	1350	BRACED	10.7	$140/LF	210,000			
2	725	"	1000	OPEN CUT	N/A	$120/LF			87,000	
2	719	"	1350	" "	"	$124/LF			89,156	
2	56	"	1350	JACKED	"	$874/LF			48,944	
3	500	"	1000	OPEN CUT	"	$120/LF				60,000
3	1000	"	1350	" "	"	$124/LF				124,000

MANHOLES

ALT	EACH	DEPTH (FT)	UNIT COST	ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
1	1	10	$2,500/EA	2,500			
2	1	12	$2,700/EA			2,700	
3	1	14	$2,900/EA				2,900

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
1	4.6	1500	5,421	$10/CY	54,213			
2	4.5	525	1,884					
2	7.0	119	581					
2	4.0	200	672					
2	6.0	150	651					
2	3.2	450	1,353					
			5,141	$7/CY			35,987	
3	4.0	550	1,847					
3	8.0	125	683					
3	3.5	575	1,803					
3	7.0	150	733					
3	5.0	100	383					
			5,449	$7/CY				38,142

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 12-E)
TABLE 12-E (CONTINUED)

MISCELLANEOUS

ALT	QTY	UNIT	DESCRIPTION		ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
2	1	EA	PROTECT 3-4" ELEC DUCTS	$700/EA			700	
2	150	LF	RELOCATE 3-4" ELEC DUCTS	$30/LF			4,500	
2	800	LF	RECONSTRUCT TELE CONDUIT & 1 VAULT	$25/LF			20,000	
2	800	LF	LANDSCAPE RESTORATION	$15/LF			12,000	
3	1	EA	PROTECT 3-4" ELEC DUCTS	$700/EA				700
3	1	EA	230 KV TOWER PROTECTION	$16,000/EA				16,000
3	2	EA	PROTECT TELE CONDUIT	$450/EA				900
3	1000	LF	LANDSCAPE RESTORATION	$15/LF				15,000
ALL	1500	LF	R/W ACQUISITION	$0/LF	0		0	0
				SUBTOTAL	266,713		300,987	257,642
			MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	53,343		60,197	51,528
				TOTAL	320,056		361,184	309,171

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 13-E)
TABLE 13-E

							ALTERNATIVE			
						UNIT COST	1		2	3

STORM DRAIN (RCP)

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)	UNIT COST	1		2	3
1	1443	60	1350	BRACED	11.4	$141/LF	203,463			
1	57	"	3000	JACKED	N/A	$885/LF	50,445			
2	50	"	1000	OPEN CUT	N/A	$120/LF			6,000	
2	1344	"	1350	" "	"	$124/LF			166,656	
2	106	"	3000	JACKED	"	$885/LF			93,810	
3	550	"	1000	OPEN CUT	"	$120/LF				66,000
3	890	"	1350	" "	"	$124/LF				110,360
3	60	"	3000	JACKED	"	$885/LF				53,100

MANHOLES

ALT	EACH	DEPTH (FT)	UNIT COST	1		2	3
1	1	11	$2,600/EA	2,600			
2	1	13	$2,800/EA			2,800	
3	1	13	$2,800/EA				2,800

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	1		2	3
1	4.8	800	3,081					
1	5.8	643	2,476					
			5,557	$10/CY	55,565			
2	3.2	650	1,955					
2	5.5	744	3,035					
			4,990	$7/CY			34,927	
3	7.0	350	1,710					
3	3.8	350	1,144					
3	5.5	800	3,264					
			6,117	$7/CY				42,818

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 13-E)
TABLE 13-E (CONTINUED)

MISCELLANEOUS

ALT	QTY UNIT	DESCRIPTION		ALTERNATIVE 1		ALTERNATIVE 2	ALTERNATIVE 3
1	1050 LF	RECONSTRUCT 2-INCH GAS MAIN	$15/LF	15,750			
1	650 LF	RECONSTRUCT 5'WIDE CONC IRRIG DITCH	$10/LF	6,500			
1	40 LF	RECOSTRUCT 12" & 18" DRAINS	$55/LF	2,200			
1	1 EA	PROTECT 1-4" ELECT	$450/EA	450			
2	1 EA	PROTECT 1-4" ELECT	$450/EA			450	
3	1 EA	PROTECT 1-4" ELECT	$450/EA				450
3	2 EA	230 KV TOWER PROTECTION	$12,000/EA				24,000
ALL	1500 LF	R/W ACQUISITION	$0/LF	0		0	0
			SUBTOTAL	336,973		304,643	299,528
		MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	67,395		60,929	59,906
			TOTAL	404,368		365,572	359,434

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 14-E)
TABLE 14-E

STORM DRAIN (RCP)

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)	UNIT COST	ALTERNATIVE 1A	ALTERNATIVE 1B	ALTERNATIVE 2	ALTERNATIVE 3
1A	1500	60	1350	BRACED	11.3	$141/LF	211,500			
1B	1500	"	1350	"	"	$141/LF		211,500		
2	1327	"	1000	OPEN CUT	N/A	$120/LF			159,240	
2	75	"	1350	" "	"	$124/LF			9,300	
2	98	"	1000	JACKED	"	$870/LF			85,260	
3	400	"	1000	OPEN CUT	"	$120/LF				48,000
3	1100	"	1350	" "	"	$124/LF				136,400

MANHOLES

ALT	EACH	DEPTH (FT)	UNIT COST	1A	1B	2	3
1A	1	11	$2,600/EA	2,600			
1B	1	11	$2,600/EA		2,600		
2	1	10	$2,500/EA			2,500	
3	2	10	$2,500/EA				5,000

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	1A	1B	2	3
1A	5.2	1500	5,725	$10/CY	57,253			
1B	5.2	1500	5,725	$10/CY		57,253		
2	4.7	1500	5,526	$7/CY			38,684	
3	3.5	600	1,881					
3	4.5	900	3,230					
			5,112	$7/CY				35,781

MISCELLANEOUS

ALT	QTY	UNIT	DESCRIPTION	UNIT COST	1A	1B	2	3
1A	1500	LF	RECONSTRUCT 2" GAS MAIN	$15/LF	22,500			
1B	1500	LF	RECONSTRUCT 2" GAS MAIN	$15/LF		22,500		
1A	1500	LF.	RECONSTRUCT 5' WIDE CONC IRRIG DITCH	$10/LF	15,000			
1B	1500	LF	RECONSTRUCT 5' WIDE CONC IRRIG DITCH	$10/LF		15,000		
2	1	EA	POWER POLE RELOCATION	$10,000/EA			10,000	
2	N/A	LS	PROTECT TWO GUY WIRES	$2,500			2,500	
3	2	EA	230 KV TOWER PROTECTION	$12,000/EA				24,000
3	1	EA	POWER POLE RELOCATION	$10,000/EA				10,000
ALL	1500	LF	R/W ACQUISITION	$0/LF	0	0	0	0
				SUBTOTAL	308,853	308,853	307,484	259,181

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 14-E)
TABLE 14-E (CONTINUED)

		ALTERNATIVE			
		1A	1B	2	3
MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	61,771	61,771	61,497	51,836
	TOTAL	370,624	370,624	368,981	311,018

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 15-E)
TABLE 15-E

STORM DRAIN (RCP)

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)	UNIT COST	ALTERNATIVE 1A	ALTERNATIVE 1B	ALTERNATIVE 2	ALTERNATIVE 3
1A	1425	60	1350	BRACED	10.6	$140/LF	199,500			
1A	75	"	2000	"	"	$148/LF	11,100			
1B	1425	"	1350	"	10.8	$140/LF		199,500		
1B	75	"	2000	"	"	$148/LF		11,100		
2	1123	"	1000	OPEN CUT	N/A	$120/LF			134,760	
2	272	"	1350	" "	"	$124/LF			33,728	
2	52	"	1000	JACKED	"	$870/LF			45,240	
2	53	"	1350	"	"	$874/LF			46,322	
3	1250	"	1000	OPEN CUT	"	$120/LF				150,000
3	175	"	1350	" "	"	$124/LF				21,700
3	75	"	2000	" "	"	$132/LF				9,900

MANHOLES

ALT	EACH	DEPTH (FT)	UNIT COST	1A	1B	2	3
1A	1	12	$2,700/EA	2,700			
1B	1	12	$2,700/EA		2,700		
2	1	11	$2,600/EA			2,600	
3	1	11	$2,600/EA				2,600

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	1A	1B	2	3
1A	4.5	1500	5,371	$10/CY	53,707			
1B	4.7	1500	5,371	$10/CY		53,707		
2	5.0	1395	5,342	$7/CY			37,396	
3	5.0	1300	4,979					
3	8.0	200	1,093					
			6,072	$7/CY				42,504

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 15-E)
TABLE 15-E (CONTINUED)

MISCELLANEOUS

ALT	QTY	UNIT	DESCRIPTION		ALTERNATIVE 1A	1B	2	3
ALL	250	SF	OPEN CUT MCQUEEN RD (PVMT RCNSTRCT)	$6/SF	1,500	1,500	1,500	1,500
1A	450	LF	RECONSTRUCT 2" GAS MAIN	$15/LF	6,750			
1B	450	LF	RECONSTRUCT 2" GAS MAIN	$15/LF		6,750		
1A	420	LF	RECOSTRUCT 5' WIDE CONC IRRIG DITCH	$10/LF	4,200			
1B	420	LF	RECOSTRUCT 5' WIDE CONC IRRIG DITCH	$10/LF		4,200		
2	15	LF	RECOSTRUCT 7' WIDE CONC IRRIG DITCH	$15/LF			225	
3	15	LF	RECOSTRUCT 7' WIDE CONC IRRIG DITCH	$15/LF				225
3	2	EA	230 KV TOWER PROTECTION	$9,000/EA				18,000
ALL	1500	LF	R/W ACQUISITION	$0 LF	0	0	0	0
				SUBTOTAL	279,457	279,457	301,771	246,429
			MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	55,891	55,891	60,354	49,286
				TOTAL	335,348	335,348	362,126	295,715

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 16-E)
TABLE 16-E

						UNIT COST	ALTERNATIVE 1A	1B	2	3
STORM DRAIN (RCP)										
ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)					
1A	800	60	1350	BRACED	8.6	$137/LF	109,600			
1A	700	"	2000	"	"	$145/LF	101,500			
1B	1500	"	1350	"	9.1	$138/LF		207,000		
2	1451	"	1000	OPEN CUT	N/A	$120/LF			174,120	
2	49	"	1000	JACKED	"	$870/LF			42,630	
3	1500	"	1000	OPEN CUT	"	$120/LF				180,000
MANHOLES										
ALT	EACH		DEPTH (FT)							
1A	1		9			$2,400/EA	2,400			
1B	1		9			$2,400/EA		2,400		
2	1		10			$2,500/EA			2,500	
3	1		10			$2,500/EA				2,500
EARTHWORK										
ALT	AVERAGE COVER (FT)		LENGTH (FT)	CUBIC YDS EXCAVATION						
1A	2.5		1500	4,357		$10/CY	43,573			
1B	3.0		1500	4,357		$10/CY		43,573		
2	4.5		1500	5,384		$7/CY			37,685	
3	4.0		1500	5,037		$7/CY				35,257
MISCELLANEOUS										
ALT	QTY UNIT		DESCRIPTION							
3	1 EA		230 KV TOWER PROTECTION			$11,000/EA				11,000
ALL	1500 LF		R/W ACQUISITION			$0/LF	0	0	0	0
						SUBTOTAL	257,073	252,973	256,935	228,757
MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES						20%	51,415	50,595	51,387	45,751
						TOTAL	308,488	303,568	308,322	274,508

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 17-E)
TABLE 17-E

STORM DRAIN (RCP)

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)	UNIT COST	ALTERNATIVE 1A	ALTERNATIVE 1B	ALTERNATIVE 2	ALTERNATIVE 3
1A	1425	60	1350	BRACED	9.6	$138/LF	196,650			
1A	75	"	2000	"	"	$146/LF	10,950			
1B	1500	"	1350	"	10.1	$139/LF		208,500		
2	928	"	1000	OPEN CUT	N/A	$120/LF			111,360	
2	479	"	1350	" "	"	$124/LF			59,396	
2	47	"	1000	JACKED	"	$870/LF			40,890	
2	46	"	1350	"	"	$874/LF			40,204	
3	1250	"	1000	OPEN CUT	"	$120/LF				150,000
3	250	"	1350	" "	"	$124/LF				31,000

MANHOLES

ALT	EACH	DEPTH (FT)	UNIT COST	1A	1B	2	3
1A	2	8	$2,300/EA	4,600			
1B	2	8	$2,300/EA		4,600		
2	2	10	$2,500/EA			5,000	
3	2	10	$2,500/EA				5,000

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	1A	1B	2	3
1A	3.5	1500	4,864	$10/CY	48,640			
1B	4.0	1500	4,864	$10/CY		48,640		
2	4.0	1500	5,037	$7/CY			35,257	
3	3.8	1500	4,902	$7/CY				34,312

MISCELLANEOUS

ALT	QTY UNIT	DESCRIPTION	UNIT COST	1A	1B	2	3
1A	1325 LF	RECONSTRUCT 5' WIDE CONC IRRIG DITCH	$10/LF	13,250			
1B	1325 LF	RECONSTRUCT 5' WIDE CONC IRRIG DITCH	$10/LF		13,250		
2	30 LF	RECONSTRUCT 5' WIDE CONC IRRIG DITCH	$10/LF			300	
3	30 LF	RECONSTRUCT 5' WIDE CONC IRRIG DITCH	$10/LF				300
3	2 EA	230 KV TOWER PROTECTION	$11,000/EA				22,000
ALL	1500 LF	R/W ACQUISITION	$0/LF	0	0	0	0
			SUBTOTAL	274,090	274,990	292,407	242,612

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 17-E)
TABLE 17-E (CONTINUED)

		ALTERNATIVE			
		1A	1B	2	3
MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	54,818	54,998	58,481	48,522
	TOTAL	328,908	329,988	350,888	291,135

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 18-E)
TABLE 18-E

STORM DRAIN (RCP)

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)	UNIT COST	ALTERNATIVE 1A	ALTERNATIVE 1B	ALTERNATIVE 2	ALTERNATIVE 3
1A	1175	60	1350	BRACED	9.6	$138/LF	162,150			
1B	1175	"	1350	"	10.3	$139/LF		163,325		
2	1050	"	1000	OPEN CUT	N/A	$120/LF			126,000	
2	50	"	1350	" "	"	$124/LF			6,200	
2	50	"	1000	JACKED	"	$870/LF			43,500	
3	900	"	1000	OPEN CUT	"	$120/LF				108,000
3	250	"	1350	" "	"	$124/LF				31,000

MANHOLES

ALT	EACH	DEPTH (FT)	UNIT COST	1A	1B	2	3
1A	0	0		0			
1B	0	0			0		
2	0	0				0	
3	1	10	$2,500/EA				2,500

100 CFS PARSHALL FLUME STRUCTURE

ALT	EACH	DESCRIPTION	UNIT COST	1A	1B	2	3
ALL	1	FLUME STRUCT	$61,800/EA	61,800	61,800	61,800	61,800
ALL	1	TELEMETRY	$5,000/EA	5,000	5,000	5,000	5,000

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	1A	1B	2	3
1A	3.5	1125	3,648					
1A	FLUME STRUCT		244					
			3,892	$10/CY	38,920			
1B	4.2	1125	3,648					
1B	FLUME STRUCT		267					
			3,915	$10/CY		39,150		
2	4.0	1500	5,037					
2	FLUME STRUCT		244					
			5,281	$7/CY			36,965	

PRICE ROAD DRAIN--EAST BRANCH ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COSTS
(SEE EXHIBIT 18-E)
TABLE 18-E (CONTINUED)

					ALTERNATIVE 1A	1B	2	3
3	3.8	1500	4,902					
3	FLUME STRUCT		267					
			5,169	$7/CY				36,181

MISCELLANEOUS

ALT	QTY UNIT	DESCRIPTION		1A	1B	2	3
1A	1500 LF	RECONSTRUCT 5' WIDE CONC IRRIG DITCH	$10/LF	15,000			
1B	1500 LF	RECONSTRUCT 5' WIDE CONC IRRIG DITCH	$10/LF		15,000		
2	100 LF	RECONSTRUCT 18" SEWER	$40/LF			4,000	
3	100 LF	RECONSTRUCT 18" SEWER	$40/LF				4,000
3	1 EA	230 KV TOWER PROTECTION	$11,000/EA				11,000
			SUBTOTAL	282,870	284,275	283,465	259,481
		MISCELLANEUOS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	56,574	56,855	56,693	51,896
			TOTAL	339,444	341,130	340,158	311,378

SUMMARY OF EAST BRANCH
ALTERNATIVES 1,2 & 3 (GILBERT)
COMPARISON OF PRELIMINARY COST
TABLE 19-E

EXHIBIT NO.	ALTERNATIVE 1A	1B	2	3
1-E	413,176	384,765	410,625	403,791
2-E	654,155	595,859	556,950	551,615
3-E	604,771	504,148	498,979	485,450
4-E	635,298	583,554	687,331	610,339
5-E	473,324	465,769	538,975	460,775
SUBTOTAL	2,780,724	2,534,095	2,692,860	2,511,970
6-E	458,648	396,248	471,958	405,674
7-E	448,648	376,248	401,374	372,818
8-E	514,990	561,895	439,156	481,148
9-E	352,312	352,312	356,180	319,669
10-E	343,668	343,668	486,470	351,617
SUBTOTAL	2,118,266	2,030,371	2,155,138	1,930,926
11-E	422,763	422,763	444,085	416,248
12-E	320,056	320,056	361,184	309,171
13-E	404,368	404,368	365,572	359,434
14-E	370,624	370,624	368,981	311,018
15-E	335,348	335,348	362,126	295,715
SUBTOTAL	1,853,159	1,853,159	1,901,948	1,691,586
16-E	308,488	303,568	308,322	274,508
17-E	328,908	329,988	350,888	291,135
18-E	339,444	341,130	340,158	311,378
SUBTOTAL	976,840	974,686	999,368	877,021
TOTAL	7,728,989	7,392,311	7,749,314	7,011,503
RANKING	3	2	4	1

METERING FACILITIES (CHANDLER)
PRELIMINARY COSTS
(SEE EXHIBIT 1-E)
TABLE 20-E

	UNIT COST	1A	1B	2	3
		ALTERNATIVE ALIGNMENT			
STORM DRAIN (RCP)					
ALT ALL; LENGTH (FT) 100; DIA (IN) 60; DLOAD 2000; TRENCH SECTION VERTICAL; SHORED DEPTH (FT) 16	$190/LF	19,000	19,000	19,000	19,000
EARTHWORK					
ALT ALL; AVERAGE COVER (FT) 11.0; LENGTH (FT) 100; CUBIC YDS EXCAVATION 540					
ALL FLUME STRUCT; CUBIC YDS EXCAVATION 333					
873	$10/CY	8,734	8,734	8,734	8,734
MISCELLANEOUS					
ALL N/A LS 100 CFS PRSHLL FLM STRUCT	$79,000/LS	79,000	79,000	79,000	79,000
ALL 1 EA PROTECT 36" DRAIN	$450/EA	450	450	450	450
	SUBTOTAL	107,184	107,184	107,184	107,184
MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	21,437	21,437	21,437	21,437
	TOTAL	128,621	128,621	128,621	128,621

COMMON FACILITIES (CHANDLER & GILBERT)
PRELIMINARY COSTS
(SEE EXHIBIT 1-E)
TABLE 21-E

	UNIT COST	ALTERNATIVE ALIGNMENT 1A	1B	2	3
STORM DRAIN (RCP)					
ALT: ALL; LENGTH (FT): 60; DIA (IN): 84; DLOAD: 2000; TRENCH SECTION: OPEN CUT; SHORED DEPTH (FT): N/A	$227/LF	13,620	13,620	13,620	13,620
JUNCTION STRUCTURE					
ALT: 1A; EACH: 1; DEPTH (FT): 20	$20,000/EA	20,000			
ALT: 1B; EACH: 1; DEPTH (FT): 18	$19,000/EA		19,000		
ALT: 2; EACH: 1; DEPTH (FT): 19	$20,000/EA			20,000	
ALT: 3; EACH: 1; DEPTH (FT): 21	$21,000/EA				21,000
EARTHWORK					
ALT: ALL; AVERAGE COVER (FT): 7.0; LENGTH (FT): 60; CUBIC YDS EXCAVATION: 400	$10/CY	4,000	4,000	4,000	4,000
	SUBTOTAL	37,620	36,620	37,620	38,620
MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	7,524	7,324	7,524	7,724
	TOTAL	45,144	43,944	45,144	46,344

APPENDIX F

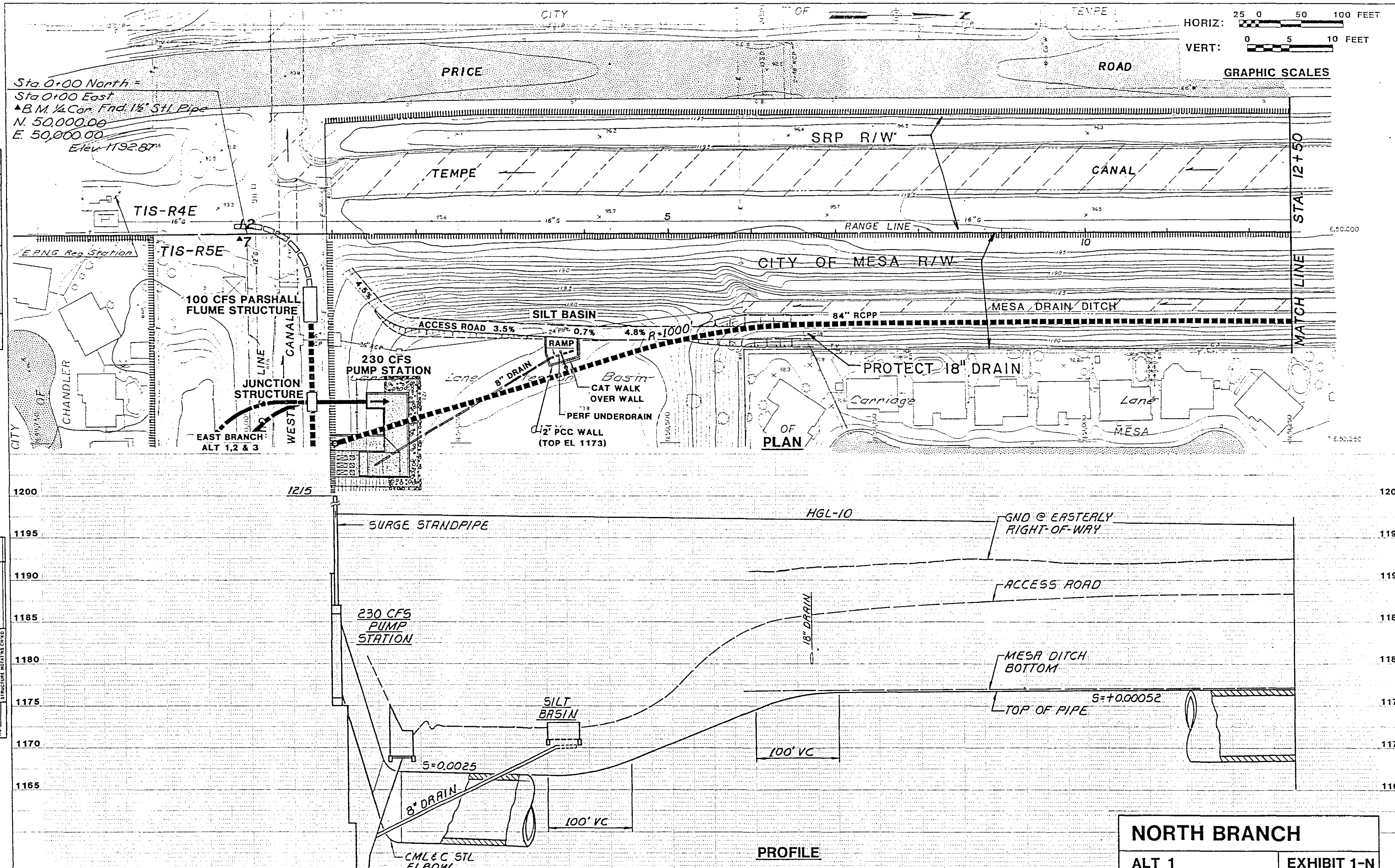
PLAN AND PROFILE SHEETS
AND PRELIMINARY COSTS FOR
NORTH BRANCH ALTERNATIVE 1

TABLES

APPENDIX F

EXHIBITS

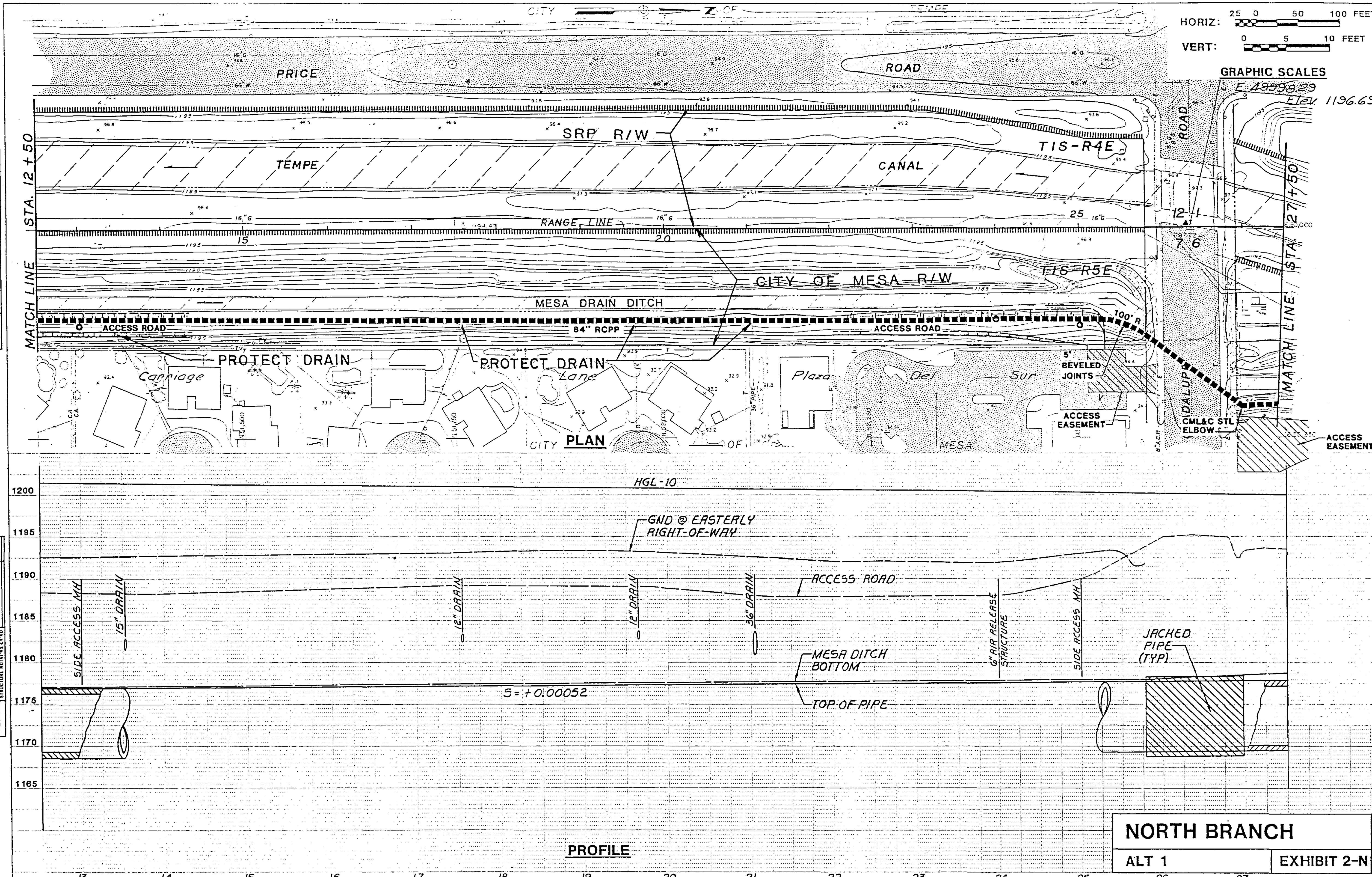
EXHIBIT NO.	TITLE
1-N	Price Road Drain--North Branch Alternative 1 (Gilbert, Chandler & Mesa) Preliminary Costs
2-N	" "
3-N	" "
4-N	" "
5-N	" "
6-N	" "
7-N	" "



NORTH BRANCH

ALT 1	EXHIBIT 1-N

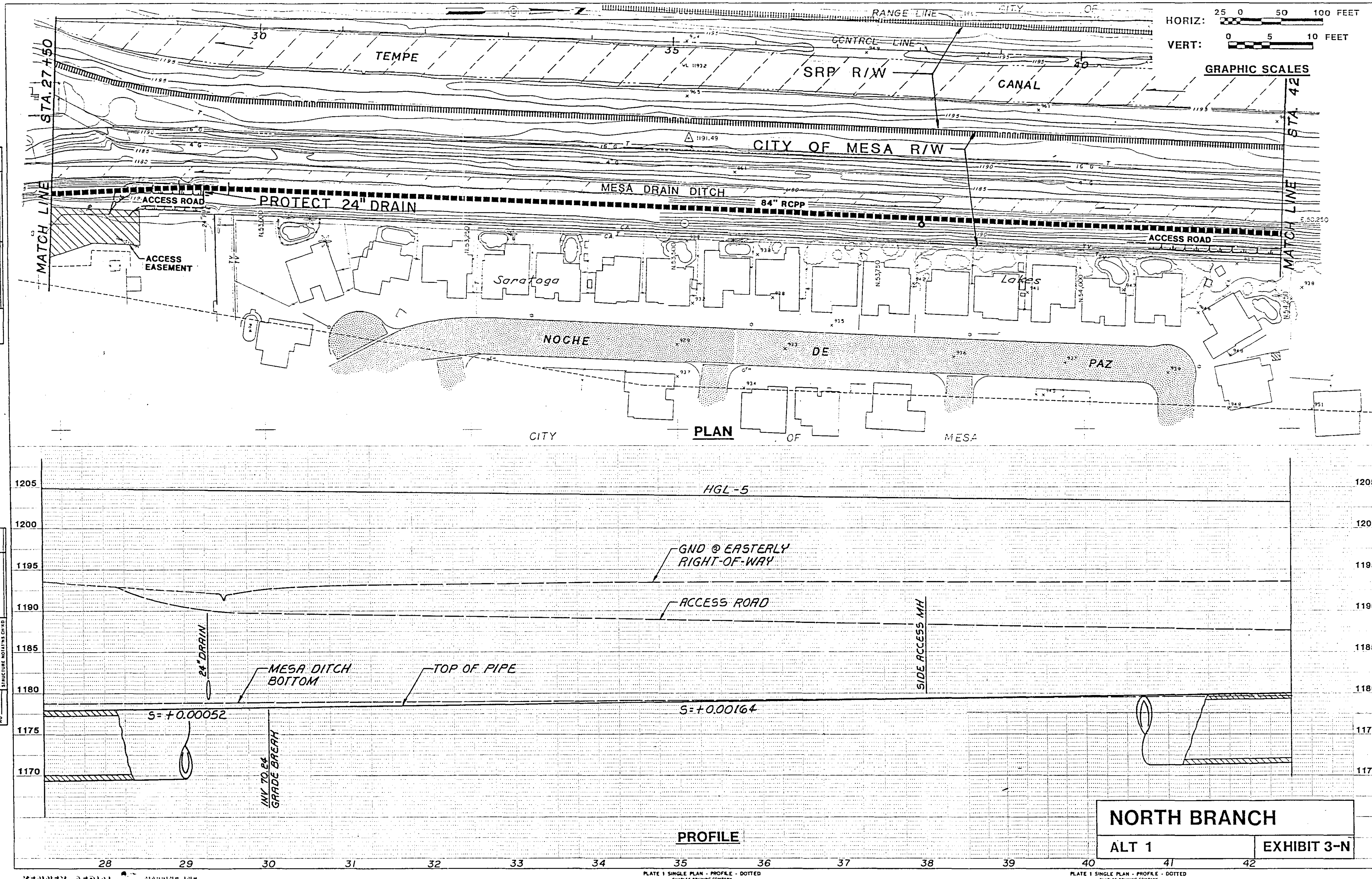
KENNEY AERIAL MAPPING INC.



NORTH BRANCH

ALT 1

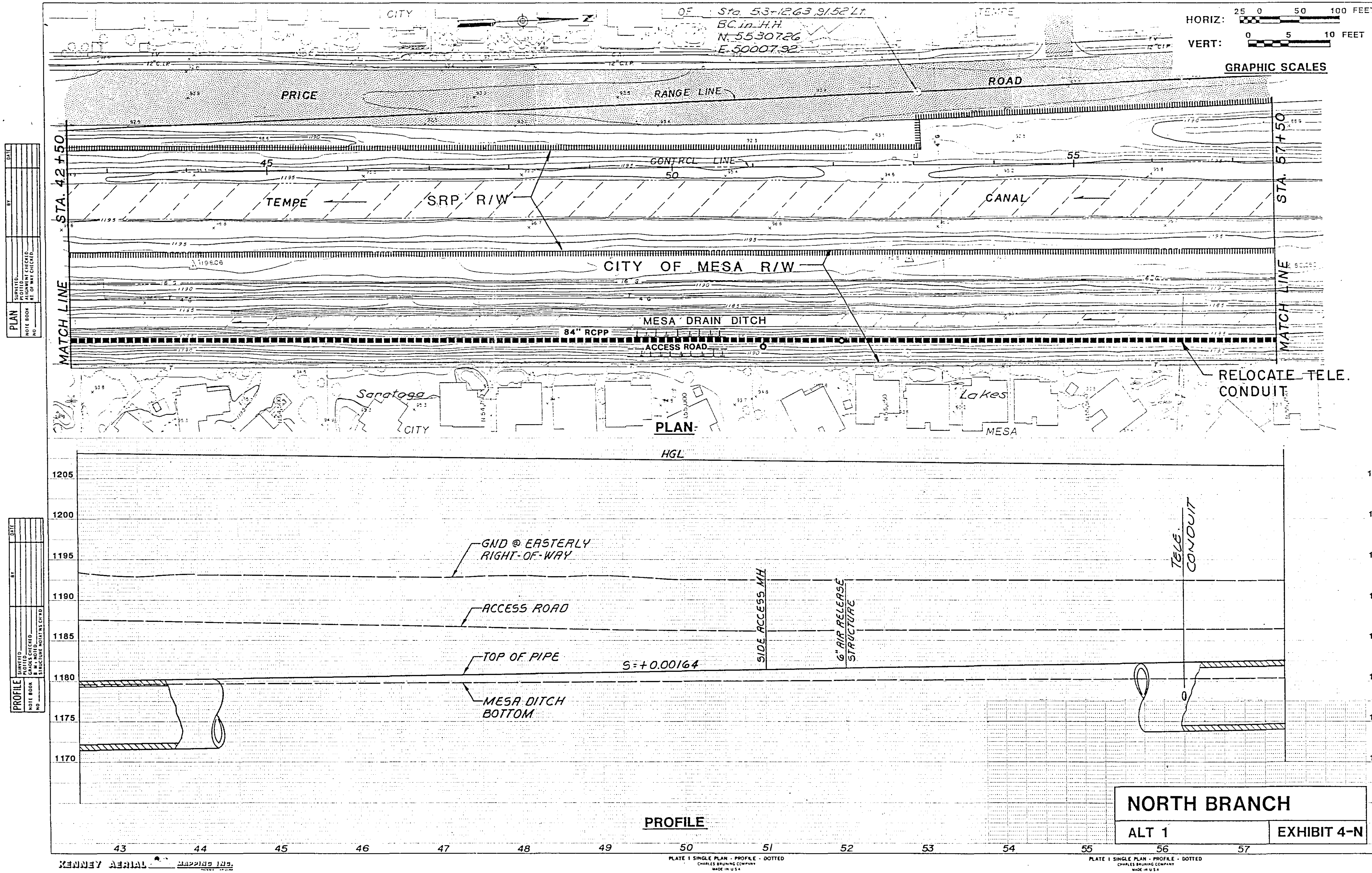
EXHIBIT 2-N



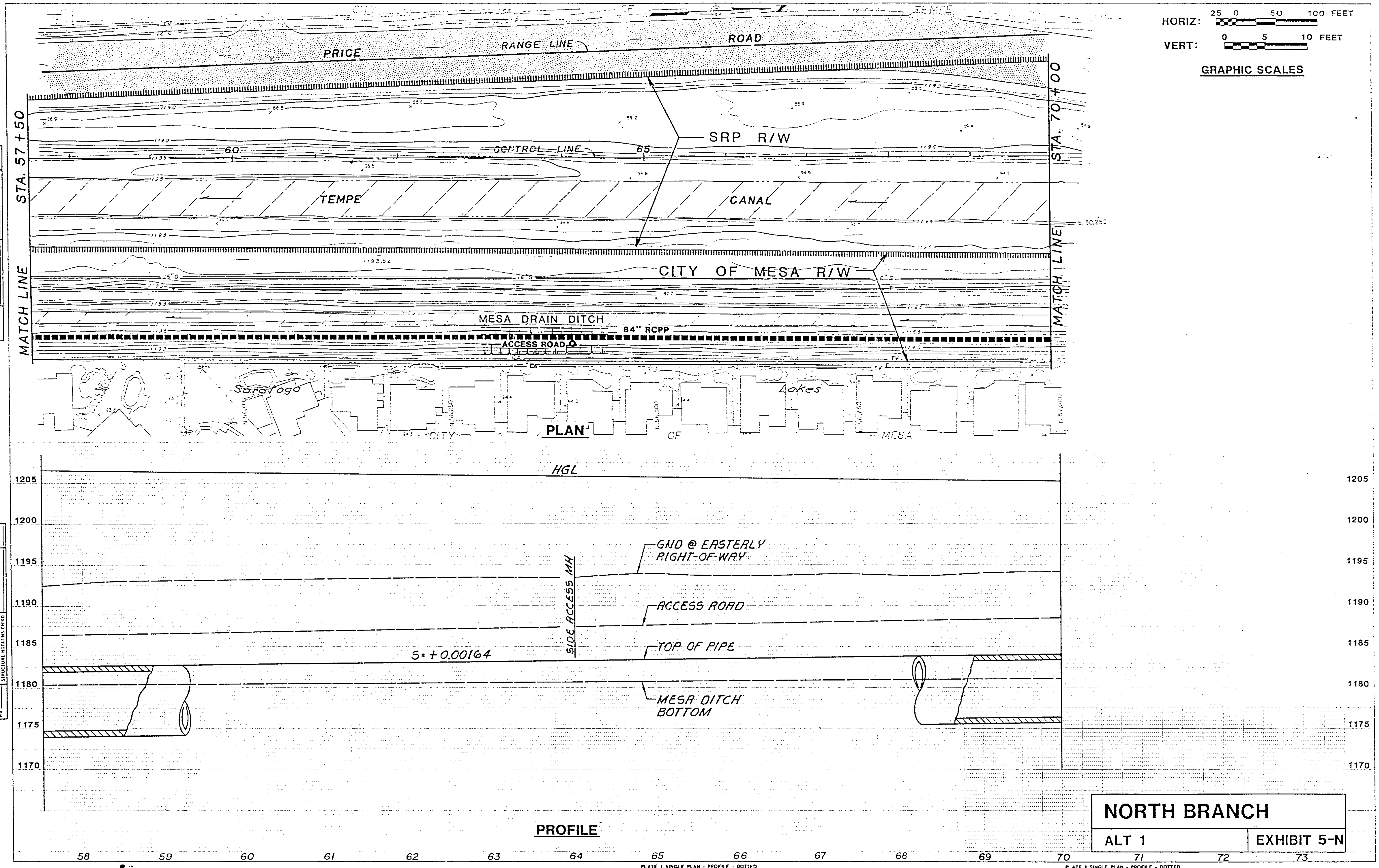
NORTH BRANCH

ALT 1

EXHIBIT 3-N

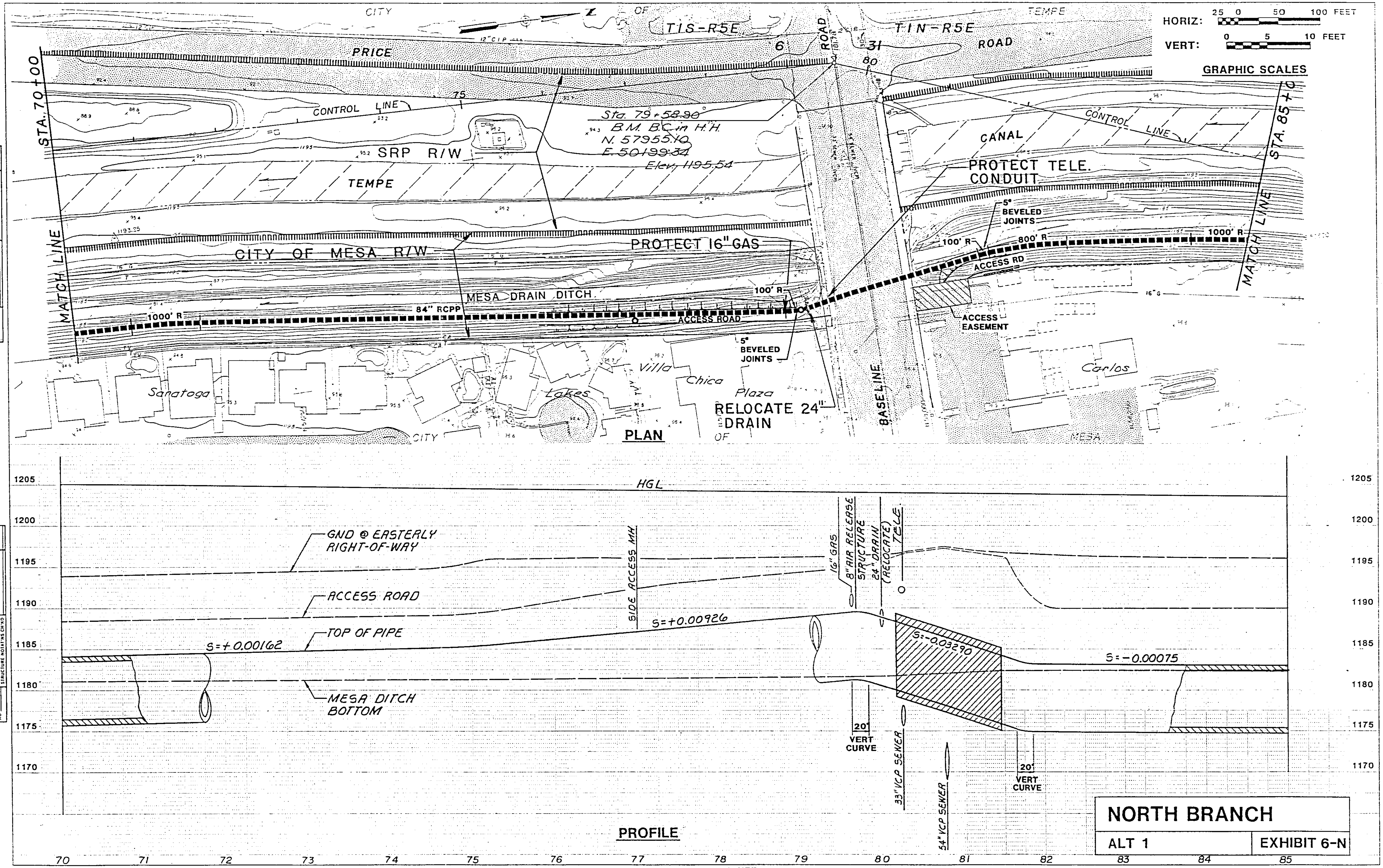


HORIZ: 25 0 50 100 FEET
VERT: 0 5 10 FEET
GRAPHIC SCALES
CITY OF TEMPE
Sta. 53+12.63, 91.52' Lt.
BC in H.H.
N. 55307.26
E. 50007.92
PRICE
RANGE LINE
ROAD
STA. 42+50
STA. 57+50
MATCH LINE
CONTROL LINE
45
50
55
TEMPE
SRP R/W
CANAL
CITY OF MESA R/W
MESA DRAIN DITCH
84" RCPP
ACCESS ROAD
RELOCATE TELE. CONDUIT
Saratoga
Lakes
CITY
MESA
PLAN
HGL
GND @ EASTERLY RIGHT-OF-WAY
ACCESS ROAD
TOP OF PIPE
S=+0.00164
MESA DITCH BOTTOM
SIDE ACCESS MH
6" AIR RELEASE STRUCTURE
TELE. CONDUIT
1205
1200
1195
1190
1185
1180
1175
1170
PROFILE
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
NORTH BRANCH
ALT 1
EXHIBIT 4-N
KENNEY AERIAL MAPPING INC.
PLATE I SINGLE PLAN - PROFILE - DOTTED



NORTH BRANCH

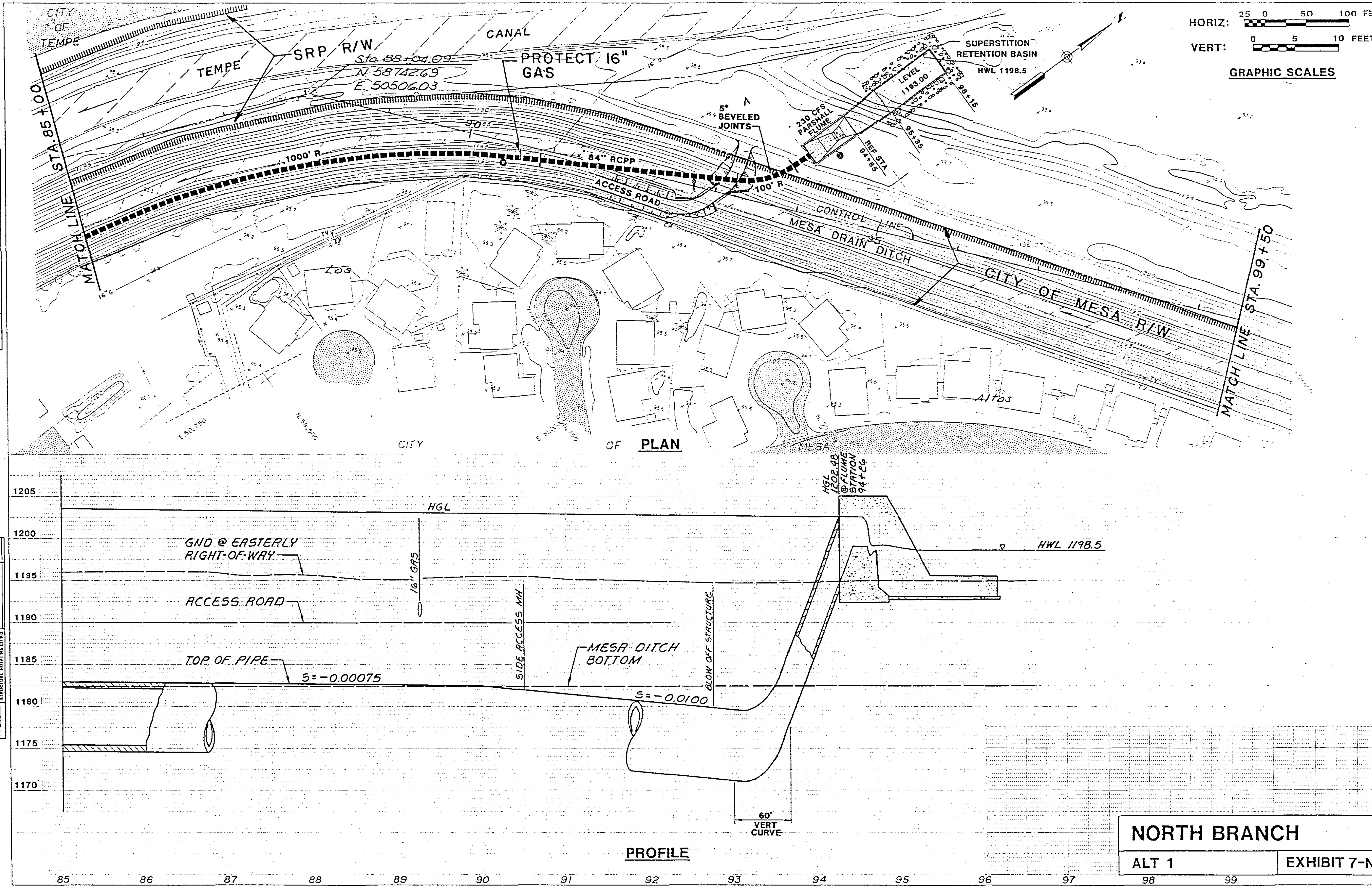
ALT 1 | EXHIBIT 5-N



NORTH BRANCH

ALT 1

EXHIBIT 6-N



NORTH BRANCH

ALT 1

EXHIBIT 7-N

KENNEY AERIAL MAPPING INC.

PLATE 1 SINGLE PLAN - PROFILE - DOTTED
CHARLES BRUNING COMPANY
MADE IN U.S.A.

APPENDIX F

TABLES

TABLE NO.	TITLE
1-N	North Branch Alternative 1 (Gilbert, Chandler, Mesa) - Preliminary Costs (See Exhibit 1-N)
2-N	" " Preliminary Costs (See Exhibit 2-N)
3-N	" " Preliminary Costs (See Exhibit 3-N)
4-N	" " Preliminary Costs (See Exhibit 4-N)
5-N	" " Preliminary Costs (See Exhibit 5-N)
6-N	" " Preliminary Costs (See Exhibit 6-N)
7-N	" " Preliminary Costs (See Exhibit 7-N)
8-N	Summary of North Branch Alternative 1 (Gilbert, Chandler, Mesa) Preliminary Costs
9-N	Common Facilities (Gilbert, Chandler, Mesa) - Preliminary Costs (See Exhibit 1-N)

PRICE ROAD DRAIN--NORTH BRANCH ALTERNATIVE 1 (GILBERT, CHANDLER & MESA)
PRELIMINARY COSTS
(SEE EXHIBIT 1-N)
TABLE 1-N

						UNIT COST	ALTERNATIVE 1
STORM DRAIN (RCPP)							
ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)		
1	420	84	1350	OPEN CUT	N/A	$217/LF	91,140
1	725	"	2000	"	"	$237/LF	171,825
APPURTENANCES							
ALT	EACH		DESCRIPTION				
1	1		BLOW OFF STRUCTURE			$8,900/EA	8,900
1	1		84" CML&C STEEL ELBOW			$9,500/EA	9,500
EARTHWORK							
ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION				
1	PUMP STATION		830			$7/CY	5,810
1	5.0	250	1,530			$7/CY	10,710
1	11.0	200	2,160			$7/CY	15,120
1	15.0	650	5,840			$7/CY	40,880
MISCELLANEOUS							
ALT	QTY UNIT	DESCRIPTION					
1	1150 LF	ACCESS RD-GRADING				$2/EA	2,300
1	260 CY	ACCESS RD-6-INCH DG				$45/CY	11,700
1	1 EA	PROTECT 18" DRAIN				$450/EA	450
1	300 LF	8" PVC DRAIN PIPE & FILTER				$20/LF	6,000
1	50 CY	REINFORCED CONC SILT BASIN & RAMP				$300/CY	15,000
1	40 LF	CAT WALK				$75/LF	3,000
ALL	1500 LF	R/W ACQUISITION				$0/LF	0
						SUBTOTAL	392,335
MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES						20%	78,467
						TOTAL	470,802

PRICE ROAD DRAIN--NORTH BRANCH ALTERNATIVE 1 (GILBERT, CHANDLER & MESA)
PRELIMINARY COSTS
(SEE EXHIBIT 2-N)
TABLE 2-N

							UNIT COST	ALTERNATIVE 1
STORM DRAIN (RCPP)								
ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)			
1	1345	84	2000	OPEN CUT	N/A		$237/LF	318,765
1	120	"	3000	JACKED	"		$1,222/LF	146,640
1	65	"	2000	OPEN CUT	"	(BEVEL)	$313/LF	20,345

APPURTENANCES

ALT	EACH	DESCRIPTION	UNIT COST	ALTERNATIVE 1
1	2	SIDE ACCESS MANHOLE	$13,000/EA	26,000
1	1	6" AIR RELEASE STRUCTURE	$10,700/EA	10,700
1	1	84" CML&C STEEL ELBOW	$9,500/EA	9,500

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	ALTERNATIVE 1
1	16	1410	13,100	$7/CY	91,700

MISCELLANEOUS

ALT	QTY	UNIT	DESCRIPTION	UNIT COST	ALTERNATIVE 1
1	1300	LF	ACCESS RD-GRADING	$2/LF	2,600
1	290	CY	ACCESS RD-6-INCH DG	$45/CY	13,050
1	3400	SF	ACCESS RD EASEMENT ACQUISITION	$.35/SF	1,190
1	1	EA	PROTECT 15" DRAIN	$450/EA	450
1	2	EA	PROTECT 12" DRAIN	$450/EA	900
1	1	EA	PROTECT 36" DRAIN	$450/EA	450
1	63	CY	RECONSTRUCT CONC HDWL'S & APRON'S	$400/CY	25,200
1	1200	SF	RECONSTRUCT MESA DRAIN PCC INVERT	$2/SF	2,400
ALL	1500	LF	R/W ACQUISITION	$0/LF	0
				SUBTOTAL	669,890
			MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	133,978
				TOTAL	803,868

PRICE ROAD DRAIN--NORTH BRANCH ALTERNATIVE 1 (GILBERT, CHANDLER & MESA)
PRELIMINARY COSTS
(SEE EXHIBIT 3-N)
TABLE 3-N

						UNIT COST	ALTERNATIVE 1
STORM DRAIN (RCPP)							
ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)		
1	1500	84	2000	OPEN CUT	N/A	$237/LF	355,500
APPURTENANCES							
ALT	EACH	DESCRIPTION					
1	1	SIDE ACCESS MANHOLE				$13,000/EA	13,000
EARTHWORK							
ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION				
1	13.0	1500	12,600			$7/CY	88,200
MISCELLANEOUS							
ALT	QTY UNIT	DESCRIPTION					
1	1500 LF	ACCESS RD-GRADING				$2/LF	3,000
1	330 CY	ACCESS RD-6-INCH DG				$45/CY	14,850
1	6800 SF	ACCESS RD EASEMENT ACQUISITION				$.35/SF	2,380
1	1 EA	PROTECT 24" DRAIN				$450/EA	450
ALL	1500 LF	R/W ACQUISITION				$0/LF	0
						SUBTOTAL	477,380
MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES						20%	95,476
						TOTAL	572,856

PRICE ROAD DRAIN--NORTH BRANCH ALTERNATIVE 1 (GILBERT, CHANDLER & MESA)
PRELIMINARY COSTS
(SEE EXHIBIT 4-N)
TABLE 4-N

						UNIT COST	ALTERNATIVE 1
STORM DRAIN (RCPP)							
ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)		
1	1500	84	2000	OPEN CUT	N/A	$237/LF	355,500

			UNIT COST	ALTERNATIVE 1
APPURTENANCES				
ALT	EACH	DESCRIPTION		
1	1	SIDE ACCESS MANHOLE	$13,000/EA	13,000
1	1	6" AIR RELEASE STRUCTURE	$10,700/EA	10,700

				UNIT COST	ALTERNATIVE 1
EARTHWORK					
ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION		
1	13.0	1500	10,500	$7/CY	73,500

				UNIT COST	ALTERNATIVE 1
MISCELLANEOUS					
ALT	QTY	UNIT	DESCRIPTION		
1	1500	LF	ACCESS RD-GRADING	$2/LF	3,000
1	330	CY	ACCESS RD-6-INCH DG	$45/CY	14,850
1	1	EA	PROTECT TELEPHONE CONDUIT	$450/EA	450
ALL	1500	LF	R/W ACQUISITION	$0/LF	0
				SUBTOTAL	471,000
			MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	94,200
				TOTAL	565,200

PRICE ROAD DRAIN--NORTH BRANCH ALTERNATIVE 1 (GILBERT, CHANDLER & MESA)
PRELIMINARY COSTS
(SEE EXHIBIT 5-N)
TABLE 5-N

	UNIT COST	ALTERNATIVE 1
STORM DRAIN (RCPP)		

ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)	UNIT COST	ALTERNATIVE 1
1	1250	84	2000	OPEN CUT	N/A	$237/LF	296,250

APPURTENANCES

ALT	EACH	DESCRIPTION	UNIT COST	ALTERNATIVE 1
1	1	SIDE ACCESS MANHOLE	$13,000/EA	13,000

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	ALTERNATIVE 1
1	10.0	1250	7,300	$7/CY	51,100

MISCELLANEOUS

ALT	QTY UNIT	DESCRIPTION	UNIT COST	ALTERNATIVE 1
1	1250 LF	ACCESS RD-GRADING	$2/LF	2,500
1	280 CY	ACCESS RD-6-INCH DG	$45/CY	12,600
ALL	1250 LF	R/W ACQUISITION	$0/LF	0
			SUBTOTAL	375,450
		MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES	20%	75,090
			TOTAL	450,540

PRICE ROAD DRAIN--NORTH BRANCH ALTERNATIVE 1 (GILBERT, CHANDLER & MESA)
PRELIMINARY COSTS
(SEE EXHIBIT 6-N)
TABLE 6-N

							UNIT COST	ALTERNATIVE 1
STORM DRAIN (RCPP)								
ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)			
1	1120	84	2000	OPEN CUT	N/A		$237/LF	265,440
1	130	"	2000	JACKED	"		$1,189/LF	154,570
1	50	"	2000	OPEN CUT	"	(BEVEL)	$272/LF	13,600
1	150	"	2000	VERTICAL	10		$267/LF	40,050

APPURTENANCES

ALT	EACH	DESCRIPTION	UNIT COST	ALTERNATIVE 1
1	1	SIDE ACCESS MANHOLE	$13,000/EA	13,000
1	1	8" AIR RELEASE STRUCTURE	$11,800/EA	11,800

EARTHWORK

ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION	UNIT COST	ALTERNATIVE 1
1	10.0	500	2,910	$7/CY	20,370
1	8.0	410	2,640	$7/CY	18,480
1	13.0	150	1,010	$7/CY	7,070
1	13.0	260	1,780	$7/CY	12,460

MISCELLANEOUS

ALT	QTY	UNIT	DESCRIPTION	UNIT COST	ALTERNATIVE 1
1	1200	LF	ACCESS RD-GRADING	$2/LF	2,400
1	270	CY	ACCESS RD-6-INCH DG	$45/CY	12,150
1	2100	SF	ACCESS RD EASEMENT ACQUISITION	$.35/SF	735
1	125	LF	ACCESS RD-RETAINING WALL(4 FT)	$50/LF	6,250
1	1	EA	PROTECT 16" GAS	$450/EA	450
1	50	LF	RECONSTRUCT 24" DRAIN	$60/LF	3,000
1	38	CY	RECONSTRUCT CONC HDWL & APRON	$400/CY	15,200
ALL	1500	LF	R/W ACQUISITION	$0/LF	0
				SUBTOTAL	597,025
MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES				20%	119,405
				TOTAL	716,430

PRICE ROAD DRAIN--NORTH BRANCH ALTERNATIVE 1 (GILBERT, CHANDLER & MESA)
PRELIMINARY COSTS
(SEE EXHIBIT 7-N)
TABLE 7-N

							UNIT COST	ALTERNATIVE 1
STORM DRAIN (RCPP)								
ALT	LENGTH (FT)	DIA (IN)	DLOAD	TRENCH SECTION	SHORED DEPTH (FT)			
1	800	84	2000	OPEN CUT	N/A		$237/LF	189,600
1	80	"	2000	"	"	(BEVEL)	$273/LF	21,840
APPURTENANCES								
ALT	EACH	DESCRIPTION						
1	1	SIDE ACCESS MANHOLE					$13,000/EA	13,000
1	1	BLOW OFF STRUCTURE					$8,900/EA	8,900
EARTHWORK								
ALT	AVERAGE COVER (FT)	LENGTH (FT)	CUBIC YDS EXCAVATION					
1	13.0	560	4,600				$7/CY	32,200
1	6.0	250	1,700				$7/CY	11,900
1	4.0	90	500				$7/CY	3,500
1	PARSHALL FLUME		900				$7/CY	6,300
MISCELLANEOUS								
ALT	QTY UNIT	DESCRIPTION						
1	1220 LF	ACCESS RD-GRADING					$2/LF	2,440
1	540 CY	ACCESS RD-6-INCH DG					$45/CY	24,300
1	625 CY	ACCESS RD-BRIDGE CROSSING+CULVERT					$800/CY	500,000
1	1 EA	PROTECT 16" GAS					$450/EA	450
1	3000 SF	RECONSTRUCT MESA DRAIN PCC INVERT					$2/SF	6,000
ALL	1220 LF	R/W ACQUISITION					$0/LF	0
							SUBTOTAL	820,430
MISCELLANEOUS ITEMS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES							20%	164,086
							TOTAL	984,516

SUMMARY OF NORTH BRANCH
ALTERNATIVE 1 (GILBERT,CHANDLER,MESA)
PRELIMINARY COSTS
TABLE 8-N

EXHIBIT NO.	ALTERNATIVE 1
1-E	470,802
2-E	803,868
3-E	572,856
4-E	565,200
5-E	450,540
SUBTOTAL	2,863,266
6-E	716,430
7-E	984,516
SUBTOTAL	1,700,946
TOTAL	4,564,212

COMMON FACILITIES (GILBERT,CHANDLER,MESA)
PRELIMINARY COSTS
(SEE EXHIBIT 1-N)
TABLE 9-N

230 CFS PUMP STATION

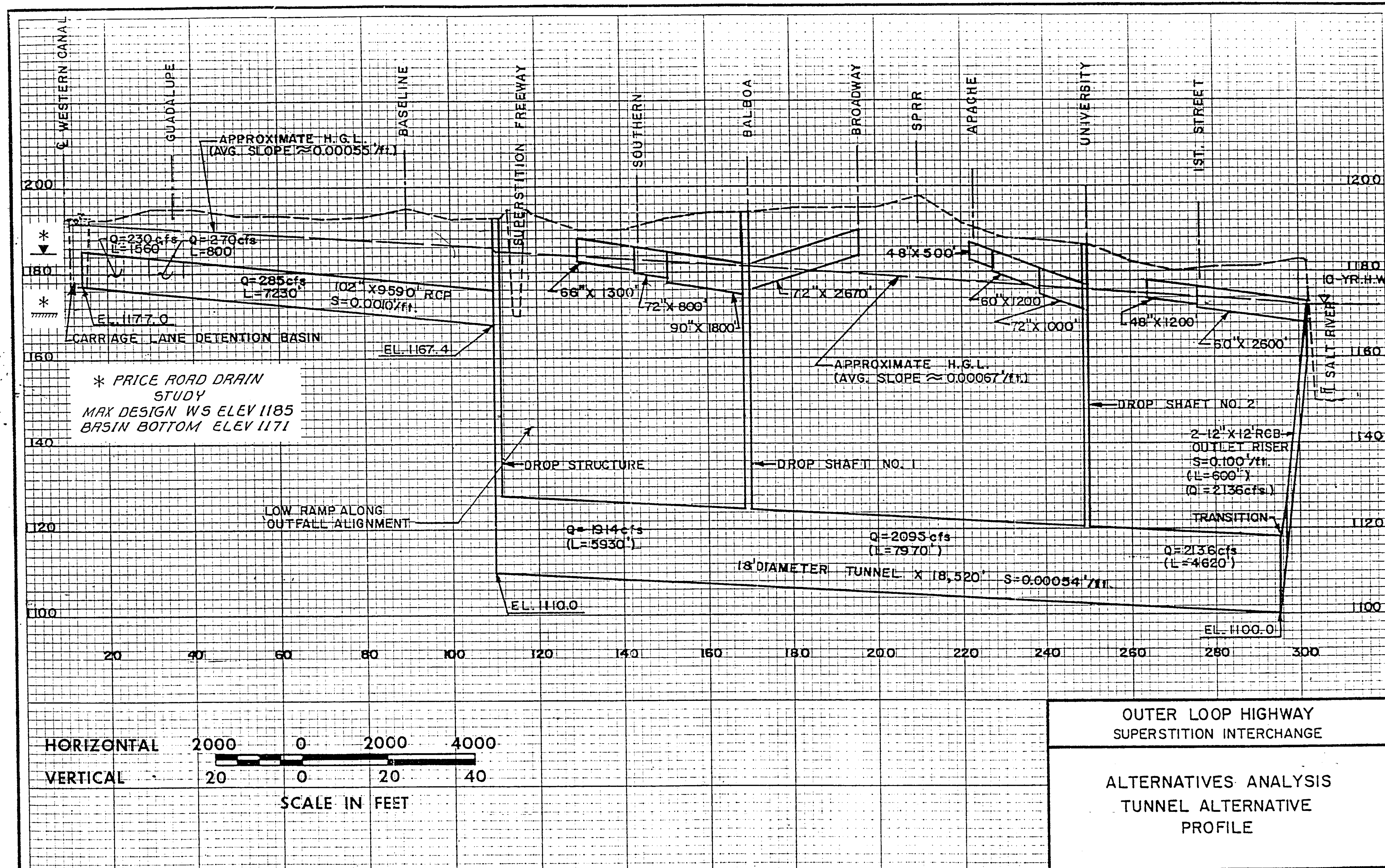
SITE WORK	65,000
INLET APRON & RIP RAP	25,000
WET WELL AND CONTROL BUILDING	420,000
SURGE TOWER AND SPLASH APRON	30,000
SUMP PUMP SYSTEM	15,000
MIXED FLOW PUMPS (3 REQUIRED)	240,000
ENGINES & RIGHT ANGLE DRIVES (3 REQ'D)	750,000
CONTROLS	20,000
UTILIY SERVICES (WATER,POWER,TELEPHONE)	20,000
FUEL STORAGE	15,000
R/W ACQUISITION	0
SUBTOTAL	$1,600,000
MISCELLANEOUS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES (25%)	$400,000
TOTAL PUMP STATION	$2,000,000

SUPERVISORY CONTROLS & TELEMETRY SYSTEM

230 CFS PUMP STATION	10,000
230 CFS PARSHALL FLUME STRUCTURE	5,000
HEADQUARTERS	25,000
SUBTOTAL	$40,000
MISCELLANEOUS, DESIGN, CONSTRUCTION ADMINISTRATION & CONTINGENCIES (20%)	$8,000
TOTAL SUPERVISORY CONTROLS & TELEMETRY SYSTEM	$48,000

APPENDIX G

ADOT TUNNEL ALTERNATIVE PROFILE
(October 1986)



OUTER LOOP HIGHWAY
SUPERSTITION INTERCHANGE

ALTERNATIVES ANALYSIS
TUNNEL ALTERNATIVE
PROFILE

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

EXHIBIT 2

APPENDIX G

MEETING ATTENDANCE ROSTER

Meeting: PRICE RD. DRAW LOCATION STUDY FINAL PRESENTATION   Location: FCD

Date: 5/23/88

Name	Title	Organization	Phone
Gordon Lutes	Principal Engineer	Boyle Engineering	(619) 268-8080
Kent Dibble	Consultant	Dibble & Assoc	955-5310
[illegible]	Consultant	" " "	955-5310
RAY JORDAN	DRAINAGE ENGR	ADOT-UHS	255-7545
Keith Nath	Dep City Eng	Mesa	834-2512
STAN POLASIK	PROJECT ENGINEER	DeLeuw Cather	244-9096
Al Pfohl	City Engineer	City of Chandler	786-2788
Harry Kent	City Eng	City of Mesa	834-2516
Nick Karan	Chief, Eng. Div.	FCD	262-1501
Doug Plasencia	Hydrologist	FCD	262-1501
H. SCOTT CLEMENT	CE	FCD	262-1501
Bob Luscombe	Associate	HNTB	954-7420
Stan Smith	Dep Chief Engr	F.C.D	262-1501

PRESENTATION OUTLINE
PRICE ROAD DRAIN
LOCATION STUDY AND PRELIMINARY DESIGN

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
CONTRACT NO. 86-8

MAY 23, 1988
2:00 P.M. AT
FLOOD CONTROL DISTRICT CONFERENCE ROOM

I. INTRODUCTION (Scott Clement)

II. PROJECT BACKGROUND (Kent Dibble)

1. History
2. Task Force Members
3. Salt River Outlet versus Gila River Outlet
4. Price Road Corridor versus Western Canal Corridor
5. Hydrology - Retention Basins
6. Open Channel versus Pipeline
7. Water Quality
8. Operations
9. Right-of-Way

III. TECHNICAL ASPECTS (Gordon Lutes)

1. Alignment
2. Profiles
3. Inlet - Outlet Structures
4. Pumping Stations
5. Retention Basins (Carriage Lane and Superstition)
6. Hydraulics
7. Operations and Maintenance
8. Costs

IV. RECOMMENDATIONS AND CONCLUSIONS (Kent Dibble)

1. Alignment
2. Cost Allocations
3. Construction Sequencing
4. Impact of ADOT Tunnel
5. Recommendations

V. DISCUSSION (Scott Clement)

PRESENTATION OUTLINE
PRICE ROAD DRAIN
LOCATION STUDY AND PRELIMINARY DESIGN

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CONTRACT NO. 86-8

MAY 23, 1988
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1. Alignment
2. Cost Allocations
3. Construction Sequencing
4. Impact of ADOT Tunnel
5. Recommendations

V. DISCUSSION (Scott Clement)

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

SCOPE OF WORK

PRICE ROAD/OUTER LOOP HIGHWAY
JOINT USE STORM WATER OUTFALL
PHASES II

JANUARY 10, 1986

PHASE II - LOCATION STUDY/PRELIMINARY DESIGN

This project shall include a detailed location study and preliminary design for an outfall storm drain which will carry water from the Cities of Mesa, Chandler and Gilbert to the Salt River. The outfall will be located within the right-of-way of the Salt River Projects' lateral 9.5 (Western Canal) from Cooper Road to Price Road. Gilbert's contributing flow will be picked up at Cooper Road and the Western Canal. Chandler's contributing flow will be picked up at Price Road and the Western Canal. From Price Road and the Western Canal, the outfall will generally follow the Price Road alignment north to the Salt River. This contract will study the area south of the Superstition Freeway. It is expected that existing right-of-way will be utilized along the Mesa drainage ditch from the Western Canal to the Superstition Freeway and along ADOT's Outer Loop Corridor from the Superstition Freeway north to the Salt River. Mesa's main contributing flow will be picked up by ADOT at the Superstition Freeway, Southern Avenue, and Broadway Road. Contributing flows from Chandler, Gilbert and a small amount from Mesa will be picked up at the Carriage Lane Detention basin and be conveyed north to the Superstition Freeway where ADOT will accept the water and design facilities to transport it north to the Salt River. Phase II services shall follow the recommendations of the Phase I report "Gila Drain-Western Canal Alternatives - Conceptual Design Study" dated May 31, 1985, with specific refinements as follows:

EVALUATION AND SELECTION OF FINAL LOCATION

I. TOPOGRAPHIC MAPPING

A. Coordinate with Arizona Department of Transportation (ADOT) for discharge location and conditions at the Superstition Freeway.

B. Establish horizontal and vertical control for 1" = 50', with 1-foot contours, for mapping outside of ADOT right-of-way (South of the Superstition Freeway).

C. Plot topographic mapping at 1" = 100' for location study and Preliminary Design, and at 1" = 50' for future Phase III construction plans.

D. Prepare base plan and profile sheets. (1" = 100')

II. RIGHT-OF-WAY

A. Coordinate with ADOT, SRP, City of Mesa, and City of Tempe.

B. Research and plot existing right-of-way on 1" = 100' map.

C. Determine right-of-way requirements for independent storm water outfall, south of the Superstition Freeway.

(Any required title reports or descriptions will be furnished to the consultant by the Flood Control District.)

III. UTILITY LOCATION

A. Send letters requesting existing and proposed facilities to utilities and review existing utility conflict studies.

B. Plot existing utilities on base map.

C. Identify utility conflicts.

D. Make recommendations for conflict resolution.

IV. COOPERATIVE DETENTION BASIN AND DRAINAGE ANALYSIS

A. Collect and review design criteria and capacity requirements.

B. Identify and layout alternate basin sites at Carriage Lane and Superstition Freeway.

C. Establish peak flows.

D. Analyze pumping requirements.

E. Determine system HGL for alternatives.

F. Develop preliminary system operations and controls.

G. Collect Arizona Department of Transportation requirements and coordinate.

H. Coordinate Stream Gauge locations with the Flood Control District.

V. ALIGNMENT

A. Establish alignment of conduit south of Superstition Freeway.

B. Determine alternative locations and configurations of Superstition Freeway crossing.

C. Draft plan sheets.

VI. PROFILE

A. Establish profile of conduit south of proposed Superstition Freeway detention basin.

B. Estimate conduit size and type for force main and gravity portions of drain.

C. Draft profile sheets.

VII. HYDRAULICS

A. Refine sizing of conduits.

VIII. PUMPING FACILITIES

A. Size pumps.

B. Prepare conceptual design of pumping/forebay structure(s).

C. Prepare operational scheme of pumping facilities in conjunction with ADOT joint needs.

IX. LOCATION STUDY REPORT (20 copies)

A. Document study finding including: preliminary plan and profile sheets, design criteria, operation and maintenance requirements, cost estimates, cost allocation among parties and recommendations.

B. Present to Task Force.

C. Finalize report and coordinate with Arizona Department of Transportation.

D. Select system for Preliminary Design.

X. PROGRESS MEETINGS AND COORDINATION

A. Task Force meetings.

B. Coordination with members.

C. Coordination with others.

D. Review Arizona Department of Transportation Concepts and Recommendations.

PHASE III - PRELIMINARY AND FINAL DESIGN

To be negotiated after Phase II completion, and specific scope definition.

DIBBLE & ASSOCIATES 3625 NORTH 16th STREET PHOENIX, ARIZONA 85016
CONSULTING ENGINEERS TELEPHONE 264-6149
BEN T. DIBBLE, P.E. • JAKE T. DOSS, P.E. • RONALD L. EWING, P.E./R.L.S. • KENT M. DIBBLE, P.E. • MYRON G. JASMANN, R.L.S.

May 7, 1987

Mr. D. E. Sagromoso, P.E.
Chief Engineer and General Manager
Flood Control District of Maricopa County
3335 West Durango Street
Phoenix, Arizona 85009

RE: Phase II - Location Study
Price Road Drain (Outer Loop Highway)
Project No. FCD 86-8

The original scope of work for subject project has undergone deletions and additions due to the Arizona Department of Transportation's (ADOT) drainage concept modifications for draining the Outer Loop Freeway north of the Superstition Freeway and the Price Road Expressway south of the Superstition Freeway. They are now considering a combination tunnel and gravity drain system.

As a result of ADOT's changes, it was mutually agreed, at our contract review meeting with Flood Control District personnel on May 5, 1987, that the following work items from our original proposal and scope of work (dated January 10, 1986) can be deleted from our work effort:

1. Task IV B. Alternative Retention Basin Analysis
2. Task IV H. Coordinate Stream Gauge Locations.
3. Task V B. Superstition Freeway Crossing.

Also, at the contract review meeting of May 5, 1987, it was agreed that the scope of work has changed to include the following work items:

1. Review alternatives and cost analyses prepared by HNTB.

2. Add to Location Study Report a general discussion of the impacts of the tunnel concept on current design.

3. Review preliminary HNTB (October, 1986) hydrographs and proposed hydraulic gradeline for the ADOT tunneling alternative.

4. Discuss possible impacts of proposed ADOT tunneling system on the Price Road Drain project. Outline scope to fully analyze impacts and identify alternatives.

5. Remobilize soils testing activities which were put on hold after completion of the East-West segment to await the outcome of HNTB study on the North-South segment.