

Initial Feasibility Report

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

I-17 Storm Drain ACDC to Bell Road

Contract No. 96-16

TRACS Project No. 017 MA 207 H4683 O1L

Federal Project No. STP-17-1(1)

Phoenix – Cordes Junction

Prepared For



Arizona Department of Transportation

Prepared By



• PLANNING • TRANSPORTATION • ENGINEERING • URBAN DESIGN

BRW, Inc., 3003 N. Central Avenue, Suite 700, Phoenix, AZ 85012



September 1999

Don Rerick - FCDX

From: Don Rerick - FCDX
Sent: Thursday, September 23, 1999 8:50 AM
To: 'jwinn@dot.state.az.us'; 'pd046@isgadm.dot.state.az.us'
Cc: Michael Lopez - FCDX; Bob Stevens - FCDX; Don Rerick - FCDX
Subject: I-17 Storm Drain - ACDC to Bell Road

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

I have reviewed the subject "Initial Feasibility Report" and have the following comments:

1. The report indicates that Alternative 3 is preferred.
2. This alternative indicates that no treatment of first flush flows will be done. If the system connects directly to the ACDC, this will not be acceptable, nor approved.
3. Also, the report does not mention anything about right-of-way needs for crossing ACDC right-of-way to make the connection to the ACDC.

With this said, you and I spoke this morning and you stated that Alternative 3 probably won't be selected and that no direct connection to the ACDC will be made.

Please keep the FCDMC in the review loop as necessary if the selected alternative does in fact directly connect to the ACDC.

Thanks.

ARIZONA DEPARTMENT OF TRANSPORTATION

OFFICE MEMO

INTERMODAL TRANSPORTATION DIVISION

September 13, 1999

TO: SEE DISTRIBUTION SHEET

FROM: JAMES L. WINN, ROADWAY PREDESIGN, 050P

JLW

*PD 046 @
136ADM.*

THRU: HERMAN MOZART, PREDESIGN PROGRAM MANAGEMENT SECTION, 050P

SUBJECT: INITIAL FEASIBILITY REPORT
17 MA 208 H468301C
ACDC TO BELL RD.
PHOENIX-CORDES JCT HIGHWAY
I 17

Please review and return or Fax (602-712-8992) your comments to this office (1739 West Jackson, Mail Drop 050P, Phoenix, AZ 85007-3218) by 10/6/1999. Indicate any "no comment" below and return this memo.

This will assist us as we begin finalizing this report. If you cannot respond by the requested date, please call Marta Raiford at (602)712-8548 or Fax us when you can provide your comments. You may utilize E-Mail, but please be sure to send your comments directly to Marta Raiford at (Ls300@isgadm.dot.state.az.us) as she maintains a record of incoming responses.

RECEIVED

Should this project follow the Federal Aid Process? YES NO
If NO, please indicate reasons.

YES NO

YES	NO	ACTIVITY	DURATION
<input type="checkbox"/>	<input type="checkbox"/>		

Do you consider this to be a candidate project for Value Engineering? Indicate which state(s). If YES, please indicate reasons.

YES NO

712-7452

NO COMMENT

PRINT NAME:
OFFICE:

ARIZONA DEPARTMENT OF TRANSPORTATION

OFFICE MEMO

INTERMODAL TRANSPORTATION DIVISION

September 13, 1999

RON BLACKSTONE, MATERIALS GEOTECHNICAL, 068R
BILL HIGGINS, HIGHWAY OPERATIONS, 102A
GEORGE WAY, MATERIALS SECTION, 068R
DOUG ALEXANDER, MATERIALS GEOTECHNICAL, 068R
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RICHARD DUARTE, ENVIRONMENTAL PLANNING, 619E
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INITIAL FEASIBILITY REPORT
17 MA 208 H468301C
ACDC TO BELL RD.
PHOENIX-CORDES JCT HIGHWAY
I 17

RECid: 7752

INITIAL FEASIBILITY REPORT

I-17 STORM DRAIN; ACDC TO BELL ROAD

DISTRICT E – MARICOPA COUNTY
TRACS PROJECT NO.: 017 MA 207 H 4683 01L
FEDERAL PROJECT NO.: STP-17-1(1)
PHOENIX - CORDES JUNCTION HIGHWAY

Prepared for:

Arizona Department of Transportation
1739 West Jackson
Phoenix, Arizona 85007

Prepared by:

BRW, Inc.
3003 North Central Avenue, Suite 700
Phoenix, Arizona 85012

In Association with:

Logan Simpson Design
398 South Mill Avenue, Suite 300
Tempe, Arizona 85281

September 1999

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EXECUTIVE SUMMARY

Project 017 MA 208 H 4683 01L (Federal Reference No. STP-17-1(1)) involves a study to determine the recommended improvements to the storm drainage system along I-17 from the Arizona Canal Diversion Channel (ACDC) to Bell Road located at MP 208 in Maricopa County, Arizona.

The existing pumps in the pumpstations at Peoria Avenue and Cactus, Thunderbird, and Greenway Roads are in need of replacement. Although the pumps can handle a 5-year storm event, the channels to which they discharge are designed to accommodate only the 2-year storm event. The I-17 Freeway is in a roadway class which requires protection for flows for up to the 50-year storm event. As a result, ADOT has retained BRW to conduct a Feasibility Study to evaluate the alternatives for improvements to the existing storm drain system for accommodating the required storm event.

The results of this study are based on the alternatives evaluation and constructibility and drainage analysis. These results indicate that Alternative 3 would provide the best overall design with the most benefits for the costs incurred.

Alternative 3 would upgrade all the existing engines, pumps, discharge piping, and intakes at the interchanges at Peoria Avenue and Cactus, Thunderbird, and Greenway Roads. The existing pumphouses would be demolished. A new pumphouse would be constructed at each interchange north of the existing pumphouse. A new concrete detention vault would be constructed in the quadrant infield of the southbound off-ramp at each interchange. This vault would be sized to detain the storm flow difference between the 50-year and the 2-year events. The existing facilities would remain in operation during construction of the new facilities.

No additional right-of-way is required.

The following projects are listed in the 2000 ADOT 5-Year Highway Construction Program:

Item No.	FY	Begin Milepost	Type of Work	Estimate
19900	2000	209.0	Groove Surface, Reseal Joints	\$3,500,000
22099	2000	209.9	Replace Deck Joint	\$163,000
25100	2000	201.8	Design/Build	\$14,000,000
15601	2001	195.00	Rehabilitate Frontage Roads	\$2,261,000
23001	2001	209.0	Design (Sign Rehab)	\$180,000
15802	2002	209.0	Sign Rehabilitation	\$1,725,000

The estimated construction cost for Alternative 3 is \$7,982,760. The final design costs are estimated at \$478,966. No private utility relocation costs or right-of-way costs are anticipated. It is anticipated that this project will be constructed with federal funds and designed by a consultant.

Additional reports that have been prepared as part of the contract include a Geotechnical Assessment. Site-specific Drainage Reports and a draft Categorical Exclusion are in the process of being prepared.

MITIGATION MEASURES

To be determined from the Categorical Exclusion prepared by Logan Simpson Design when available.

1.0 INTRODUCTION

1.1 Foreword

This report presents the results of a study to identify feasible alternatives, determine a recommended alternative and identify a long range improvement plan for replacement of the existing pump stations along I-17 at Peoria Avenue and Cactus, Thunderbird, Greenway, and Bell Roads in north Phoenix, Maricopa County. I-17 is classified as a Principal Arterial Interstate connecting I-10 in Phoenix with I-40 in Flagstaff. It is in the Drainage Class 1, which corresponds to a protection from flooding for up to the 50-year event.

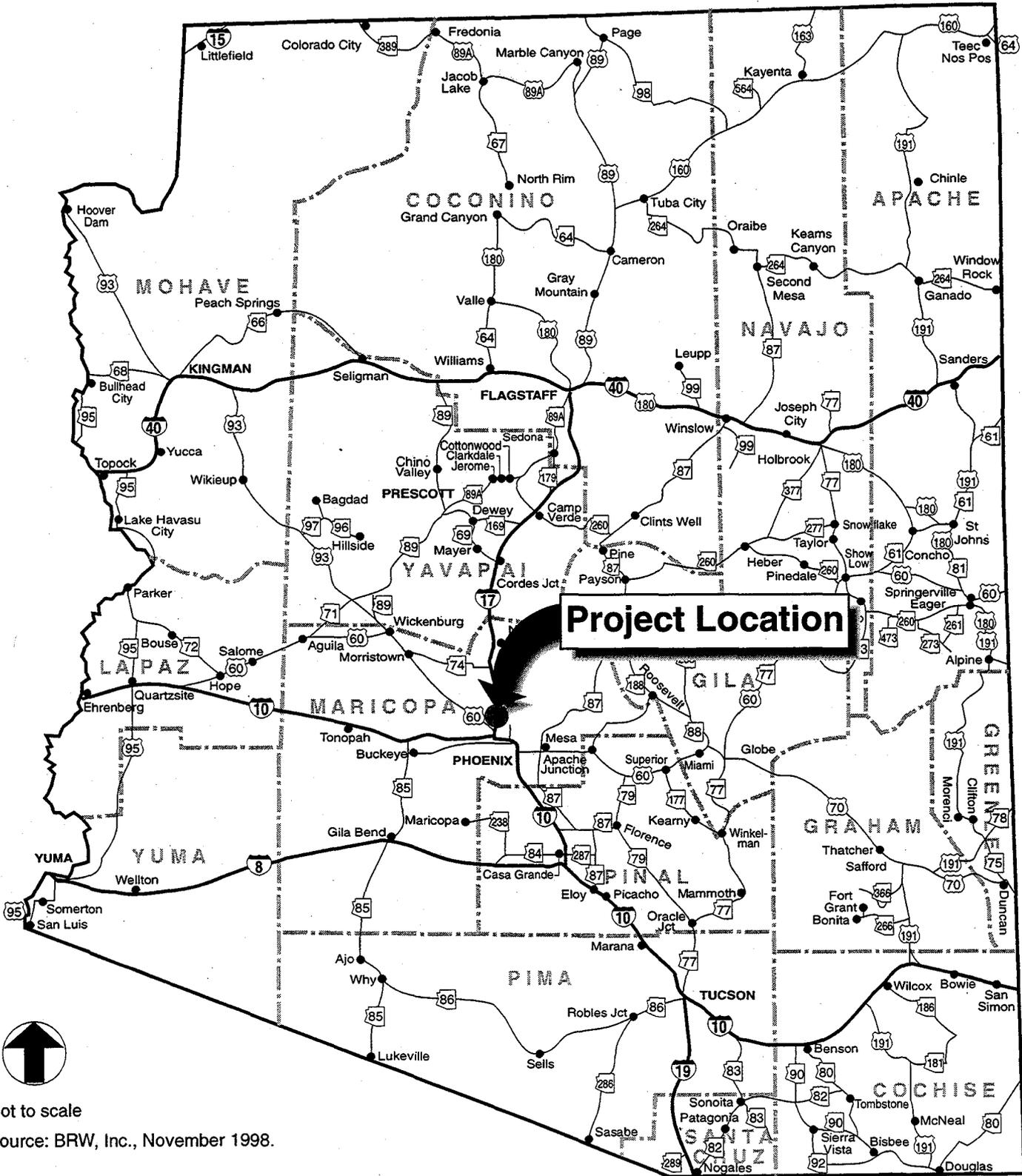
1.2 Need for the Project

The existing pump stations can pump storm flows for up to the 5-year event. However, the discharge is into the City of Phoenix street storm drain system that is sized to accommodate only storm flows for up to a 2-year event. Flows above this level overtop the city system and discharge back to flood the interchange. This has been verified with interviews with the District maintenance personnel. Additionally, the existing pumps need major overhaul or replacement with the exception of the recently installed Bell Road pumps.

ADOT proposes to improve or replace the pump stations to provide protection for up to the 50-year storm event.

1.3 Description of the Project

The I-17 Storm Drain project extends from the Arizona Canal Diversion Channel (ACDC) (MP 208.25) to Bell Road (MP 212.94) a distance of 4.69 miles (see Project Vicinity Map). The preferred alternative would upgrade all the existing engines, pumps, discharge piping, and intakes at the interchanges at Peoria Avenue and Cactus, Thunderbird, and Greenway Roads. The existing pumphouses would be demolished. A new pumphouse would be constructed at each interchange north of the existing pumphouse. A new concrete detention vault would be constructed in the northwest quadrant infield of each interchange. This vault would be sized to detain the storm flow difference between the 50-year and the 2-year events. The existing facilities would remain in operation during construction of the new facilities.



Not to scale

Source: BRW, Inc., November 1998.

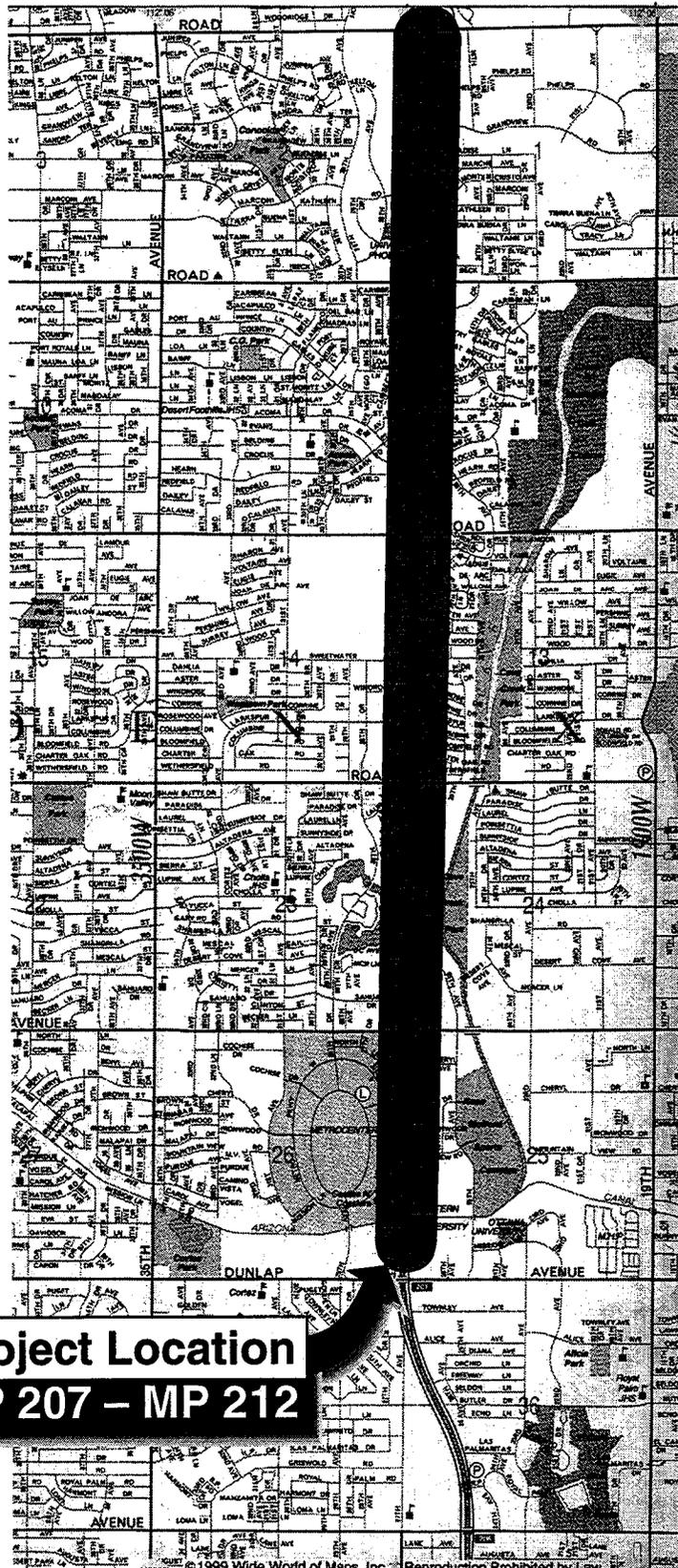


I-17 Storm Drain; ACDC to Bell Road

Arizona Department of Transportation

Figure 1
Project Location





Project Location
MP 207 – MP 212



Not to scale



I-17 Storm Drain; ACDC to Bell Road

Arizona Department of Transportation

Figure 2
Vicinity Map



BRW

A DAMES & MOORE GROUP COMPANY

1.4 Project Objectives

The objective of this project is to improve or replace the pump stations to provide protection for up to the 50-year storm event within the existing interstate corridor.

1.5 Characteristics of the Project Area

The I-17 Storm Drain project area from ACDC to Bell Road is predominantly developed with primarily office-commercial with some light industrial and residential uses. The existing southbound frontage road is in the area between the west Right-of-Way line and the outside edge of pavement of southbound I-17, which varies in width from 57 to over 120 feet. The frontage road varies from one-12' lane variable shoulders at the ramp merge area to four-12' lanes with no shoulder at the crossroad terminals. In general, the frontage road consists of two-12' lanes with no shoulders. The median area separating the mainline from the frontage road varies from 18 to 30 feet. The speed limit of the frontage road is 45 mph.

Original and Successor Construction Projects

The original and successor construction projects which have occurred within the project limits shown below in Table 1.

**TABLE 1
ORIGINAL AND SUCCESSOR CONSTRUCTION PROJECTS**

PROJECT NUMBER	BEGIN MP	END MP	AS-BUILT DATE	DESCRIPTION
I-17-1(148)	194.00	262.20	1984	MP, Guide, Exit Signs
I-17-1-934	194.40	213.50	1971	Repair PCC Joints
I-17-1(133)	196.90	213.02	1981	Landscaping/Irrigation
IR-17-1(117)	198.00	218.25	1989	Median Improvements
I-17-1(80)	199.10	208.89	1978	Peoria T.I. Landscaping
I-17-1(114)	199.80	209.52	1973	Median Rail Safety
NH-17-1(316)	200.10	208.20	1995	Overlay/Safety
I-17-1(85)	200.40	212.80	1969	Install Markers
I-17-1(63)	200.50	210.22	1966	Median Barriers
I-17-1-510	201.90	208.36	1990	Marking

PROJECT NUMBER	BEGIN MP	END MP	AS-BUILT DATE	DESCRIPTION
FIR-17-1(170)	205.90	209.90	1989	Remove & Replace AC
I-17-1(39)	207.40	210.51	1963	PCC
I-17-1(68)	207.40	230.59	1969	Signs/Safety
NH-17-1(312)	207.90	214.90	1994	Median Closure & Shoulders
I-17-1-948	208.00	208.23	1973	GD / Surface
I-17-1-983	208.00	212.96	1979	ACFC
NH-17-1(320)	208.00	208.50		Reconstruct T.I.
NI-003-2-59A	208.00	213.00	1958	Seal Coat
S-39(1)	208.00	212.98	1947	BST
I-17-1(45)	208.20	208.21	1962	Arizona Canal Bridges
I-17-3-901	208.20	208.20	1981	Pave Canal Bottom
I-17-3-912	208.20	208.20	1987	ACDC Bridge
I-17-3-917	208.20	208.21	1986	ACDC Phase I Closure
IR-17-1(150)	208.20	213.41	1983	Pvmt Markers
I-17-1(123)	208.30	220.52	1980	Resurface
IR-17-1(160)	208.40	213.68	1986	Pvmt Rehab/Widening
LSI-17-1(71)	208.50	210.95	1969	T-bird Rd Landscaping
I-17-1-541	208.90	213.91	1993	Bridge Jt. Replacement
I-17-1-955	208.90	208.90	1974	Repair Girders NB
I-17-1-519	209.00	209.00	1990	Ramp Widening
IR-17-1(174)	209.00	209.00	1990	Peoria Ave. T.I.
IR-17-1(165)	209.30	211.96	1985	Pavement Rehab
I-17-1-984	209.90	220.47	1979	Seal Coat
IR-17-1(175)	210.00	210.35	1990	Cactus Road T.I.
I-17-1(40)	210.50	213.46	1973	PCC
I-17-1(40)	210.50	213.46	1963	PCC
I-17-3-906	210.70	210.70	1982	Bridge Repair
I-17-1-511	210.90	211.10	1991	Modify Ramp

PROJECT NUMBER	BEGIN MP	END MP	AS-BUILT DATE	DESCRIPTION
I-17-1-927	210.90	210.90	1970	Repair Girders
I-17-1-928	210.90	210.90	1970	Revamp Signals
I-17-1-953	210.90	210.90	1973	Revamp Signs
I-17-1-981	210.90	210.90	1978	Bridge Repair
I-17-1-990	210.90	210.90	1980	Traffic Signals
I-17-1-997	210.90	210.90	1980	Bridge Repairs
IR-17-1(176)	210.90	210.90	1987	T-bird Road T.I.
I-17-1-520	211.00	211.00	1990	Masonry Noise Wall
LSI-17-1(79)	211.00	212.10	1969	Bell Rd Landscaping
I-17-1-507	211.90	211.90	1970	Add Ramps
I-17-1-967	212.00	212.00	1975	Traffic Signals
NH-17-1(188)	212.20	213.45	1994	Reconstruct T.I /Widen
MA-17-1(322)	212.30	212.82	1995	Landscape & Irrigation
AZM-600-0-510	213.00	214.71	1988	GD/Pave/Str
S-39(2)	213.00	218.72	1947	BST
I-17-1-952	213.30	213.41	1974	ACFC Seal Test
I-17-1-916	213.40	230.52	1968	Seal Coat
I-17-1-929	213.40	241.60	1970	Seal Coat
I-17-1(41)	213.50	216.54	1963	AC

Reconstruction of the southbound frontage road to new standards is not within the scope of this Storm Drain project. The existing Interstate right-of-way corridor varies in width from 263 to 288 feet along the mainline. The right-of-way widths increase at the interchanges. The west right-of-way line is typically 94 feet from the southbound I-17 centerline. Ownership of adjacent property is private.

The developed areas and the interstate have altered the natural drainage pattern. The drainage generally flows east to west. Typically the drainage flows along the right-of-way to just north of the interchanges where it is conveyed in a pipe or box culvert under the Interstate to the west. From there it flows south and west along the West and North right-of-way line into the city storm drain along the north right-of-way line of the city streets. Large drainage facilities include a 2-6'x3' Box Culvert at Sta 598+73 and a 3-10'x3' Box Culvert at Sta 613+88 (between Greenway and Bell Roads).

The surrounding areas are almost built out for mostly office-commercial uses with some light industrial and residential. The soils are composed of sand, gravel, and cobbles moderately cemented with some boulders deposited by the meandering Cave Creek over the time of eons.

2.0 TRAFFIC AND ACCIDENT DATA

Not Applicable to this project

3.0 AASHTO CONTROLLING DESIGN CRITERIA

Not Applicable to this project

4.0 DESIGN CONCEPT ALTERNATIVES

4.1 Introduction

BRW developed five build alternatives for the I-17 Storm Drain in scoping meetings with ADOT staff. Alternative 1 involves replacing the existing pumps and remodeling the existing pumphouses. Alternative 2 involves replacing the existing pumps, remodeling the existing pumphouses, and adding a concrete detention vault at each interchange. Alternative 3 involves constructing a new pumphouse as well as replacing the existing pumps and constructing a concrete detention vault at each interchange. Alternative 4 consists of eliminating the pumpstations at the interchanges and constructing a gravity storm drain system from ACDC to Bell Road a distance of 4.69 miles with open cut-and-cover and shoring methods. In 1994, BRW prepared Project Assessments (PA's) to implement Alternative 1 at Peoria Avenue TI and Cactus Road TI. In 1997 during scoping meetings, the Phoenix Maintenance District requested expanding the construction scope to include expanding the existing wet wells to meet current standards. This led to the development of Alternatives 2, 3, and 4. At a Consensus Meeting in October 1998, a fifth alternative was added. Alternative 5 involves constructing the improvements included in Alternative 4 by a trenchless method to be selected. The "Do Nothing" Alternative would not alter the existing pumpstations or storm drain collection system.

The selection of alternatives for further development was determined by the issues of protection for flows for up to the 50-year storm event, constructibility, and construction cost.

This Study further developed and evaluated the "Do Nothing" Alternative and "Build" Alternatives 3 and 4. Each alternative is described below.

4.2 Design Concept Alternatives Considered and Discontinued

In the early stages of the feasibility study, several of the Design Concepts were considered and some were discontinued. Alternative 1 consisted of upgrading the existing engines, pumps, and discharge piping, and remodeling the existing pumphouses. This alternative would not accomplish the objective of providing flood protection for up to a 50-year storm event therefore it was discontinued.

Alternative 2 consists of upgrading the existing engines, pumps, and discharge piping, and remodeling the existing pumphouses as described in Alternative 1. Additionally the existing wet well would be expanded horizontally and vertically and a concrete detention vault would be constructed in the northwest quadrant infield of each interchange. This alternative would be difficult to construct because the existing wet well would need to be taken off-line to allow construction of its expansion. For this reason this alternative was discontinued from further consideration.

Alternative 5 would construct the gravity drain included in Alternative 4 by trenchless methods such jack-and-bore or tunneling. As shown in the Geotechnical Assessment included as a separate report, the average cost of pipe installing by this method is 217% of installation by the cut-and-cover methods included in Alternative 4. For this reason Alternative 5 was discontinued from further consideration.

4.3 Design Concept Alternatives Studied

Alternative 3 would upgrade all the existing engines, pumps, discharge piping, and intakes at the interchanges at Peoria Avenue and Cactus, Thunderbird, and Greenway Roads. The existing pumphouses would be demolished. A new pumphouse would be constructed at each interchange north of the existing pumphouse. A new concrete detention vault would be constructed in the northwest quadrant infield of each interchange. This vault would be sized to detain the storm flow difference between the 50-year and the 2-year events. The existing facilities would remain in operation during construction of the new facilities.

Alternative 4 would eliminate the existing pumpstations at Peoria Avenue and Cactus, Thunderbird, Greenway, and Bell Roads. A new gravity storm drain would be constructed to collect the flows from each of these interchanges, convey them along the southbound I-17 frontage road, and discharge them into the Arizona Canal Diversions Channel. The off-site flows that are currently conveyed through the Interstate right-of-way to the city storm drain channels and pipes would continue to do so.

4.4 Evaluation of Alternatives

Both of the alternatives (3 and 4) described above have been evaluated with respect to initial construction cost, life-cycle cost, long-term maintenance and reliability, maintenance of traffic during construction, impacts to utilities including storm drains

during construction, and environmental concerns. Each evaluation criterion is briefly described below.

- **Initial Construction Cost** – This criterion is used to rate each alternative based on the initial construction costs, which includes all the anticipated items. The cost estimates have been prepared to a level commensurate with a Stage I design level.
- **Life-Cycle Cost** – This evaluation criterion uses life-cycle cost estimating methods to rate the alternatives by their annual costs for their useful lives.
- **Long-term Maintenance and Reliability** – This criterion considers both alternatives based on their long-term maintenance need and relative reliability.
- **Maintenance of Traffic During Construction** – This criterion considers the traffic control required during construction of either alternative. Maintenance of traffic access for emergency vehicles, business patrons, and residences will be important.
- **Utility Impacts** – This criterion evaluated each alternative on the basis of utility adjustments or relocations required including existing storm drain facilities.
- **Environmental Concerns** – This criterion considers the environmental issues associated with each of the considered improvement alternatives; specifically effects on the water quality of discharges to the Arizona Canal Diversion Channel and ultimately Skunk Creek.

The results of the evaluation are summarized in Table 2.

TABLE 2
EVALUATION OF “DO NOTHING”, ALTERNATIVES 3 AND 4

Alternative			
Evaluation Criteria	“Do Nothing”	3	4
Initial Construction Cost	No cost; least expensive alternative	ACDC to Greenway Road \$7,982,760 Greenway Road to Bell Road \$0	ACDC to Greenway Road \$36,089,108 Greenway Road to Bell Road \$5,030,799

TABLE 2 (Continued)
EVALUATION OF "DO NOTHING", ALTERNATIVES 3 AND 4

Alternative			
Evaluation Criteria	"Do Nothing"	3	4
Life-Cycle Costs	No costs beyond maintenance and operating costs	\$541,569	\$1,678,021
Long-term Maintenance and Reliability	The long-term maintenance will continue to mount while the reliability of the system will continue to degrade.	This alternative will continue to have potential for long-term maintenance and reliability problems as the pumps age. Factors include the risk and associated costs of pump failure at the time of need, ongoing maintenance needs, and risk of electrical outages or gas line breaks at the time of need.	With the proposed improvements, the storm drain should be almost free of long-term maintenance needs or reliability problems.
Maintenance of Traffic During Construction	No new impacts	Traffic will be slightly impacted during the construction of storm drain laterals within the interchanges. The new pumphouses and detention vaults will be constructed away from the traveled way.	This alternative requires the closure of the southbound I-17 frontage road during construction, however, alternate routes exist for almost all businesses and residences. The one exception and the existing crossroads will have pipe jacking to minimize the disruption to traffic.

TABLE 2 (Continued)
EVALUATION OF "DO NOTHING", ALTERNATIVES 3 AND 4

Alternative			
Evaluation Criteria	"Do Nothing"	3	4
Utility Impacts	No impacts.	The only impacted utilities are those which service the existing pumpstations and need to be reconnected to the new pumpstations.	All utilities will be kept in service by being suspended across the storm drain trench with the following exceptions. A sanitary sewer in Sweetwater Avenue will be jacked under. A double 6'x3' CBC south of Greenway, a double 6'x3' CBC north of Greenway and a triple 10'x3' CBC south of Bell will be removed and replaced.
Environmental Concerns	None	Existing storm drains discharge into the city system and then to ACDC without treatment of the first flush.	Included in this alternative the first flush is treated before discharging into the ACDC.

4.5 CONCLUSIONS

The results of the study indicate that based upon the alternative evaluation criteria, Alternative 3 would provide the best overall design with the most benefits for the costs incurred.

Alternative 4 was not recommended because its initial construction cost is 4 times that of Alternative 3. Also its annual cost including capital recovery, operations, and maintenance is twice that of Alternative 3.

5.0 MAJOR DESIGN FEATURES OF THE PREFERRED ALTERNATIVE

5.1 Introduction

The purpose of this Chapter is to document the Design Criteria and Issues associated with the Preferred Alternative to facilitate the Final Design Phase efforts.

5.2 Design Controls

The Detention Vaults and Pumpstations will be designed to accommodate the on-site flows of the 50-year storm event for the traffic interchanges within the project limits.

5.3 Horizontal and Vertical Alignments

The conceptual location of the preferred alternative and typical layout are shown in Appendix A of this Report.

5.4 Access – Not Applicable

5.5 Right-of-Way

The preferred alternative, Detention Vaults and New Pumpstations, does not require any new right-of-way because it will be constructed within the existing Interstate right-of-way generally in the infield of the northwest quadrant at the Peoria Avenue, and Cactus, Thunderbird, and Greenway Roads interchanges.

5.6 Drainage

Features of the Drainage System of the preferred alternative include construction, at Peoria Avenue and Cactus, Thunderbird, and Greenway Roads, of a new pumpstation north of the existing one. All existing engines, pumps, and discharge piping will be replaced. A concrete detention vault will be constructed in each northwest quadrant infield. These vaults will be sized to detain the difference in storm water flows between the 50-year and 2-year storm events. New storm drain pipes will convey the storm flows from the existing collection system to the new detention vaults, to the new pumpstation,

and finally to the existing outfall. The existing pumpstations will be decommissioned and removed.

A drainage study with hydrologic and hydraulic analysis will be required in the Final Design. In addition to determining the onsite runoff of the 50-year storm event, there is a large offsite flow entering the contributing area immediately north of the Greenway Road intersection. Also the offsite flows often overtop the channels on the north side at the first intersection west of I-17 at each interchange. The impacts of these flows on the interchange storm drain system need to be identified and addressed. All hydraulic and hydrologic analysis will need to be discussed with City of Phoenix staff.

5.7 Section 404 of the Clean Water Act

The existing discharge points are unchanged therefore a Section 404 permit will not be required.

5.8 Floodplain Considerations

There are no significant floodplain considerations.

5.9 Earthwork

Installation of the concrete detention vault in an open pit will provide waste material. This waste material is that volume which is excavated from the pit and replaced with either the vault or structural backfill. It will be the contractor's responsibility to dispose properly of this material.

5.10 Constructibility and Traffic Control

The constructibility of the concrete detention vault and new pumpstation are limited by the available working space in the infield. Short duration closures of the ramps may be required to move contractor equipment and deliver pumps and concrete for the detention vaults. Some traffic control will be required to install the new lateral under the existing ramps.

5.11 Intersections

No intersections will be upgraded as part of this project.

5.12 Utilities

There are few utilities in the I-17 corridor. None require relocation. An inventory of existing utilities crossing the southbound frontage road is included in Table 3.

**TABLE 3
UTILITY INVENTORY**

MP	Utility Size and Type	Owner	Comments	Impacts to Open Trench Construction
207			<i>Dunlap Avenue TI</i>	
207.27			ACDC Canal	Outfall
207.29	1-36" CP	ADOT	10' North of ACDC Approach Slab	Replace
207.29	6-5" Ducts	APS	North of Ariz Canal	Maintain
207.27	Duct	U S West	60' North of Ariz Canal R/W	Maintain
207.76	12" Steel - Water	City of Phoenix	ACDC Service Road and Bikepath. 12' South of Peoria	Maintain
208			<i>Peoria Avenue TI</i>	
208.50	12" Steel - Water	City of Phoenix	2665' North of Peoria	Maintain
208.60	1-29" x 18" CMPA	ADOT	2100' South of Cactus	Replace
209			<i>Cactus Road TI</i>	
209.18	2-58"x36" CMPA	ADOT	975' North of Cactus	Replace
209.25	4" HP Steel	Southwest Gas	1330' North of Cactus	Maintain

MP	Utility Size and Type	Owner	Comments	Impacts to Open Trench Construction
209.26	6" VCP – Sewer	City of Phoenix	Doesn't cross; MH west of SB Frt Rd. 1275' S. of Sweetwater	N/A
209.31	1-29"x18" CMPA	ADOT	1650' North of Cactus	Replace
209.53	1-29"x18" CMPA	ADOT	2500' South of Thunderbird	Replace
209.49	12" Steel – Water	City of Phoenix	41' South of Sweetwater	Maintain
209.50			Sweetwater Avenue – No TI	
209.51	33" RCP – Sewer	City of Phoenix	In 54" steel sleeve. 15' North of Sweetwater	Maintain
209.53	1-29"x18" CMPA	ADOT	2500' South of Thunderbird	Replace
209.75	22" Steel – Water	City of Phoenix	1330' North of Sweetwater	Maintain
209.80	Duct	U S West	<i>1037' South of Thunderbird</i>	<i>Maintain</i>
210			Thunderbird Road TI	
210.20	2-6'x3' CBC	ADOT	1050' North of Thunderbird	Replace
210.24	4" HP Steel	Southwest Gas	1250' North of Thunderbird	Maintain
210.50	4" HP Steel	Southwest Gas	20' North of Acoma	Maintain

MP	Utility Size and Type	Owner	Comments	Impacts to Open Trench Construction
210.50	12" ACP - Water	City of Phoenix	2660' North of Thunderbird	Maintain
210.50	2-6'x3' CBC	ADOT	2650' South of Greenway	Replace
<i>211</i>			<i>Greenway Rd TI</i>	
211.00	54" RCP-Sewer	City of Phoenix	7' North of Greenway	Maintain
211.00	48" RCP Water	City of Phoenix	18' South of Greenway	Maintain
211.02	Conduit	U S West	120' North of Greenway	Maintain
211.22	2-6'x3' CBC	ADOT	1140' North of Greenway	Replace
211.51	3-3'x10' CBC	ADOT	2606' South of Bell	Replace
<i>212</i>			<i>Bell Road TI</i>	

5.13 Structures

The preferred alternative has no impacts to existing bridges or noise walls.

5.14 Pavement Design

Not applicable

5.15 Design Exceptions

None Required

6.0 ITEMIZED COST ESTIMATE

New Pump House
DETAILED ESTIMATE

FOR
STAGE 1 - ACDC CANAL TO PEORIA AVENUE
TYPICAL FOR CACTUS, THUNDERBIRD, AND GREENWAY
NEW PUMP HOUSE, NEW DETENTION STORAGE

Project Tracs No.: 017 MA 208 H4683 01L
 Location: Storm Drain, ACDC Canal to Bell Road
 Route: I-17, Phoenix, Cordes Junction Highway

Item Description	Unit	Quantity	Unit Price	Amount
Removal of Structures & Obstructions	L. Sum	1	15,000.00	\$15,000
Pipe Culvert, 16"	L.F.	60	45.00	\$2,700
Pipe Culvert, 24"	L.F.	320	60.00	\$19,200
Pipe Culvert, 42"	L.F.	245	120.00	\$29,400
Slope Paving	S.Y.	100	30.00	\$3,000
Drainage Excavation	C.Y.	50	10.00	\$500
2 Natural Gas Engines, 2 Pumps with Controls & Misc. Connections	L. Sum	1	286,000.00	\$286,000
Provide 2" Water Service	L. Sum	1	5,000.00	\$5,000
Provide Natural Gas Service	L. Sum	1	17,000.00	\$17,000
Trash Rack (60 Degree) with Bolts	Each	1	1,200.00	\$1,200
New Pumphouse	L. Sum	1	500,000.00	\$500,000
Abandon Existing Pumpstation	Each	1	\$10,000	\$10,000
Concrete for Vault (Detention Basin)	C.Y.	1,150	200.00	\$230,000
Reinforced Steel for Vault (Detention Basin)	LB	150,000	0.40	\$60,000
Structural Excavation for Vault (Detention Basin)	C.Y.	7,500	8.00	\$60,000
Structural Backfill for Vault (Detention Basin)	C.Y.	2,000	12.00	\$24,000
Pavement Cut & Replacement for Ramp	S.Y.	110	30.00	\$3,300
Curb & Gutter	L.F.	240	10.00	\$2,400
Slotted Drain, 24"	L.F.	80	40.00	\$3,200
Catch Basin	Each	4	2,500.00	\$10,000
Manhole	Each	4	3,500.00	\$14,000
Subtotal				\$1,295,900
Survey (3%)				\$38,880
Maintenance Protection of Traffic (14%)				\$181,430
Mobilization (7%)				\$90,710
Construction Engineering and Contingencies (30%)				\$388,770
Total Construction Cost				\$1,995,690
Initial Cost of Pumps & Service	\$	\$308,000		
Life	Years	18		
Rate of Return	%	4%		
Capital Recovery Factor		0.07899		
Capital Recovery Cost for pumps	\$308,000 x		0.07899	\$24,330
Initial Cost of Vaults (Total minus pumps)	\$	\$1,687,690		
Life	Years	50		
Rate of Return	%	4%		
Capital Recovery Factor		0.04655		
Capital Recovery Cost for Vaults	\$1,687,690 x		0.04655	\$78,562
Annual Maintenance				\$20,000
Annual Operations				\$6,000
Total Annual Cost				\$128,892

APPENDIX A

PLAN OF PREFERRED ALTERNATIVE

N

21-17

Ramp

ROW

23' x 20' x 20' min

Proposed
11' x 50' x 160'
Detention Vault

42" pipe

Prop. Pump House

24" rcp @ 1% min

42" pipe
33" pipe
EXIST

Ditch

Peoria Ave / Cactus Rd.

Appendix A

ARIZONA DEPARTMENT OF TRANSPORTATION

ALTERNATIVE 3, NEW
PUMP HOUSE, ADD DETENTION STORAGE

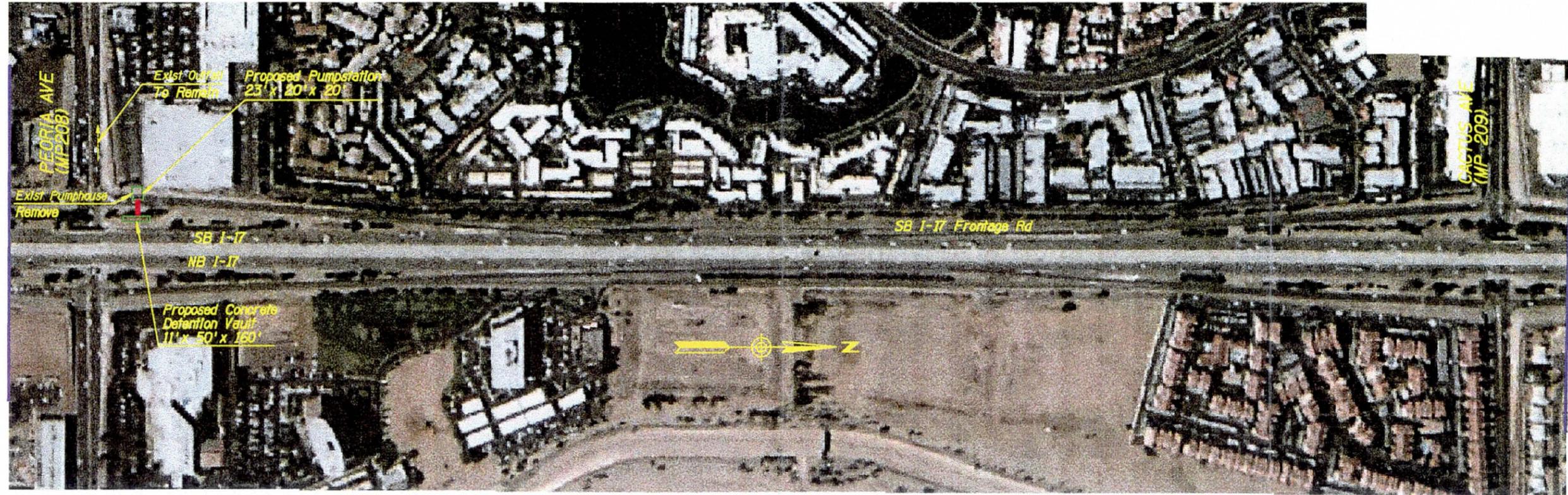
CACTUS RD/PEORIA AVE TI PUMPS



3003 N. Central Ave.
Suite 700
Phoenix, Arizona 85012
(602) 234-1591

Sheet 1 of 5

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	STP-17-1(K)			



DATE	
LOCATION	
REVISIONS	
DESIGN PLANS	
SURVEY NO.	

APPENDIX A

DESIGN	NAME	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION INTERMODAL TRANSPORTATION DIVISION	PRELIMINARY NOT FOR CONSTRUCTION OR RECORDING
DRAWN	BRL			
CHECKED	JMF			
 3003 N. Camelback Ave. Suite 700 Phoenix, Arizona 85018 4800 234-1998		STORM DRAIN FEASIBILITY STUDY PLAN SHEET STA 50+00 TO STA 108+00		
ROUTE	I-17	LOCATION	ACDC TO BELL ROAD	DWG. NO.

ooooDGN SPECIFICATIONoooo
ooooSYSTEMEoooo

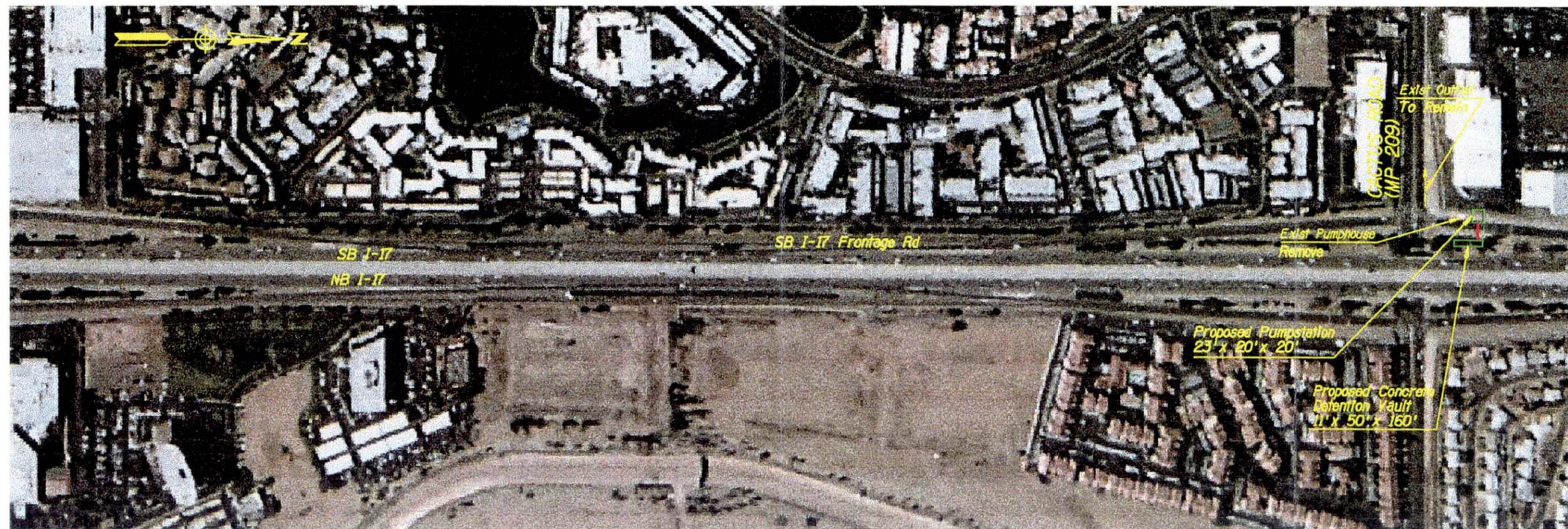
VIEW NAME:

TRACS NO. H4683 01 L

STP-17-1(K)

2 OF 5

F.H.R.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	STP-17-1(1)			



APPENDIX A

DESIGN	NAME	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION INTERMODAL TRANSPORTATION DIVISION	PRELIMINARY NOT FOR CONSTRUCTION OR RECORDING
DRAWN				
CHECKED				
 3003 N. CENTRAL AVE. SUITE 100 PHOENIX, ARIZONA 85028 (602) 234-8998			STORM DRAIN FEASIBILITY STUDY PLAN SHEET STA 50+00 TO STA 108+00	
ROUTE	LOCATION		DWG. NO.	
I-17	ACDC TO BELL ROAD			

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	STP-17-1(I)			



DATE	LOCATION	REVISIONS	DESIGNED PLUS	CHECKED	DATE

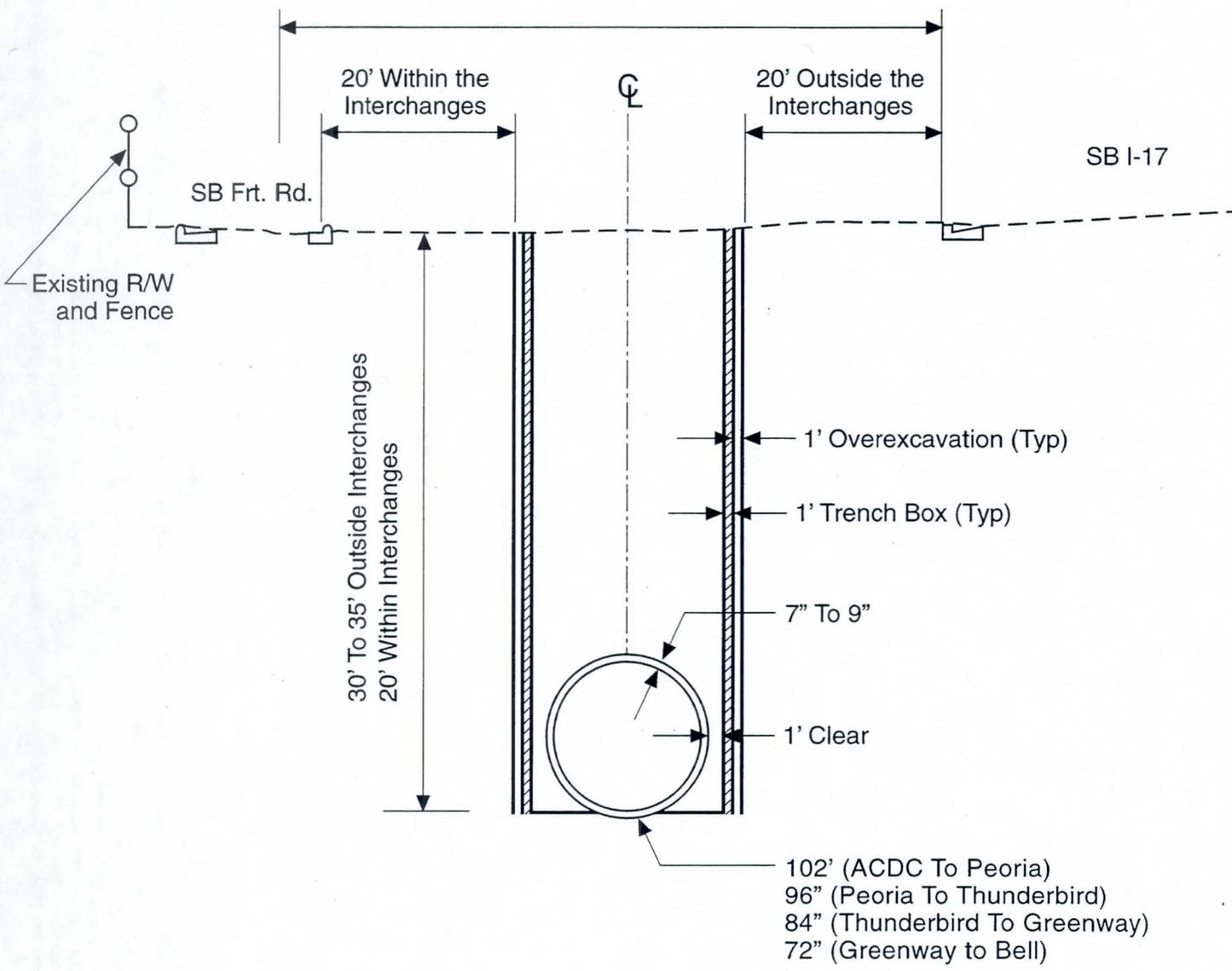
APPENDIX A

DESIGN	NAME	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION INTERMODAL TRANSPORTATION DIVISION	PRELIMINARY NOT FOR CONSTRUCTION OR RECORDING
DRAWN			STORM DRAIN FEASIBILITY STUDY PLAN SHEET STA 166+00 TO STA 224+00	
CHECKED				
 3003 N. Central Ave., Suite 700 Phoenix, Arizona 85012 (602) 234-1888			ROUTE: I-17 LOCATION: ACDC TO BELL ROAD	DWG. NO.

00000DGN0SPECIFICATION00000 VIEW NAME:
 00000SYTIME00000

APPENDIX B

PLAN AND PROFILE OF ALTERNATIVE NOT RECOMMENDED



**Typical Section
Open Trench With Shoring**



I-17 Storm Drain; ACDC to Bell Road

Arizona Department of Transportation

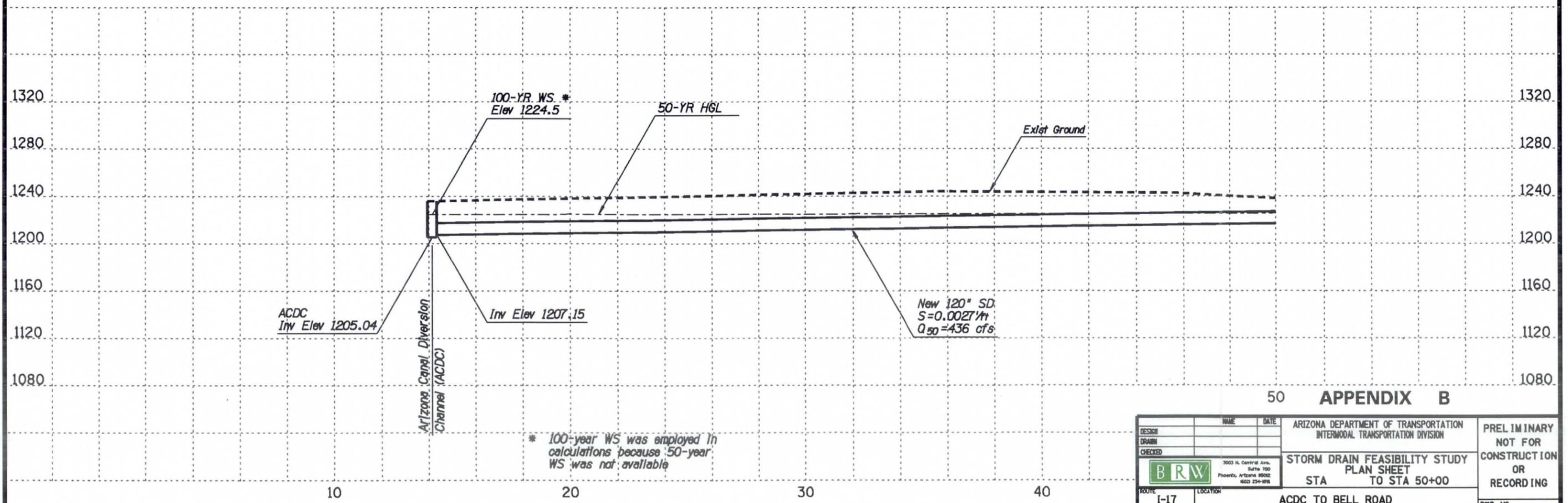
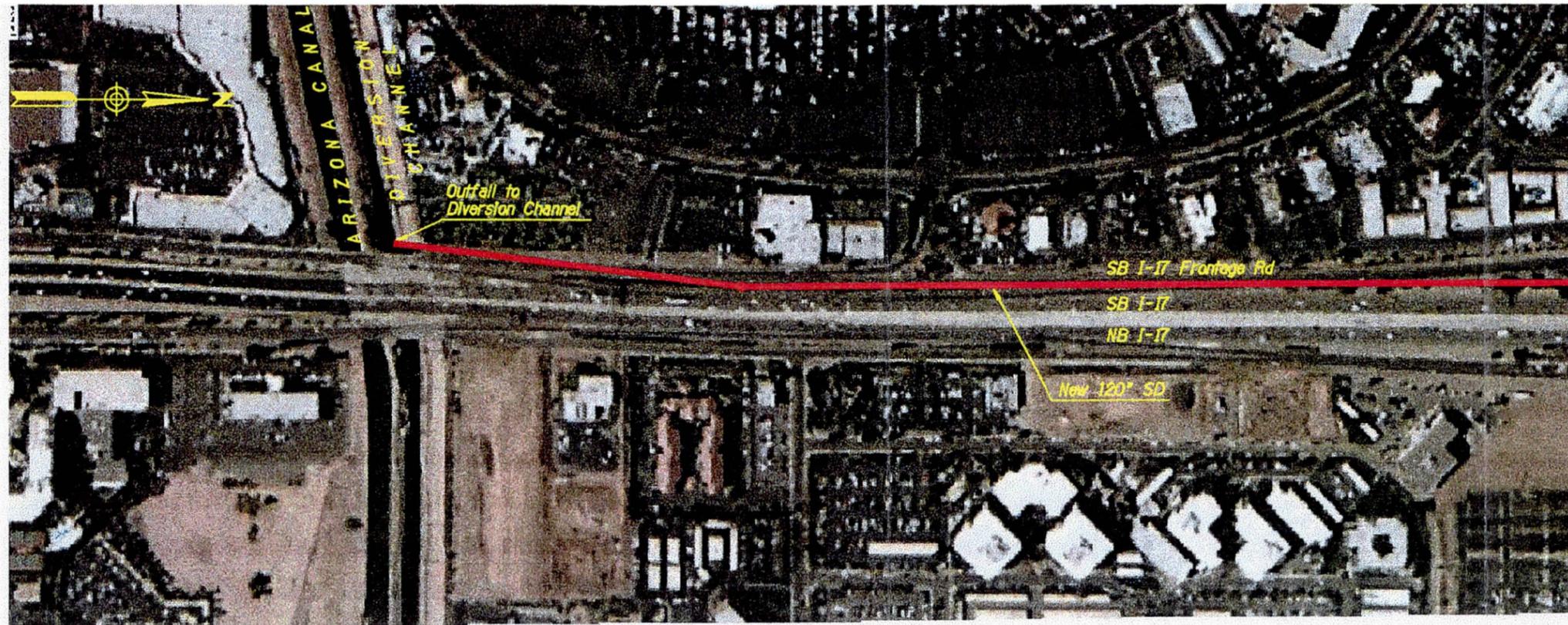
**Appendix B
Trench Section**



BRW

A DAMES & MOORE GROUP COMPANY

F.A.R.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	STP-17-1(1)			



* 100-year WS was employed in calculations because 50-year WS was not available

50 APPENDIX B

DESIGN	NAME	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION INTERMODAL TRANSPORTATION DIVISION	PRELIMINARY NOT FOR CONSTRUCTION OR RECORDING
DRAWN				
CHECKED				
			STORM DRAIN FEASIBILITY STUDY PLAN SHEET	
ROUTE I-17 LOCATION ACDC TO BELL ROAD			STA TO STA 50+00	DWG. NO.

00000DGN0SPECIFICATION00000
00000SYTIME00000

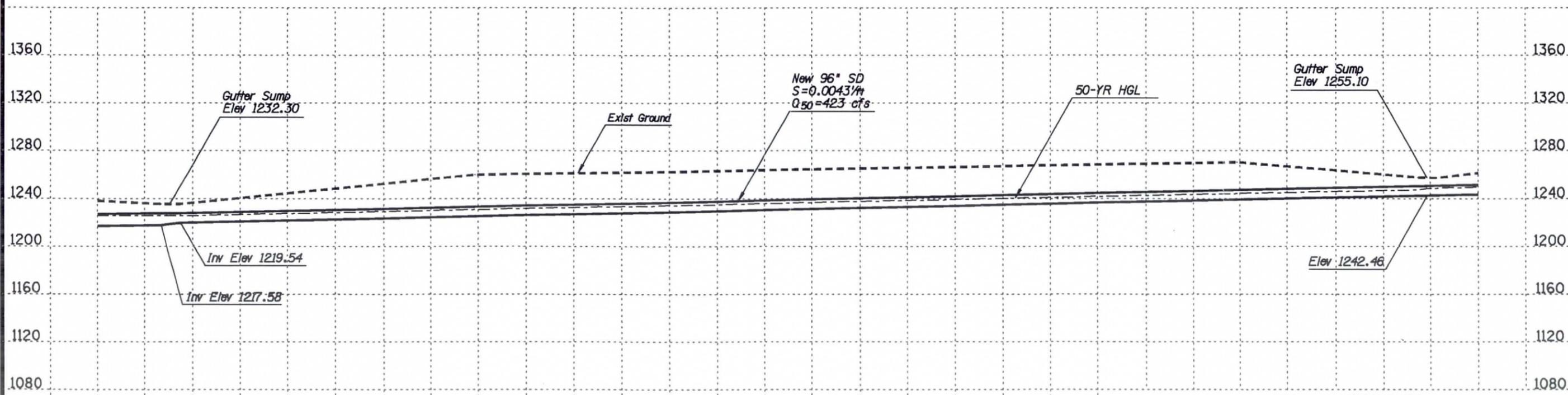
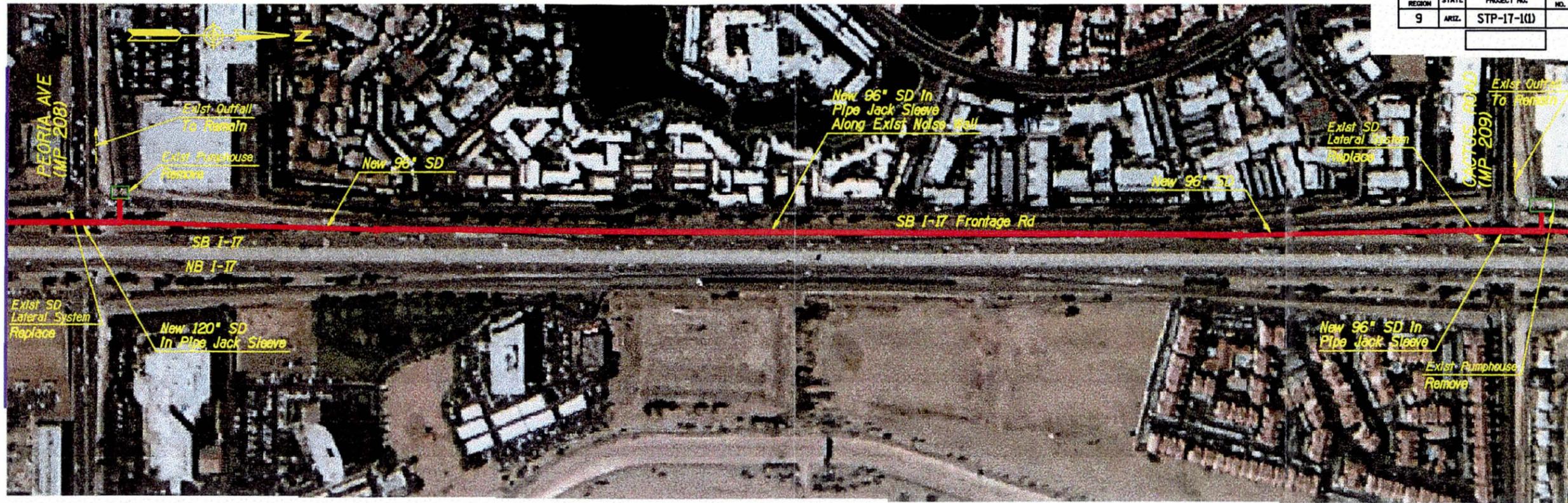
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TRACS NO. 14683 01 L

STP-17-1(1)

1 OF 5

F.A.R.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	STP-17-1(I)			

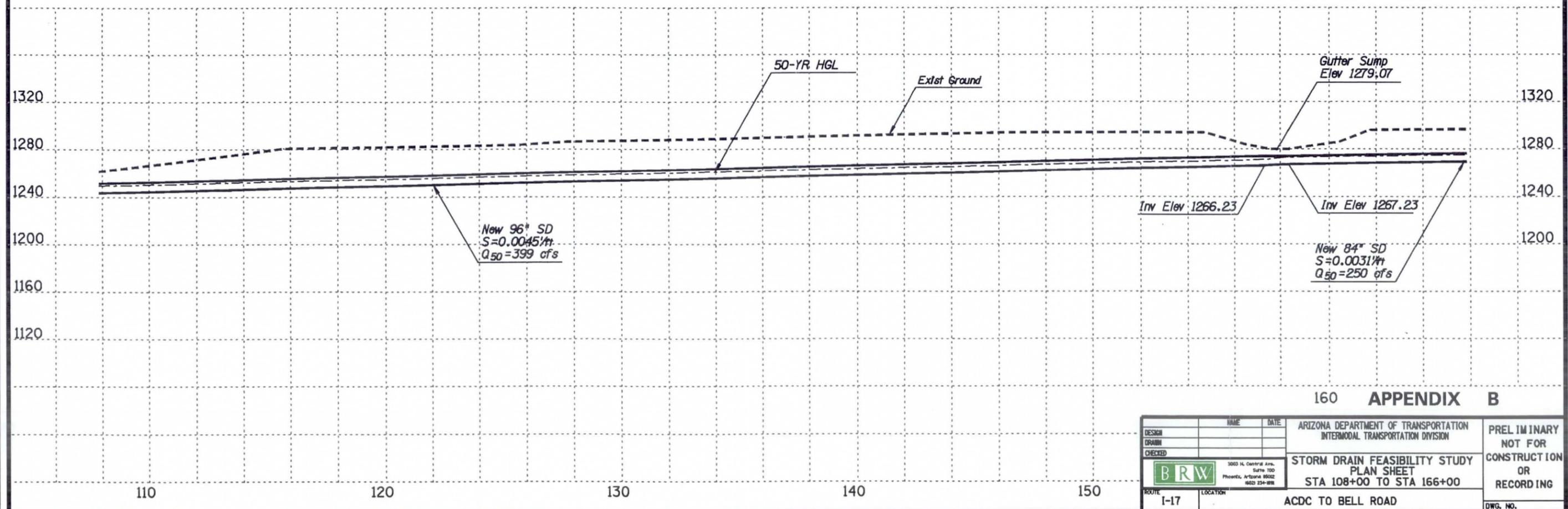
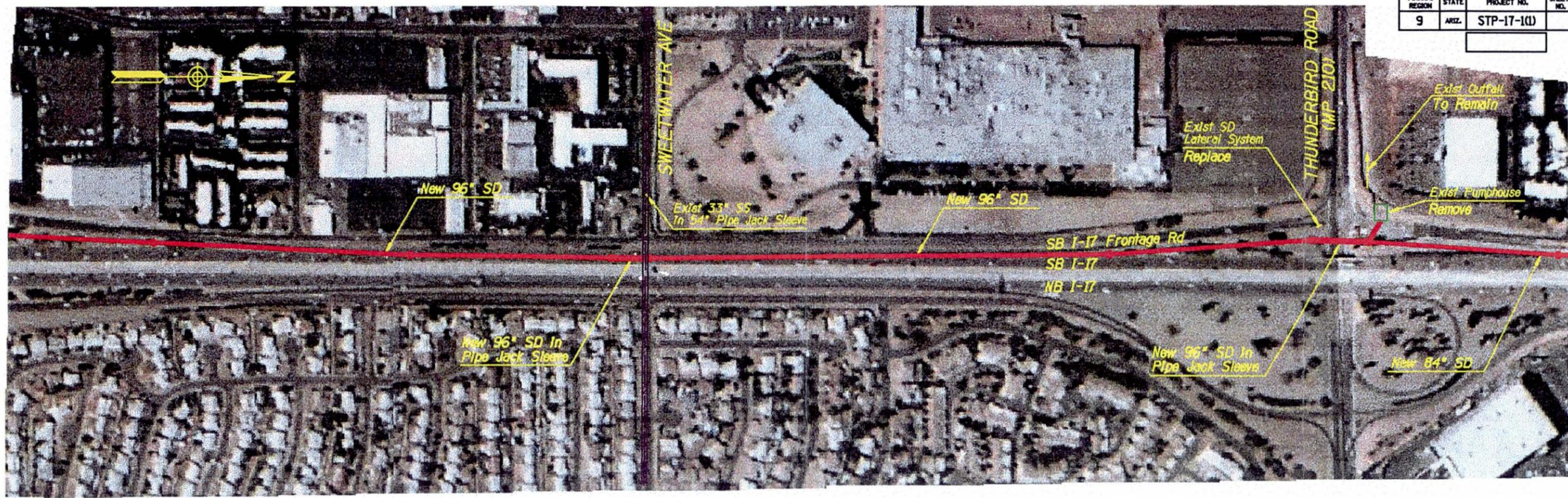


100 APPENDIX B

00000DGN0SPECIFICATION00000 VIEW NAME: 00000SYSTEME00000

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DRAWN				
CHECKED				
			2003 N. Central Ave. Suite 100 Phoenix, Arizona 85002 602 254-0991	
ROUTE	LOCATION	STORM DRAIN FEASIBILITY STUDY PLAN SHEET STA 50+00 TO STA 108+00		DWG. NO.
I-17	ACDC TO BELL ROAD			

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	STP-17-101			



DESIGN	NAME	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION INTERMODAL TRANSPORTATION DIVISION	PRELIMINARY NOT FOR CONSTRUCTION OR RECORDING
DRAWN				
CHECKED				
			1000 N. Central Ave. Suite 100 Phoenix, Arizona 85002 602 254-8888	
ROUTE	LOCATION		STORM DRAIN FEASIBILITY STUDY PLAN SHEET STA 108+00 TO STA 166+00	DWG. NO.
I-17	ACDC TO BELL ROAD			

00000DGN0SPECIFICATION00000
00000SYSTIME00000

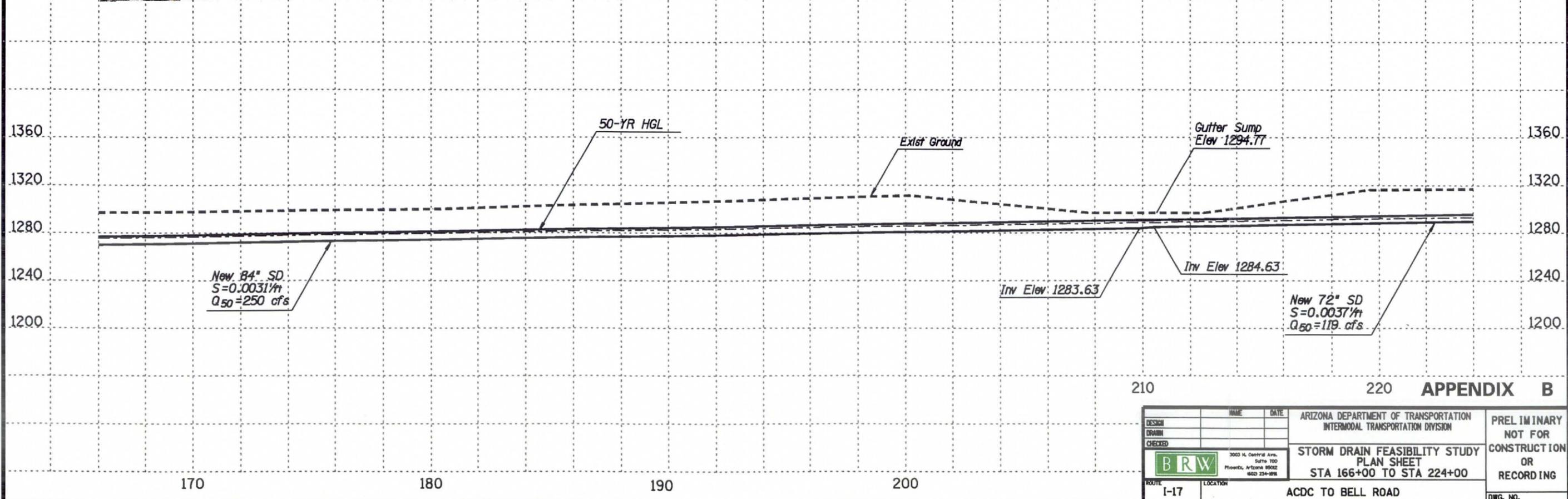
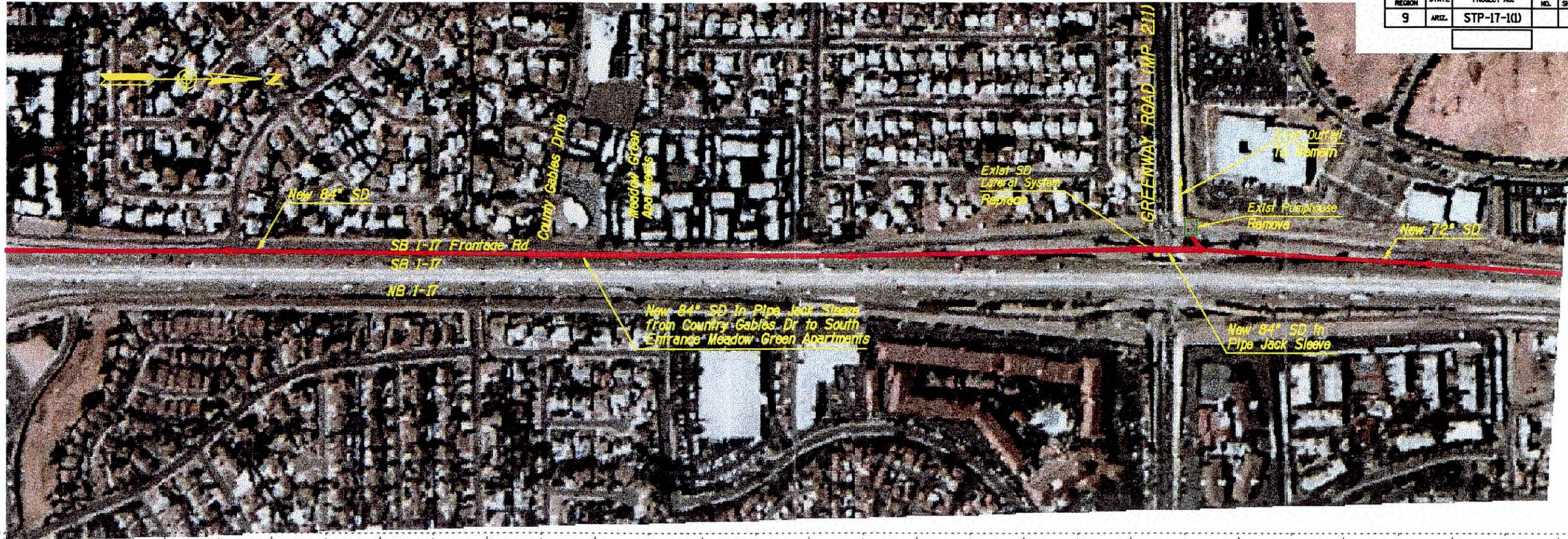
VIEW NAME:

TRACS NO. M4683 01 L

STP-17-101

3 OF 5

F.A.R.W. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	STP-17-1(I)			

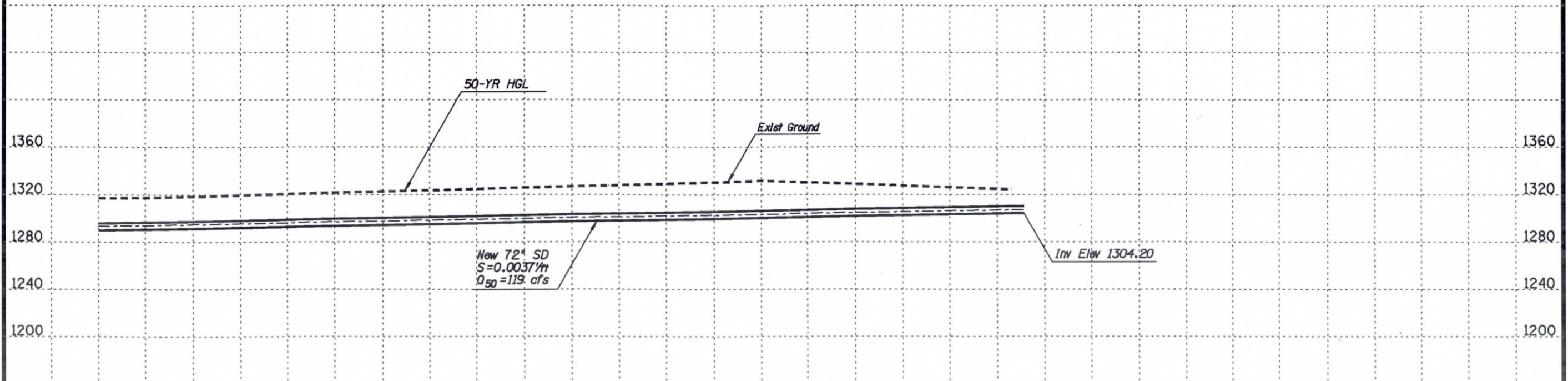
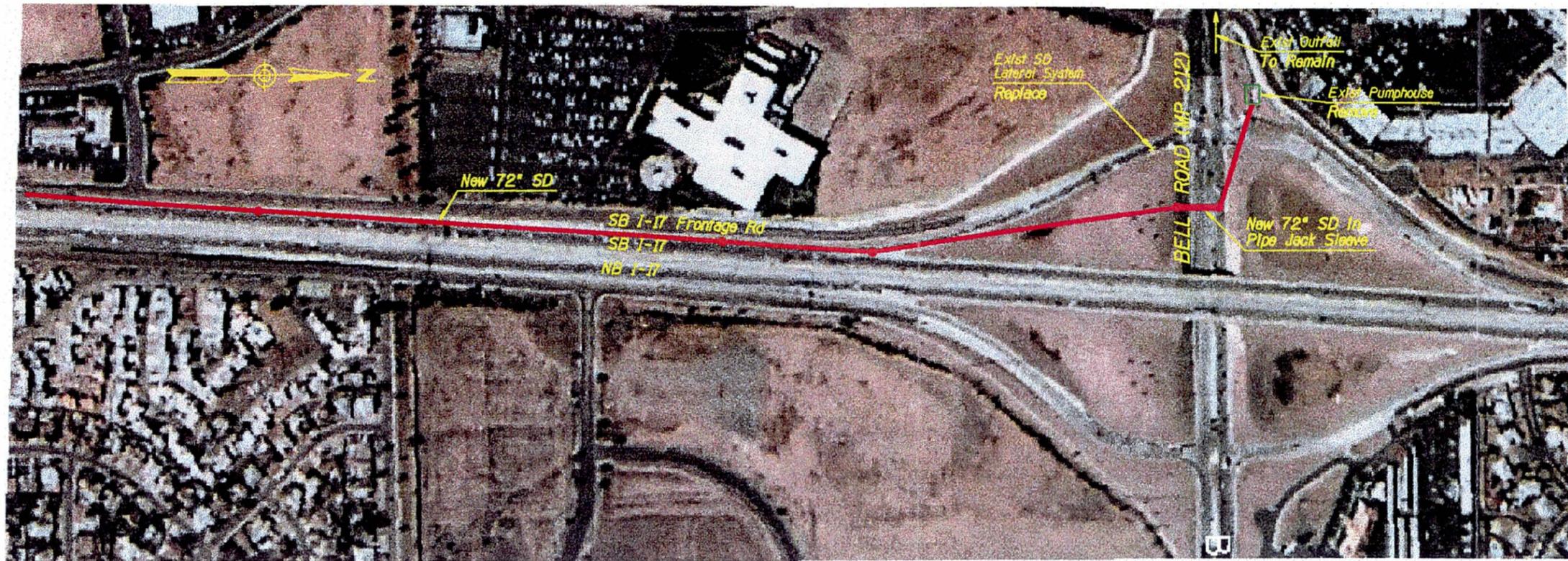


DESIGN	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION INTERMODAL TRANSPORTATION DIVISION STORM DRAIN FEASIBILITY STUDY PLAN SHEET STA 166+00 TO STA 224+00	PRELIMINARY NOT FOR CONSTRUCTION OR RECORDING
DRAWN			
CHECKED			
		3023 N. Central Ave. Suite 100 Phoenix, Arizona 85002 602 234-8998	
ROUTE	LOCATION		DWG. NO.
I-17	ACDC TO BELL ROAD		

00000DGN0SPECIFICATION00000
00000SYTIME00000

VIEW NAME:

F.H.R.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	STP-17-1(1)			



270 APPENDIX B

DESIGN	NAME	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION INTERMODAL TRANSPORTATION DIVISION	PRELIMINARY NOT FOR CONSTRUCTION OR RECORDING
DRAWN				
CHECKED				
 3003 N. Central Ave. Suite 100 Phoenix, Arizona 85028 602-234-9881			STORM DRAIN FEASIBILITY STUDY PLAN SHEET STA 224+00 TO STA	
ROUTE	I-17		ACDC TO BELL ROAD	DWG. NO.

00000DGN0SPECIFICATION00000
00000SYTIME00000

VIEW NAME:

TRACS NO. W4683 01 L

STP-17-1(1)

5 OF 5

APPENDIX C

**CONSTRUCTION COST ESTIMATE OF ALTERNATIVE NOT
RECOMMENDED**

**DETAILED ESTIMATE
FOR
ACDC CANAL TO GREENWAY ROAD
Project Length = 3.72 Miles**

Project Tracs No.: 017 MA 208 H4683 01L
 Location: Storm Drain, ACDC Canal to Bell Road
 Route: I-17, Phoenix - Cordes Junction Highway

Item Description	Unit	Quantity	Unit Price	Amount
Removal of Structures and Obstructions	L.Sum	1	\$ 10,000.00	\$ 10,000.00
ACDC Connection with Flap Gate	Each	1	\$ 25,000.00	\$ 25,000.00
Pipe Culvert, 24"	L.F.	1280	\$ 60.00	\$ 76,800.00
Pipe Culvert, 42"	L.F.	980	\$ 120.00	\$ 117,600.00
Pipe Culvert, 120"	L.F.	3705	\$ 760.00	\$ 2,815,800.00
Pipe Culvert, 96"	L.F.	7100	\$ 660.00	\$ 4,686,000.00
Pipe Culvert, 84"	L.F.	4730	\$ 615.00	\$ 2,908,950.00
120" Pipe Jacking	L.F.	150	\$ 1,740.00	\$ 261,000.00
96" Pipe Jacking	L.F.	6080	\$ 1,455.00	\$ 8,846,400.00
84" Pipe Jacking	L.F.	150	\$ 1,330.00	\$ 199,500.00
120" Culvert in Pipe Jacking	L.F.	150	\$ 580.00	\$ 87,000.00
96" Culvert in Pipe Jacking	L.F.	6080	\$ 325.00	\$ 1,976,000.00
84" Culvert in Pipe Jacking	L.F.	150	\$ 250.00	\$ 37,500.00
Remove Existing Pump Station	Each	4	\$ 10,000.00	\$ 40,000.00
Pavement Cut and Replacement	S.Y.	9533	\$ 30.00	\$ 285,990.00
Curb and Gutter	L.F.	5470	\$ 10.00	\$ 54,700.00
Slotted Drain,24"	L.F.	320	\$ 40.00	\$ 12,800.00
Catch Basin	Each	16	\$ 2,500.00	\$ 40,000.00
Manhole (60")	Each	8	\$ 3,500.00	\$ 28,000.00
Storm Drain Junction Structure	Each	10	\$ 10,000.00	\$ 100,000.00
Storm Drain Junct Str in Pipe Jack Access Shaft	Each	13	\$ 8,000.00	\$ 104,000.00
Storm Drain Junct Str with Storm Ceptor Insert	Each	1	\$ 40,000.00	\$ 40,000.00
Pipe Jacking Access Shaft	Each	14	\$ 150,000.00	\$ 2,100,000.00
Remove and Replace Box Culvert 2-6'X3'	Each	2	\$ 18,000.00	\$ 36,000.00
Subtotal				\$ 24,889,040.00
Survey (3%)				\$ 746,671.20
Maintenance Protection of Traffic (7%)				\$ 1,244,452.00
Mobilization (7%)				\$ 1,742,232.80
Construction Engineering (15%)				\$ 3,733,356.00
Contingencies (15%)				\$ 3,733,356.00
Total Construction Cost				\$ 36,089,108.00

**DETAILED ESTIMATE
FOR
GREENWAY ROAD TO BELL ROAD
Project Length = 1.0 Miles**

Project Tracs No.: 017 MA 208 H4683 01L
 Location: Storm Drain, ACDC Canal to Bell Road
 Route: I-17, Phoenix - Cordes Junction Highway

Item Description	Unit	Quantity	Unit Price	Amount
Removal of Structures and Obstructions	L.Sum	1	\$ 5,000.00	\$ 5,000.00
Pipe Culvert, 72"	L.F.	5360	\$ 560.00	\$ 3,001,600.00
72" Pipe Jacking	L.F.	190	\$ 1,150.00	\$ 218,500.00
72" Culvert in Pipe Jacking	L.F.	190	\$ 190.00	\$ 36,100.00
Remove Existing Pump Station	Each	1	\$ 10,000.00	\$ 10,000.00
Pavement Cut and Replacement	S.Y.	3333	\$ 30.00	\$ 99,990.00
Curb and Gutter	L.F.	290	\$ 10.00	\$ 2,900.00
Manhole (60")	Each	2	\$ 3,500.00	\$ 7,000.00
Storm Drain Junction Structure	Each	5	\$ 10,000.00	\$ 50,000.00
Storm Drain Junct Stru Pipe Jack in Access Shaft	Each	2	\$ 8,000.00	\$ 16,000.00
Pipe Jacking Access Shaft	Each	2	\$ 150,000.00	\$ 300,000.00
Remove and Replace Box Culvert 2-6'X3'	Each	1	\$ 17,000.00	\$ 17,000.00
Remove and Replace Box Culvert 3-10'X3'	Each	1	\$ 35,000.00	\$ 35,000.00
Subtotal				\$ 3,799,090.00
Survey (3%)				\$ 113,972.70
Maintenance Protection of Traffic (7%)				\$ 265,936.30
Mobilization (7%)				\$ 265,936.30
Construction Engineering (15%)				\$ 569,863.50
Contingencies (15%)				\$ 569,863.50
Total Construction Cost				\$ 5,030,798.80

APPENDIX D

LIFE CYCLE COST ANALYSIS OF ALTERNATIVES CONSIDERED

Summary

Item Description	Alternative 4 Gravity Drain Initial Cost	Alternative 3 New Detention and Pumphouse Initial Cost	Gravity Drain Capital Recovery Cost	Gravity Drain Maintenance & Operations Cost	Gravity Drain Total Annual Cost	New Detention and Pumphouse Capital Recovery Cost	New Detention and Pumphouse Maintenance & Operations Cost	New Detention and Pumphouse Total Annual Cost
Stage 1 - ACDC Canal to Greenway	\$36,089,108	\$7,982,760	\$ 1,472,724	\$0	\$1,472,724	\$411,569	\$104,000	\$515,569
Stage 2 - Greenway Road to Bell Road	\$5,030,799	\$0	\$ 205,297	\$0	\$205,297	\$0	\$26,000	\$26,000
Total Construction Cost	\$41,119,907	\$7,982,760	\$ 1,678,021	\$0	\$1,678,021	\$411,569	\$130,000	\$541,569
Difference in Initial Cost		\$33,137,147	415.11% of Alternative 3					
Difference in Annual Cost		\$1,136,452	209.84% of Alternative 3					
Cost of money (bond rate minus inflation)=		4.00%						

New Pump House
DETAILED ESTIMATE

FOR
STAGE 1 - ACDC CANAL TO PEORIA AVENUE
TYPICAL FOR CACTUS, THUNDERBIRD, AND GREENWAY
NEW PUMP HOUSE, NEW DETENTION STORAGE

Project Tracs No.:
 Location:
 Route:

017 MA 208 H4683 01L
 Storm Drain, ACDC Canal to Bell Road
 I-17, Phoenix, Cordes Junction Highway

Item Description	Unit	Quantity	Unit Price	Amount
Removal of Structures & Obstructions	L. Sum	1	15,000.00	\$15,000
Pipe Culvert, 16"	L.F.	60	45.00	\$2,700
Pipe Culvert, 24"	L.F.	320	60.00	\$19,200
Pipe Culvert, 42"	L.F.	245	120.00	\$29,400
Slope Paving	S.Y.	100	30.00	\$3,000
Drainage Excavation	C.Y.	50	10.00	\$500
2 Natural Gas Engines, 2 Pumps with Controls & Misc. Connections	L. Sum	1	286,000.00	\$286,000
Provide 2" Water Service	L. Sum	1	5,000.00	\$5,000
Provide Natural Gas Service	L. Sum	1	17,000.00	\$17,000
Trash Rack (60 Degree) with Bolts	Each	1	1,200.00	\$1,200
New Pumphouse	L. Sum	1	500,000.00	\$500,000
Abandon Existing Pumpstation	Each	1	\$10,000	\$10,000
Concrete for Vault (Detention Basin)	C.Y.	1,150	200.00	\$230,000
Reinforced Steel for Vault (Detention Basin)	LB	150,000	0.40	\$60,000
Structural Excavation for Vault (Detention Basin)	C.Y.	7,500	8.00	\$60,000
Structural Backfill for Vault (Detention Basin)	C.Y.	2,000	12.00	\$24,000
Pavement Cut & Replacement for Ramp	S.Y.	110	30.00	\$3,300
Curb & Gutter	L.F.	240	10.00	\$2,400
Slotted Drain, 24"	L.F.	80	40.00	\$3,200
Catch Basin	Each	4	2,500.00	\$10,000
Manhole	Each	4	3,500.00	\$14,000
Subtotal				\$1,295,900
Survey (3%)				\$38,880
Maintenance Protection of Traffic (14%)				\$181,430
Mobilization (7%)				\$90,710
Construction Engineering and Contingencies (30%)				\$388,770
Total Construction Cost				\$1,995,690
Initial Cost of Pumps & Service	\$	\$308,000		
Life	Years	18		
Rate of Return	%	4%		
Capital Recovery Factor		0.07899		
Capital Recovery Cost for pumps	\$308,000 x		0.07899	\$24,330
Initial Cost of Vaults (Total minus pumps)	\$	\$1,687,690		
Life	Years	50		
Rate of Return	%	4%		
Capital Recovery Factor		0.04655		
Capital Recovery Cost for Vaults	\$1,687,690 x		0.04655	\$78,562
Annual Maintenance				\$20,000
Annual Operations				\$6,000
Total Annual Cost				\$128,892

Gravity Drain

**DETAILED ESTIMATE
FOR
STAGE 1 - ACDC CANAL TO GREENWAY ROAD
GRAVITY STORM DRAIN (RCP)
Project Length =3.72 Miles**

Project Tracs No.: 017 MA 208 H4683 01L
Location: Storm Drain, ACDC Canal to Bell Road
Route: I-17, Phoenix, Cordes Junction Highway

Item Description	Unit	Quantity	Unit Price	Amount
See Detailed Estimate				
Initial Cost of Pipe	\$	\$36,089,108		
Life	Years	100		
Rate of Return	%	4%		
Capital Recovery Factor		0.040808		
Capital Recovery Cost for pipe	\$36,089,108 x		0.040808	\$1,472,724.32
Annual Maintenance				\$0
Total Annual Cost				\$1,472,724

Gravity Drain

**DETAILED ESTIMATE
FOR
STAGE 2 - GREENWAY ROAD TO BELL ROAD
GRAVITY STORM DRAIN (RCP)
Project Length = 1.0 Miles**

Project Tracs No.: 017 MA 208 H4683 01L
 Location: Storm Drain, ACDC Canal to Bell Road
 Route: I-17, Phoenix, Cordes Junction Highway

Item Description	Unit	Quantity	Unit Price	Amount
See Detailed Estimate				
Initial Cost of Pipe	\$			\$5,030,799
Life	Years			100
Rate of Return	%			4%
Capital Recovery Factor			0.040808	
Capital Recovery Cost for pipe	\$5,030,799 x		0.040808	\$205,296.85
Annual Maintenance				\$0
Total Annual Cost				\$205,297