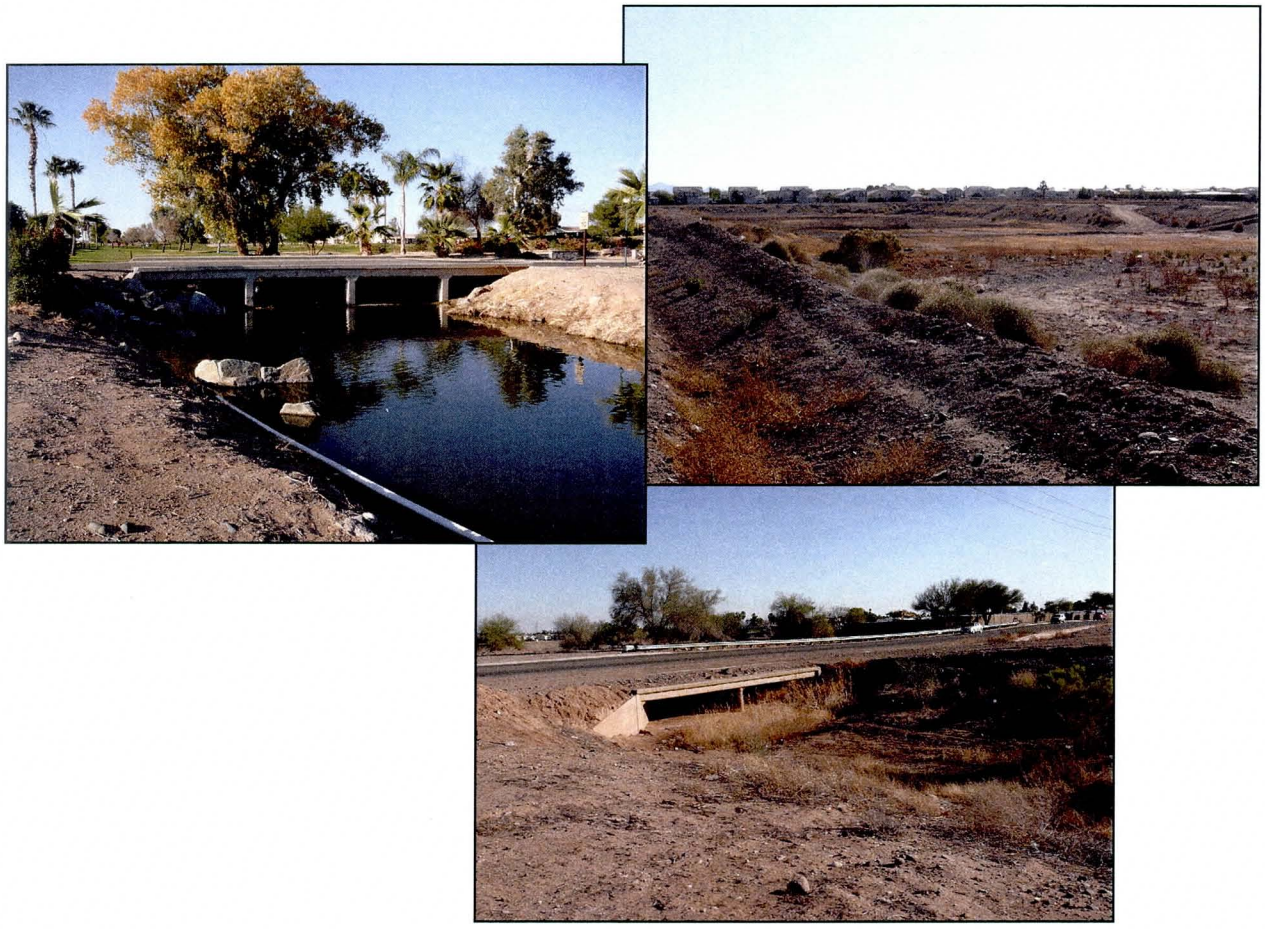

Lower El Mirage Wash Design Concept Report
Phase 1 – Analysis and Recommendations
Summary Report for Phase 1

FCD Contract No: 2008C014

Work Assignment No. 2

June 4, 2010

Prepared for:

Flood Control District of Maricopa County
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Date Signed 6/4/10
ARIZONA U.S.A.
Exp 9/30/2010

EXECUTIVE SUMMARY

This report documents the study results for a reach of Lower El Mirage Wash from the confluence at the Agua Fria River upstream to Cactus Road. The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) indicates about 35 homes lie within a special flood hazard area. The FEMA FIRM Panel of record is 04013C1605J, dated September 30, 2005. The special flood hazard area south of Cactus Road is from the original Flood Insurance Study, circa 1992.

Recently, the contributing watershed hydrology has been updated and restudied several times. The most recent update documents a significant decrease for Lower El Mirage Wash discharges (reduced from 1750 cfs to 200 cfs). This report documents the existing condition hydrology and localized revisions to the recently completed Loop 303 / White Tanks ADMPU Area Hydrologic Analysis (FCDMC, 2009).

During the course of this study, detailed mapping for the study reach was acquired and incorporated into the hydraulic model (HEC-RAS) for the study reach. The results of the modeling indicate that 35 homes can now be removed from the mapped floodplain. To expedite the removal of the 35 homes and revisions to FEMA special flood hazard areas, this project has been broken into phases.

Phase 1 (this document) determines the following:

- Existing condition discharge, 200 cfs
- Existing flooding hazards and estimation of flooding limits.
- Existing channel capacity for the study reach without flooding existing homes, 270 cfs.

Phase 2 is currently being scoped and has been divided into two independent tasks. They include:

- Part A – Filing a request for Letter of Map Revision (LOMR) with FEMA. This task will include both new hydrology and floodplain mapping.
- Part B – Alternatives Development and Analysis of proposed drainage improvements in the study reach will be evaluated for hydrologic and hydraulic impacts. Proposed improvements may include local as well as regional projects. This shall be accomplished through the FCDMC alternatives analysis process. Any floodplain revisions resulting from the alternative analysis will be carried forward into the design phase.

At the conclusion of the alternatives analysis, any of the recommended alternative(s) may be proposed for future design projects. Any floodplain revisions resulting from the design projects will be filed as a Conditional Letter of Map Revision (CLOMR) at the end of the design phase.

TABLE OF CONTENTS

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CERTIFICATE NO.
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ARIZONA, U.S.A.

LIST OF FIGURES

LIST OF EXHIBITS

LIST OF TABLES

LIST OF APPENDICES

Appendix A – Scope of Work

Appendix B – Data Collection Memorandum

Appendix C – Project Contacts, Meeting Minutes, and Comment Resolution

- C1 – Project Contacts
- C2 – Meeting Minutes
- C3 – Written Comments
- C4 – Record of Comment Resolution

Appendix D – Rainfall Runoff Response Modeling using HEC-1

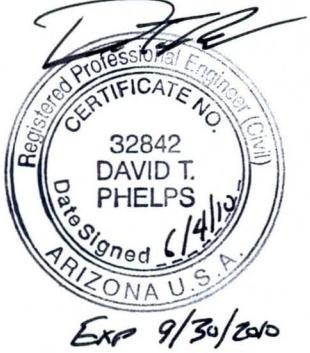
- D1 – Technical Memorandum - Hydrologic Review of ADMPU-AHA (2009) Existing Condition HEC-1 files
- D2 – Existing Condition without CIP HEC-1 output (hard copy)
- D3 – Backup data for revisions to ADMPU-AHA (2009) Existing Condition without CIP HEC-1 model
- D4 – Existing Condition with CIP HEC-1 output (hard copy)
- D5 – Backup data for revisions to ADMPU-AHA (2009) Existing Condition with CIP HEC-1 model

Appendix E – Floodplain modeling using HEC-RAS

- E1 – Effective HEC-RAS output (hard copy)
- E2 – Corrected Effective HEC-RAS output (hard copy)
- E3 – Pictures of existing structures

Appendix F – Project Exhibits

Appendix G – Digital Data



1.0 INTRODUCTION

Lower El Mirage Wash and its contributing watershed are located in the West Valley of the Phoenix Metro area, within Maricopa County, Arizona. A Site Map showing the vicinity of the project is shown on Figure 1. The Lower El Mirage Wash drainage passes through the Cities of Surprise and El Mirage. This study addresses the lower reach of Lower El Mirage Wash. For simplicity, "this study" is referred to hereafter as LEMW DCR.

1.1 Project Area

The project area is focused on the specific reach of Lower El Mirage Wash bounded by the Agua Fria River at the downstream end and the confluence of the Lower El Mirage Wash Tributary with Lower El Mirage Wash at the upstream end. The confluence is located approximately 800 feet upstream (north) of Cactus Road. The Vicinity Map is shown on Figure 2.

1.2 Overview

The lower reach of Lower El Mirage Wash passes through a private development known as Pueblo El Mirage, located within the City of El Mirage. The Pueblo El Mirage development was constructed circa 1985, prior to the original White Tanks/Agua Fria Area Drainage Master Study (ADMS) by WLB in 1991 (FCDMC, 1991). The 1985 design flow utilized for the development is reported to be significantly less than the 1991 ADMS and subsequent ADMP updates (FCDMC, 2004). The Lower El Mirage Wash Floodplain for the Pueblo El Mirage area was mapped as part of the original 1991 ADMS, and constitutes the effective floodplain mapping for Lower El Mirage Wash south of Cactus Road.

1.3 Purpose and Need

The current FEMA floodplain mapping for the Pueblo El Mirage development shows multiple structures located within the effective floodway/ floodplain. Additionally, areas designated for development are located within the floodway/floodplain of record.

The *Final Hydrology Report, Loop 303 / White Tanks ADMPU Area Hydrologic Analysis in Maricopa County, Arizona v1.2 / September 2009* (FCDMC, 2009) documents peak flow discharge values significantly less than the original 1991 ADMS used to establish the effective floodway/floodplain of record. This recent hydrology study is referred to as the ADMPU-AHA (2009). The recently completed ADMPU-AHA (2009) utilized rainfall data from NOAA 14 rather than NOAA 2, as in previous studies. In addition to rainfall data, the watershed was updated with current land use data, existing detention/retention data and new flow split estimates. Consequently, the Lower El Mirage Wash floodway/floodplain of record appears to overestimate the 100-yr flooding potential for Pueblo El Mirage Wash. In addition to the findings of the ADMPU-AHA (2009), there are several upstream watershed components that influence the magnitude of discharge in this project study reach. The purpose for Phase I of this study is to determine and evaluate the existing condition 100-yr event passing through the Pueblo El Mirage development.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER EL MIRAGE WASH DCR
Phase 1
Analysis and Recommendations
FCD 2008C014 WA #2

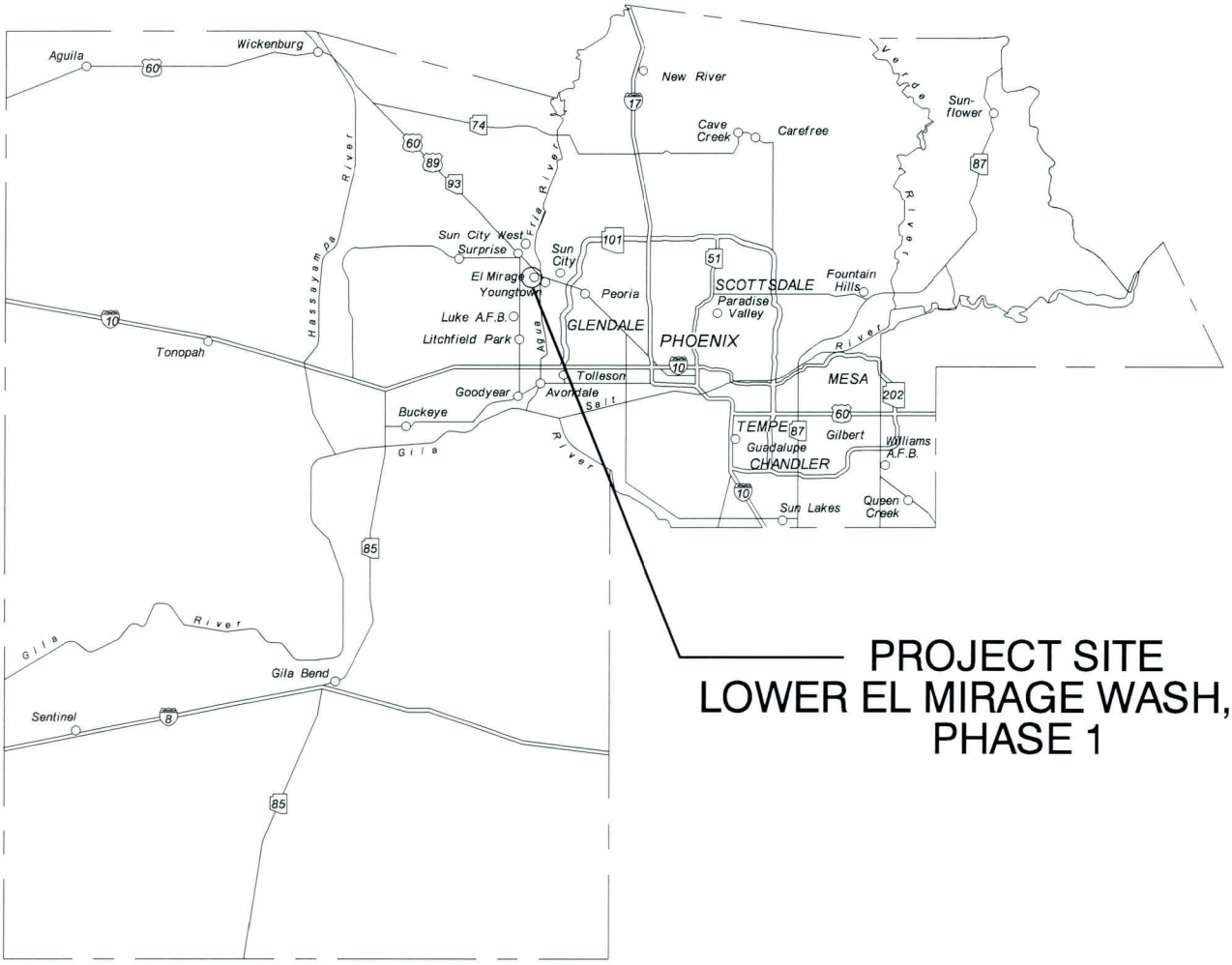


FIGURE 1
SITE MAP

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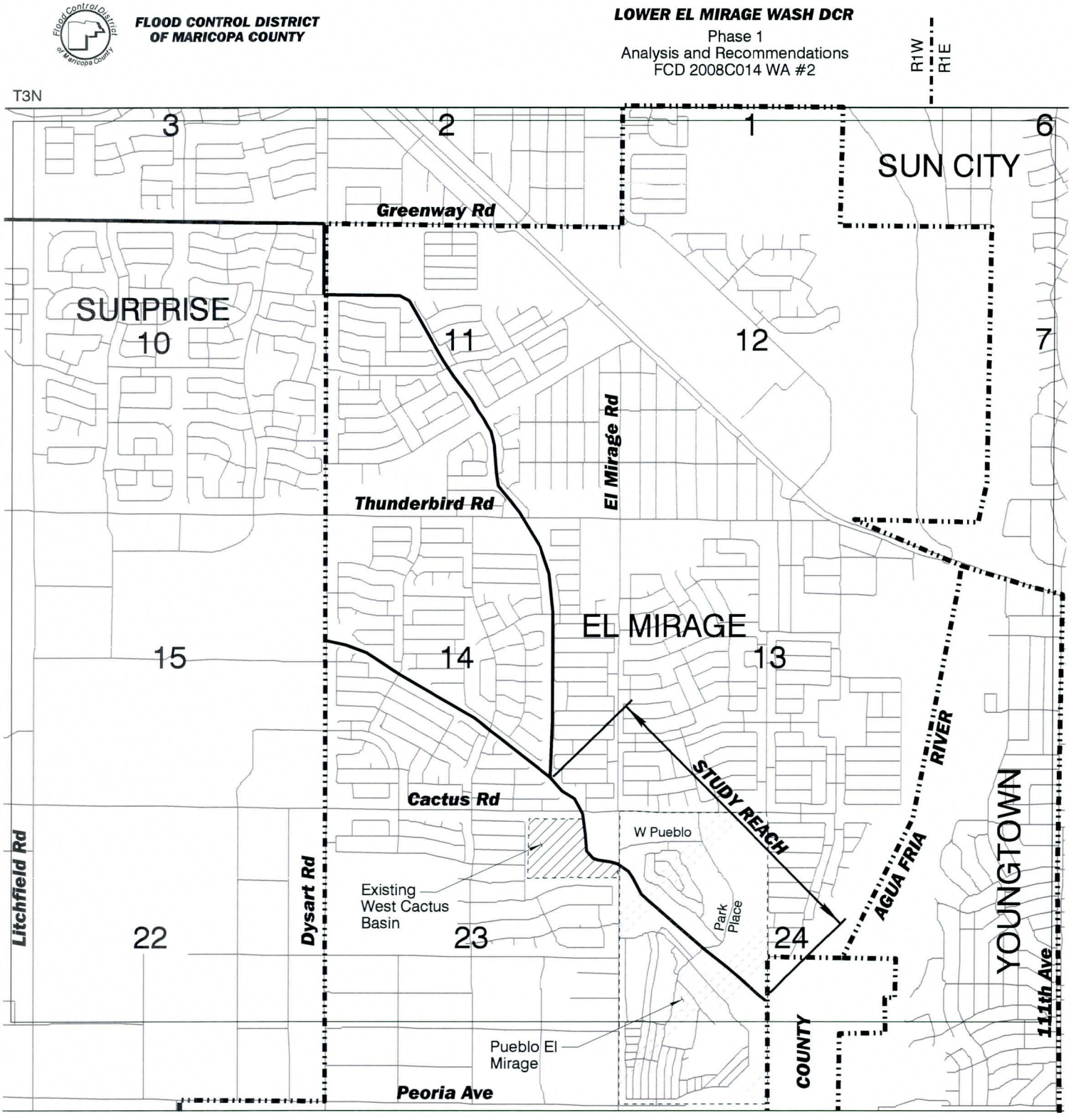
AZTEC
TYPSA Group www.typsa.es
www.aztec.us
4561 E. McDowell Road
Phoenix, AZ 85008-4505
Tel (602) 454-0402
Fax (602) 454-0403

R:\Phoenix\Projects\AZE0913 FCD On-Call\02 LowerElMirageWashDCR\CADD\Sheets\Exhibits\Drainage\Figure 1.dgn

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER EL MIRAGE WASH DCR
Phase 1
Analysis and Recommendations
FCD 2008C014 WA #2



Key to Symbols

- Lower El Mirage Wash Existing Channel
- City Limit
- 23 Section Number

N

N.T.S.

FIGURE 2
VICINITY MAP

AZTEC TYPSA Group www.aztec.us www.typsa.es
4561 E. McDowell Road
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Fax (602) 454-0403

R:\Phoenix\Projects\AZE0913 FCD On-Call\02 LowerElMirageWashDCR\CADD\Sheets\Exhibits\Drainage\Figure 2.dgn

1.4 Scope of Work

The scope and purpose of Phase 1 is three fold. First, the existing condition discharge for Lower El Mirage Wash will be determined using the ADMPU-AHA (2009) existing condition without CIP HEC-1 model. Second, the existing condition flooding limits will be estimated using the HEC-2 model of record. Third, determination of maximum conveyance for Lower El Mirage Wash through the Pueblo El Mirage development, without flooding existing homes, is required. The Scope of Work for this project is included in Appendix A.

A change order was approved to provide four additional work tasks. The four work tasks are: (1) supplemental survey data, (2) determination of existing condition stormwater storage for West Cactus Basin, (3) update HEC-RAS model using results of the first two tasks, and (4) measurement and estimation of observed storm event during the third week of January, 2010. The Scope of Work for Change Order No. 1 is included in Appendix A.

1.5 Project Goals

The goals for Phase 1 of this study are:

- Establish the existing condition peak discharge.
- Estimate existing condition flooding limits.
- Determine capacity of Lower El Mirage Wash through Pueblo El Mirage.
- Measurement and estimation of the observed January 21, 2010 event.

2.0 DATA COLLECTION

2.1 Previous Studies

Several drainage studies have documented various peak discharge rates for this study reach. Table 1 provides a comparison of peak discharge rates documented by previous studies for Lower El Mirage Wash, east of El Mirage Road, passing through Pueblo El Mirage.

TABLE 1.1 – Comparison of peak discharge rates for Pueblo El Mirage

Date	Drainage Study	100-yr peak Discharge (cfs)
1985	Federal Emergency Management Agency, Original FIS	250[1]
2001	Lower EL Mirage Wash Channelization LOMR	1,753[1, 2]
2004	Loop 303 Corridor / White Tanks ADMP update	857[1, 3]
2009	Loop 303 / White Tanks ADMP-AHA (2009)	214[3]
2010	This study - revisions to the ADMPU-AHA (2009)	200[4]
2010	This study - revisions to the ADMPU-AHA (2009)	230[5]

Notes:
(1) Per "West Cactus Detention Basin and Channels Project CAR" (FCDMC, 2004).
(2) FEMA LOMR, by A-N West for the City of El Mirage for channelization upstream (northwest) of El Mirage Road.
(3) Flow revision and resulting mapping revisions not submitted to FEMA.
(4) Existing condition without CIP.
(5) Existing condition with CIP, conceptual design for West Cactus Basin.

2.2 Mapping and Survey Data

Mapping for Phase 1 of this project consists of several mapping data sets. Hydrologic analysis utilized mapping produced for previous projects. The Phase 1 hydraulic analysis utilized two sets of mapping. The original White Tanks / Agua Fria ADMP mapping was used to estimate wash hydraulics. Supplemental survey data collected in January 2010 by FCDMC survey crews was used to supplement the White Tanks / Agua Fria ADMP mapping. In addition, the existing West Cactus Basin was surveyed. Detailed mapping resulting from 2008 aerial photography for the study reach was ordered and delivered on schedule for Phase 2, near the end of Phase 1. Vertical mapping datum's vary. Computations and elevations presented throughout this report are on the National Geodetic Vertical Datum of 1929 (NGVD29), unless indicated otherwise.

To convert NGVD29 to North American Vertical Datum of 1988 (NAVD88), add 1.87 ft (**NGVD29 + 1.87-ft = NAVD88**). Detailed information regarding the mapping and survey data used for this project is provided in Appendix B.

2.3 FEMA and Floodplain Data

Lower El Mirage Wash is regulated by the Federal Emergency Management Agency (FEMA). The study reach contains both floodway and floodplain delineations. The current Flood Insurance Rate Map (FIRM) for this project is panel 04013C1605J (1605 of 4350) for Maricopa County and incorporated areas. The current FIRM panel is dated September 30, 2005, portions of which are reproduced on Exhibit F1.

The vertical datum used by FEMA is NGVD29 for this area.

3.0 HYDROLOGY

3.1 Existing Conditions

For Phase 1 of LEMW DCR, the ADMPU-AHA (2009) was utilized for the effective hydrology model. Specifically, the existing condition without CIP HEC-1 model was reviewed and revised to establish existing condition magnitudes of rainfall runoff for this study. The technical memorandum documenting specifics of the hydrologic review is included in Appendix D1. Based on the review, four revisions were made to update the existing condition without CIP HEC-1 model for local conditions.

3.1.1 Revision No 1 – extract watershed

The first revision was to extract the portion of Major Basin D draining to CPD54, which is the HEC-1 concentration point at the outlet of this study reach. The portion of the local watershed contained within the ADMPU-AHA (2009) Major Basin D that drains to CPD54 is illustrated on Exhibit F2 in Appendix F. The extracted portion of the ADMPU-AHA (2009) without CIP HEC-1 model was named "WT1E01a".

3.1.2 Revision No 2 – remove operation SRD25

The second revision to more accurately represent the local watershed was to remove operation SRD25 at Dysart / Waddell / RR intersection. This revision was based on review of the HEC-1 model in combination with local physical conditions at this intersection.

3.1.3 Revision No 3 – revise operation SRD42

The third revision included incorporation of supplemental survey data for operation SRD42 (Cactus Road). The Cactus Road stage-storage-discharge modeling was updated using both the 2004 Stanley survey data and the 2010 FCDMC survey data. The 2004 supplemental survey measured the channel geometry which represents the stage storage data located upstream of Cactus Road. The 2010 supplemental survey data measured the Cactus Road culvert and roadway overtopping geometry and represents the stage discharge data. The combined stage-storage-discharge data used for SRD42 (Cactus Road) is provided in Appendix D3.

3.1.4 Revision No 4 – revise operation SRD53

The last revision included incorporation of supplemental survey data for operation SRD53 (West Cactus Basin). The stage-storage-discharge data was updated using both the 2004 Stanley data and the 2010 FCDMC data. The 2004 supplemental survey was used to define the bottom elevations of the existing West Cactus Basin. The 2010 supplemental survey data measured the top and bottom toe of the basin and the El Mirage Road culvert and roadway geometry. The combined stage-storage-discharge data for SRD53 (El Mirage Road) is provided in Appendix D5. The existing West Cactus Basin contours are shown on Exhibit F5 in Appendix F.

The HEC-1 model and backup data containing the local watershed revisions was submitted to the FCDMC for review. The local watershed model, including the revisions documented above, was approved by

FCDMC. The peak discharges resulting from the local watershed revisions and comparison to the ADMPU-AHA (2009) discharges are provided in Table 3.1. Refer to Exhibit F3 in Appendix F for the HEC-1 routing diagram. A hard copy of HEC-1 output for this study is provided in Appendix D2. Digital copies of HEC-1 input and output for this study and the ADMPU-AHA (2009) are provided in Appendix G.

TABLE 3.1 – Summary and comparison of existing condition discharges for "without CIP" model

Location	HEC-1 ID	2009 ADMPU[1]	LEMW DCR[2]
Dysart / Waddell – inflow to area NW of intersection	CPD25	200	200
Dysart / Waddell – discharge from area NW of intersection	SRD25	20	200[3]
Dysart @ Lower El Mirage Wash, West Branch	CPD39	130	180
Thunderbird Rd. @ Lower El Mirage Wash, North Branch	SRD27	490	490
Lower El Mirage Wash, US of Cactus Rd.	CPD42	450	500
Lower El Mirage Wash, passing Cactus Rd.	SRD42	350	490
Inflow to West Cactus Basin	CPD53	350	480
Discharge from West Cactus Basin and through Pueblo El Mirage	SRD53	210	200
Lower El Mirage Wash @ south end of Pueblo El Mirage	CPD54	300	300

Notes: (1) HEC-1 output filename for "ADMPU-AHA (2009)" is "WTE01.out"
(2) HEC-1 output filename for "LEMW DCR" is "WTE01a.oh1"
(3) Operation SRD25 was removed from "WTE01a.oh1"

3.2 Future Conditions

It is desirable to understand some of the proposed CIP improvements and effects they may have on this study reach. They include adjacent improvements of a large capacity culvert crossing at Cactus Road and reshaping of the West Cactus Basin. Additionally, there are several proposed CIP projects within the watershed that will affect the peak discharge in Lower El Mirage wash. As such, proposed CIP conditions are represented by the ADMPU-AHA (2009) existing conditions, with CIP in place, HEC-1 model. Three revisions were made to the HEC-1 model.

3.2.1 Revision No 1 – extract watershed

The first revision was to extract the portion of Major Basin D draining to CPD54, which is the HEC-1 concentration point at the outlet of this study reach. The portion of the local watershed contained within the ADMPU-AHA (2009) Major Basin D that drains to CPD54 is reproduced on Exhibit F2 in Appendix F. The extracted portion of the ADMPU-AHA (2009) with CIP HEC-1 model was named "WT1EC01a".

3.2.1 Revision No 2 – remove operation SRD42

The second revision included removal of operation SRD42 (storage route at Cactus Road). The City of El Mirage indicated they desire improvements at Cactus Road. They have indicated a large box or con-arch culvert and raising the roadway profile is preferred. The removal of SRD42 reflects the effects of a large capacity culvert under Cactus Road.

3.2.1 Revision No 3 – revise operation SRD53

The last revision included preliminary concept grading for the West Cactus Basin and a preliminary El Mirage Road culvert / basin outlet to estimate a possible future West Cactus Basin at SRD53. The City of El Mirage prefers that future improvements be contained within Parcel 501-44-004-L. The West Cactus Basin footprint and preliminary concept grading used to estimate the proposed CIP basin is shown on Exhibit F6. Future grading will establish the discharge passing through Pueblo El Mirage. Potential basin alternatives and a preliminary design will be investigated during Phase 2 of this study.

The peak discharges resulting from the above revisions and comparison to the ADMP-AHA (2009) discharges are provided in Table 3.2. Refer to Exhibit F4 in Appendix F for the HEC-1 routing diagram.

TABLE 3.2 – Summary and comparison of existing condition discharges for "with CIP" model

Location	HEC-1 ID	2009 ADMPU[1]	LEMW DCR[2]
Dysart / Waddell – inflow to area NW of intersection	CPD25	310	310
Dysart / Waddell – outflow from area NW of intersection	D25D39	290	290
Dysart @ Lower El Mirage Wash, West Branch	CPD39	360	360
Thunderbird Rd. @ Lower El Mirage Wash, North Branch	SRD27	490	490
Lower El Mirage Wash, upstream of Cactus Rd.	CPD42	660	660
Lower El Mirage Wash, downstream of Cactus Rd.	SRD42	540	660
Total inflow to West Cactus Basin	CPD53	530	640
Discharge from West Cactus Basin and through Pueblo El Mirage	SRD53	430	230[3]
Lower El Mirage Wash @ southeastern end of Pueblo El Mirage	CPD54	320	320

Notes: (1) HEC-1 output filename for "ADMPU-AHA (2009)" is "WTEC01.out"
(2) HEC-1 output filename for "LEMW DCR" is "WTEC01a.oh1"
(3) Discharge resulting from preliminary concept grading and outlet for West Cactus Basin.

4.0 HYDRAULICS

The FCDMC supplied the original FEMA FIS HEC-2 files for Lower El Mirage Wash as the base hydraulic model for this study. The HEC-2 data was generated from the 1991 White Tanks ADMS mapping (FCDMC, 1991). The HEC-2 data set does not contain some of the existing wash geometry located within Pueblo El Mirage or any modeling of culvert structures within the study reach.

4.1 Effective HEC-RAS Model

The base HEC-2 model was imported into HEC-RAS. This establishes the effective HEC-RAS model. The HEC-RAS file family name is "EMWeff".

4.2 Corrected Effective HEC-RAS Model

To improve the accuracy of existing condition floodplain estimation for this study reach, the effective HEC-RAS model was modified to include several physical features. Specifically, the modifications included supplemental survey data, detailed mapping and existing condition discharge values.

The supplemental survey data obtained in January 2010 was utilized to incorporate several culvert crossings and a golf cart bridge. Detailed mapping for this study reach was ordered and delivered on schedule for Phase 2, near the end of Phase 1. Review of the detailed mapping revealed limited conveyance areas that had not been surveyed. The detailed mapping was used to generate new cross section data for the entire reach of Lower El Mirage Wash. Additionally, the magnitudes of flow were revised to match the existing condition flows reported in Table 3.1 for this study. The HEC-RAS file family name for the corrected effective model is "EMceff01". Hydraulic computations and modeling for the corrected effective model are on NAVD88 datum.

4.2.1 Cactus Road at Lower El Mirage Wash

The existing Cactus Road crossing consists of three 24" culvert pipes and an elevated dip section at Lower El Mirage Wash. Supplemental survey data was obtained to define the culvert crossing and overtopping cross section at Cactus Road. This data was utilized to add the existing culvert crossing to the corrected effective HEC-RAS model. Pictures of this crossing are provided in Appendix E3.

Field inspection and survey data for this crossing reveal the overtopping control section is located between the roadway pavement and the upstream culvert headwall. The overtopping elevation is 1114.0. The elevated dip section in Cactus Road is lower than the overtopping control section.

Hydraulic analysis of this culvert shows that it passes about 80 cfs below the roadway. It is estimated that the existing condition without CIP 100-yr event is approximately 500 cfs at Cactus Road.

4.2.2 El Mirage Road at Lower El Mirage Wash

The existing El Mirage Road crossing consists of a double 10-ft wide by 3-ft tall (2-10'x3') concrete box culvert and an elevated dip section at El Mirage Wash. Supplemental survey data was obtained to define the culvert crossing and overtopping cross section at El Mirage Road. This data was utilized to add the existing culvert crossing to the corrected effective HEC-RAS model. Pictures of this crossing are provided in Appendix E3.

Field inspection and survey data for the basin at this crossing reveal the overtopping control section consists of the culvert inlet headwall and a raised graded perimeter. The control section (overtopping elevation is 1111.7) is located northwest of the roadway dip section and is higher than the El Mirage Road dip section. This configuration is shown on Figure 3 and reveals the inlet headwall and raised perimeter must overtop before runoff discharges across El Mirage Road from the West Cactus Basin.

An existing fence crosses LEMW about 100-ft east of El Mirage Road. The existing fence foundation is elevated about two feet above the wash bottom and about two feet above the culvert invert creating a backwater upstream to the roadway crossing. The fence is not a flood control structure, and is subject to failure. In fact, during the January 2010 storm, part of the north channel bank was undermined at the fence crossing. The backwater effects of the existing fence were not modeled in the corrected effective HEC-RAS model per FCDMC direction. When neglecting the fence, the existing El Mirage Road culvert capacity is about 430 cfs before overtopping occurs. It is estimated that the existing condition without CIP 100-yr event is 200 cfs at El Mirage Road.

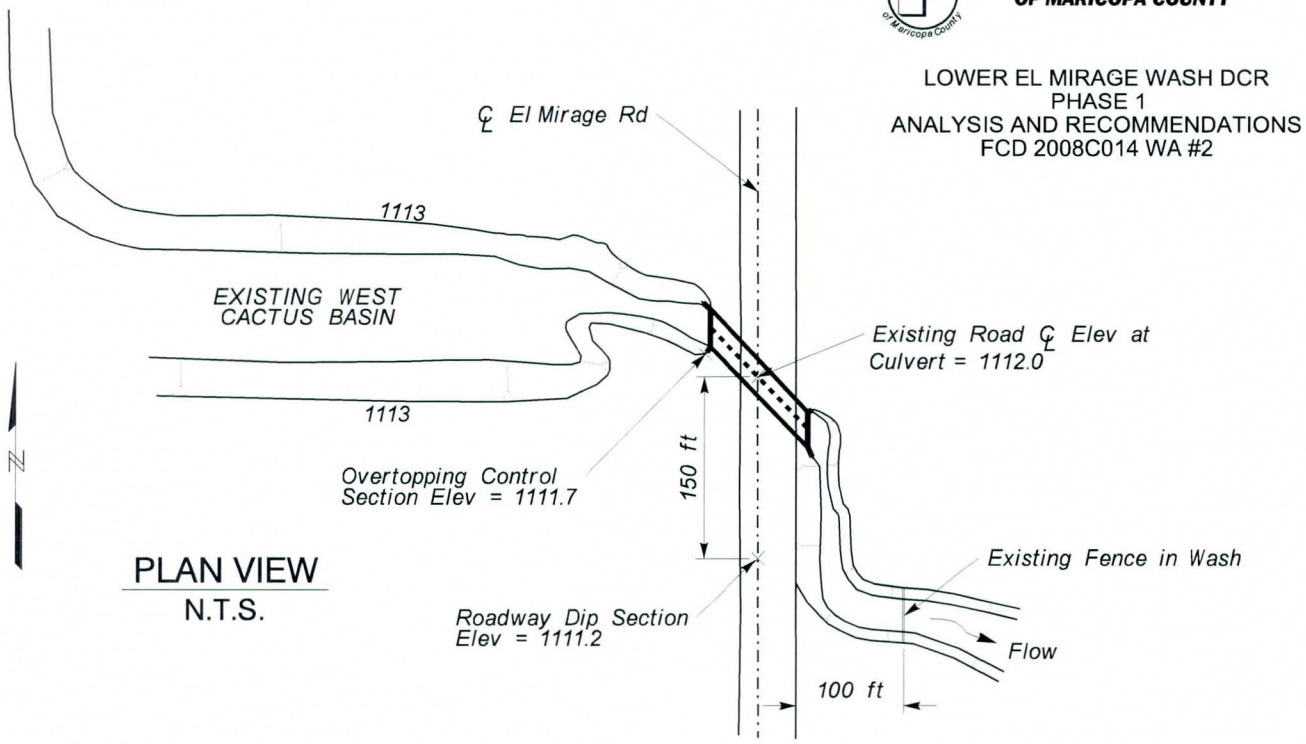
4.2.3 Park Place at Lower El Mirage Wash

The existing Park Place culvert crossing consists of a four barrel 10-ft wide by 3-ft tall (4-10'x3') concrete box culvert. Supplemental survey data was obtained to define the culvert crossing and overtopping cross section. The culvert geometry was added to the corrected effective HEC-RAS model. Survey points, modeled cross section locations and structure elevation data near the Park Place culvert are shown on Exhibit F7. Pictures of this crossing are provided in Appendix E3.

Field inspection and survey data of this area indicate both outside barrels are partially blocked. This appears to be a result of sloughing bank material. The existing box was modeled as a four barrel box culvert. The two inside barrels were modeled as 10'x3' cells and the outside two barrels were modeled as 3'x3' cells. In this condition, the existing box culvert passes about 300 cfs, without overtopping. With the water surface elevation (WSEL) capped at 1.0 feet below existing finish floor elevations at this location, the structure capacity is reduced to 270 cfs. The existing condition without CIP 100-yr event at Park Place is 200 cfs.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER EL MIRAGE WASH DCR
PHASE 1
ANALYSIS AND RECOMMENDATIONS
FCD 2008C014 WA #2



PLAN VIEW
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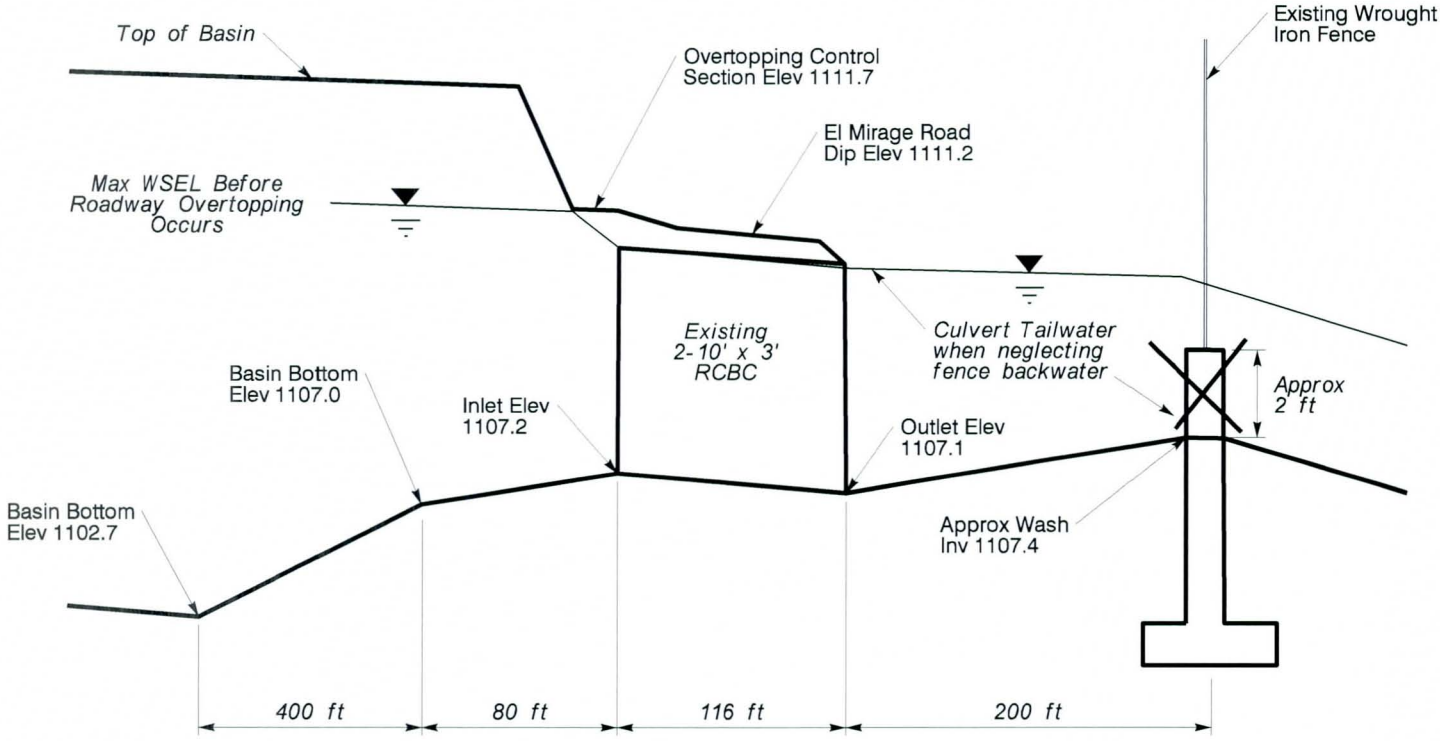

PROFILE VIEW
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FIGURE 3

Existing Culvert at El Mirage Road

AZTEC
TYPSA Group www.aztec.us www.typsa.es
4561 E. McDowell Road
Phoenix, AZ 85008-4505
Tel (602) 454-0402
Fax (602) 454-0403

R:\Phoenix\Projects\AZE0913 FCD On-Call\02 LowerElMirageWashDCR\CADD\Sheets\Exhibits\Drainage\Figure 3.dgn

The base flow at this location is from recirculation of the golf course ponds / water hazard. According to the maintenance manager, the maximum pumping rate is 0.8 cfs (500,000 gallons per day). The base flow was not included in the corrected effective HEC-RAS model.

4.2.4 Golf Cart Path at Lower El Mirage Wash

There is a golf cart path bridge crossing of Lower El Mirage Wash about 700-ft downstream of Park Place. This crossing is adjacent to existing vacant lots with building pads. Supplemental survey data was obtained and utilized to define the golf cart path bridge crossing. This data was added to the corrected effective HEC-RAS model. Pictures of this crossing are provided in Appendix E3.

Inspection of the detailed mapping and HEC-RAS modeling reveal the bank to bank capacity near this location is more than 300 cfs. The bridge restricts the flow capacity of the wash. The conveyance capacity under the bridge is about 130 cfs. The corrected effective HEC-RAS model shows that 300 cfs stays within the golf course at the restriction caused by the bridge. The existing condition without CIP 100-yr event at this location is 200 cfs. The detailed mapping and modeled cross sections for this bridge are reproduced on Exhibit F7.

4.3 Existing Channel Capacity

There are several geometric features that restrict the channel capacity of Lower El Mirage wash through Pueblo El Mirage. These existing geometric features were incorporated into the corrected effective HEC-RAS model. Multiple discharges were evaluated. It was determined that the existing Park Place culvert in combination with existing finish floor elevations provide the limiting capacity for the study reach. The existing capacity of Lower El Mirage Wash through Pueblo El Mirage is 270 cfs. Discharges of 270 cfs or less will safely pass through Pueblo El Mirage while providing one foot or more of freeboard beneath existing finish floor elevations.

5.0 STORM EVENT OF JANUARY 21, 2010

Several storm events occurred the third week of January 2010. As a result, the FCDMC requested measurement and estimation of the observed storm event. The FCDMC collects and maintains rainfall gage data. There are two gages located in the vicinity of this watershed: Gage No. 5500 and Gage No. 5410. Gage No. 5410 is located a quarter mile west of Northern Avenue and Litchfield Road. Gage No. 5500 is located at the Grand Avenue Bridge over the Agua Fria River. Both gages recorded rainfall on January 19th and again on January 21st. The largest rainfall event occurred on January 21, 2010.

5.1 Measured high water observations

As documented in the Progress Meeting Number 1 minutes, Mr. Lance Calvert, City of El Mirage Public Works Director, reported that both Cactus Road and El Mirage Road were overtopped due to this storm event. Two additional observations along Waddell Road were reported. The first observation was that Waddell Road was dry near the railroad crossing. The second observation was of Waddell Road overtopping near 137th Avenue which is ¾ miles west of the railroad crossing. Photographs of the observation at Cactus Road are reproduced in Appendix E3. No other photographs were provided. Survey crews from the FCDMC met AZTEC on January 29th, 2010 to survey several locations and obtain high water data.

5.1.1 Observed high water marks in support of hydrologic review

Dysart / Waddell / Railroad:
A distinct debris line located within the subdivision drainage retention basin, located northwest of the Dysart / Waddell intersection (City of Surprise) was observed. The measured high water elevation was 1145.93. FCDMC survey crews went back to this location at a later date to measure the top bank or sidewalk elevation (whichever is higher) along Waddell Road, going west from Dysart. The elevation profile shows that runoff in excess of the storage area will overtop Waddell Road several hundred feet west of the Railroad.

Waddell / 137th Avenue:
A distinct debris line was observed at an elevation indicating that Waddell Road had been overtopped, confirming the City of El Mirage's observation. This elevation was not surveyed.

5.1.2 Observed high water marks in support of discharge estimation

Cactus Road at Lower El Mirage Wash:
A distinct debris line was observed within the overtopping control section of the Cactus Road crossing. The debris line was also observed along both banks of the wash. The average measured high water elevation within the overtopping control section at Cactus Road was 1115.56.

West Cactus Basin:
A distinct debris line located within the existing West Cactus Basin was observed. Measurements were taken at locations south of Cactus Road and west of El Mirage Road. The average measured high water elevation within West Cactus Basin was 1111.30.

Golf Cart Path Bridge:
The golf cart path bridge is located about 730-ft downstream of park place. A distinct debris line located at the upstream side of the bridge was observed on both sides of the wash. The average measured high water elevation at the golf cart path bridge was 1100.7.

5.2 Estimation of discharge corresponding to high water observations

AZTEC was asked to use the high water mark survey data to calibrate/verify the HEC-RAS model results at three locations.

The observed event discharges were reported from the corrected effective HEC-RAS model. At each location, the discharge corresponding to the observed WSEL was determined by trial and error. Once the observed WSEL was reproduced by HEC-RAS, the resulting discharge was recorded. The results of the high water observations and corresponding magnitudes of flow are provided in Table 5.1.

TABLE 5.1 – Summary of observed storm event

Location	Observed event		100-yr Q (cfs)[2]
	Measured WSEL (ft)	Estimated Q (cfs)[1]	
Cactus Road at Lower El Mirage Wash	1115.6	480	490
El Mirage Road at Lower El Mirage Wash	1111.3[3]	400[4]	200
Golf Cart Path located D/S of Park Place	1101.1	200	200

Notes: (1) From HEC-RAS model corresponding to observed WSEL.
(2) Existing condition 100-yr discharge, using the without CIP HEC-1 model (WTE01a).
(3) High water from West Cactus Basin level pool. Evidence of road overtopping was not found.
(4) Estimated discharge for culvert when neglecting backwater effects from existing fence.

5.2.1 Observed WSEL and estimated discharge at Cactus Rd.

When comparing discharges resulting from observed WSEL values to the existing condition without CIP 100-yr peak discharge values, there is good correlation at Cactus Road.

5.2.2 Observed WSEL and estimated discharge at El Mirage Rd

The observed high water elevation of 1111.3 was measured within the basin level pool at an elevation about 0.4 feet below the overtopping weir crest. On January 29, 2010, evidence of debris on or near the roadway dip section was not found. The culvert discharge corresponding to the observed inlet headwater indicates about 400 cfs will pass through the culvert when backwater effects are ignored, i.e. inlet control only.

5.2.3 Observed WSEL and estimated discharge at Golf Cart Path Bridge

When comparing discharges resulting from observed WSEL values to the existing condition without CIP 100-yr peak discharge values, there is good correlation at the Golf Cart Path Bridge.

5.3 Observed Storm Event Conclusions

Comparison of observed values to the LEMW DCR existing condition without CIP discharges (WTE01a) showed close correlation at Cactus Road and the Golf Cart Bridge. Both locations were easily modeled with no significant complications. The measured water surface elevations and corresponding estimated discharges at these two locations closely matched the hydraulic modeling efforts for Phase 1. The close correlation supports validity of modeling efforts for LEMW DCR.

Close correlation was not found at the El Mirage Road culvert crossing. This is due to backwater effects caused by the Pueblo El Mirage fence. The backwater is difficult to accurately reproduce and attempts to do so could produce misleading results. Fence failure was observed on January 29. Pictures of the fence failure are shown in Appendix E3. Removal of the hydraulic restriction caused by the fence will improve both the wash capacity and West Cactus Basin discharge hydraulics.

6.0 RECOMMENDATIONS FOR PHASE 2

The main objective of this study (Phase 1) was to document the existing condition flood hazard within the study reach. The analyses provided herein indicate minimal risk for 100-yr event flooding of existing structures within Pueblo El Mirage.

According to the effective FEMA Special Flood Hazard (SFH) Zones and 2009 aerial mapping, at least 5 existing structures fall within the effective floodway and at least 30 structures lie within the effective floodplain (Zone AE). The results of Phase 1 indicate most, if not all of these structures could be successfully removed from effective FEMA SFH Zones. Additional study during Phase 2 is needed to document the corrected effective floodway / floodplain.

List of recommendations in support of Phase 1 goals:

1) File for a FEMA LOMR to remove 35+ structures from existing SFH based on existing conditions with CIP (WTEC01a) as modified resulting from the Phase 2 study.

2) Determine proposed CIP projects for Lower El Mirage Wash. Some of the elements will be studied through alternative analysis. Use the existing condition with CIP HEC-1 and revise/verify to account for some or all of the following:
    a. Planned CIP along Waddell Road.
    b. Preferred alternative for Cactus Road culvert and roadway improvements.
    c. Preferred alternative for West Cactus Basin grading improvements and corresponding outlet culvert improvements under El Mirage Road.
    d. Preferred alternative for El Mirage Road box culvert, and any downstream improvements.
    e. El Mirage Road improvements by MCDOT.

List of additional recommendations:

1) Partner with City of El Mirage to improve Cactus Road and available storage. This allows West Cactus Basin to utilize existing storm water storage within the City's drainage easement north of Cactus Road or possibly reduce the peak inflow to West Cactus Basin. Approximately 15 acre-ft of level pool storage exists above elevation 1107, north of Cactus Road.

2) Partner with Pueblo El Mirage to re-grade the LEMW from El Mirage Road to the existing Pueblo El Mirage fence. A secondary goal is the elimination or reduction of the hydraulic restriction caused by the Pueblo El Mirage fence across LEMW by reconstructing the fence.

3) Consider lowering the El Mirage Road culvert by about 2 feet. This should be considered jointly with the previous recommendation. This option provides gravity drainage for the entire West Cactus Basin. However, several hundred feet of Lower El Mirage Wash will need to be regraded. The grading improvements should daylight north of the existing golf course green. Alternative analysis during Phase 2 will provide an appropriate outlet culvert size for this recommendation.

7.0 REFERENCES

1) Bentley Systems, Inc., Bentley CulvertMaster computer program, version 3.2, August 2008.

2) Flood Control District of Maricopa County, White Tanks/Agua Fria Area Drainage Master Study (ADMS), WLB Group, Inc., 1991.

3) Flood Control District of Maricopa County, Final Hydrology Report, Loop 303 / White Tanks ADMPU Area Hydrologic Analysis in Maricopa County, HDR, Arizona v1.2 / September 2009.

4) Flood Control District of Maricopa County, Revised and approved HEC-1 models for the 2009 ADMPU, October 16, 2009.

5) Flood Control District of Maricopa County, Data Collection Memo, Loop 303 / White Tanks ADMPU Area Hydrologic Analysis in Maricopa County, HDR, Arizona v1.1 / October 2008.

6) Flood Control District of Maricopa County, West Cactus Detention Basin and Channels Project, Candidate Assessment Report, Stanley Consultants, Inc., October 2004.

7) Flood Control District of Maricopa County, West Cactus Detention Basin and Channels Project, Survey Report, Stanley Consultants, Inc., October 2004.

8) Flood Control District of Maricopa County, Lower El Mirage Wash Mapping Services, Aero Tech Mapping Technologies, LLC, DRAFT delivery - March 2010.

9) US Army Corps of Engineers, Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package, User's Manual, June 1998.

10) US Army Corps of Engineers, Hydrologic Engineering Center, HEC-1 generalized computer program, extended memory version 4.1, June 1998.

11) US Army Corps of Engineers, Hydrologic Engineering Center, HEC-RAS, River Analysis System, User's Manual, March 2008.

12) US Army Corps of Engineers, Hydrologic Engineering Center, HEC-RAS, computer program, version 4.0.0, March 2008.

13) US Army Corps of Engineers, Hydrologic Engineering Center, Uneven Weir Flow Program, version 1.0, 1987.

APPENDIX A

Scope of Work

EXHIBIT A

SCOPE OF WORK

CONTRACT FCD 2008C014
WORK ASSIGNMENT #2

Lower El Mirage Wash
Design Concept Report
Phase 1- Analysis and Recommendations

December 4, 2009

A. PROJECT DESCRIPTION

1.0 GENERAL DESCRIPTION

1.1 The estimated peak flows within the Lower El Mirage Wash have been reduced due to the revised hydrology completed in the Loop 303/White Tanks Area Drainage Master Plan Update (ADMPU) – Area Hydrologic Analysis (AHA). The City of El Mirage submitted a request to the Flood Control District of Maricopa County's (DISTRICT) Capital Improvement Program Prioritization Process for a detention basin at the southwest corner of Cactus Road and El Mirage Road to alleviate the flooding problems downstream in Pueblo El Mirage and upstream at Cactus Road. Pursuant to the City's request, the District is procuring the services of a consulting engineering firm to perform a study evaluating the need for the basin and possibly to identify items for study in a future phase of this project, if necessary.

2.0 PURPOSE

2.1 This study is broken into two phases. The first phase will analyze whether the new flows still create a flooding hazard along the wash and recommend if further alternatives analysis is needed or if a Letter of Map Revision (LOMR) is needed to revise the current floodplain delineation. The second phase, which will be conducted under a second assignment, will perform the recommendation as agreed upon by the DISTRICT.

3.0 STUDY AREA AND LOCATION

3.1 Lower El Mirage Wash is located in the City of El Mirage from the Agua Fria River just north of the Peoria Avenue alignment northwest toward Waddell Road.

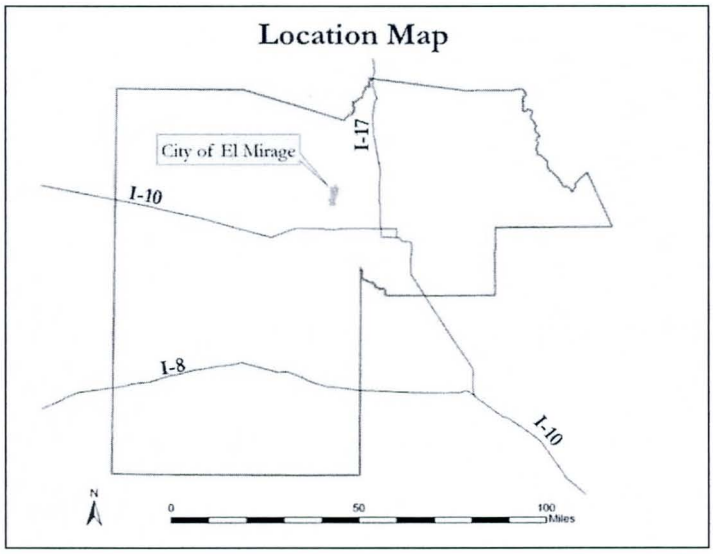

Figure 1: Location Map

Lower El Mirage Wash

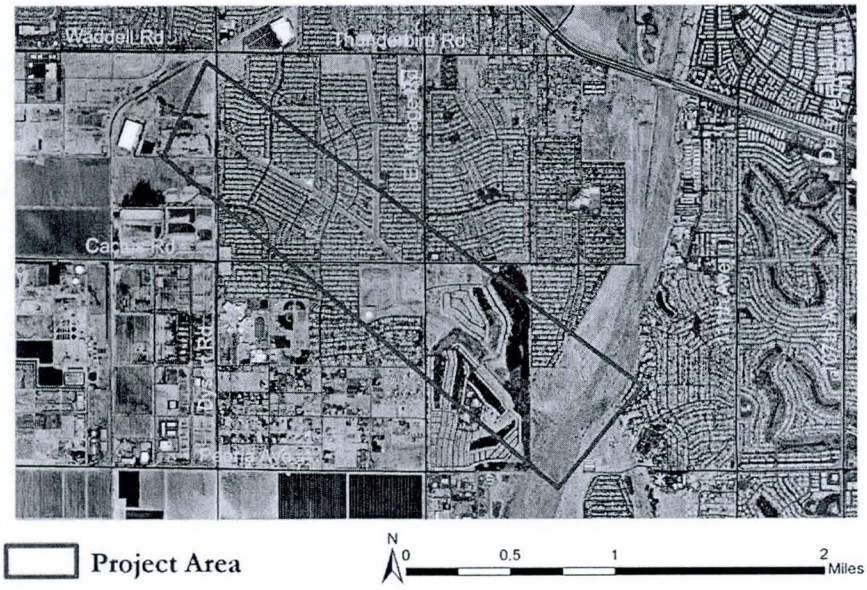

Figure 2: Project Area

4.0 PARTICIPANTS

Study participants include the DISTRICT, the City of El Mirage, and AZTEC Engineering, (CONSULTANT). Coordination with the following organizations is expected for information and input into the study:

The CONULTANT shall coordinate with the following representatives:

Ms. Valerie Swick, E.I.T., P.H., CFM
Project Manager
Flood Control District of Maricopa County
(602) 506-2929

Mr. John Holmes
Project Hydrologist
Flood Control District of Maricopa County
(602) 506-3320

Lance Calvert, P.E.
Public Works Director/City Engineer
City of El Mirage
(623) 876-2971

5.0 TIME

5.1 The CONSULTANT shall complete the project within one hundred twenty (120) calendar days from the Notice-to-Proceed (NTP) date.

6.0 OUT OF SCOPE ITEMS

6.1 Should the CONSULTANT believe that DISTRICT staff, or any partner agency staff, is requesting the CONSULTANT provide work that is not within the scope of the contract documents, the CONSULTANT must notify the DISTRICT Project Manager immediately in writing and describe the work which the CONSULTANT believes is out-of-scope. Such notification shall be provided to the DISTRICT Project Manager prior to the commencement of any such out-of-scope work.

B. PROJECT COORDINATION

1.0 SCHEDULE

1.1 The CONSULTANT shall prepare a project schedule. The project schedule outline shall be consistent with the numbering and tasks defined in this scope of work (SOW) and the fee proposal. The project schedule shall be prepared in Microsoft Project and delivered electronically and in hard copy to the DISTRICT. The CONSULTANT shall update the project schedule as necessary to keep it current. The CONSULTANT shall provide new electronic and paper copies of the schedule to reflect revisions and updates.

1.2 The CONSULTANT shall prepare a significant events calendar that shows, at a minimum, general schedule for Stakeholder meetings, and submittal milestones. The CONSULTANT shall update the calendar as necessary to keep it current.

1.3 The CONSULTANT shall provide to the DISTRICT, in the project schedule, a three (3) week review period for each schedule submittal.

2.0 INVOICES

2.1 The CONSULTANT shall submit an estimate of the projected monthly billings for the entire project at the Kick-Off meeting and update monthly thereafter to be submitted to the DISTRICT Project Manager with each monthly invoice.

2.2 The CONSULTANT shall submit monthly invoices that reflect work completed during the invoice period. Invoices will be consistent with the tasking of the SOW, project schedule, fee proposal and projected billing. Invoices will show percent complete, billed, and remaining by task and for the total work assignment. A draft copy of invoices will be provided electronically for the DISTRICT Project Manager's review. The CONSULTANT shall submit hard copy of invoices to:

Accounts Payable
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

The CONSULTANT shall provide a electronic copy of invoice submittals to the DISTRICT Project Manager.

3.0 PROJECT MANAGEMENT

3.1 The CONSULTANT Project Manager shall attend all meetings as required by the DISTRICT. The CONSULTANT Project Manager shall coordinate with the DISTRICT on all Stakeholder meetings; and shall keep the DISTRICT Project Manager informed and keep a record of all coordination with outside agencies and other affected parties.

3.2 Progress/ status reports including past thirty (30) days activity, next thirty (30) days activity, percent complete for each task, and projected monthly billings will be electronically delivered to the DISTRICT's Project Manager no later than the first of each month.

4.0 PROJECT COORDINATION

4.1 The CONSULTANT shall schedule project coordination meetings with the DISTRICT, as detailed in C.3.4. The CONSULTANT shall provide draft agendas for all meetings to be reviewed by the DISTRICT's Project Manager. The CONSULTANT is responsible for the preparation of minutes of all meetings and to deliver draft meeting minutes within one (1) week after of meetings. Coordination meetings shall also include Stakeholders and shall be used as an opportunity for Stakeholder input on the alternatives analysis process or other aspects of the project as needed.

5.0 REPORTS

5.1 All reports or documents shall be submitted to the DISTRICT for review in draft form. The DISTRICT will have a three (3) week review period. Upon receipt of review comments, the CONSULTANT shall incorporate appropriate revisions to complete the report, and submit written responses to each comment to expedite the final review.

5.2 Calculated discharge values will be reported to the nearest whole number between 1.0 and 10 ft^3/s, to the nearest ten cubic feet per second between 10 and 1000 ft^3/s, and to the nearest 100 ft^3/s for calculated discharges greater than 1000 ft^3/s. For example, 10,250 cfs should be reported as 10,300 cfs.

C. TASKS

1.0 DATA COLLECTION

1.1 The CONSULTANT shall collect, review and document the existing studies and other reports pertinent to the project from the DISTRICT, the City of El Mirage, various landowners and developers, and other sources for the study area. Data/reports to be collected will include materials relevant to the project such as: previous hydrology and hydraulics studies and computer models completed within the study area. The data collection effort will focus on obtaining the most current information in association with the Loop 303/White Tanks ADMPU – Area Hydrologic Update (AHA). The CONSULTANT shall provide a list summarizing the collected data in the data collection portion of the Summary Report.

The following is a list of documents that the DISTRICT will provide as available to the CONSULTANT in electronic format:

- Hydraulics models (HEC-2) of delineation of Lower El Mirage Wash from White Tanks/Agua Fria ADMP.
- Work maps of the Lower El Mirage Wash floodplain delineation. Sheets 10 and 18 of the White Tanks/Agua Fria ADMP.
- Westpoint Towne Center Final Drainage Report, plans/drawings for existing storm water storage facility located at Greenway & Dysart.
- Waddell Road Improvements CAR files Including HEC-1 models by HDR.
- Waddell Road Improvements CAR – Addendum by Prestige Engineering including HEC-1 models.
- West Cactus Detention Basin & Channels Project CAR.
- FCDMC approved HEC-1 Models – update of HDR models.
- GIS Files – HDR files: with & without CIP: drainage basins, drainage path, existing and future land use, soils database.
- CAD Files – HDR files: drainage basins – w/ and w/o CIP, HEC-1 schematics w/ and w/o CIP, major basin splits – w/ and w/o CIP.
- HEC-1 Schematics – HDR Existing/Existing w/CIP pdfs.
- Drainage Basins – HDR Existing/Existing w/CIP pdfs.
- Municipality maps pdfs.
- Volume 1 – Final Hydrology Report by HDR.
- Volume 6 – Cross-section Data for Sub-watershed D – HDR files.
- Landscape character data from the White Tanks ADMPU – AHA for this study area.
- Landscape character data collected after the ADMPU – AHA for this study area.

1.2 The CONSULTANT shall identify, and compile a list of existing hydrologic and hydraulic studies and models for the Study Area that will impact the drainage facilities within the Study Area. The list of previous studies shall be included in the Data Collection Memo.

1.3 The CONSULTANT shall review the hydrologic function of the existing detention basin at Dysart Rd. and Greenway Rd and its impact on the Lower El Mirage Wash south of Cactus Road. The review will consist of a site visit and a qualitative assessment of the basin's function. The intent of the assessment is to determine if the basin should be included or excluded from the model. If it is determined that the basin does provide a hydrologic function, then the qualitative assessment will be used to determine if modifications to the hydrologic model will be required in Phase 2 of this study.

1.4 The CONSULTANT shall make at least two (2) site visits to become familiar with existing conditions and to facilitate the preparation of an inventory of the existing drainage facilities within the hydraulic study area. The hydraulic study area is defined as the reach of Lower El Mirage Wash between the Agua Fria River and several hundred feet upstream of Cactus Road. The inventory shall be included in the Data Collection Memo. The CONSULTANT shall coordinate with the DISTRICT Project Manager for the site visits.

1.5 The CONSULTANT shall develop a Data Collection Memo that shall list relevant documents, plans, reports, a drainage facilities inventory and other items collected since completion of the ADMPU - AHA for the Study Area.

2.0 BASELINE HYDROLOGY AND HYDRAULICS

2.1 The CONSULTANT shall extract Area D, HEC-1 hydrologic models from the Loop 303/White Tanks ADMPU – Area Hydrologic Analysis (2009). Review and concurrence shall be limited to routing operations within the study area.

2.2 CONSULTANT shall convert the Lower El Mirage Wash floodplain hydraulic model from HEC-2 to HEC-RAS. The HEC-RAS model will become the basis for determination of existing condition flooding. As such, the following revisions are anticipated:

- Review of existing condition parameters
- Verify HEC-RAS results match HEC-2 results

2.3 The CONSULTANT shall run the Lower El Mirage Wash floodplain hydraulic model with the flows as determined by the ADMPU – AHA to determine the floodplain elevations within Pueblo El Mirage. The resulting floodplain will be marked on the existing floodplain work maps. CAD and/or GIS mapping of the resulting floodplain will be undertaken during Phase II, if warranted.

2.4 The CONSULTANT shall run the Lower El Mirage Wash floodplain hydraulic model to determine the flow at which the mobile homes within Pueblo El Mirage are no longer in a flood hazard.

2.5 The CONSULTANT shall prepare a report documenting the results of the hydraulic model and the recommendation for either a revised floodplain delineation or alternatives analysis for a plan to mitigate the flooding hazard.

3.0 MEETINGS

3.1 The CONSULTANT shall be responsible for the preparation and printing of all the graphic displays for the meetings, not to exceed two (2) large scale graphics.

3.2 The CONSULTANT shall provide a draft agenda for all meetings to be reviewed by the DISTRICT's Project Manager.

3.3 The CONSULTANT shall be responsible to record minutes for all meetings and provide a draft copy to the DISTRICT Project Manager within one (1) week. The CONSULTANT shall document all opportunities, concerns and comments received.

3.4 The CONSULTANT shall attend no more than six (6) project coordination meetings to be held with District staff. The first meeting shall act as the Kick-Off meeting. The remaining meeting shall be scheduled as needed. The Stakeholders shall be invited to all meetings. Cross-reference to section B.4.1.

3.5 The CONSULTANT shall attend up to three (3) additional project meetings as directed by the DISTRICT's Project Manager during any stage or task identified in this process.

D. DELIVERABLES

1.0 DOCUMENTATION

The CONSULTANT shall develop the following documentation for this Phase 1 Study:

1.1 Telephone contacts and personal contacts made during the course of the project. This information will be submitted in an appendix of the Summary Report.

1.2 Meeting agendas and minutes. This information will be submitted in an appendix of the Summary Report.

1.3 Data Collection Memo. This information will be submitted in DRAFT form at the end of the Data Collection task. District comments will be resolved and included in the Final Data Collection Memo as part of the DRAFT Summary Report in an appendix. The Final Data Collection Memo will not be submitted as a standalone document.

1.4 Summary Report: The CONSULTANT shall prepare a Summary Report for Phase 1 (Analysis and Recommendations) of the Lower El Mirage Wash DCR. This report shall include an executive summary, documentation of all the plans, reports, maps, and documents collected for this project, any findings/recommendations, and any issues that need further investigation. The CONSULTANT shall base the Report on the following suggested table of contents:

- Executive Summary

- Introduction
  - Project Area
  - Overview
  - Need and Purpose
  - Scope
- Data Collection
- Hydrology
  - Existing Conditions
  - Future Conditions
- Hydraulics Analysis results from the revised model
- Phase 2 Recommendation
- APPENDIX
  - Data Collection Memo
  - Project Exhibits
  - Project Contacts
  - Meeting Agendas and Minutes
  - Hard copy output of Hydrology
  - Hard copy output of Hydraulics
  - Digital data CD

The Lower El Mirage Wash DCR – Phase 1 (Analysis and Recommendations) Summary Report shall be submitted to the District in DRAFT format. The DISTRICT shall provide written comments to the CONSULTANT within three (3) weeks. Upon receipt of DISTRICT comments, the CONSULTANT shall resolve and incorporate DISTRICT comments into the summary report. The CONSULTANT will then issue The Lower El Mirage Wash DCR – Phase 1 (Analysis and Recommendations) Summary Report.

1.5 The CONSULTANT shall prepare and deliver to the DISTRICT for review five (5) hard copies of all submittals. Upon completion of the project, the CONSULTANT shall also deliver a separate CD containing electronic copies of the report and all exhibits in PDF format and a CD containing the models and documents/ graphics/ drawings in the original format in which the documents were developed.

2.0 EXHIBITS

2.1 Exhibits shall be 11x17 and/or 24"x 36" color plots unless otherwise indicated in this scope of work. The DISTRICT will provide mounting as necessary.

EXHIBIT A

SCOPE OF WORK for CO#1

CONTRACT FCD 2008C014
WORK ASSIGNMENT #2

Lower El Mirage Wash
Design Concept Report
Phase 1- Analysis and Recommendations
Change Order No. 1
February 17, 2010

A. OVERVIEW

Progress Meeting No. 1, held 26 January 2010, identified four additional work tasks. The four additional work tasks and corresponding scope of services are included herein. These items constitute the basis of change order requested for change order number 1.

The results of these additional work items will be incorporated into the Phase 1 Design Concept Report. The duration and project schedule for Phase 1 are anticipated to be extended as extra time for supplemental survey and subsequent analysis of data are required.

B. ADDITIONAL WORK TASKS

1.0 Supplemental Ground Survey and Revisions to Topographic Mapping

This task requires additional survey for: the existing West Cactus Basin including high water mark measurements from recent storm events and cross sections of hydraulic control sections. Several storm events occurred during the week of 1/17/2010 through 1/24/2010. It was agreed during the progress meeting immediately after the storms that a high water mark survey should be conducted to estimate the peak flows at various watershed locations. Survey results would also provide a basis to calibrate and check the HEC-RAS model at control sections.

It was agreed to survey high water marks at several control sections along the Lower El Mirage Wash. The control sections identified were: Cactus Road crossing and culverts; El mirage Road and culverts, Park Place crossing culverts and a golf cart path crossing of the wash downstream of Park Place.

FCDMC survey crews will perform the ground survey and will supply raw survey data (X, Y, Z coordinates) to AZTEC. The data will establish the existing condition baseline for this project either by incorporation of the new survey data or the use of the new survey data to verify the accuracy of previous information. The data will also be used to estimate peak flows that occurred during the recent storms, to calibrate the HEC-RAS model and verify or refine the stage-storage curve for the West Cactus Basin.

1.1 Survey Data Collection: AZTEC agreed to two additional site visits to provide direction to the field crews as needed to identify the high water marks, West Cactus Basin geometry and control sections required to complete the survey. In addition to the basin and high water marks, the following control sections are being surveyed:

- Cactus Road crossing over El Mirage Wash
- El Mirage Road culvert and crossing.
- Golf cart path crossing downstream of Park Place.

The control sections are locations within the watershed that may act as a weir during a given range of flows. A weir section and high water mark provides for a direct calculation

of the peak flow rate at that location. The control section geometry will be hard coded into the HECRAS model to strengthen the accuracy of the floodplain modeling.

1.2 Surface Model for West Cactus Basin from New Survey Data: AZTEC will develop an existing condition basin area surface model. The surface model will be compared to existing topographic data. The existing condition HEC-1 model (WT1E01) provides a stage-storage-discharge operation to represent existing conditions at West Cactus Basin. Because the model does not appear to accurately represent existing conditions, verification of the data is warranted.

1.3 Revised Surface Model: The surface model created in Task 1.2 will be compared to existing topographic data. A revised surface model will be developed using one of the following sources: (1) current aerial mapping; (2) survey data from the 2004 "West Cactus Detention Basin and Channels Project CAR"; (3) new survey data obtained from FCDMC Survey crews in January 2010; (4) a combination of 3 and either 1 or 2.

2.0 HEC-1 Routing Revisions for the Existing West Cactus Basin

2.1 Stage-Storage-Discharge Rating Curves: AZTEC will use the updated surface model created in Task 1 to develop a new stage-storage rating curve. Survey data collected at El Mirage Road will be utilized to establish an existing condition stage-discharge rating curve. Modeling of the newly developed existing condition stage-storage-discharge data will be incorporated into the WT1E01 HEC-1 model.

It is anticipated that the existing condition with CIP model, WT1EC01, stage-storage-discharge data for the improved basin will be revised during Phase 2.

3.0 Update HEC-RAS model and Work Maps using new ground survey

The base hydraulic model for this project consists of the 1992 HEC-2 model. The model does not include culvert data for Cactus Road, El Mirage Road, or any crossings within Pueblo El Mirage. The District requested that this information be included in the Phase 1 floodplain analysis using HEC-RAS. Additional survey data supplied by the District survey crews will allow AZTEC to incorporate these features into the Phase 1 analysis.

3.1 Update HEC-RAS: Update the existing condition HEC-RAS modeling to include the results of the survey data collected at all three of the locations listed in Task 1.1 above.

3.2 Update Work Maps: The existing condition floodplain, resulting from the updates listed above, will be marked on the existing floodplain work maps. CAD and/or GIS mapping of the resulting floodplain will be undertaken during Phase 2, if warranted.

4.0 Estimation of Peak Discharges and HEC-RAS Calibration based on ground survey of recent storm events.

AZTEC was asked to use the high water mark survey data to calibrate the HEC-RAS model at a few select locations. This effort is not intended to be a detailed study or a comprehensive effort to calibrate the model throughout the project area. There is insufficient detail available to accomplish that. Nor will there be any attempt to calibrate any of the hydrology models.

4.1 Hydraulic Analysis: Hydraulic analysis will be performed using the control sections as critical sections. Three control sections will be analyzed to attempt to ascertain the approximate peak flow rate that occurred at those locations.

4.2 Coordination Meeting: Coordination and meeting time with FCD staff will be required to finalize the calibration efforts. An additional team meeting is anticipated to discuss results and receive direction from the District.

4.3 HEC-RAS Calibration: HEC-RAS calibration will be performed using the results from task items 3.1, 4.1, and 4.2. AZTEC will use the results to "tune" the HECRAS model such that the water surface model from Cactus Road through the Pueblo El Mirage subdivision is reasonably close to the results of the modeling at the control sections.

4.4 Documentation of results: analysis and results will be added to a section in the DCR.

APPENDIX B

Data Collection Memorandum

AZTEC
TYPSA Group www.aztec.us
www.typsa.es

4561 East McDowell Road
Phoenix, AZ 85008-4505
phone: 602-454-0402
fax: 602-454-0403

Technical Memorandum

To: Valerie Swick, Flood Control District of Maricopa County (FCDMC) Date: 5/27/2010
Project: FCD 2008C014, Work Assignment No. 2
Lower El Mirage Wash DCR, Phase I - Analysis and Recommendations
Subject: Data Collection Memorandum
From: David T. Phelps

INTRODUCTION:

This memorandum summarizes the data collection effort relevant to this project. Phase 1 of the Lower El Mirage Wash DCR requires an evaluation of existing condition flooding within the Pueblo El Mirage development, which is located east of El Mirage Road. First, mapping and supplemental survey data used for this project are listed below. After that, background information from previous studies is provided. Following that, a listing of the documents and electronic data collected for this project is provided in Table 1. Drainage structures located within the study reach are provided in Table 2.

MAPPING and SURVEY DATA:

The following is a listing of mapping and/or supplemental survey data used for this project:

White Tanks / Agua Fria ADMP

Mapping: 1 inch = 400 feet, with a 2-foot contour index (FCDMC, 1991).
Flight date: December 1989 and February 1990 aerials.
Horizontal Datum: State plane NAD27, Arizona Central, International Feet. Data projected to NAD83 by FCDMC using Arc/Info (ESRI).
Vertical Datum: National Geodetic Vertical Datum of 1929 (NGVD29).

West Cactus Detention Basin and Channels Project CAR

Mapping: 1 inch = 400 feet, with a 2-foot contour index (FCDMC, 1991).
Flight date: December 1989 and February 1990 aerials.
Datum: Same as White Tanks / Agua Fria ADMP (FCDMC, 1991).

Supplemental Survey: Additional survey data obtained using combination GPS and conventional level (FCDMC, 2004).
Horizontal Datum: North American Datum of 1983 (NAD83).
Vertical Datum: National Geodetic Vertical Datum of 1929 (NGVD29).

Loop 303 / White Tanks ADMPU-AHA (2009)

Mapping: Varies - documented by the ADMPU-AHA (2009) data collection memo (FCDMC, 2008).
Flight date: Varies - documented by the ADMPU-AHA (2009) data collection memo.
Horizontal Datum: Varies - documented by the ADMPU-AHA (2009) data collection memo. This study area appears to be state plane NAD27, Arizona Central, International Feet. Data projected to NAD83 by FCDMC using Arc/Info (ESRI).
Vertical Datum: Varies - documented by the ADMPU-AHA (2009) data collection memo. This study area appears to be National Geodetic Vertical Datum of 1929 (NGVD29).

FCDMC supplemental survey data collected January 2010

Phase 1 Mapping: West cactus basin existing surface developed from January 2010 survey data.

Supplemental Survey: Additional Survey data obtained using combination GPS and conventional level.
Horizontal Datum: North American Datum of 1983 (NAD83), State Plane, Arizona Central 0202, Geoid03AZ.
Vertical Datum: North American Vertical Datum of 1988 (NAVD88).

Detailed Mapping for Study Reach

Mapping:	1 inch = 200 feet, with a 2-foot contour index, with mapping coverage limited to the study area (FCDMC, 2010).
Flight date:	March 22, 2008.
Horizontal Datum:	North American Datum of 1983 (NAD83), 1992.0 EPOCH - Arizona Coordinate System, 1983 Central Zone, International Feet.
Vertical Datum:	North American Vertical Datum of 1988 (NAVD88).

HYDROLOGIC BACKGROUND:

The *Final Hydrology Report, Loop 303 / White Tanks ADMPU Area Hydrologic Analysis in Maricopa County, Arizona v1.2 / September 2009* (2009 ADMPU) documents the current rainfall runoff response model (HEC-1) for this watershed. Generally speaking, the 2009 ADMPU provides a reduction of runoff when compared to prior models. The September 2009 ADMPU HEC-1 models were revised by the Flood Control District of Maricopa County on 16 October 2009, and constitute the base models utilized for this project.

FUTURE CIP ELEMENTS:

Several CIP elements affect the Lower El Mirage Wash Watershed. Conceptual plans for these elements are modeled in the current "with CIP" HEC-1 model to indicate the affect of future CIP projects. Each CIP element is listed below:

- ADOT SR 303L (Loop 303)
- Reems Road Channel, north of Waddell Road
- AT&SF Railroad Channel located adjacent to the railroad from Waddell Road to south of the existing Dysart Drain, to relieve ponding upstream of the railroad
- West Cactus Basin (previously referred to as the El Mirage Basin), a storage basin that will facilitate attenuation of Lower El Mirage Wash runoff passing Cactus Road, before entering Pueblo El Mirage.

HYDRAULIC BACKGROUND:

The most current hydraulic model for Lower El Mirage Wash is the original Federal Emergency Management Agency (FEMA) HEC-2 model completed by WLB in 1992. The HEC-2 model does not contain modeling of any culvert or bridge structures and was utilized to establish the base HEC-RAS model.

Table 1 – Listing of data collected

Data ID	Title or Description	Client	Author	Date	Data type	Received from	Comment
R.01	Loop 303 /White Tanks ADMPU Area Hydrologic Analysis in Maricopa County, Arizona, Draft Data Collection Memo	FCDMC	HDR	9/30/09	Memorandum - pdf copy	FCDMC	
R.02	Loop 303 /White Tanks ADMPU Area Hydrologic Analysis in Maricopa County, Arizona, Final Hydrology Report, v 1.2	FCDMC	HDR	Sept 2009	Report - pdf copy - HEC-1 files	FCDMC	See ED.01 for latest HEC-1

Table 1 – Listing of data collected

Data ID	Title or Description	Client	Author	Date	Data type	Received from	Comment
R.03	West Point Towne Center, Final Master / Infrastructure Drainage Report	Group Six Properties	David Evans and Ass.	July 1996	Drainage Report - pdf copy	FCDMC	
R.04	West Cactus Dentention Basin and Channels Project, Candidate Assessment Report (CAR)	FCDMC	Stanley Consult.	Nov 2004	Alternative Analysis Report - pdf copy	FCDMC	
R.05	West Cactus Basin and Channels Project, Survey Report	FCDMC	Stanley Consult.	Nov 2004	Survey data	FCDMC	FCD call No A470.962S
R.06	Waddell Road Drainage Improvements, Candidate Assessment Report, Final	FCDMC	HDR	4/10/09	Alternative Analysis Report - pdf copy - HEC-1 files	FCDMC	See ED.01 for latest HEC-1
R.07	Two Tables, one Figure and HEC-1 files from the Addendum to Waddell Road Drainage Improvements CAR	FCDMC	Prestige	Aug 2009	Alternative analysis - pdf copy of 2 Tables and 1 Fig.	FCDMC	Do not have entire report
R.08	Lower El Mirage Design Concept Report	FCDMC	Wood/ Patel	3/17/08	HEC-RAS model for Lower El Mirage Wash	FCDMC	HES-RAS model ignores structures
R.09	Final Drainage Report for Rancho Mirage	Marwest Group	Hook Engin.	June 1999	Drainage Report - pdf copy	FCDMC	Right name, wrong location
ED.01	HEC-1 models, Loop 303 White Tanks ADMP Update	FCDMC	FCDMC	10/16/09	HEC-1 input and output files	FCDMC	Latest update
ED.02	HEC-1 models, Loop 303 White Tanks ADMP Update	FCDMC	HDR	8/18/09	HEC-1 input and output files	FCDMC	Superseded on 10/16/09
ED.03	HEC-1 models, Loop 303 White Tanks ADMP Update	FCDMC	HDR	Aug 2009	CAD base files for watershed	FCDMC	
ED.04	DDMS data for HEC-1 models, Loop 303 White Tanks ADMP Update	FCDMC	HDR	Aug 2009	DDMS database files	FCDMC	
ED.05	HEC-1 models, Loop 303 White Tanks ADMP 2005 Update	FCDMC	URS	1/14/04	HEC-1 input files	FCDMC	Superseded – 2005 ADMPU
ED.06	HEC-2 models for the Lower El Mirage Wash	FCDMC	WLB Group	2/19/1992	HEC-2 input files	FCDMC	Original FIS Floodplain model
ED.07	Lower El Mirage Work Map, sheet 18	FCDMC	WLB Group	10/27/92	FIS floodplain work map	FCDMC	Floodplain work map
ED.08	2010 Survey data	FCDMC	FCDMC	2/11/2010	Digital copy of points (x,y,z) and descriptions	FCDMC	Raw survey data points.

Note: R = Report
ED = Electronic document

Table 2 – Inventory of drainage structures

Structure ID	Location	Size & Type	Inlet	Outlet	Comments
1	Lower El Mirage Wash at Cactus	Elevated dip crossing with 3-24" RC pipes	Headwall	Projecting	Pipes are 2-feet below El Mirage Road RCB.
2	Lower El Mirage Wash at El Mirage Road	2-9'x3' RCBC	Headwall w/ wings	Headwall w/ wings. Guardrail on east side.	Roadway dip located north of RCB – verify w/ survey/ mapping
3	Lower El Mirage Wash at Pueblo El Mirage fence	Wrought iron fencing mounted to concrete stem wall.	n/a	n/a	Fence foundation and grates limit flow capacity.
4	Lower El Mirage Wash at Park Place	4-10'x3' RCBC	Embankment fill encroaches past outer barrels. Total blockage is about 60% of each outer barrel.		Culvert capacity has been constricted
5	Lower El Mirage Wash - temporary crossing located about 670 feet downstream of the fence	Unknown – aerial indicates a small pipe with earthen embankments.	n/a	n/a	Need to survey
6	Golf cart crossing near baseball field, about 700 ft downstream of the Park Place RCBC	Unknown – nuisance flow culvert.	Headwall	Headwall	Golf cart crossing
7	Golf cart crossing - about 650 feet downstream of 6.	Unknown - nuisance flow culvert.	Headwall	Headwall	Golf cart crossing
8	Golf cart crossing – about 130 feet downstream of 7.	3-24" corrugated HDPE	Headwall	Headwall	Golf cart crossing
9	West Cactus Basin, southwest corner	Storm drain bubble up	125th Avenue storm drain in Rancho Mirage	Bubble up structure	Grate elev. = 1105± (NGVD 29) – 2'-ft below El Mirage Rd RCBC
10	West Cactus Basin, southwest corner	Storm drain bubble up	Berry Lane storm drain in Rancho Mirage	Bubble up structure	Grate elev. = 1105± (NGVD 29) – 2'-ft below El Mirage Rd RCBC
11	Lower El Mirage Wash, just upstream of fence	Storm drain bubble up	Pueblo El Mirage – location unknown	Bubble up structure	

David T. Phelps, P.E.

cc: John Holmes (FCDMC)
Tony Bokich (AZTEC)
AZTEC Files

APPENDIX C

Project Contacts, Meeting Minutes and Comment Resolution

Appendix C1 – Project Contacts

Appendix C2 – Meeting Minutes

Appendix C3 – Written Comments

Appendix C4 – Record of Comment Resolution

Appendix C1

Project Contacts

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Contact List

Lower El Mirage Wash DCR

FCD 2008C014, Work Assignment No 2
Lower El Mirage Wash DCR, Phase 1 – Analysis and Recommendations

Flood Control District Contacts:

Valerie Swick, Project Manager	direct:	602-506-2929
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	email:	vas@mail.maricopa.gov
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	email:	tbokich@aztec.us
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	email:	sroberts@RobertsResorts.com
Niel Roberts of Roberts Resorts	cell:	480-214-5997
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Scottsdale, AZ 85260	fax:	415-456-4073
	email:	sroberts@RobertsResorts.com
Dennis Zwagerman (Consultant for Pueblo El Mirage)	phone:	602-999-8109
Dennis Zwagerman Associates, Inc.		
Phoenix, AZ		

Appendix C2

Meeting Minutes

AZTEC
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Meeting Date:	November 19, 2009	Meeting Time:	3:00 PM
Location:	Flood Control District of Maricopa County (FCDMC)		
Subject:	Scoping Meeting No. 1	Project:	Lower El Mirage Wash, DCR (Phase I)
		FCD Contract	2008C014 – Work Assignment #2
		Project No:	AZTEC No. AZE0913-02
Attendees:	Valerie Swick (FCDMC) John Holmes (FCDMC) Greg Jones (FCDMC)	Tony Bokich (AZTEC) David Phelps (AZTEC)	
Prepared By:	David Phelps / Tony Bokich	Date Published:	November 30, 2009

The purpose of the meeting was to review the DRAFT Scope of Work and estimated hours:

- Discussion regarding data collection tasks.
- Combine tasks 1.1 and 1.4 and revise hours.
- Discussion regarding Baseline H&H tasks.
- Revise Task 2.1 to entail extracting area D from the WTADMPU HEC-1 model. The reasons for extracting the subarea are to simplify the revisions to and review of the HEC-1 model. This task will also serve to create a project specific model for alternatives evaluation during Phase 2, if necessary. A general review of the overall routing for operations contributing to the Lower El Mirage Wash and a detailed review of the operations at the Dysart & Greenway basin will be part of this task. Detailed review of unit hydrograph and other physical watershed parameters contributing to the study wash have already been reviewed in detail by the District.
- AZTEC to review hours for SOW Task 2 items.
- Discussion regarding Task 3 items – Meetings.
- Review task 3 hours.
- Combine Task 3.1 with 3.6 and invite stakeholders to all meetings.
- Combine Tasks 3.4 and 3.5.

ACTION ITEM(s):

- FCDMC and AZTEC to update SOW and fee estimate based on the above.

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Meeting Minutes

Lower El Mirage Wash DCR

Meeting Date:	December 22, 2009	Meeting Time:	2:30 PM
Location:	Flood Control District of Maricopa County (FCDMC), Buckhorn-Mesa conference room		
Subject:	Kick off meeting FCD 2008C014, Work Assignment No. 2	Project:	Lower El Mirage Wash DCR Phase I– Analysis and recommendations
		Project No:	AZTEC No. AZE0913-02
Attendees:	Valerie Swick (FCDMC) John Holmes (FCDMC)	Tony Bokich (AZTEC) David Phelps (AZTEC)	
Prepared By:	David Phelps / Tony Bokich	Date Published:	January 4, 2010

Introductions – self introductions. The contacts for this project are:
FCDMC Project Manager: Valerie Swick
FCDMC Project Hydrologist: John Holmes
City of El Mirage contact: Lance Calvert (not in attendance)
AZTEC Project Manager: Tony Bokich
AZTEC Project Engineer: David Phelps

Discussion items:

1) DRAFT PROJECT SCHEDULE - The draft project schedule was presented and discussed. AZTEC received the NTP on December 16th. The signed contract is dated the 10th of December and specifies a 120 day end date of April 6th, 2010. Agreed to target the end date. However, it was further agreed that the end date can be extended if needed.

   ACTION ITEM: FCDMC will check on regular meeting times (Wed PM) and AZTEC will provide the schedule.

2) DATA COLLECTION - status of each data collection bullet item was discussed. In general, all bullet items have been received, with the exception of the landscape character items. Additionally, AZTEC has not yet reviewed 100% of the data, so additional requests may come later.
   - Hydraulics models (HEC-2) of delineation of Lower El Mirage Wash from White Tanks/Agua Fria ADMP – ***received.*** *AZTEC has received the HEC-2 model covering the study reach.*
   - Work maps of the Lower El Mirage Wash floodplain delineation. Sheets 10 and 18 of the White Tanks/Agua Fria ADMP – ***received.*** *Phase II may require additional sheets.*
   - Westpoint Towne Center Final Drainage Report, plans/drawings for existing storm water storage facility located at Greenway & Dysart - ***received.***
   - Waddell Road Improvements CAR files Including HEC-1 models by HDR - ***received.***
   - Waddell Road Improvements CAR – Addendum by Prestige Engineering including HEC-1 models - ***received.***
   - West Cactus Detention Basin & Channels Project CAR - ***received.***
   - FCDMC approved HEC-1 Models – update of HDR models - ***received.***
   - GIS Files – HDR files: with & without CIP: drainage basins, drainage path, existing and future land use, soils database - ***received.***
   - CAD Files – HDR files: drainage basins – w/ and w/o CIP, HEC-1 schematics w/ and w/o CIP, major basin splits – w/ and w/o CIP - ***received.***
   - HEC-1 Schematics – HDR Existing/Existing w/CIP pdfs - ***received.***
   - Drainage Basins – HDR Existing/Existing w/CIP pdfs - ***received.***
   - Municipality maps pdfs - ***received.***
   - Volume 1 – Final Hydrology Report by HDR - ***received.***
   - Volume 6 – Cross-section Data for Sub-watershed D – HDR files - ***received.***
   - Landscape character data from the White Tanks ADMPU – AHA for this study area – **not yet received.**
   - Landscape character data collected after the ADMPU – AHA for this study area - **not yet received.**

Technical notes of interest regarding the data collection items listed above:

a) The HEC-1 modeling basis for the CAR reports (Waddell Rd and West Cactus) is the 2005 version of the White Tanks ADMP update. The 2009 ADMP update (FCDMC approved HEC-1 models) are the only HEC-1 models using the NOAA 14 precipitation.

b) The 2009 ADMP update for the existing conditions without CIP (HEC-1 filename "WT1E01.dat") will be used for the existing condition floodplain analysis.

c) The Waddell Rd. Improvements CAR Addendum is modeling a proposing a channel on the north side of Waddell Rd., while the HDR CAR models the existing condition weir flow over Waddell Rd.

ACTION ITEM: FCDMC will check on landscape character data to get things going for Phase II.
ACTION ITEM: FCDMC will provide information from the El Mirage Rd. DCR (McDOT by Baker).
ACTION ITEM: AZTEC to check on physical location of the LOMR to FIRM panel 1605J dated 10/22/2009.
ACTION ITEM: AZTEC to research City of El Mirage regarding additional drainage reports.

3) INITIAL SITE VISIT – The initial site visit will be tomorrow afternoon (12/23/09). The following areas will be inspected:
   - Existing detention basin at Dysart Rd & Greenway.
   - Wash crossings at Cactus and El Mirage Rd.
   - Lower El Mirage Wash from Agua Fria River to El Mirage Rd.
   - Area identified by City for possible detention basin site, located upstream of El Mirage Road.

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Meeting Minutes

Lower El Mirage Wash DCR

Meeting Date:	January 26, 2010	Meeting Time:	1:30 PM
Location:	Flood Control District of Maricopa County (FCDMC)		
Subject:	FCD 2008C014, work assignment no. 2 Progress meeting number 1	Project:	Lower El Mirage Wash DCR Phase I– Analysis and recommendations
		Project No:	AZTEC No. AZE0913-02
Attendees:	Valerie Swick (FCDMC) Lance Calvert (City of El Mirage)	Tony Bokich (AZTEC) David Phelps (AZTEC)	
Prepared By:	David Phelps / Tony Bokich	Date Published:	March 16, 2010

Introductions – self introductions.

Discussion items:

1) HEC-1 modeling - The hydrologic technical memorandum issued January 21, 2010 was discussed. It was agreed that the model needs revision.

   ACTION ITEM: AZTEC will discuss revisions in more detail with John Holmes.

2) HEC-RAS modeling – accuracy of the HEC-2 geometry was discussed.
   - Existing culverts are not included in existing HEC-2.
   - Several wash constrictions are not modeled by the HEC-2 geometry.
   - The date of the HEC-2 model is February of 1992. What has changed since?
   - The work mapping does not show some of the features seen during the 12/23/09 field visit.

   ACTION ITEM: FCDMC directed AZTEC to work towards a change order request.

3) Floodplain limits – The existing condition floodplain resulting from the "WT1E01" HEC-1 model was marked on the original FIS work map. We agreed that hydrology revisions should be completed prior to re-marking. Further agreed that the work map does not reflect current topography for study area.

4) Data Collection Memorandum – Five copies of the DRAFT Data Collection Memorandum were delivered.

5) Project schedule – Several tasks not previously included in the Phase 1 scope were discussed. See "other items" below.

6) Upcoming meetings –
   a. Stakeholder meeting was confirmed to be 1/28/2010 from 2:30 to 3:30 at FCDMC. Discussion regarding agenda and preparation.
   b. Progress meeting no 2 was tentatively moved to Wednesday Feb 24th, to accommodate Lance's schedule.

   ACTION ITEM: AZTEC will provide Agenda for the 1/28/10 Stakeholder Meeting

   ACTION ITEM: Valerie will check on FCDMC staff availability and sent out invitation.

7) Other Items:
   A) Additional work tasks to include in Phase 1 – four items were requested:
      a. Routing revisions for Existing West Cactus Basin.
      b. Verification of existing storage within the rough graded existing West Cactus Basin.
      c. Amend HEC-RAS model to include ground survey for Pueblo El Mirage, Cactus and El Mirage Roads.
      d. Calibration / estimation of discharge and water elevation resulting from recent storm observations.

   ACTION ITEM: Valerie will check with management regarding scope modification request.
   ACTION ITEM: AZTEC will draft a scope modification request.

   B) Observations from storms last week – Lance reported that Cactus Road overtopped and a portion of the downstream embankment was lost. El Mirage Road was overtopped - flow depth appeared to be less than one foot. The intersection and RR crossing at Waddell/Dysart was dry, however flow crossed Waddell near 137th Ave, which is ¾ mile west of Waddell/Dysart. Runoff was contained within the wash and Pueblo El Mirage golf course. The model homes appeared to be more at risk than the homes adjacent to the wash.

   C) Survey – additional survey data will be obtained by FCDMC survey crews. Mr. John Stock joined the meeting and discussion regarding areas to survey ensued. It was agreed the following areas would be surveyed:
   - El Mirage Road, dip crossing, guard railing and existing box culvert.
   - Downstream of El Mirage Road, (1) wrought iron fence foundation crossing wash, and (2) location of block fence (3-5 shots) located southeast of El Mirage box culvert.
   - Existing building concrete pads – select locations.
   - Existing Park Place box culvert.
   - Existing West Cactus Basin area – top and toe elevations.
   - Cactus Road, roadway dip crossing, headwall and pipes.
   - Significant golf cart crossings and restrictions within Lower El Mirage Wash located downstream of El Mirage Road.
   - High water observation marks at: (1) Cactus Road, and (2) El Mirage Road.
   - High water observations within the golf course area, along Park Place and the model homes.
   - Curb profile along Waddell Road from Dysart/RR intersection to west. Sufficient to define analysis of weir overtopping along Waddell Road.

   ACTION ITEM: Valerie to assign field person to accompany John Stock during survey.
   ACTION ITEM: Valerie to coordinate survey time.

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Meeting Minutes

Lower El Mirage Wash DCR

Meeting Date:	January 28, 2010	Meeting Time:	2:30 PM
Location:	Flood Control District of Maricopa County (FCDMC)		
Subject:	FCD 2008C014, work assignment no. 2 Stakeholder meeting number 1	Project:	Lower El Mirage Wash DCR Phase I– Analysis and recommendations
		Project No:	AZTEC No. AZE0913-02
Attendees:	Valerie Swick (FCDMC) John Holmes (FCDMC) Lance Calvert (City of El Mirage) Scott Roberts (Roberts Resorts) Niel Roberts (Roberts Resorts)	Tony Bokich (AZTEC) David Phelps (AZTEC) Dennis Zwagerman (DZA Inc.)	
Prepared By:	David Phelps / Tony Bokich	Date Published:	March 16, 2010

Introductions – self introductions.

Discussion items:

1) Status of project – there was discussion regarding the project history. Lower El Mirage Wash has been studied for several years. It was pointed out that this project is a "break out" piece of the recently completed Loop 303 / White Tanks Area Drainage Master Plan update Area Hydrologic Analysis in Maricopa County (WTADMPU). As such the focus of this project is much narrower and more detailed for the project area than the previous study. This new project is broken into two phases. Phase 1 of this study began in December 2009, and is programmed to be completed by April 2010. At that time, it should be known if Phase 2 is necessary.

2) Project goals – the following project goals were discussed.

    a. Phase 1
        i. Verify existing condition peak discharge.
        ii. Establish existing condition flooding limits.
    b. Phase 2
        i. Determine action plan based on Phase 1 results. Select one of the following:
            1. FEMA LOMR submittal based on new hydrology and hydraulics.
            2. Alternatives analysis.
                a. Evaluate alternatives and select a preferred alternative.
                b. Establish a basis of design for the preferred alternative.
                c. Prepare a DRAFT CLOMR submittal to FEMA.

    At the end of this project, the FCDMC will submit documents to FEMA requesting revision to the existing floodplain. At this point in time, the Phase 1 study and analysis results are needed prior to determination of the FEMA submittal package.

3) Project schedule - there is a project change order in progress for the Phase 1 scope. If approved, the change order items will lengthen the current schedule. It is desired to complete Phase 1 no later than end of June 2010.

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Sign In Sheet

Lower El Mirage Wash DCR

Flood Control District of Maricopa County 1959–2009

Meeting Subject: Stakeholder meeting number 1

Date: January 28, 2010

Project Name: Lower El Mirage Wash DCR
Phase 1 – Analysis and Recommendations

Project No: FCD 2008C014, WA #1
AZTEC # AZE0913-02

Initial	Name	Agency	Phone	email
VAS	Valerie Swick	Flood Control District of Maricopa County	602-506-2929	vas@mail.maricopa.gov
JH	John Holmes	Flood Control District of Maricopa County	602-506-3320	jwh@mail.maricopa.gov
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TBHS	Tony Bokich	AZTEC Engineering	602-458-7487	tbokich@aztec.us
DP	David Phelps	AZTEC Engineering	602-458-9284	dphelps@aztec.us
	Dennis Zwagerman	DZA, INC.	602-999-5109	dza-plan@aol.com
	Scott Roberts	Roberts Resorts	480-235-0687	SRoberts@RobertsResorts.c
	Nic Roberts	" "	602-214-5997	NRoberts@RobertsResorts.c

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Meeting Minutes

Lower El Mirage Wash DCR

Meeting Date:	February 3, 2010	Meeting Time:	1:00 PM
Location:	AZTEC, Camelback 1		
Subject:	Technical meeting number 1 FCD 2008C014, work assignment no. 2	Project:	Lower El Mirage Wash DCR Phase I– Analysis and recommendations
		Project No:	AZTEC No. AZE0913-02
Attendees:	John Holmes (FCDMC)	Tony Bokich (AZTEC) David Phelps (AZTEC)	
Prepared By:	David Phelps / Tony Bokich	Date Published:	March 16, 2010

Overview – These meeting minutes document the discussion and proposed resolution to concerns highlighted in the Technical Memorandum issued January, 21 2010. The memorandum documented AZTEC's Phase 1 hydrologic review. The resolution meeting was held at AZTEC on February 3rd. Action items resulting from that meeting are separated as Phase 1 and Phase 2. Definitions, terminology and nomenclature used below are provided in the January 21st Technical Memorandum.

ACTION ITEMS FOR PHASE 1:

1) Memorandum area of concern no. 1 – Dysart / Waddell railroad intersection and corresponding retention for the Roseview subdivision (CPD25); bullet item *"WT1E01 model should be revised to remove the SRD25 operation"*.

PHASE 1 ACTION ITEM: FCDMC will review and advise AZTEC regarding removal of the SRD25 from the WT1E01 model.

2) Memorandum area of concern no. 3 – West Cactus Basin stage-storage-discharge operation (CPD53); bullet item *"Consideration should be given to revision of the WT1E01 model to reflect the actual basin geometry"*.

PHASE 1 ACTION ITEM: FCDMC will supply survey of existing ground for West Cactus Basin area.
PHASE 1 ACTION ITEM: AZTEC will schedule FCDMC survey for existing ground for West Cactus Basin area.
PHASE 1 ACTION ITEM: AZTEC will evaluate and incorporate existing ground elevation data for SRD53.

ACTION ITEMS FOR PHASE 2:

1) Memorandum area of concern no. 1 – Dysart / Waddell railroad intersection and corresponding retention for the Roseview subdivision (CPD25); bullet item *"Clarification regarding the intent of the CIP is required and may lead to model revisions"*.

PHASE 2 ACTION ITEM: FCDMC will review and advise AZTEC regarding adjustments to magnitude of retention volume diversions at DD24RE and DD25RE in the WT1EC01 model.

2) Memorandum area of concern no. 2 – Cactus Road stage-storage-discharge operation (CPD42); bullet items *"It appears the WT1EC01 model should include culvert improvements at CPD42"* and *"The affect of the culvert improvement on the study reach should be investigated"*.

PHASE 2 ACTION ITEM: FCDMC will review and advise AZTEC regarding adjustments to CPD42/SRD42 for the WT1EC01 model.

3) Memorandum area of concern no. 3 – West Cactus Basin stage-storage-discharge operation (CPD53); bullet items *"The WT1EC01 model should be revised to eliminate the instability at the SRD53 operation"* and *"Consideration should be given to revision of the WT1EC01 model to reflect a viable CIP improvement"*.

PHASE 2 ACTION ITEM: FCDMC will review and advise AZTEC regarding adjustments to SRD53 for the WT1EC01 model. It is anticipated that this will be accomplished during Phase 2 alternatives analysis.

4) Memorandum area of concern no. 4 – Reems / Waddell intersection (CPD19); bullet item *"Consideration should be given to revision of the WT1EC01 model to more accurately represent the future diversion from the project watershed".*

PHASE 2 ACTION ITEM: FCDMC will review and advise AZTEC regarding adjustments to the WT1EC01 model, if any.

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Meeting Minutes

Lower El Mirage Wash DCR

Meeting Date:	March 16, 2010	Meeting Time:	1:00 PM
Location:	Flood Control District of Maricopa County (FCDMC)		
Subject:	FCD 2008C014, work assignment no. 2 Progress meeting number 2	Project:	Lower El Mirage Wash DCR Phase I– Analysis and recommendations
		Project No:	AZTEC No. AZE0913-02
Attendees:	Valerie Swick (FCDMC) John Holmes (FCDMC) Lance Calvert (City of El Mirage)	Tony Bokich (AZTEC) David Phelps (AZTEC)	
Prepared By:	David Phelps / Tony Bokich	Date Published:	April 8, 2010

Introductions – self introductions.

Discussion items:

1) Issue meeting minutes from last month: (a) Technical No. 1, (b) Progress No. 1, and (c) Stakeholder No. 1.

2) Status of modeling revisions and survey data:

   a. HEC-1 model revised to eliminate operation SRD25 (Dysart / Waddell / RR intersection).
   b. Survey data utilized to revise HEC-1 operations SRD42 (Cactus Road) and SRD53 (West Cactus Basin).
   c. Survey data input into HEC-RAS model for Cactus Road, El Mirage Road, Park Place & Golf Cart Path.
   d. Control Sections and high water measurements.
   e. Status of WLB survey Data from Roberts – this was offered during Jan 28 meeting, but not documented in minutes.

   ACTION ITEM: AZTEC to provide Valerie with contact for Scott Roberts.
   ACTION ITEM: Valerie to request WLB survey data from Roberts.
   ACTION ITEM: AZTEC to provide Existing Condition without CIP HEC-1 Model to FCDMC for review.

3) Hydraulic backwater modeling:

   a. It does not appear that existing structures are in floodplain.
   b. Additional data near Park Place is required before this is reported.
   c. The fence downstream of El Mirage Road is the hydraulic control – this significantly affects the magnitude of flow within Pueblo El Mirage.
   d. There have been improvements in Pueblo El Mirage that are not modeled. Our model contains the significant improvements.

   ACTION ITEM: FCDMC to provide DRAFT copy of detailed mapping next week.
   ACTION ITEM: AZTEC to utilize DRAFT mapping to verify floodplain location relative to existing structures.
   ACTION ITEM: AZTEC to document existing condition without CIP HEC-1, assuming no fence blockage of flow.

4) Floodplain limits: discussion regarding future flows resulting from CIP projects, specifically the Waddell CAR, Cactus Road Culvert and West Cactus Basin. There is potential for increased flow in Pueblo El Mirage in the near term future resulting from any one, or combination these projects.

   ACTION ITEM: AZTEC to check Phase 1 scope regarding alternatives analysis.

5) Project Schedule.

   ACTION ITEM: AZTEC to revise the project schedule to include the approved CO#1.

6) Upcoming meetings: None were scheduled.

7) Other items:
   a. Discussed Phase 1 scope items AZTEC has not yet finished.
   b. Discussed potential revisions to the existing conditions with CIP HEC-1 model. In particular, are revisions to the 2009 ADMPU necessary to account for the Waddell CAR addendum by Prestige?
   c. Discussed improvements at El Mirage Road. Potential to move the box crossing south and extend it beneath the Pueblo El Mirage Fence. This would alleviate the fence blockage in the wash, which causes several feet of backwater on the existing El Mirage Road box and crossing.

ACTION ITEM: AZTEC to determine maximum discharge for Pueblo El Mirage, using additional survey data.
ACTION ITEM: AZTEC to provide a table comparing existing condition discharges without CIP for the 2009 ADMPU and this project.
ACTION ITEM: AZTEC to send Valerie a DRAFT outline for DCR.
ACTION ITEM: AZTEC to send John a request outlining exactly what we are looking at in the Waddell CAR.
ACTION ITEM: AZTEC to document possible El Mirage Road improvements in DCR.

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Meeting Minutes

Lower El Mirage Wash DCR

Meeting Date:	April 8, 2010	Meeting Time:	2:00 PM
Location:	Flood Control District of Maricopa County (FCDMC)		
Subject:	FCD 2008C014, work assignment no. 2 Progress meeting number 3	Project:	Lower El Mirage Wash DCR Phase I– Analysis and recommendations
		Project No:	AZTEC No. AZE0913-02
Attendees:	Valerie Swick (FCDMC) John Holmes (FCDMC) Lance Calvert (City of El Mirage)	Tony Bokich (AZTEC) David Phelps (AZTEC)	
Prepared By:	David Phelps / Tony Bokich	Date Published:	May 10, 2010

Purpose – This unscheduled progress meeting was called to coincide with the delivery of the DRAFT Summary Report for Phase 1. It was Progress Meeting Number 3.

Discussion items:

1) AZTEC delivered 5 copies of the DRAFT Summary Report for Lower El Mirage Wash DCR, Phase 1 to Valerie Swick.
    a. One of the five copies was provided to Lance Calvert (City of El Mirage).
2) Status of project and modeling efforts were discussed.
    a. Hydrology Findings:
        i. Existing condition without CIP HEC-1 modeling efforts result in 200 cfs passing El Mirage Road.
        ii. Existing condition with CIP HEC-1 modeling assumptions result in 230 cfs passing El Mirage Rd.
    b. Explanation of assumptions used for the preliminary basin grading concept shown on Exhibit F3 of DRAFT report.
    c. Maximum discharge capacity for channel through Pueblo El Mirage is more than 230 cfs, but appears to be less than 300 cfs. Need to obtain elevation data for existing buildings prior to documenting the channel capacity. Scott Roberts of Roberts Resorts will be contacted to obtain survey data that he indicated exists for the homes along the wash.
    d. The reach of Pueblo El Mirage Wash located downstream (east) of El Mirage Road and upstream of the golf course, was identified as a possible constraint to flow due to the channel geometry and the existing wrought iron fence that spans the wash at the right of way line. Phase 2 modeling of this area using the detailed mapping will more accurately determine the capacity for this reach.
3) The team discussed the results of the study to date and some topics for future study.
4) Alternatives for future action include:
    a. FEMA CLOMR/LOMR
        i. File a LOMR based on hydrology for existing conditions (200 cfs in Pueblo El Mirage).
        ii. File a LOMR based on hydrology for existing conditions, but with future CIP discharge. Discharge rate is expected to be slightly higher, about 230 to 300 cfs. Upper limit to be determined by the wash capacity with freeboard below the finish floor elevation of the existing homes. Valerie was to discuss with Lynn Thomas, et al, to better understand the FEMA process for this situation. The conceptual plan is to base the LOMR on a future discharge that is higher than the existing discharge to account for planned CIP.
        iii. File a CLOMR based on future CIP. Similar concept as ii. above but with future CIP included in the hydraulic modeling. This timeline is at least 1-yr longer than i & ii.

b. ALTERNATIVES ANALYSIS

Alternatives may be developed to improve any or all of the following: the Cactus Road crossing; the El Mirage Road crossing; the existing channel between El Mirage Road and Park Place; the West Cactus Basin. The objectives of the alternatives analysis is to identify, analyze and evaluate potential CIP's that take advantage of the surplus capacity of Lower El Mirage Wash through Pueblo El Mirage and provide a direct benefit to the citizens of the City of El Mirage. Potential CIP's will be focused on flood control improvements with side benefits for transportation safety and multi-use opportunities. Specific alternatives discussed in the meeting include:

i. Box culvert under Cactus Road. It appears that the City has a desire for a 10-ft tall culvert for multi-use pedestrian traffic. The larger box will likely pass the peak discharge beneath Cactus Road. The existing drainage way north of Cactus will provide additional storm water storage for the west cactus basin.
ii. Conceptual re-grading of West Cactus Basin to confine basin limits to the City owned parcel, lowering of basin bottom, provide multi-use opportunities and enhance maintenance access with minimal earthwork. What is the resultant discharge at El Mirage Road for this condition? Q-100 cannot exceed wash capacity. Alternative analysis will require input from the City regarding future layout of West Cactus Basin.
iii. Culvert improvements under El Mirage Road to lower outlet and increase efficiency. The culvert size and configuration would be optimized to provide maximum storage in the basin and improve downstream conditions.
iv. Removal of existing fence downstream of El Mirage Road and re-grading of channel to allow for lowering of West Cactus Basin bottom and straightening the channel to remove severe bends.

ACTION ITEM: Valerie will investigate Phase 2 action plan with FCDMC management.
ACTION ITEM: Valerie will investigate possible design project as a product of the Phase 2 alternative analysis.
ACTION ITEM: Comments regarding DRAFT Summary Report are due to AZTEC by 5/7/2010.

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Meeting Minutes

Lower El Mirage Wash DCR

Meeting Date:	April 30, 2010	Meeting Time:	9:00 AM
Location:	Flood Control District of Maricopa County (FCDMC)		
Subject:	FCD 2008C014, work assignment no. 2 Stakeholder meeting number 2	Project:	Lower El Mirage Wash DCR Phase I– Analysis and recommendations
		Project No:	AZTEC No. AZE0913-02
Attendees:	Valerie Swick (FCDMC) John Holmes (FCDMC) Lance Calvert (City of El Mirage) Scott Roberts (Roberts Resorts)	Tony Bokich (AZTEC) David Phelps (AZTEC) Dennis Zwagerman (DZA Inc.)	
Prepared By:	David Phelps	Date Published:	May 18, 2010

Introductions – self introductions. Scott arrived late – David forgot to have him sign the Sign in sheet.

Discussion items:

1) No formal agenda was prepared. Goal of meeting is to update Mr. Roberts with project status and confirm that vision for Phase 2 is acceptable.

2) Status of project – The existing condition 100-yr peak discharge for Lower El Mirage Wash through Pueblo El Mirage is much less than the previous studies, and has been documented as 200 cfs. The capacity of the existing wash, as it is today, without opening the outer cells of the Park Place culvert, is more than the 100-yr existing condition peak discharge (200 cfs). Preliminarily, we have estimated the wash capacity to be 230 cfs. This estimate was limited to data obtained during the Phase 1 study. We are in the process of using more detail to document the existing wash capacity. As such, Phase 2 of this project will be broken into two parts.

3) Phase 2 - part 1: This will begin after the scoping documents are finalized, hopefully by mid June. Part 1 will document the existing condition wash geometry from the detailed mapping (shown during meeting). A Letter of Map Revision (LOMR) will be requested from FEMA which will document the 100-yr flood hazard using the wash capacity and detailed mapping. This process will include public announcements. The FCDMC will file the LOMR.

    a. The term wash capacity was discussed. The wash capacity will be determined based on existing wash features. The capacity is determined by keeping the water surface within the wash and below existing structures. Any future improvements (park place culvert, golf cart path bridge, wash widening, etc.) will not be accounted for when determining the wash capacity.
    b. The LOMR process was selected over the Conditional Letter of Map Revision (CLOMR) process to provide flood hazard revisions sooner. Requests to FEMA showing wash improvements require construction documents to obtain a CLOMR and "As-Built" documents to obtain a LOMR. Construction documents will delay revisions to the existing flood hazard area.

4) Phase 2 – part 2: This will begin at the same time as Part 1, but will most likely take longer. Alternative analysis for West Cactus Basin will determine the best design for basin improvements. The West Cactus Basin improvements will be required to discharge the wash capacity or less. At the end of Part 2, a Conditional Letter of Map Revision (CLOMR) will be filed with FEMA to revise any flood hazard areas resulting from the improvements.

5) The FCDMC issued a letter to Pueblo El Mirage some time ago. This letter was unfavorable for Pueblo El Mirage. The FCDMC will issue a new letter that will be favorable to Pueblo El Mirage.

ACTION ITEM: Valerie will issue a letter to rectify the unfavorable letter.

Lower El Mirage Wash — 4/30/10 @ FCD

NAME	Company	Phone	email
David Phelps	AZTEC	602-454-0402	dphelps@aztecus
DENNIS ZWAGERMAN	DZA	602-999-8109	dzaplan@aol.com
LANCE CALVERT	EL MIRAGE	623-876-2971	lcalvert@elmirage.o
Valerie Swick	FCD	602-506-2929	vasc@mail.maricopa.gov
John Holmes	FCD	6025063320	jwh@mail.maricopa.go

Appendix C3

Written Comments

Flood Control District
of Maricopa County

LOWER EL MIRAGE WASH DCR **PROJECT MEMORANDUM**

Date: March 31, 2010

To: Tony Bokich, P.E.
AZTEC Engineering

From: Valerie Swick

Subject: **Lower El Mirage Wash DCR, H & H Review Comments, modifications to the Existing Conditions hydrology, digital submittal received from AZTEC Eng. on March 18, 2010**

The John Holmes has completed the review of the subject submittal and comments are as follows:

1. The two exhibits with the description "Existing condition stage-storage data," refer to the data source as "FCDMC Jan 2009 survey points…" Shouldn't this read: Jan 2010?

2. The AZTEC modified hydrology shows flow overtopping Waddell Road to the south at a low point located west of the intersection with Dysart Road, during the 100-yr event. As this is presumably consistent with the recent ground survey conducted by FCDMC Chief Surveyor, John Stock, please make a note of this in the report.

3. Furthermore, flow will possibly not be contained within the corner basin at Waddell Road and Dysart Road under existing conditions; consistent with AZTEC's removal of SRD25 stage-storage-discharge curve from the FCD approved model (WT1E01).

4. The updated stage-storage-discharge curve, SRD42, was determined from the same survey as mentioned in item#1, above; please make a note of this in the report, as well.

5. The modifications AZTEC made to the FCDMC approved HEC-1 existing conditions model (WTE101) appear to be reasonable and the field survey supports these changes. The analysis and support files may be sufficient for Phase I of the subject DCR, however, more detailed analysis may be required prior to design of any recommended alternative, to verify peak flows throughout the study area and the basin volume in the West Cactus Basin.

Please let me know if you have any questions.

2801 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-1501 Fax: 602-506-4601

Flood Control District
of Maricopa County

LOWER EL MIRAGE WASH DCR **MEMORANDUM**

Date: May 4, 2010

To: Tony Bokich, P.E.
AZTEC Engineering

From: Valerie Swick, Project Manager

Subject: Comments on the Lower El Mirage Wash DCR DRAFT Summary Report for Phase 1, submitted April 8, 2010

In general the report was very good. There are only a few minor items that need to be addressed.

1. On Page 1, in Section 1.3 you reference the hydrology as 2009 ADMPU. To make this consistent with other reports, please reference it as ADMPU-AHA (2009). This will reduce the confusion of all the models in the area.

2. Page 1, Section 1.3 – please include the information that the hydrology also used the rainfall data from NOAA 14 rather than NOAA 2 which other studies have used.

3. Page 9, Section 3.2. In the bullet point 1) you state "Extract portion of Major Basin D draining to CPD54. Can you explain somewhere in the report what Major Basin D is?

4. There needs to be a schematic for the HEC-1 IDs included in the report.

5. Include a figure or map that shows the location of the concentration points for Table 3.1 and 3.2.

6. Page 14, Section 5.3. The second word of correlation is spelled incorrectly (last sentence). Include more detail for your conclusion for the correlation.

7. Appendix D5 – Please put a note to explain why 5 ac-ft was subtracted from the estimated storage.

8. Appendix D5 – What is 'due diligence effort" suppose to be? Diligence is spelled incorrectly.

9. Appendix C1 – The emails for Valerie Swick and John Holmes need to be corrected to @mail.maricopa.gov rather than just @maricopa.gov.

10. Photos on CD – in SiteVisit20091223 folder, P35 and P36 appear to have the incorrect vantage point for reference. It appears that it should be looking southwest rather than northwest.

    Please let me know if you have any questions.

Thank you.

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Appendix C4

Record of Comment Resolution

REVIEW COMMENTS & RESOLUTION FORM

Project Name: **FCD 2008C014 WA#2** Lower El Mirage Wash DCR, Phase 1 - Analysis and Recommendations ***Aztec No.*** AZE0913-02	**Submittal:** Existing condtions hydrology digital submittal, dated March 18, 2010. **Consultant:** Aztec Engineering	**Disposition Codes:** A. Will Comply B. Consultant to Evaluate C. Client to Evaluate D. No Further Action

Item No.	Agency	Reviewer	Comment #	Location (sheet/ DWG #)	Review Comments	Code	Response	Responder
1	FCDMC	J.H.	1		The two exhibits with the description "Existing condition stage-storage data," refer to the data source as "FCDMC Jan 2009 survey points..." Shouldn't this read: Jan 2010?	A	Referances to FCDMC survey data in future submittals will be corrected to read Jan 2010.	dtp
2	FCDMC	J.H.	2		The AZTEC modified hydrology shows flow overtopping Waddell Road to the south at a low point located west of the intersection with Dysart Road, during the 100-yr event. As this is presumably consistent with the recent ground survey conducted by FCDMC Chief Surveyor, John Stock, please make a note of this in the report.	A		dtp
3	FCDMC	J.H.	3		Furthermore, flow will possibly not be contained within the corner basin at Waddell Road and Dysart Road under existing conditions; consistent with AZTEC's removal of SRD25 stage-storage-discharge curve from the FCD approved model (WT1E01.	D	Agreed. However, no further action is required.	dtp
4	FCDMC	J.H.	4		The updated stage-storage-discharge curve, SRD42, was determined from the same survey as mentioned in item#1, above; please make a note of this in the report, as well	A	Referances to FCDMC survey data in future submittals will be corrected to read Jan 2010.	dtp
5	FCDMC	J.H.	5		The modifications AZTEC made to the FCDMC approved HEC-1 existing conditions model (WTE101) appear to be reasonable and the field survey supports these changes. The analysis and support files may be sufficient for Phase I of the subject DCR, however, more detailed analysis may be required prior to design of any recommended alternative, to verify peak flows throughout the study area and the basin volume in the West Cactus Basin.	D	Agreed. However, no further action is required.	dtp

REVIEW COMMENTS & RESOLUTION FORM

Project Name: **FCD 2008C014 WA#2** Lower El Mirage Wash DCR, Phase 1 - Analysis and Recommendations ***Aztec No.*** AZE0913-02	**Submittal:** Draft Summary Report for Phase 1, dated April 8, 2010 **Consultant:** Aztec Engineering	**Disposition Codes:** A. Will Comply B. Consultant to Evaluate C. Client to Evaluate D. No Further Action

Item No.	Agency	Reviewer	Comment #	Location (sheet/ DWG #)	Review Comments	Code	Response	Responder
1	FCDMC	V.S.	1	Page 1, in Section 1.3	Referenced the hydrology as 2009 ADMPU. To make this consistent with other reports, please reference it as ADMPU-AHA (2009). This will reduce the confusion of all the models in the area	A		dtp
2	FCDMC	V.S.	2	Page 1, Section 1.3	Please include the information that the hydrology also used the rainfall data from NOAA 14 rather than NOAA 2 which other studies have used	A		dtp
3	FCDMC	V.S.	3	Page 9, Section 3.2	In the bullet point 1) you state "Extract portion of Major Basin D draining to CPD54. Can you explain somewhere in the report what Major Basin D is?	A		dtp
4	FCDMC	V.S.	4		There needs to be a schematic for the HEC-1 IDs included in the report.	A		dtp
5	FCDMC	V.S.	5		Include a figure or map that shows the location of the concentration points for Table 3.1 and 3.2	A		dtp
6	FCDMC	V.S.	6	Page 14, Section 5.3	The second word of correlation is spelled incorrectly (last sentence). Include more detail for your conclusion for the correlation.	A		dtp
7	FCDMC	V.S.	7	Appendix D5	Please put a note to explain why 5 ac-ft was subtracted from the estimated storage	A		dtp
8	FCDMC	V.S.	8	Appendix D5	What is 'due diligence effort" suppose to be? Diligence is spelled incorrectly	A		dtp
9	FCDMC	V.S.	9	Appendix C1	The emails for Valerie Swick and John Holmes need to be corrected to @mail.maricopa.gov rather than just @maricopa.gov	A		dtp
10	FCDMC	V.S.	10	Photos on CD	In SiteVisit20091223 folder, P35 and P36 appear to have the incorrect vantage point for reference. It appears that it should be looking southwest rather than northwest	A		dtp

APPENDIX D

Rainfall Runoff Response Modeling Using HEC-1

Appendix D1 – Technical Memorandum - Hydrologic Review of ADMPU-AHA (2009) Existing Conditon HEC-1files

Appendix D2 – Existing Condition without CIP HEC-1 output (hard copy)

Appendix D3 – Backup data for revisions to ADMPU-AHA (2009) Existing Condition without CIP HEC-1 model

Appendix D4 – Existing Condition with CIP HEC-1 output (hard copy)

Appendix D5 – Backup data for revisions to ADMPU-AHA (2009) Existing Condition with CIP HEC-1 model

Appendix D1

Technical Memorandum:
Hydrologic Review of ADMPU-AHA (2009) Existing Conditon HEC-1 files

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Technical Memorandum

Review of Loop 303 / White Tanks ADMP 2009 update hydrology for Lower El Mirage Wash

To: Valerie Swick, Flood Control District of Maricopa County (FCDMC) Date: 1/21/2009
Project: FCD 2008C014, Work Assignment No. 2
Lower El Mirage Wash DCR, Phase I – Analysis and Recommendations
Subject: Review of Loop 303 / White Tanks ADMP 2009 update hydrology for Lower El Mirage Wash
From: David T. Phelps, PE / Tony Bokich, PE

INTRODUCTION:

This technical memorandum discloses the findings of our basic review of the project hydrology. AZTEC performed a review of the 2009 ADMPU models for the existing condition for both the 'without CIP' scenario and the 'with CIP' scenario. For the portion of the model contributory to the study reach. The purpose of the review was to assess the validity of the model as compared to field observations and other published and non-published reports and data. After the initial assessment we focused on several key operations in the model where significant differences were noted between the 'with CIP' and 'without CIP' models. The findings were more significant and extensive than anticipated and as a result we felt that it would be beneficial to document the findings in this memo.

GENERAL:

Phase 1 of the Lower El Mirage Wash DCR requires determination of existing condition flooding within the Pueblo El Mirage development, which is located east of El Mirage Road. The project hydrology is documented in the *Final Hydrology Report, Loop 303 / White Tanks ADMPU Area Hydrologic Analysis in Maricopa County, Arizona v1.2 / September 2009* (2009 ADMPU).

The 2009 ADMPU utilized the Corps of Engineers HEC-1 program to model the rainfall runoff response. Generally speaking, the 2009 ADMPU provides a reduction of runoff when compared to prior models. The September 2009 ADMPU HEC-1 models were revised by the Flood Control District of Maricopa County on 16 October 2009, and constitute the base models reviewed and utilized for this project. The model representing the 'without CIP' scenario is identified as WT1E01 and the 'with CIP' model is WT1EC01. Throughout this memorandum this nomenclature is used for the sake of brevity.

The current Federal Emergency Management Agency (FEMA) 100-year discharge of record for Lower El Mirage Wash between El Mirage Road and the Agua Fria River is 1,753 cfs. The 2009 ADMPU existing conditions models document 300 cfs for WT1E01 and 320 cfs for WT1EC01. There is uncertainty regarding hydrograph operations contained in both the "WT1EC01" and "WT1E01" existing condition models. Our model investigation indicates a possible range of 300 cfs to 630 cfs for this study reach. Clarification from District staff or further study may be required to clarify the existing condition discharge for Lower El Mirage Wash.

RESULTS OF REVIEW:

A basic hydrologic review of hydrograph routing schematics and combine operations was performed. Review of unit hydrograph parameters, rainfall losses, rainfall data, physical routing data (geometry, length, roughness, etc.) and hydraulic / geometric data to establish HEC-1 flow split data was not part of the review scope. One specific geographic location was identified in the scope of work for review of hydrologic function, the existing detention basin located northwest of the Dysart Rd. and Greenway Rd. Intersection within the West Point Towne Center subdivision.

<u>Dysart / Greenway intersection and corresponding retention for West Point Towne Center (HEC-1 CPD14):</u>
The West Point Towne Center is a master planned community and contains a large detention basin located northwest of the Dysart / Greenway intersection. The HEC-1 concentration point identifier for this operation is CPD14. This basin appears to be a regional drainage basin, but is physically isolated from the majority of subdivision runoff. The footprint of the basin appears to match the FEMA floodplain and is owned by the development. Review of this facility and

surrounding area consisted of the drainage report for the *West Point Towne Center, Final Master / Infrastructure Drainage Report for Group Six Properties, September 1996,* and a site visit with FCDMC staff conducted on 12 December 2009. Review of the development drainage report in combination with diversion areas documented by the 2005 ADMP update and the 2009 ADMP update provide the same general magnitude of detention storage. The 2005 ADMP update modeled 63.9 ac-ft of retention storage. The 2009 update modeled 63.4 ac-ft of retention storage, and 28.6 ac-ft of uncontrolled runoff. The subdivision report (Table 3.6) indicates 67.6 ac-ft of storage is provided within the subdivision, and 89.5 ac-ft of storage is required.

Based on this review, it appears that the 2009 ADMPU representation of 63.4 ac-ft of storage provided by the subdivision is a reasonable representation of existing conditions. Field investigation supports the subdivision drainage report indicating storage basins are provided throughout the development. It should be noted that the ADMP mapping for this area predates the subdivision. As such, further detailed investigation would necessitate current mapping.

The current existing condition HEC-1 models (both with and without CIP) divert 63.4 ac-ft of retention for the West Pointe Town Center subdivision. No additional stage-storage operations are modeled, nor are they deemed necessary due to existing flow patterns. Opportunity to develop the existing park area into a regional detention area does exist. Further detailed study, if deemed necessary, will reveal the amount of storage available within the park area and the resulting downstream flow reduction.

- **Removal by District staff of the stage-storage-discharge routing operation representing the existing park basin was appropriate.**

AREAS OF CONCERN:

Several hydrograph operations that were reviewed were found to have areas of concern: (1) Dysart / Waddell / railroad intersection and adjacent retention basin for the Roseview subdivision (HEC-1 CPD25), (2) Cactus Road stage-storage-discharge operation (CPD42), (3) West Cactus Basin stage-storage-discharge operation (CPD53), and (4) Reems / Waddell intersection (CPD19). A brief summary of findings for each hydrograph operation follow:

1) Dysart / Waddell / railroad intersection and corresponding retention for the Roseview subdivision (CPD25):
The Roseview subdivision contains several retention basins throughout the subdivision. One of the existing retention basins is located directly northwest of Dysart and Waddell Roads. A railroad crossing runs diagonally across this intersection. The existing condition model WT1E01 contains a reservoir routing operation located upstream of this intersection at SRD25. This routing operation is in addition to a 37.1 ac-ft runoff diversion for subdivision retention. Based on the data provided in Volume 6 of the 2009 ADMPU and the HEC-1 comment cards, it appears that this operation is intended to provide storage routing of off-site runoff.

   Inspection of aerial and topographic mapping provided in Volume 6 of the 2009 ADMPU seems to indicate the detention basin only stores runoff from the subdivision. The 37.1 ac-ft diversion at DD25RE accounts for all but approximately 6 ac-ft of the subdivision runoff. Therefore, it appears that the SRD25 stage-storage-discharge operation actually represents a 'double-counting' of existing storage. As a result, it appears that removal of the SRD25 operation in the WT1EC01 model was the appropriate thing to do, and it should probably also be removed from the WT1E01 model as well.

   Review of the WT1EC01 model shows that the SRD25 operation was eliminated, but the 37.1 ac-ft diversion at DD25RE is still utilized. It is unclear what the future CIP is intended to accomplish and what the actual impact to the downstream watershed should be.

- **WT1E01 model should be revised to remove the SRD25 operation.**
- **Clarification regarding the intent of the CIP is required and may lead to model revisions.**

2) Cactus Road stage-storage-discharge operation (HEC-1 CPD42):
This location consists of a combination culvert / low water crossing. The culvert consists of three 24-inch concrete pipes. Both existing condition HEC-1 models provide the same stage-storage-discharge data at CPD42. However, both the Waddell CAR and West Cactus Basin CAR indicate that this crossing will be raised and a Con-Arch or RCB will be provided. The current operation attenuates the existing condition peak by about 100-cfs in both models. Future culvert improvements will most likely pass the inflow with reduced attenuation, increasing the flow in the study reach.

- **It appears the WT1EC01 model should include culvert improvements at CPD42.**
- **The affect of the culvert improvement on the study reach should be investigated.**

3) West Cactus Basin stage-storage-discharge operation (CPD53):
A non-engineered basin is located within Lower El Mirage Wash downstream of Cactus Road and upstream of El Mirage Road. The basin currently functions as an on-line basin, providing about 33 acre-feet of storage below the existing El Mirage Road culvert. The West Cactus Basin CAR documents this regional basin was constructed by developers, and no engineering reports or construction plans could be found. There is concern that the existing WT1E01 model does not reflect existing conditions.

Inspection of the WT1E01 model shows a peak discharge at El Mirage Road of 210 cfs and 300 cfs at the Agua Fria River. The WT1EC01 model shows a peak discharge at El Mirage Road of 430 cfs, but only 320 cfs at the Agua Fria River. Inspection of operation SRD53 reveals that the two models contain different stage-storage-discharge data for SRD53. Additionally, the WT1EC01 model contains hydrograph oscillations at SRD53 which cause unreliable results downstream. By substituting the SRD53 storage routing operation from the WT1E01 model into the WTEC01 model, the instability disappears. The resulting WT1EC01 peak flow at El Mirage Road and the Agua Fria River become 300 cfs and 340 cfs, respectively.

- **Any future modifications to this basin could significantly affect runoff magnitudes in the study reach.**
- **Consideration should be given to revision of the WT1E01 model to reflect the actual basin geometry.**
- **The WT1EC01 model should be revised to eliminate the instability at the SRD53 operation.**
- **Consideration should be given to revision of the WT1EC01 model to reflect a viable CIP improvement.**

4) Reems / Waddell intersection (CPD19):
The WT1E01 model provides a flow split across Reems Road at Waddell Road. The WT1EC01 model eliminates this flow split and provides a comment card in reference to Greer Ranch CLOMR. This CIP improvement will physically change the upstream watershed and remove runoff from the study reach. Review of this change anticipates a reduced peak flow for the study reach. However, the future Reems Road Channel, between Waddell and Cactus, reduces the contributing drainage area to Lower El Mirage Wash by about 17 square miles. The areal reduction causes the existing condition WT1EC01 model to show an increase in flow magnitude for downstream reaches.

- **Consideration should be given to revision of the WTE01 model to more accurately represent the future diversion from the project watershed.**

Appendix D2

Existing Condition without CIP HEC-1 Output (hard copy)

Pertitnent portions of the HEC-1 output file are provided herein.

A digital copy of HEC-1 output (hard copy in pdf format) is provided in Appendix G. The corresponding HEC-1 Diagram, including hydrograph operation revisions documented herein, is shown on Figure F3 in Appendix F. Copies of the original ADMPU-AHA (2009) HEC-1 routing diagrams are provided in Appendix G.

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN   1998                *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   01APR10  TIME  16:34:26   *
*                                       *
*****************************************
```

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

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

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

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


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

   1          ID        Flood Control District of Maricopa County
   2          ID        L303_EX_MB01 - Loop 303/ White Tanks ADMPU AHA
   3          ID        100 YEAR
   4          ID        24 Hour Storm
   5          ID        Unit Hydrograph: S-Graph
   6          ID        08/19/2009
   7          ID
   8          ID            FCDMC CONTRACT 2007C031
   9          ID            BY HDR ENGINEERING (#79902)
  10          ID            EXISTING CONDITIONS-AUGUST 2009
  11          ID            MAJOR BASIN 01
  12          ID            FILE NAME: EX-MB01.DAT
  13          ID
  14          ID      ************************************************************************
  15          ID
  16          ID      FOLLOWING ARE THE CHANGES BY FCDMC:
  17          ID      1. Removed SRD14. - by JWH 10-16-09
  18          ID      FILE NAME: WT1E01.DAT
  19          ID
  20          ID      For details concerning changes to this HEC-1 model, please contact
  21          ID      FCDMC, H&H Branch.
  22          ID
  23          ID   ***************************************************************************
  24          ID
  25          ID   AZTEC revisions for FCD2008C014, Work Assignment No. 2 are listed below:
  26          ID   1. Extracted portion of Major Basin D draining to CPD54 (Lower El Mirage)
  27          ID      and removed (commented out) "DUMMY" combine after operation D28AFR
  28          ID   2. Removed (deleted) SRD25 operation.
  29          ID   3. Replaced SRD42 operation with stage-storage-discharge data
  30          ID   4. Revised SRD53 operation stage-storage-discharge using 2010 FCD survey data
  31          ID   5. KO cards added/revised
  32          ID
  33          ID      Filename: WT1E01a.ih1          Date: 04/01/2010 - dtp
  34          ID
  35          IT       5       0       0    2000
  36          IN      15
  37          IO       5
              *DIAGRAM
              *
  38          JD   3.480  0.0001
  39          PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
  40          PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
  41          PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
  42          PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
  43          PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
  44          PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
  45          PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
  46          PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
  47          PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
  48          PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
  49          JD   3.393     5.0
  50          JD   3.306    10.0
  51          JD   3.219    20.0
  52          JD   3.132    30.0
  53          JD   3.028    60.0
```

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

  54          JD   2.965    90.0
  55          JD   2.927   120.0
              *
              *

  56          KK     D03BASIN
  57          KM        BASIN BOUNDARY FROM KINGSWOOD PARKE
  58          BA   0.723
  59          LG    0.23    0.25    4.80    0.37      35
  60          UI       0     121     484     719    1140    1220     811     548     245     149
  61          UI      70      36      35       0       0       0       0       0       0       0
  62          UI       0       0       0       0       0       0       0       0       0       0
  63          UI       0       0       0       0       0       0       0       0       0       0
  64          UI       0       0       0       0       0       0       0       0       0       0
              *

  65          KK  DD03REDIVERT
  66          KM        Master Drainage Report Update for Kingswood Parke Phase One
  67          KM        (excess retention provided for future development was
  68          KM        subtracted from total retenttion provided)
  69          DT    RD03    51.7     0.0
  70          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
  71          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
              *
```

DATA REMOVED FROM HARD COPY - Refer to digital copy of output

```
1247          KK     D22BASIN
1248          KM        BASIN BOUNDARY FROM ROYAL RANCH UNIT I AND II
1249          BA   0.454
1250          LG    0.24    0.25    4.70    0.37      32
1251          UI       0      63     233     357     500     764     567     411     284     135
1252          UI      87      50      20      20      20       0       0       0       0       0
1253          UI       0       0       0       0       0       0       0       0       0       0
1254          UI       0       0       0       0       0       0       0       0       0       0
1255          UI       0       0       0       0       0       0       0       0       0       0
              *

1256          KK  DD22REDIVERT
1257          KM        Drainage Report for Royal Ranch Unit 2 (Basins P1&N in D23), Final
1258          KM        Drainage Report for Royal Ranch Unit 2, Parcel 5, Final Drainage
1259          KM        Report for Royal Ranch Unit 2 Parcel 8, portion estimated by aerial for
1260          KM        Del Webb
1261          DT    RD22    37.5     0.0
1262          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
1263          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
              *

1264          KK   DD122RETRIEVE
1265          DR  DD122S
              *

1266          KK  D12D22ROUTE
1267          KM        Cross-section: Cross section determined from aerial
1268          KM        Manning's N Value: street and earth with sparse trees and shrubs
1269          RS       7    FLOW
1270          RC   0.032   0.013   0.013    7744  0.0040    0.00
1271          RX  100.00  105.00  145.00  145.10  160.00  174.00  178.00  180.00
1272          RY 1000.0  999.90  999.50  999.00  999.20  999.50  999.60  999.65
              *

1273          KK   CPD22COMBINE
1274          HC       3  18.945
              *

1275          KK  D22D23ROUTE
1276          KM        Cross-section: Cross-section determined from aerial
1277          KM        Manning's N Value: earth with sparse trees and shrubs/ riprap
1278          RS       2    FLOW
1279          RC   0.032   0.032   0.032    2705  0.0037    0.00
1280          RX  100.00  104.00  106.00  110.00  118.00  122.00  126.00  138.00
1281          RY 1161.0 1160.00 1159.00 1158.00 1158.10 1159.00 1160.00 1161.00
              *

1282          KK     D23BASIN
1283          KM        BASIN BOUNDARY FROM SIERRA VERDE
1284          BA   0.541
1285          LG    0.27    0.27    5.00    0.32      26
1286          UI       0      59     138     272     346     448     673     629     483     371
1287          UI     284     172     101      76      56      17      18      18      18       0
1288          UI       0       0       0       0       0       0       0       0       0       0
```



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

1289          UI       0       0       0       0       0       0       0       0       0       0
1290          UI       0       0       0       0       0       0       0       0       0       0
              *

1291          KK  DD23REDIVERT
```

```
1292          KM        Final Drainage Report for Sierra Verde Parcel 5, Infrastructure Drainage
1293          KM        Report for Sierra Verde (temporary basins removed), Final Drainage
1294          KM        Report for Sierra Verde Parcel 4Final Drainage Report for Harmony
1295          KM        Apartments, Drainage Report for Royal Ranch Unit 2 Final Drainage
1296          KM        Report for Sierra Verde Parcel 9, Final Drainage Report for Sierra Verde
1297          KM        Parcel 3, Final Drainage Report for Sierra Verde Parcel 2, Final Drainag
1298          KM        Report for Sierra Verde Parcel 1, Drainage Report for Fry's at Waddell
1299          KM        and Litchfield Roads
1300          DT    RD23     36.3      0.0
1301          DI     0.0    500.0   5000.0 50000.0      0.0      0.0      0.0      0.0      0.0      0.0
1302          DQ     0.0    500.0   5000.0 50000.0      0.0      0.0      0.0      0.0      0.0      0.0
              *

1303          KK   DD131RETRIEVE
1304          DR  DD131S
              *

1305          KK  D13D23ROUTE
1306          KM        Cross-section: Cross-section determined from aerial 1/2 street section
1307          KM        Manning's N Value: street, earth with sparse trees and shrubs
1308          RS       3    FLOW
1309          RC   0.032   0.013   0.032    5460  0.0044    0.00
1310          RX  100.00  100.00  109.00  109.00  148.00  148.00  197.00  198.00
1311          RY  1180.0 1176.28 1176.28 1175.78 1175.00 1175.50 1177.00 1177.10
              *

1312          KK   CPD23COMBINE
1313          HC       3   22.13
              *

1314          KK   DD231DIVERT
1315          KM        Waddell at Litchfield split flow
1316          DT  DD231S      0.0      0.0
1317          DI     0.0    518.8    867.4   1680.6   2985.0      0.0      0.0      0.0      0.0      0.0
1318          DQ     0.0     51.3    223.3    727.6   1503.5      0.0      0.0      0.0      0.0      0.0
              *

1319          KK   DD232DIVERT
1320          KM        Waddell at Litchfield split flow
1321          DT  DD232S      0.0      0.0
1322          DI     0.0    467.5    644.1    953.0   1481.6      0.0      0.0      0.0      0.0      0.0
1323          DQ     0.0     55.8    138.4    242.9    365.2      0.0      0.0      0.0      0.0      0.0
              *

1324          KK  D23D24ROUTE
1325          KM        Manning's N Value: Litchfield Manor, CS 400 HDR 896
1326          RS       2    FLOW
1327          RC   0.025   0.025   0.025    2496  0.0020    0.00
1328          RX  100.00  100.10  104.10  108.10  112.10  123.70  143.60  151.60
1329          RY  1157.0 1155.00 1154.00 1153.00 1153.10 1155.00 1156.00 1157.00
              *
```



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

1330          KK     D24BASIN
1331          KM        BASIN BOUNDARY FROM LITCHFIELD MANOR
1332          BA   0.492
1333          LG    0.27    0.25    5.10    0.31      28
1334          UI       0      56     145     267     346     467     677     539     421     315
1335          UI     227     116      89      56      26      17      17      17       0       0
1336          UI       0       0       0       0       0       0       0       0       0       0
1337          UI       0       0       0       0       0       0       0       0       0       0
1338          UI       0       0       0       0       0       0       0       0       0       0
              *

1339          KK  DD24REDIVERT
1340          KM        Final Drainage Report for Litchfield Manor (excess retention per report)
1341          DT    RD24     40.9      0.0
1342          DI     0.0    500.0   5000.0 50000.0      0.0      0.0      0.0      0.0      0.0      0.0
1343          DQ     0.0    500.0   5000.0 50000.0      0.0      0.0      0.0      0.0      0.0      0.0
              *

1344          KK   DD132RETRIEVE
1345          DR  DD132S
              *

1346          KK  D13D24ROUTE
1347          KM        Cross-section: Cross-section determined from aerial 1/2 street section
1348          KM        Manning's N Value: street, earth with sparse trees and shrubs
1349          RS       3    FLOW
1350          RC   0.032   0.013   0.013    5460  0.0044    0.00
1351          RX  100.00  100.10  145.00  145.10  175.00  175.10  184.90  185.00
1352          RY  1178.0 1176.50 1175.50 1175.00 1175.78 1176.28 1176.28 1180.00
              *

1353          KK   CPD24COMBINE
1354          HC       3  22.622
              *

1355          KK  DD24SEDIVERT
1356          KM        Waddell near Dysart split flow (subdivision boundary)
1357          DT   DD24S      0.0      0.0
1358          DI     0.0     55.3    366.8   1137.9   2658.6      0.0      0.0      0.0      0.0      0.0
```

```
1359          DQ     0.0     0.0    81.5   397.9  1115.4     0.0     0.0     0.0     0.0     0.0
              *

1360          KK  D24D25ROUTE
1361          KM        Cross-section: Cross-section determined from aerial
1362          KM        Manning's N Value: Grass, earth with sparse trees and shrubs
1363          RS       3    FLOW
1364          RC   0.032   0.025   0.032    2701  0.0017    0.00
1365          RX  100.00  105.00  120.00  130.00  150.00  165.00  200.00  210.00
1366          RY  1000.0  999.50  997.20  996.00  995.90  997.20  999.50 1000.00
              *
1                                        HEC-1 INPUT                                        PAGE 35

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

1367          KK     D25BASIN
1368          KM        BASIN BOUNDARY FROM ROSEVIEW MULTI PHASE
1369          BA   0.497
1370          LG    0.25    0.25    4.80    0.35      30
1371          UI       0      63     200     335     439     678     685     499     371     247
1372          UI     120      87      53      19      20      19       0       0       0       0
1373          UI       0       0       0       0       0       0       0       0       0       0
1374          UI       0       0       0       0       0       0       0       0       0       0
1375          UI       0       0       0       0       0       0       0       0       0       0
              *

1376          KK  DD25REDIVERT
1377          KM        Drainage Report for Roseview - Parcels 1-6, Master Drainage
1378          KM        Report for Roseview, Retention for Parcels 7 and 8 were estimated
1379          KM        based on aerial, Parcel 5a has no retention
1380          DT    RD25    37.1     0.0
1381          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
1382          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
              *

1383          KK   CPD25COMBINE
1384          HC       2  23.119
              *

1385          KK   DD251DIVERT
1386          KM        Waddell/Dysart/RR split flow
1387          DT  DD251S     0.0     0.0
1388          DI     0.0    69.9  1206.6  4171.1  8464.1     0.0     0.0     0.0     0.0     0.0
1389          DQ     0.0    69.9  1097.4  3288.4  6292.9     0.0     0.0     0.0     0.0     0.0
              *

1390          KK   DD252DIVERT
1391          KM        Waddell/Dysart/RR split flow
1392          DT  DD252S     0.0     0.0
1393          DI     0.0     0.0   109.3   882.7  2171.2     0.0     0.0     0.0     0.0     0.0
1394          DQ     0.0     0.0   109.3   363.0   701.2     0.0     0.0     0.0     0.0     0.0
              *

1395          KK  D2542AROUTE
1396          KM        Cross-section: Cross-section estimated from aerial, estimated 3' deep
1397          KM        Manning's N Value: earth with sparse trees and shrubs
1398          KM        Route is from D25 to D42 (broken into 2 routes, 1st route)
1399          RS       1    FLOW
1400          RC   0.032   0.032   0.032    2090  0.0057    0.00
1401          RX  100.00  101.00  102.00  122.00  128.00  145.00  146.00  147.00
1402          RY  1000.0  999.90  999.80  997.00  997.10  999.80  999.90 1000.00
              *

1403          KK  D2542BROUTE
1404          KM        Cross-section: Cross-section from Lower El Mirage Channelization
1405          KM        (Report FCDMC 18-198B) / Manning's N Value: clean earth; straight
1406          KM        Route is from D25 to D42 (broken into 2 routes, 2nd route)
1407          RS       1    FLOW
1408          RC   0.022   0.022   0.022    4791  0.0042    0.00
1                                        HEC-1 INPUT                                        PAGE 36

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

1409          RX  100.00  103.00  105.50  137.50  187.50  219.50  222.00  225.00
1410          RY  1000.0  999.50  998.50  990.50  990.40  998.50  999.50 1000.00
              *

1411          KK     D37BASIN
1412          KM        BASIN BOUNDARY FROM  AG LAND, 1990 TOPO AND BNSF RR ALIGNMENT
1413          BA   0.197
1414          LG    0.50    0.25    5.60    0.32       0
1415          UI       0      18      24      50     100     109     142     151     151     128
1416          UI     135      94      92      66      52      46      32      25      21      17
1417          UI      15      10      10       8       2       2       2       3       2       2
1418          UI       3       2       2       2       3       2       2       0       0       0
1419          UI       0       0       0       0       0       0       0       0       0       0
              *

1420          KK   DD232RETRIEVE
1421          DR  DD232S
              *

1422          KK  D23D37ROUTE
1423          KM        Cross-section: Ag field, assumed 0.5%
```

```
1424          KM        side slopes, V-ditch Manning's N Value: avg value for cultivated
1425          KM        areas from Estimated Manning's Roughness
1426          KM        Coefficient for Stream Channels and Flood Plains in MC
1427          RS      36    FLOW
1428          RC   0.038   0.038   0.038    3332  0.0024    0.00
1429          RX  100.00  200.00  400.00  500.00  550.00  600.00  800.00  900.00
1430          RY  1000.0  999.50  998.50  998.00  998.25  998.50  999.50 1000.00
              *

1431          KK   DD251RETRIEVE
1432          DR  DD251S
              *

1433          KK  D25D37ROUTE
1434          KM        Cross-section: Estimated 2' deep and 4:1 side slopes, width based on
1435          KM        aerial & topo / Manning's N Value: earth w/ sparse trees and brush
1436          RS       7    FLOW
1437          RC   0.032   0.032   0.032    2711  0.0007    0.00
1438          RX  100.00  115.00  130.00  138.00  144.00  152.00  165.00  185.00
1439          RY  1000.0  999.50  999.00  996.00  996.10  999.00  999.50 1000.00
              *

1440          KK  DD24SERETRIEVE
1441          DR   DD24S
              *

1442          KK  D24D37ROUTE
1443          KM        Cross-section: Ag field, assumed 0.5% side
1444          KM        slopes, V-ditch  Manning's N Value: Ag field
1445          RS       5    FLOW
1446          RC   0.038   0.038   0.038    1422  0.0028    0.00
1447          RX  100.00  200.00  400.00  500.00  550.00  600.00  800.00  900.00
1448          RY  1000.0  999.50  998.50  998.00  998.25  998.50  999.50 1000.00
              *
1                                        HEC-1 INPUT                                    PAGE 37

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

1449          KK   CPD37COMBINE
1450          HC       4  23.316
              *

1451          KK  DD37SEDIVERT
1452          KM        split flow across low point in RR tracks
1453          DT   DD37S     0.0     0.0
1454          DI     0.0  1457.6  3118.3  5527.2  9114.3     0.0     0.0     0.0     0.0     0.0
1455          DQ     0.0     0.0     4.6   291.9  1203.2     0.0     0.0     0.0     0.0     0.0
              *

1456          KK  D37D39ROUTE
1457          KM        Cross-section: Ag field, assumed 0.5%
1458          KM        side slopes, V-ditch / Manning's N Value: Ag field
1459          RS       1    FLOW
1460          RC   0.038   0.038   0.038    2643  0.0030    0.00
1461          RX  100.00  200.00  400.00  500.00  550.00  600.00  800.00  900.00
1462          RY  1000.0  999.50  998.50  998.00  998.25  998.50  999.50 1000.00
              *

1463          KK     D35BASIN
1464          KM        BASIN BOUNDARY FROM MARYVALE PARK PARCELS, AG LAND AND 1990 TOPO
1465          BA   0.254
1466          LG    0.50    0.25    4.55    0.52       0
1467          UI       0      21      26      55     108     126     162     180     183     171
1468          UI     150     153     116     103      77      63      56      38      32      26
1469          UI      21      19      13      13      12       6       3       2       3       3
1470          UI       2       3       3       2       3       3       2       3       3       0
1471          UI       0       0       0       0       0       0       0       0       0       0
              *

1472          KK   DD231RETRIEVE
1473          DR  DD231S
              *

1474          KK  D23D35ROUTE
1475          KM        Cross-section: Ag field, assumed 0.5%
1476          KM        side slopes, V-ditch / Manning's N Value: Ag field
1477          RS      14    FLOW
1478          RC   0.038   0.038   0.038    2692  0.0037    0.00
1479          RX  100.00  200.00  400.00  500.00  550.00  600.00  800.00  900.00
1480          RY  1000.0  999.50  998.50  998.00  998.25  998.50  999.50 1000.00
              *

1481          KK   CPD35COMBINE
1482          HC       2  22.384
              *

1483          KK  DD35SEDIVERT
1484          KM        Litchfield at 1/2 mi S. of Waddell split flow
1485          DT   DD35S     0.0     0.0
1486          DI     0.0   112.5   584.6  1947.2  4136.3     0.0     0.0     0.0     0.0     0.0
1487          DQ     0.0    18.8    97.4   368.7   900.0     0.0     0.0     0.0     0.0     0.0
              *
1                                        HEC-1 INPUT                                    PAGE 38
```

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

1488          KK  D35D38ROUTE
1489          KM        Cross-section: Cross-section from Surprise Pointe Master
1490          KM        Drainage Report / Manning's N Value: riprap
1491          RS       3    FLOW
1492          RC   0.032   0.032   0.032    2588  0.0023    0.00
1493          RX  100.00  105.00  110.00  125.50  131.50  151.00  155.00  160.00
1494          RY  1000.0  999.90  999.80  996.10  996.00  999.80  999.90 1000.00
              *

1495          KK     D38BASIN
1496          KM        BASIN BOUNDARY FROM  AG LAND, 1990 TOPO AND BNSF RR ALIGNMENT
1497          BA   0.124
1498          LG    0.50    0.25    4.45    0.56       0
1499          UI       0      11      15      33      64      70      91      94      96      81
1500          UI      84      60      57      40      34      27      19      16      14      10
1501          UI       9       6       6       5       1       1       2       1       2       1
1502          UI       1       2       1       2       1       1       2       0       0       0
1503          UI       0       0       0       0       0       0       0       0       0       0
              *

1504          KK  DD37SERETRIEVE
1505          DR   DD37S
              *

1506          KK  D37D38ROUTE
1507          KM        Cross-section: Cross-section estimated from aerial and topo-railroad
1508          KM        Manning's N Value: earth w/ sparse trees and brush
1509          RS       1    FLOW
1510          RC   0.032   0.032   0.032    1505  0.0040    0.00
1511          RX  100.00  120.00  127.00  134.00  155.00  170.00  190.00  290.00
1512          RY  1148.1 1148.00 1147.00 1146.00 1146.10 1147.00 1148.00 1148.10
              *

1513          KK   CPD38COMBINE
1514          HC       3  23.694
              *

1515          KK   DD381DIVERT
1516          KM        RR tracks btwn Cactus and Waddell split flow
1517          DT  DD381S     0.0     0.0
1518          DI     0.0   178.5  1607.5  4129.9  7990.7     0.0     0.0     0.0     0.0     0.0
1519          DQ     0.0   156.9  1414.9  3582.1  6821.6     0.0     0.0     0.0     0.0     0.0
              *

1520          KK   DD382DIVERT
1521          KM        RR tracks btwn Cactus and Waddell split flow
1522          DT  DD382S     0.0     0.0
1523          DI     0.0    21.7   192.6   547.8  1169.1     0.0     0.0     0.0     0.0     0.0
1524          DQ     0.0    15.2    51.2    99.4   157.1     0.0     0.0     0.0     0.0     0.0
              *
1                                        HEC-1 INPUT                                        PAGE 39

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

1525          KK  D38D39ROUTE
1526          KM        Cross-section: Ag field, assumed 0.5% side slopes, V-ditch
1527          KM        Manning's N Value: Earth with grass and forbs
1528          RS      20    FLOW
1529          RC   0.025   0.025   0.025    2996  0.0013    0.00
1530          RX  100.00  200.00  400.00  500.00  550.00  600.00  800.00  900.00
1531          RY  1000.0  999.50  998.50  998.00  998.25  998.50  999.50 1000.00
              *

1532          KK     D39BASIN
1533          KM        BASIN BOUNDARY FROM  AG LAND, 1990 TOPO AND BNSF RR ALIGNMENT
1534          BA   0.182
1535          LG    0.50    0.25    5.60    0.32       0
1536          UI       0      17      25      56      97     121     137     146     140     125
1537          UI     112      98      69      53      50      32      26      21      16      14
1538          UI      10      10       7       2       2       2       2       3       2       2
1539          UI       2       2       2       3       2       0       0       0       0       0
1540          UI       0       0       0       0       0       0       0       0       0       0
              *

1541          KK   DD252RETRIEVE
1542          DR  DD252S
              *

1543          KK  D25D39ROUTE
1544          KM        Cross-section: Cross-section from Surprise Pointe Master
1545          KM        Drainage Report / Manning's N Value: clean earth
1546          RS       1    FLOW
1547          RC   0.022   0.022   0.022    2101  0.0029    0.00
1548          RX  100.00  101.00  102.00  120.00  120.50  132.20  133.00  134.00
1549          RY  1000.0  999.90  999.80  996.80  996.90  999.80  999.90 1000.00
              *

1550          KK   CPD39COMBINE
1551          HC       4  23.876
              *
```

```
1552          KK  D39D42ROUTE
1553          KM        Cross-section: Cross-section from Lower El Mirage Channelization
1554          KM        (Report FCDMC 18-198B) / Manning's N Value: clean earth; straight
1555          RS      5    FLOW
1556          RC   0.022   0.022   0.022    5691  0.0035    0.00
1557          RX  100.00  103.00  105.50  137.50  187.50  219.50  222.00  225.00
1558          RY  1000.0  999.50  998.50  990.50  990.40  998.50  999.50 1000.00
              *

1559          KK     D26BASIN
1560          KM        BASIN BOUNDARY FROM RACHO EL MIRAGE, SCHOOL
1561          KM        MOBILE HOME PARK, SUNWEST CEMETARY AND GRAND AVE CHANNEL
1562          BA   0.642
1563          LG    0.24    0.25    5.80    0.24      34
1564          UI       0     163     566     876    1350     940     579     247     140      44
1565          UI      37       0       0       0       0       0       0       0       0       0
1566          UI       0       0       0       0       0       0       0       0       0       0
1                                         HEC-1 INPUT                                                PAGE 40

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

1567          UI       0       0       0       0       0       0       0       0       0       0
1568          UI       0       0       0       0       0       0       0       0       0       0
              *

1569          KK   DD26REDIVERT
1570          KM        Retention volume estimated based on aerial
1571          DT    RD26    52.4     0.0
1572          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
1573          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
              *

1574          KK   DD142RETRIEVE
1575          DR   DD142S
              *

1576          KK  D14D26ROUTE
1577          KM        Cross-section: Cross-section from Lower El Mirage Channelization
1578          KM        (Report FCDMC 18-198B) / Manning's N Value: clean earth; straight
1579          RS      2    FLOW
1580          RC   0.022   0.022   0.022    5050  0.0048    0.00
1581          RX  100.00  102.50  105.50  137.50  187.50  219.50  222.00  225.00
1582          RY  1000.0  999.50  999.00  991.00  991.10  999.00  999.80 1000.00
              *

1583          KK   CPD26COMBINE
1584          HC       2     5.4
              *

1585          KK  D26D27ROUTE
1586          KM        Cross-section: Cross-section determined from FCDMC 18
1587          KM        Manning's N Value: Clean earth
1588          RS      2    FLOW
1589          RC   0.022   0.022   0.022    2050  0.0039    0.00
1590          RX  100.00  102.50  105.50  137.50  187.50  219.50  222.00  225.00
1591          RY  1000.0  999.50  999.00  991.00  991.00  999.00  999.50 1000.00
              *

1592          KK     D27BASIN
1593          KM        BASIN BOUNDARY FROM RANCHO EL MIRAGE
1594          KM        WEST EL MIRAGE AND BNSF RR ALIGNMENT
1595          BA   0.316
1596          LG    0.20    0.24    4.90    0.35      42
1597          UI       0     101     334     573     674     411     197      89      33      20
1598          UI       0       0       0       0       0       0       0       0       0       0
1599          UI       0       0       0       0       0       0       0       0       0       0
1600          UI       0       0       0       0       0       0       0       0       0       0
1601          UI       0       0       0       0       0       0       0       0       0       0
              *

1602          KK   DD27REDIVERT
1603          KM        Retention volume estimated based on aerial
1604          DT    RD27     8.2     0.0
1605          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
1606          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
              *
1                                         HEC-1 INPUT                                                PAGE 41

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

1607          KK   CPD27COMBINE
1608          HC       2   5.716
              *

1609          KK   SRD27STORAGE
1610          KM        Storage at culvert under TB Road
              * KO
1611          RS       1    STOR
1612          SV                                                 22.80   51.41
1613          SQ           52.00  202.00  415.00  658.00  906.00 1127.00 2999.00
1614          SE  1140.0 1142.00 1144.00 1146.00 1148.00 1150.00 1152.00 1154.00
1615          ST
              *
```

```
1616          KK  D27D42ROUTE
1617          KM        Cross-section: Cross-section from Lower El Mirage Channelization
1618          KM        (Report FCDMC 18-198B) / Manning's N Value: clean earth; straight
1619          RS       3    FLOW
1620          RC   0.022   0.022   0.022    5598  0.0032    0.00
1621          RX  100.00  102.50  105.50  137.50  187.50  219.50  222.00  225.00
1622          RY  1000.0  999.50  999.00  991.00  991.10  999.00  999.50 1000.00
              *

1623          KK     D42BASIN
1624          KM        BASIN BOUNDARY FROM PARQUE VERDE MULTI PHASE
1625          KM        DYSART SCHOOL DISTRICT, AND BUENA VISTA
1626          BA   0.994
1627          LG    0.24    0.24    5.20    0.29      32
1628          UI       0     150     594     890    1330    1722    1186     816     463     246
1629          UI     148      46      46      45       0       0       0       0       0       0
1630          UI       0       0       0       0       0       0       0       0       0       0
1631          UI       0       0       0       0       0       0       0       0       0       0
1632          UI       0       0       0       0       0       0       0       0       0       0
              *

1633          KK  DD42REDIVERT
1634          KM        Retention volume estimated based on aerial, Cactus and Dysart
1635          KM        Subdivision and Parque Verde - No Reports available
1636          DT    RD42    71.8     0.0
1637          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
1638          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
              *

1639          KK   CPD42COMBINE
              *  KO     1       2
1640          HC       4  26.933
              *

1641          KK   SRD42STORAGE
1642          KM        Storage behind Cactus Road - 2009 ADMPU data revised by AZTEC
1643          KM            Storage and roadway data based on 2010 survey by FCDMC (NGVD29)
1644          KM            Discharge data based on 3-24" pipes + overflow through control section
              *  KO     1       2
1645          RS       1    STOR
1                                        HEC-1 INPUT                                        PAGE 42

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

1646          SV       0    0.03    1.63   11.41    12.0    12.6    13.3    14.0   14.62    15.3
1647          SV    16.4   18.09    20.2
1648          SQ       0       9      41      81      82     118   147.5     184     230     294
1649          SQ     422     717    1123
1650          SE  1105.2  1107.0  1110.0  1114.0  1114.2  1114.4  1114.6  1114.8  1115.0  1115.2
1651          SE  1115.5  1116.0  1116.5
              *

1652          KK  D42D53ROUTE
1653          KM        Cross-section: Cross-section estimated from aerial and topo data
1654          KM        from West Cactus Basin CAR (with average width of 2 channel segments)
1655          KM        Manning's N Value: clean earth; straight
1656          RS       1    FLOW
1657          RC   0.022   0.022   0.022    1558  0.0026    0.00
1658          RX  100.00  103.00  105.00  145.00  271.00  311.00  313.00  315.00
1659          RY  1000.0  999.90  999.80  995.80  995.90  999.80  999.90 1000.00
              *

1660          KK     D53BASIN
1661          KM        BASIN BOUNDARY FROM EL MIRAGE MARKET PLACE, RANCHO MIRAGE UNIT 3
1662          BA   0.118
1663          LG    0.31    0.32    4.60    0.36      11
1664          UI       0      55     169     306     215     107      39      12       9       0
1665          UI       0       0       0       0       0       0       0       0       0       0
1666          UI       0       0       0       0       0       0       0       0       0       0
1667          UI       0       0       0       0       0       0       0       0       0       0
1668          UI       0       0       0       0       0       0       0       0       0       0
              *

1669          KK  DD53REDIVERT
1670          KM        Retention volume estimated based on aerial
1671          DT    RD53    12.1     0.0
1672          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
1673          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
              *

1674          KK   CPD53COMBINE
              *  KO     1       2
1675          HC       2  27.051
              *

1676          KK   SRD53STORAGE
1677          KM        West Cactus Basin - 2009 ADMPU data revised by AZTEC
1678          KM            Storage and roadway data based on 2010 survey by FCDMC (NGVD29)
1679          KM            Discharge data based on 2-10'x3' RCBC + overflow through control section
              *  KO     1       2
1680          SV       0    0.66     4.1    20.0    27.6    47.2    57.8    67.0    69.2    74.0
1681          SV    78.0    81.7    85.0    87.0    90.0
1682          SQ       0     0.0     0.0     0.0    25.0     225     375     430     474     526
1683          SQ     633     737     835     955    1117
1684          SE  1103.0  1104.0  1105.0  1107.2  1108.0  1110.0  1111.0  1111.7  1112.0  1112.3
```

```
1685          SE  1112.7  1113.0  1113.2  1113.4  1113.6
              * SQ     0     0.0     0.0     0.0    12.0      55     100     140     154     2
              * SQ   298     405     498     625     792
              *
1                                        HEC-1 INPUT                                        PAGE 43

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


1686          KK  D53D54ROUTE
1687          KM        Cross-section: Golf course, Cross-section determined from
1688          KM        aerial-golf course / Manning's N Value: earth w/ grass
              *  KO     1       2
1689          RS       4    FLOW
1690          RC   0.025   0.025   0.025    3999  0.0045    0.00
1691          RX  100.00  174.00  228.00  298.00  357.50  413.00  468.00  486.00
1692          RY  1106.0 1104.00 1103.00 1102.00 1101.90 1103.00 1104.00 1104.10
              *

1693          KK     D43BASIN
1694          KM        BASIN BOUNDARY FROM MONTA BLANCA ESTATES, SUNNYVALE AND SUNDIAL
1695          BA   0.500
1696          LG    0.25    0.25    4.70    0.37      33
1697          UI       0      75     299     448     669     867     596     410     233     124
1698          UI      75      23      23      23       0       0       0       0       0       0
1699          UI       0       0       0       0       0       0       0       0       0       0
1700          UI       0       0       0       0       0       0       0       0       0       0
1701          UI       0       0       0       0       0       0       0       0       0       0
              *

1702          KK  DD43REDIVERT
1703          KM        Retention volume estimated based on aerial
1704          DT    RD43    35.5     0.0
1705          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
1706          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
              *

1707          KK  D43D54ROUTE
1708          KM        Cross-section: Golf course, assumed 0.5%
1709          KM        side slopes, V-ditch / Manning's N Value: grass - golf course
              *  KO     1       2
1710          RS      14    FLOW
1711          RC   0.025   0.025   0.025    3872  0.0023    0.00
1712          RX  100.00  200.00  400.00  500.00  550.00  600.00  800.00  900.00
1713          RY  1000.0  999.50  998.50  998.00  998.25  998.50  999.50 1000.00
              *

1714          KK     D54BASIN
1715          KM        BASIN BOUNDARY FROM FAIRWAYS GOLF COURSE DIVISION
1716          KM        AND PUEBLO EL MIRAGE RV RESORT
1717          BA   0.271
1718          LG    0.20    0.27    4.45    0.49      14
1719          UI       0      65     226     345     557     406     260     119      64      25
1720          UI      15      15       0       0       0       0       0       0       0       0
1721          UI       0       0       0       0       0       0       0       0       0       0
1722          UI       0       0       0       0       0       0       0       0       0       0
1723          UI       0       0       0       0       0       0       0       0       0       0
              *
1                                        HEC-1 INPUT                                        PAGE 44

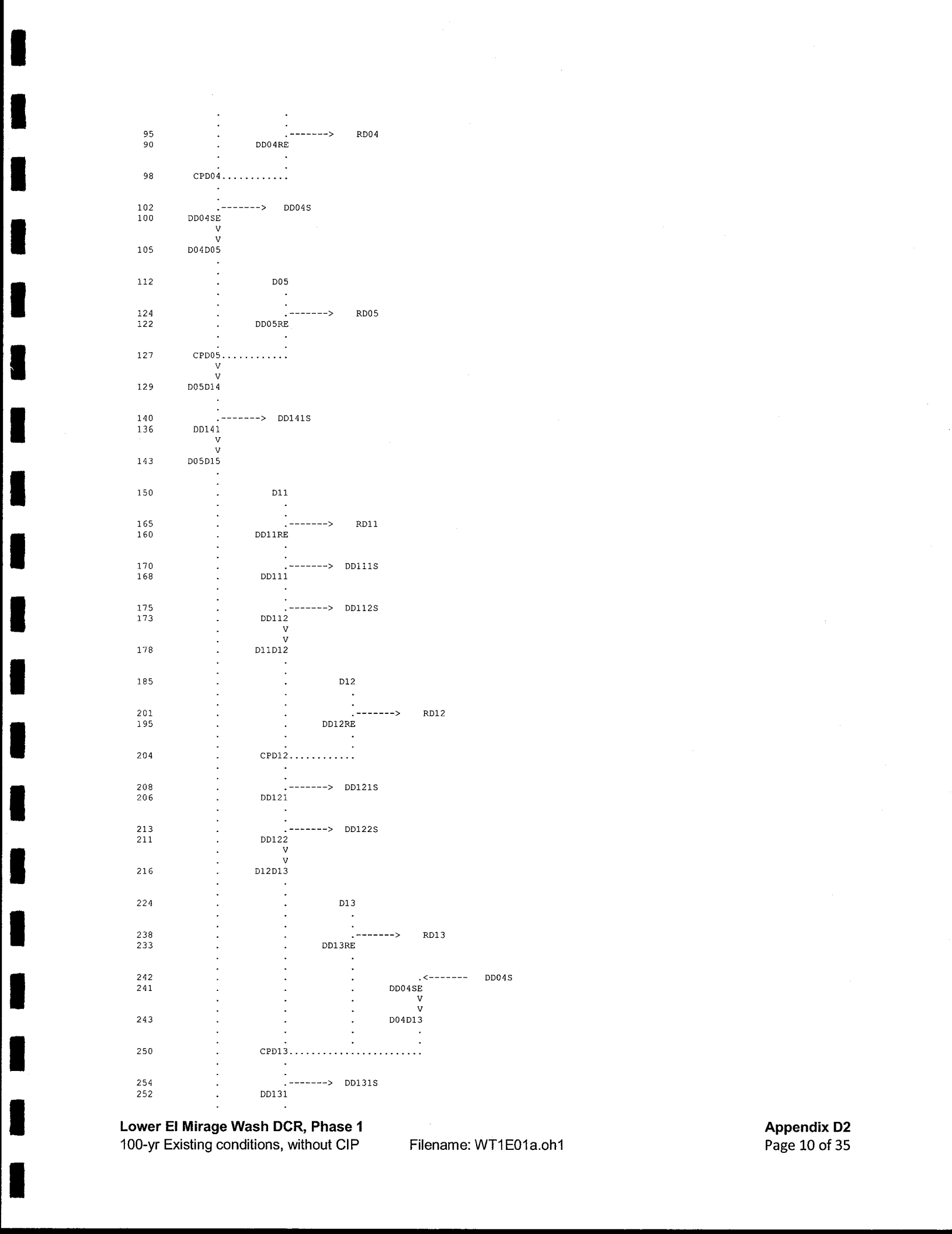
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


1724          KK  DD54REDIVERT
1725          KM        NO REPORTS - ESTIMATED FIRST FLUSH RETENTION FROM AERIAL
1726          KM        DUE TO LOCATION OF DEVELOPMENT TO THE RIVER
1727          DT    RD54     3.0     0.0
1728          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
1729          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
              *

1730          KK   CPD54COMBINE
              *  KO     1       2
1731          HC       3  27.822
              *
              *
1732          ZZ
1
          SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    56         D03
                 .
                 .
    69           .-------->    RD03
    65       DD03RE
                 V
                 V
    72       D03D04
                 .
                 .
    79           .         D04
```


95
90
RD04
DD04RE
98
CPD04
102
100
DD04S
DD04SE
105
D04D05
112
D05
124
122
RD05
DD05RE
127
CPD05
129
D05D14
140
136
DD141S
DD141
143
D05D15
150
D11
165
160
RD11
DD11RE
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168
DD111S
DD111
175
173
DD112S
DD112
178
D11D12
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D12
201
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RD12
DD12RE
204
CPD12
208
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DD121S
DD121
213
211
DD122S
DD122
216
D12D13
224
D13
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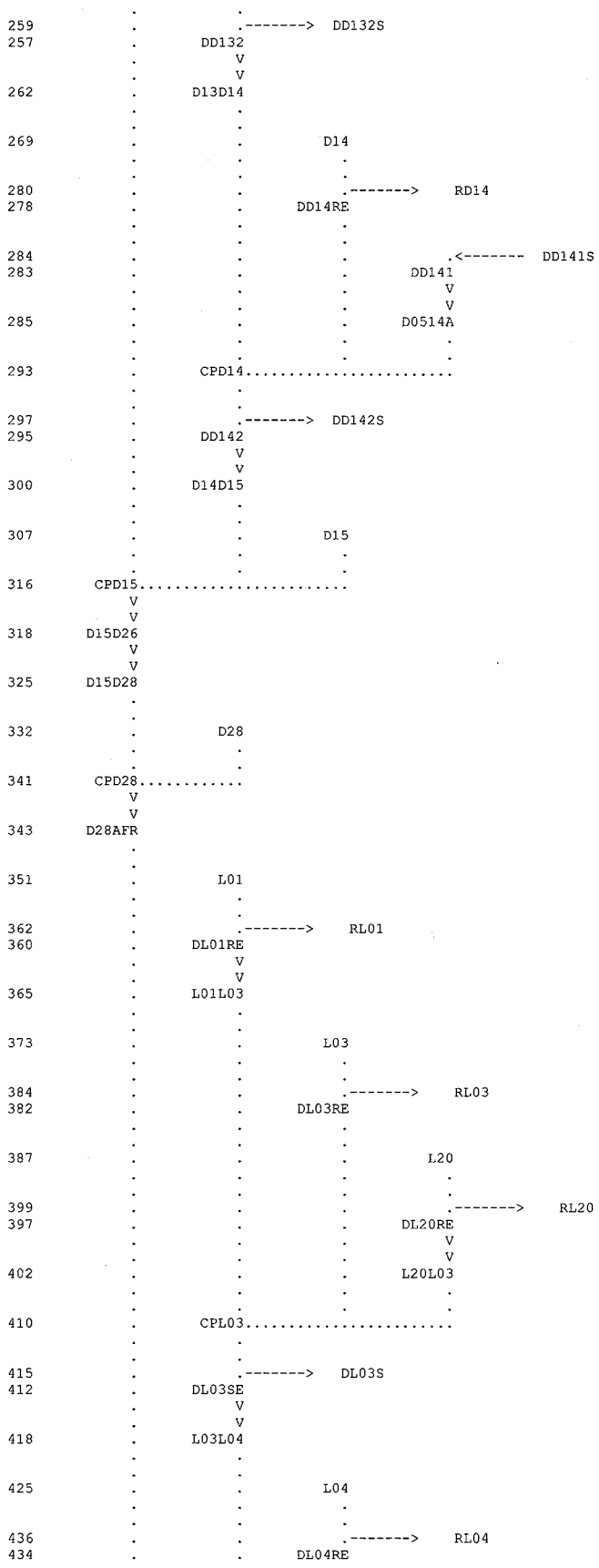
DD131S
DD131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257
DD132S
DD132
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285
D0514A
293
CPD14
297
295
DD142S
DD142
300
D14D15
307
D15
316
CPD15
318
D15D26
325
D15D28
332
D28
341
CPD28
343
D28AFR
351
L01
362
360
RL01
DL01RE
365
L01L03
373
L03
384
382
RL03
DL03RE
387
L20
399
397
RL20
DL20RE
402
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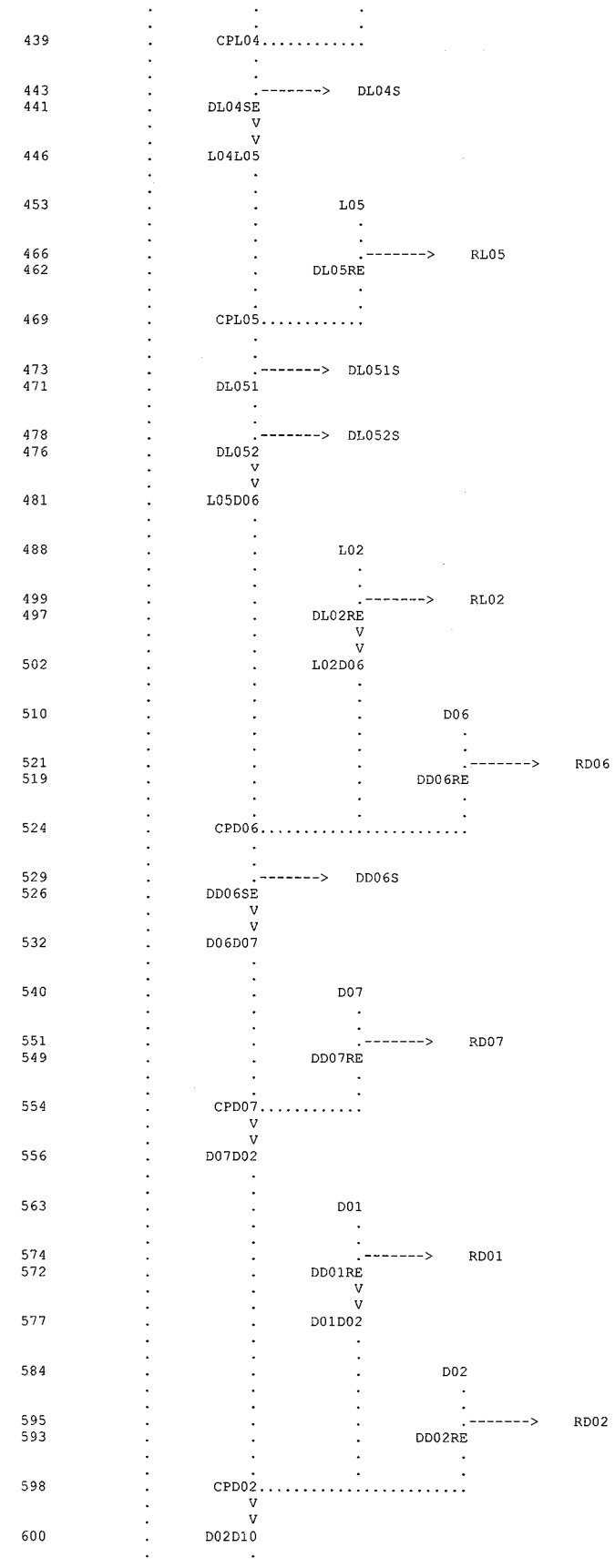
DL04RE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DL051S
471
DL051
478
DL052S
476
DL052
481
L05D06
488
L02
499
RL02
497
DL02RE
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L02D06
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RD06
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DD06RE
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CPD06
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DD06S
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DD06SE
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D06D07
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D07
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RD07
549
DD07RE
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CPD07
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D07D02
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D01
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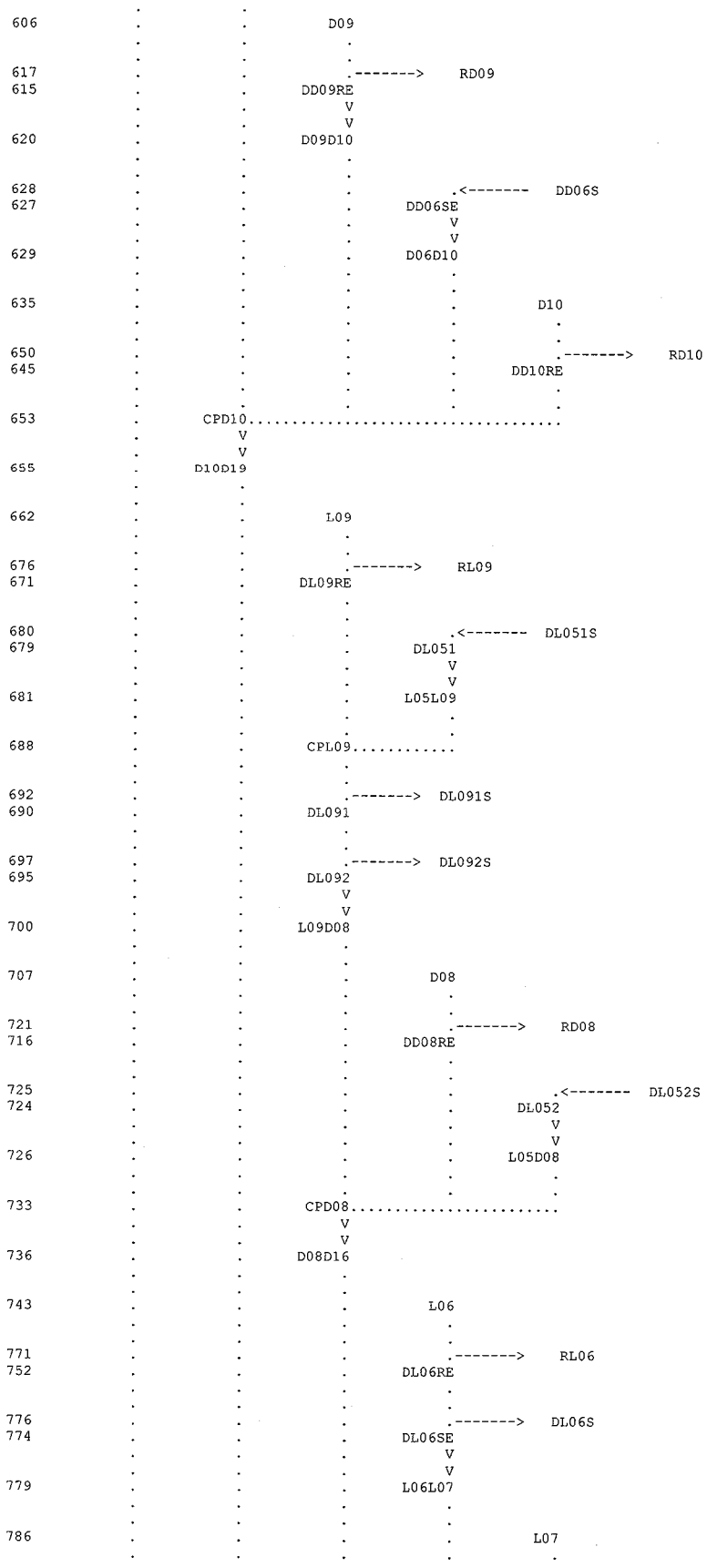
D02D10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RD10
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DD10RE
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CPD10
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D10D19
662
L09
676
RL09
671
DL09RE
680
DL051S
679
DL051
681
L05L09
688
CPL09
692
DL091S
690
DL091
697
DL092S
695
DL092
700
L09D08
707
D08
721
RD08
716
DD08RE
725
DL052S
724
DL052
726
L05D08
733
CPD08
736
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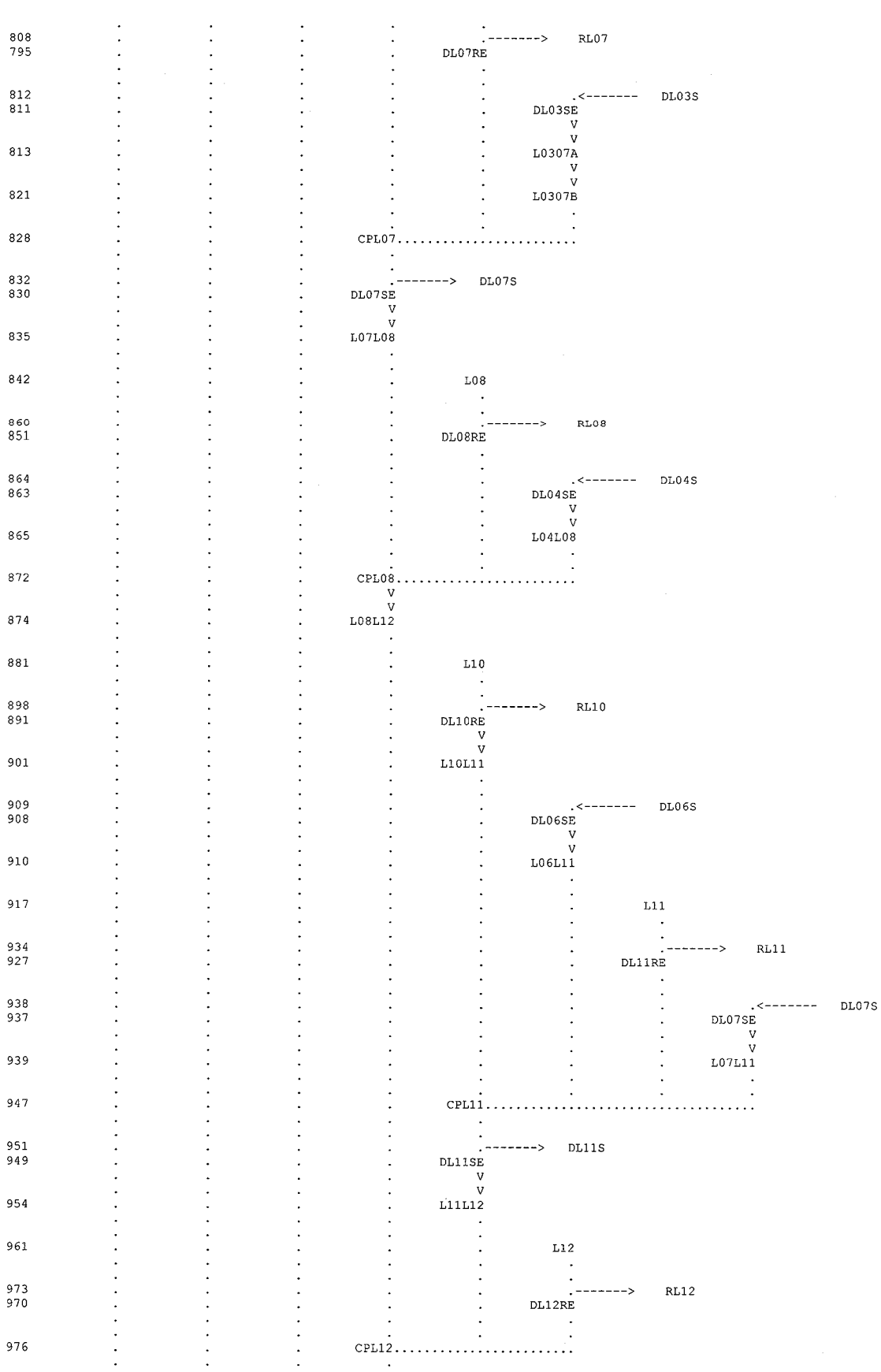
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DL03S
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L0307B
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832
830
DL07SE
DL07S
835
L07L08
842
L08
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851
DL08RE
RL08
864
863
DL04SE
DL04S
865
L04L08
872
CPL08
874
L08L12
881
L10
898
891
DL10RE
RL10
901
L10L11
909
908
DL06SE
DL06S
910
L06L11
917
L11
934
927
DL11RE
RL11
938
937
DL07SE
DL07S
939
L07L11
947
CPL11
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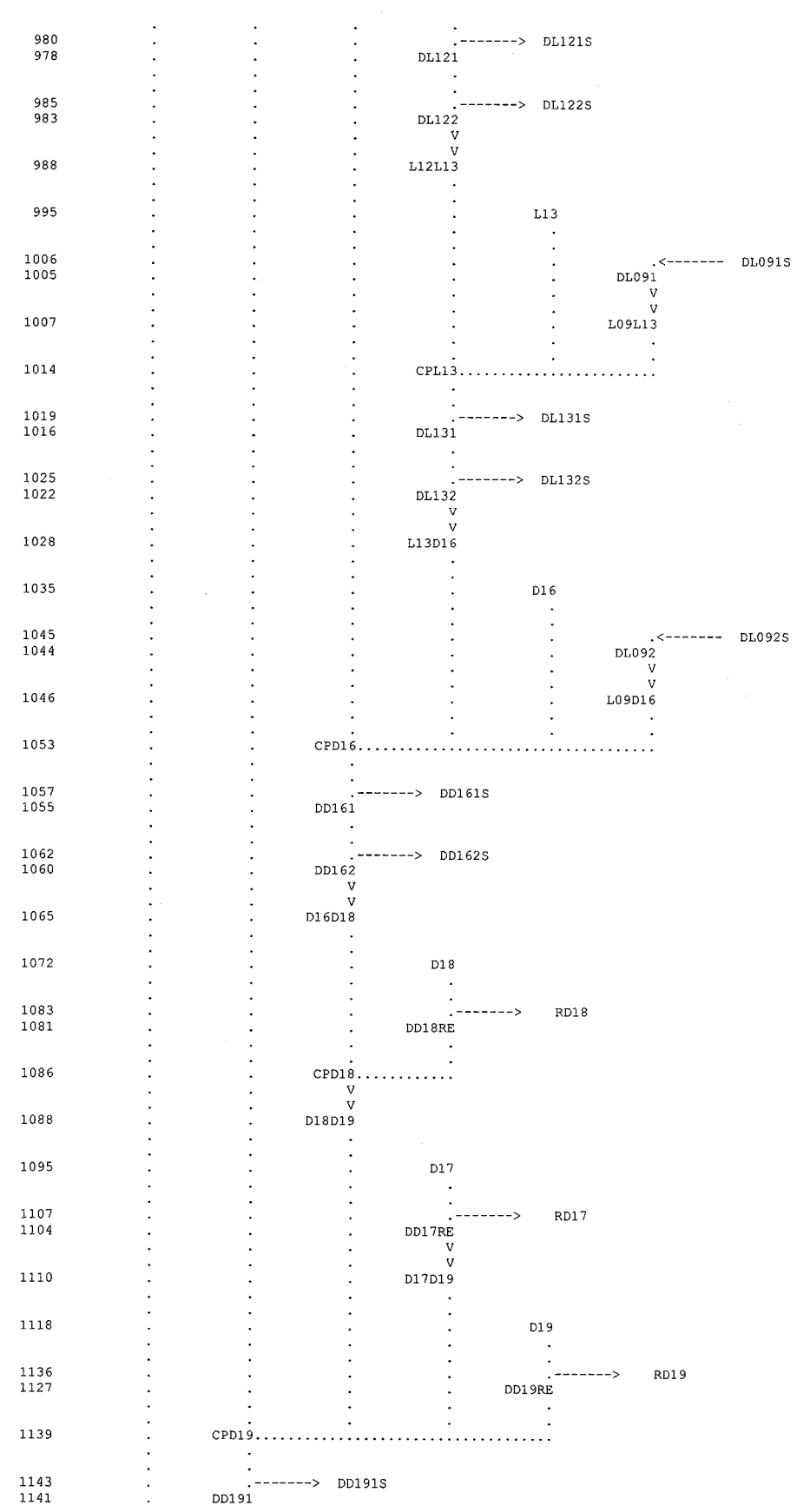
CPL12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DL091S
1007
L09L13
1014
CPL13
1019
1016
DL131
DL131S
1025
1022
DL132
DL132S
1028
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D16
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1044
DL092
DL092S
1046
L09D16
1053
CPD16
1057
1055
DD161
DD161S
1062
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DD162
DD162S
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D18
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1081
DD18RE
RD18
1086
CPD18
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D18D19
1095
D17
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1104
DD17RE
RD17
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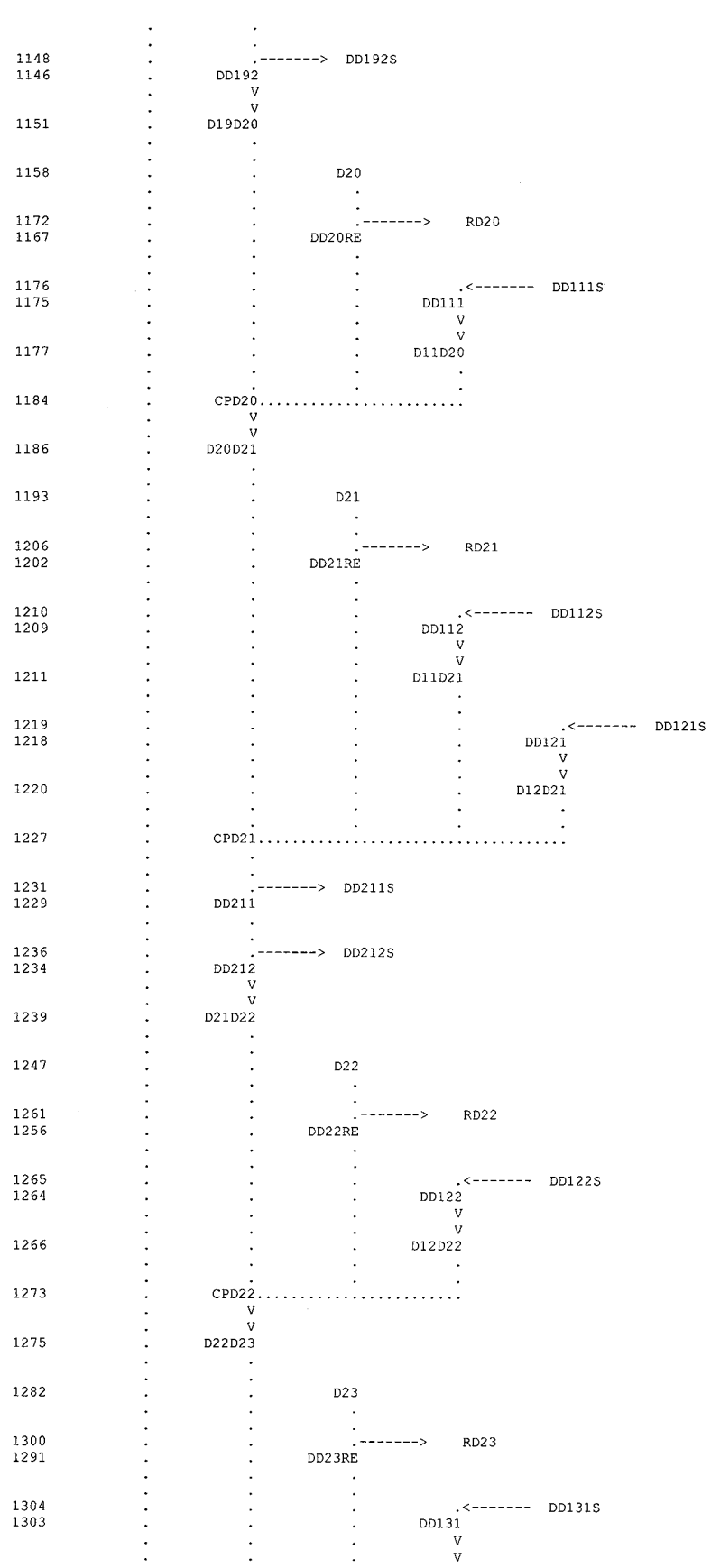
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DD111
1177
D11D20
1184
CPD20
1186
D20D21
1193
D21
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RD21
1202
DD21RE
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1209
DD112
1211
D11D21
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D12D21
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CPD21
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DD211
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DD212S
1234
DD212
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DD22RE
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DD122S
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DD122
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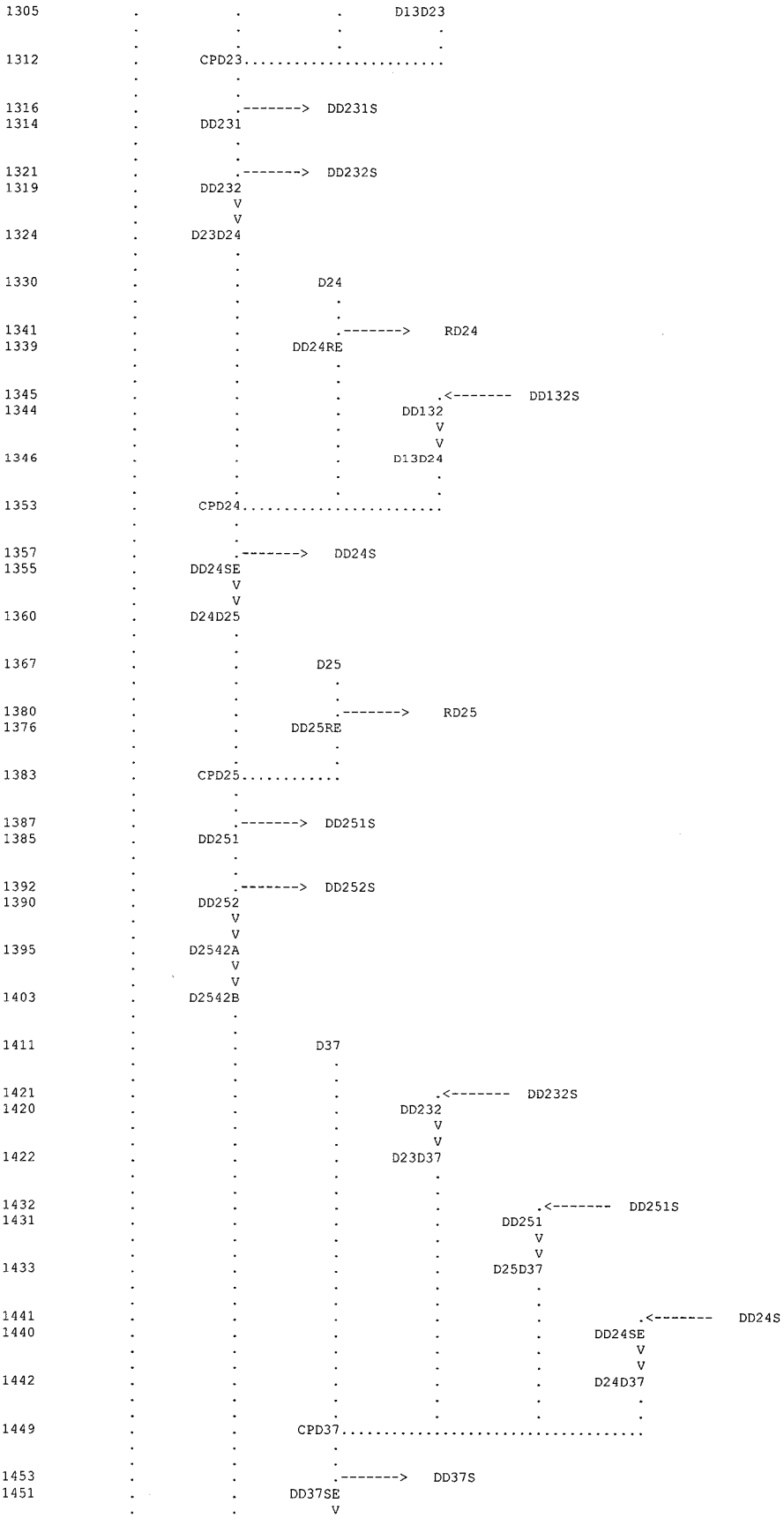
DD131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1345 DD132S
1344 DD132
1346 D13D24
1353 CPD24
1357 DD24S
1355 DD24SE
1360 D24D25
1367 D25
1380 RD25
1376 DD25RE
1383 CPD25
1387 DD251S
1385 DD251
1392 DD252S
1390 DD252
1395 D2542A
1403 D2542B
1411 D37
1421 DD232S
1420 DD232
1422 D23D37
1432 DD251S
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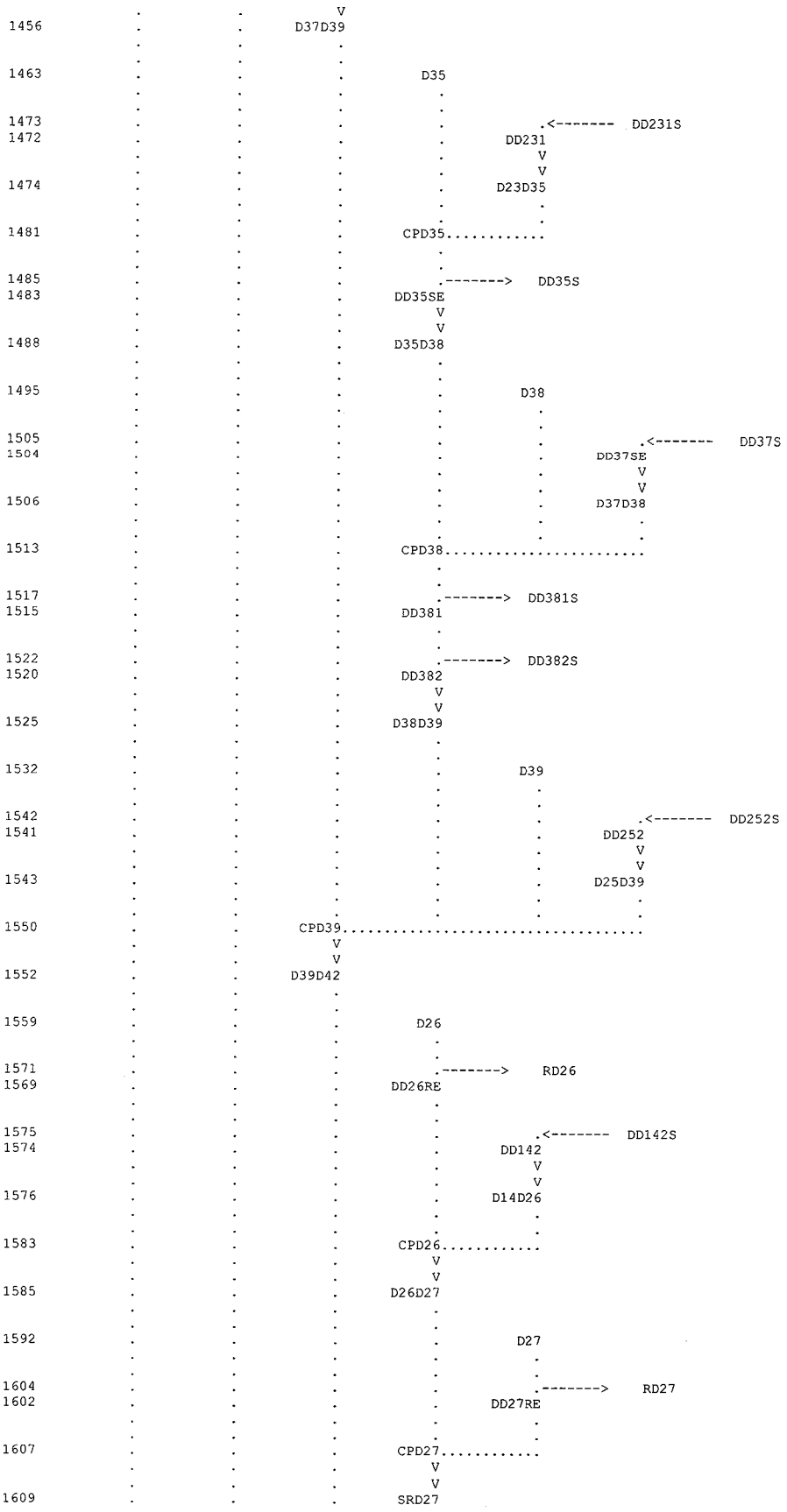
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1495 D38
1505 DD37S
1504 DD37SE
1506 D37D38
1513 CPD38
1517 DD381S
1515 DD381
1522 DD382S
1520 DD382
1525 D38D39
1532 D39
1542 DD252S
1541 DD252
1543 D25D39
1550 CPD39
1552 D39D42
1559 D26
1571 RD26
1569 DD26RE
1575 DD142S
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1602 DD27RE
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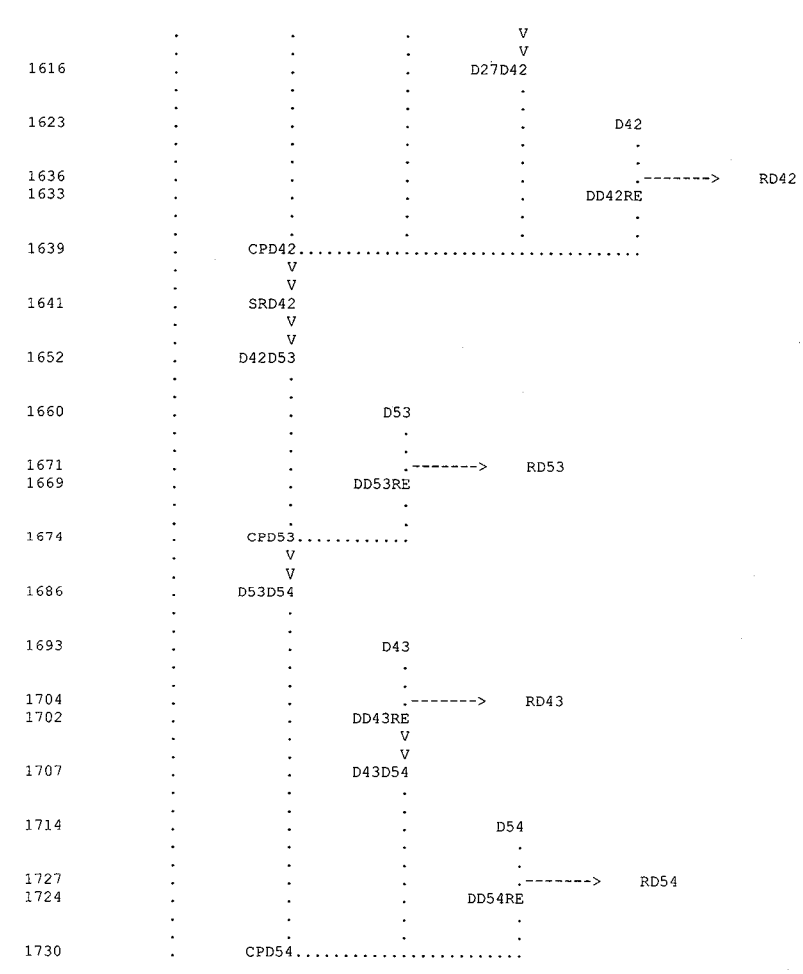
1609 SRD27



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN  1998                *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   01APR10  TIME  16:34:26   *
*                                       *
*****************************************
```

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

Flood Control District of Maricopa County
L303_EX_MB01 - Loop 303/ White Tanks ADMPU AHA
100 YEAR
24 Hour Storm
Unit Hydrograph: S-Graph
08/19/2009

FCDMC CONTRACT 2007C031
BY HDR ENGINEERING (#79902)
EXISTING CONDITIONS-AUGUST 2009
MAJOR BASIN 01
FILE NAME: EX-MB01.DAT

****

FOLLOWING ARE THE CHANGES BY FCDMC:
1. Removed SRD14. - by JWH 10-16-09
FILE NAME: WT1E01.DAT

For details concerning changes to this HEC-1 model, please contact
FCDMC, H&H Branch.

****

AZTEC revisions for FCD2008C014, Work Assignment No. 2 are listed below:
1. Extracted portion of Major Basin D draining to CPD54 (Lower El Mirage)
   and removed (commented out) "DUMMY" combine after operation D28AFR

```
                    2. Removed (deleted) SRD25 operation.
                    3. Replaced SRD42 operation with stage-storage-discharge data
                    4. Revised SRD53 operation stage-storage-discharge using 2010 FCD survey data
                    5. KO cards added/revised

                       Filename: WT1E01a.ihl            Date: 04/01/2010 - dtp


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

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      7   0  ENDING DATE
                     NDTIME       2235  ENDING TIME
                      ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                       TOTAL TIME BASE  166.58 HOURS

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

 38 JD          INDEX STORM NO. 1
                       STRM       3.48  PRECIPITATION DEPTH
                       TRDA        .00  TRANSPOSITION DRAINAGE AREA

 39 PI            PRECIPITATION PATTERN
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                       .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                       .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                       .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00

 49 JD          INDEX STORM NO. 2
                       STRM       3.39  PRECIPITATION DEPTH
                       TRDA       5.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .01       .00       .01
                       .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                       .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
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                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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```

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.00	.00	.00	.00	.00	.00	.00	.00		

50 JD INDEX STORM NO. 3
STRM 3.31 PRECIPITATION DEPTH
TRDA 10.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.01	.00	.01
.01	.01	.01	.01	.01	.01	.01	.01	.03	.03
.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00		

51 JD INDEX STORM NO. 4
STRM 3.22 PRECIPITATION DEPTH
TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.01	.00	.01
.01	.01	.01	.01	.01	.01	.01	.01	.03	.03
.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.00	.00	.00	.00
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52 JD INDEX STORM NO. 5
STRM 3.13 PRECIPITATION DEPTH
TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.01	.01	.01	.01	.01	.01	.01	.01	.03	.03
.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.00	.00	.00	.00
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53 JD INDEX STORM NO. 6
STRM 3.03 PRECIPITATION DEPTH
TRDA 60.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.01	.01	.01	.01	.01	.01	.01	.01	.03	.03
.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
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54 JD INDEX STORM NO. 7
STRM 2.96 PRECIPITATION DEPTH
TRDA 90.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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.01	.01	.01	.01	.01	.01	.01	.01	.03	.03
.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.00	.00	.00	.00
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55 JD INDEX STORM NO. 8
STRM 2.93 PRECIPITATION DEPTH
TRDA 120.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

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.01	.01	.01	.01	.01	.01	.01	.01	.03	.03
.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.00	.00	.00	.00
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DATA REMOVED FROM HARD COPY - Refer to digital copy of output

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

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	D03	960.	12.25	110.	34.	11.	.72		
+	DIVERSION TO	RD03	960.	12.25	96.	26.	9.	.72		
+	HYDROGRAPH AT	DD03RE	177.	12.67	25.	8.	3.	.72		
+	ROUTED TO	D03D04	110.	12.92	24.	8.	3.	.72		
+	HYDROGRAPH AT	D04	1149.	12.33	142.	44.	15.	.89		
+	DIVERSION TO	RD04	1118.	12.33	85.	24.	8.	.89		
+	HYDROGRAPH AT	DD04RE	1065.	12.42	72.	20.	7.	.89		
+	2 COMBINED AT	CPD04	1062.	12.42	95.	28.	9.	1.61		
+	DIVERSION TO	DD04S	647.	12.42	30.	7.	2.	1.61		
+	HYDROGRAPH AT	DD04SE	414.	12.42	65.	21.	7.	1.61		
+	ROUTED TO	D04D05	308.	12.67	64.	21.	7.	1.61		
+	HYDROGRAPH AT	D05	325.	12.17	35.	12.	4.	.16		
+	DIVERSION TO	RD05	137.	11.92	13.	4.	1.	.16		
+	HYDROGRAPH AT	DD05RE	325.	12.17	27.	8.	3.	.16		
+	2 COMBINED AT	CPD05	337.	12.67	89.	28.	9.	1.78		
+	ROUTED TO	D05D14	272.	12.83	88.	28.	9.	1.78		
+	DIVERSION TO	DD141S	150.	12.83	17.	4.	1.	1.78		

+	HYDROGRAPH AT	DD141	122.	12.17	71.	24.	8.	1.78
+	ROUTED TO	D05D15	122.	12.92	70.	24.	8.	1.78
+	HYDROGRAPH AT	D11	780.	12.42	107.	33.	11.	.66
+	DIVERSION TO	RD11	750.	12.33	58.	16.	5.	.66
+	HYDROGRAPH AT	DD11RE	719.	12.50	60.	17.	6.	.66
+	DIVERSION TO	DD111S	591.	12.50	49.	14.	5.	.66
+	HYDROGRAPH AT	DD111	128.	12.50	12.	3.	1.	.66
+	DIVERSION TO	DD112S	46.	12.50	6.	2.	1.	.66
+	HYDROGRAPH AT	DD112	82.	12.50	6.	2.	1.	.66
+	ROUTED TO	D11D12	52.	12.67	6.	2.	1.	.66
+	HYDROGRAPH AT	D12	241.	12.58	53.	16.	5.	.35
+	DIVERSION TO	RD12	241.	12.58	28.	8.	3.	.35
+	HYDROGRAPH AT	DD12RE	225.	12.75	31.	9.	3.	.35
+	2 COMBINED AT	CPD12	272.	12.75	36.	10.	3.	1.01
+	DIVERSION TO	DD121S	118.	12.75	13.	4.	1.	1.01
+	HYDROGRAPH AT	DD121	154.	12.75	23.	7.	2.	1.01
+	DIVERSION TO	DD122S	63.	12.75	11.	3.	1.	1.01
+	HYDROGRAPH AT	DD122	91.	12.75	13.	4.	1.	1.01
+	ROUTED TO	D12D13	52.	13.67	12.	4.	1.	1.01
+	HYDROGRAPH AT	D13	1138.	12.25	124.	36.	12.	1.03
+	DIVERSION TO	RD13	431.	12.00	30.	9.	3.	1.03
+	HYDROGRAPH AT	DD13RE	1138.	12.25	103.	27.	9.	1.03
+	HYDROGRAPH AT	DD04SE	647.	12.42	30.	7.	2.	1.61
+	ROUTED TO	D04D13	189.	13.50	30.	7.	2.	1.61
+	3 COMBINED AT	CPD13	1138.	12.25	144.	38.	13.	3.65
+	DIVERSION TO	DD131S	210.	12.25	13.	3.	1.	3.65
+	HYDROGRAPH AT	DD131	923.	12.25	130.	34.	11.	3.65
+	DIVERSION TO	DD132S	396.	12.25	39.	10.	3.	3.65
+	HYDROGRAPH AT	DD132	527.	12.25	91.	24.	8.	3.65
+	ROUTED TO	D13D14	449.	12.67	89.	24.	8.	3.65
+	HYDROGRAPH AT	D14	1097.	12.42	148.	46.	15.	.94
	DIVERSION TO							

+		RD14	1097.	12.42	117.	32.	11.	.94
+	HYDROGRAPH AT	DD14RE	490.	12.67	47.	14.	5.	.94
+	HYDROGRAPH AT	DD141	150.	12.83	17.	4.	1.	1.78
+	ROUTED TO	D0514A	122.	13.08	17.	4.	1.	1.78
+	3 COMBINED AT	CPD14	980.	12.67	151.	42.	14.	4.76
+	DIVERSION TO	DD142S	599.	12.67	122.	35.	12.	4.76
+	HYDROGRAPH AT	DD142	381.	12.67	30.	8.	3.	4.76
+	ROUTED TO	D14D15	331.	12.83	29.	8.	3.	4.76
+	HYDROGRAPH AT	D15	420.	12.17	44.	14.	5.	.22
+	3 COMBINED AT	CPD15	481.	12.83	137.	45.	15.	4.98
+	ROUTED TO	D15D26	440.	12.92	136.	45.	15.	4.98
+	ROUTED TO	D15D28	405.	13.00	136.	45.	15.	4.98
+	HYDROGRAPH AT	D28	425.	12.17	38.	12.	4.	.25
+	2 COMBINED AT	CPD28	714.	12.25	171.	57.	19.	5.23
+	ROUTED TO	D28AFR	681.	12.25	171.	57.	19.	5.23
+	HYDROGRAPH AT	L01	269.	12.17	25.	8.	3.	.16
+	DIVERSION TO	RL01	269.	12.17	18.	5.	2.	.16
+	HYDROGRAPH AT	DL01RE	159.	12.33	9.	3.	1.	.16
+	ROUTED TO	L01L03	58.	12.75	8.	3.	1.	.16
+	HYDROGRAPH AT	L03	958.	12.33	116.	35.	12.	.79
+	DIVERSION TO	RL03	958.	12.33	116.	34.	11.	.79
+	HYDROGRAPH AT	DL03RE	1.	19.83	1.	0.	0.	.79
+	HYDROGRAPH AT	L20	390.	12.42	47.	14.	5.	.35
+	DIVERSION TO	RL20	390.	12.42	41.	11.	4.	.35
+	HYDROGRAPH AT	DL20RE	88.	12.83	9.	3.	1.	.35
+	ROUTED TO	L20L03	46.	13.25	9.	3.	1.	.35
+	3 COMBINED AT	CPL03	60.	13.25	17.	5.	2.	1.29
+	DIVERSION TO	DL03S	37.	12.67	15.	5.	2.	1.29
+	HYDROGRAPH AT	DL03SE	23.	13.25	2.	0.	0.	1.29
+	ROUTED TO	L03L04	18.	13.58	2.	0.	0.	1.29
+	HYDROGRAPH AT	L04	663.	12.42	82.	24.	8.	.63
+	DIVERSION TO	RL04	663.	12.42	81.	22.	7.	.63

+	HYDROGRAPH AT	DL04RE	8.	15.67	6.	2.	1.	.63
+	2 COMBINED AT	CPL04	17.	13.58	6.	2.	1.	1.93
+	DIVERSION TO	DL04S	0.	.00	0.	0.	0.	1.93
+	HYDROGRAPH AT	DL04SE	17.	13.58	6.	2.	1.	1.93
+	ROUTED TO	L04L05	6.	17.25	5.	2.	1.	1.93
+	HYDROGRAPH AT	L05	659.	12.33	84.	27.	9.	.49
+	DIVERSION TO	RL05	659.	12.33	61.	17.	6.	.49
+	HYDROGRAPH AT	DL05RE	399.	12.50	33.	10.	3.	.49
+	2 COMBINED AT	CPL05	386.	12.50	37.	12.	4.	2.41
+	DIVERSION TO	DL051S	10.	12.50	0.	0.	0.	2.41
+	HYDROGRAPH AT	DL051	375.	12.50	36.	12.	4.	2.41
+	DIVERSION TO	DL052S	9.	12.50	1.	0.	0.	2.41
+	HYDROGRAPH AT	DL052	366.	12.50	35.	12.	4.	2.41
+	ROUTED TO	L05D06	251.	12.67	35.	12.	4.	2.41
+	HYDROGRAPH AT	L02	1727.	12.58	279.	85.	28.	1.88
+	DIVERSION TO	RL02	1727.	12.58	219.	59.	20.	1.88
+	HYDROGRAPH AT	DL02RE	906.	12.92	88.	26.	9.	1.88
+	ROUTED TO	L02D06	454.	13.42	83.	26.	9.	1.88
+	HYDROGRAPH AT	D06	616.	12.33	77.	23.	8.	.46
+	DIVERSION TO	RD06	616.	12.33	60.	16.	5.	.46
+	HYDROGRAPH AT	DD06RE	252.	12.67	24.	7.	2.	.46
+	3 COMBINED AT	CPD06	513.	13.42	137.	44.	15.	4.76
+	DIVERSION TO	DD06S	143.	13.42	8.	2.	1.	4.76
+	HYDROGRAPH AT	DD06SE	370.	12.58	129.	42.	14.	4.76
+	ROUTED TO	D06D07	370.	13.58	127.	42.	14.	4.76
+	HYDROGRAPH AT	D07	919.	12.50	134.	40.	13.	.89
+	DIVERSION TO	RD07	919.	12.50	116.	31.	10.	.89
+	HYDROGRAPH AT	DD07RE	250.	13.00	29.	9.	3.	.89
+	2 COMBINED AT	CPD07	425.	13.00	152.	50.	17.	5.64
+	ROUTED TO	D07D02	409.	13.67	150.	50.	17.	5.64
+	HYDROGRAPH AT	D01	1347.	12.58	212.	63.	21.	1.56
+	DIVERSION TO	RD01	1347.	12.58	184.	49.	16.	1.56

	HYDROGRAPH AT						
+		DD01RE	334.	13.17	46.	14.	5.	1.56
	ROUTED TO						
+		D01D02	147.	14.33	42.	14.	5.	1.56
	HYDROGRAPH AT						
+		D02	1750.	12.50	266.	80.	27.	1.84
	DIVERSION TO						
+		RD02	1750.	12.50	237.	63.	21.	1.84
	HYDROGRAPH AT						
+		DD02RE	378.	13.08	53.	17.	6.	1.84
	3 COMBINED AT						
+		CPD02	524.	13.25	212.	73.	24.	9.05
	ROUTED TO						
+		D02D10	480.	13.83	211.	73.	24.	9.05
	HYDROGRAPH AT						
+		D09	360.	12.33	42.	13.	4.	.26
	DIVERSION TO						
+		RD09	360.	12.33	29.	8.	3.	.26
	HYDROGRAPH AT						
+		DD09RE	225.	12.50	18.	5.	2.	.26
	ROUTED TO						
+		D09D10	172.	12.58	17.	5.	2.	.26
	HYDROGRAPH AT						
+		DD06SE	143.	13.42	8.	2.	1.	4.76
	ROUTED TO						
+		D06D10	77.	13.92	8.	2.	1.	4.76
	HYDROGRAPH AT						
+		D10	774.	12.33	100.	31.	10.	.63
	DIVERSION TO						
+		RD10	774.	12.33	70.	19.	6.	.63
	HYDROGRAPH AT						
+		DD10RE	479.	12.58	40.	12.	4.	.63
	4 COMBINED AT						
+		CPD10	605.	12.58	249.	87.	29.	9.95
	ROUTED TO						
+		D10D19	586.	12.83	247.	87.	29.	9.95
	HYDROGRAPH AT						
+		L09	574.	12.42	74.	23.	8.	.49
	DIVERSION TO						
+		RL09	574.	12.42	74.	20.	7.	.49
	HYDROGRAPH AT						
+		DL09RE	10.	15.25	6.	2.	1.	.49
	HYDROGRAPH AT						
+		DL051	10.	12.50	0.	0.	0.	2.41
	ROUTED TO						
+		L05L09	2.	13.75	0.	0.	0.	2.41
	2 COMBINED AT						
+		CPL09	10.	15.25	6.	2.	1.	2.90
	DIVERSION TO						
+		DL091S	1.	15.25	1.	0.	0.	2.90
	HYDROGRAPH AT						
+		DL091	9.	15.25	6.	2.	1.	2.90
	DIVERSION TO						
+		DL092S	0.	.00	0.	0.	0.	2.90
	HYDROGRAPH AT						
+		DL092	9.	15.25	6.	2.	1.	2.90
	ROUTED TO						
+		L09D08	7.	16.92	5.	2.	1.	2.90
	HYDROGRAPH AT						
+		D08	467.	12.58	75.	23.	8.	.51
	DIVERSION TO						
+		RD08	467.	12.58	48.	13.	4.	.51
	HYDROGRAPH AT						

+		DD08RE	367.	12.75	35.	10.	3.	.51
	HYDROGRAPH AT							
+		DL052	9.	12.50	1.	0.	0.	2.41
	ROUTED TO							
+		L05D08	3.	14.08	1.	0.	0.	2.41
	3 COMBINED AT							
+		CPD08	367.	12.75	40.	12.	4.	3.41
	ROUTED TO							
+		D08D16	176.	13.58	36.	12.	4.	3.41
	HYDROGRAPH AT							
+		L06	876.	12.33	94.	28.	9.	.70
	DIVERSION TO							
+		RL06	876.	12.33	94.	28.	9.	.70
	HYDROGRAPH AT							
+		DL06RE	0.	.00	0.	0.	0.	.70
	DIVERSION TO							
+		DL06S	0.	.00	0.	0.	0.	.70
	HYDROGRAPH AT							
+		DL06SE	0.	.00	0.	0.	0.	.70
	ROUTED TO							
+		L06L07	0.	.00	0.	0.	0.	.70
	HYDROGRAPH AT							
+		L07	775.	12.33	88.	26.	9.	.63
	DIVERSION TO							
+		RL07	775.	12.33	87.	23.	8.	.63
	HYDROGRAPH AT							
+		DL07RE	17.	14.08	9.	3.	1.	.63
	HYDROGRAPH AT							
+		DL03SE	37.	12.67	15.	5.	2.	1.29
	ROUTED TO							
+		L0307A	37.	13.58	14.	5.	2.	1.29
	ROUTED TO							
+		L0307B	37.	13.83	14.	5.	2.	1.29
	3 COMBINED AT							
+		CPL07	50.	14.08	22.	8.	3.	2.62
	DIVERSION TO							
+		DL07S	10.	14.08	5.	2.	1.	2.62
	HYDROGRAPH AT							
+		DL07SE	40.	14.08	18.	6.	2.	2.62
	ROUTED TO							
+		L07L08	35.	14.25	17.	6.	2.	2.62
	HYDROGRAPH AT							
+		L08	612.	12.42	83.	25.	8.	.49
	DIVERSION TO							
+		RL08	612.	12.42	75.	20.	7.	.49
	HYDROGRAPH AT							
+		DL08RE	110.	13.00	16.	5.	2.	.49
	HYDROGRAPH AT							
+		DL04SE	0.	.00	0.	0.	0.	1.93
	ROUTED TO							
+		L04L08	0.	.00	0.	0.	0.	1.93
	3 COMBINED AT							
+		CPL08	110.	13.00	32.	11.	4.	3.74
	ROUTED TO							
+		L08L12	60.	14.08	31.	11.	4.	3.74
	HYDROGRAPH AT							
+		L10	845.	12.42	103.	30.	10.	.84
	DIVERSION TO							
+		RL10	845.	12.42	65.	17.	6.	.84
	HYDROGRAPH AT							
+		DL10RE	647.	12.58	46.	13.	4.	.84
	ROUTED TO							
+		L10L11	442.	12.83	45.	13.	4.	.84

+	HYDROGRAPH AT	DL06SE	0.	.00	0.	0.	0.	.70
+	ROUTED TO	L06L11	0.	.00	0.	0.	0.	.70
+	HYDROGRAPH AT	L11	744.	12.33	94.	29.	10.	.62
+	DIVERSION TO	RL11	744.	12.33	89.	24.	8.	.62
+	HYDROGRAPH AT	DL11RE	56.	13.17	15.	5.	2.	.62
+	HYDROGRAPH AT	DL07SE	10.	14.08	5.	2.	1.	2.62
+	ROUTED TO	L07L11	8.	15.42	4.	2.	1.	2.62
+	4 COMBINED AT	CPL11	440.	12.83	62.	19.	6.	4.09
+	DIVERSION TO	DL11S	3.	12.83	0.	0.	0.	4.09
+	HYDROGRAPH AT	DL11SE	435.	12.83	62.	19.	6.	4.09
+	ROUTED TO	L11L12	356.	13.00	61.	19.	6.	4.09
+	HYDROGRAPH AT	L12	304.	12.58	43.	12.	4.	.36
+	DIVERSION TO	RL12	243.	12.42	17.	5.	2.	.36
+	HYDROGRAPH AT	DL12RE	304.	12.58	27.	7.	2.	.36
+	3 COMBINED AT	CPL12	492.	12.92	113.	36.	12.	5.56
+	DIVERSION TO	DL121S	86.	12.92	20.	6.	2.	5.56
+	HYDROGRAPH AT	DL121	405.	12.92	93.	30.	10.	5.56
+	DIVERSION TO	DL122S	5.	12.92	1.	0.	0.	5.56
+	HYDROGRAPH AT	DL122	400.	12.92	92.	30.	10.	5.56
+	ROUTED TO	L12L13	320.	13.25	89.	30.	10.	5.56
+	HYDROGRAPH AT	L13	183.	12.83	40.	10.	3.	.48
+	HYDROGRAPH AT	DL091	1.	15.25	1.	0.	0.	2.90
+	ROUTED TO	L09L13	1.	19.75	1.	0.	0.	2.90
+	3 COMBINED AT	CPL13	443.	13.17	120.	38.	13.	7.02
+	DIVERSION TO	DL131S	425.	13.17	117.	38.	13.	7.02
+	HYDROGRAPH AT	DL131	19.	13.17	3.	1.	0.	7.02
+	DIVERSION TO	DL132S	13.	13.17	2.	1.	0.	7.02
+	HYDROGRAPH AT	DL132	6.	13.17	1.	0.	0.	7.02
+	ROUTED TO	L13D16	4.	14.50	1.	0.	0.	7.02
+	HYDROGRAPH AT	D16	207.	12.75	45.	12.	4.	.52
+	HYDROGRAPH AT	DL092	0.	.00	0.	0.	0.	2.90
+	ROUTED TO	L09D16	0.	.00	0.	0.	0.	2.90

	4 COMBINED AT						
+		CPD16	234.	13.58	73.	22.	8.	8.05
	DIVERSION TO						
+		DD161S	190.	13.58	58.	17.	6.	8.05
	HYDROGRAPH AT						
+		DD161	45.	13.58	16.	5.	2.	8.05
	DIVERSION TO						
+		DD162S	18.	13.58	7.	2.	1.	8.05
	HYDROGRAPH AT						
+		DD162	27.	13.58	9.	3.	1.	8.05
	ROUTED TO						
+		D16D18	25.	13.83	9.	3.	1.	8.05
	HYDROGRAPH AT						
+		D18	321.	12.17	28.	9.	3.	.20
	DIVERSION TO						
+		RD18	321.	12.17	28.	9.	3.	.20
	HYDROGRAPH AT						
+		DD18RE	0.	21.42	0.	0.	0.	.20
	2 COMBINED AT						
+		CPD18	25.	13.83	9.	3.	1.	8.25
	ROUTED TO						
+		D18D19	23.	14.00	9.	3.	1.	8.25
	HYDROGRAPH AT						
+		D17	324.	12.17	28.	9.	3.	.20
	DIVERSION TO						
+		RD17	324.	12.17	28.	8.	3.	.20
	HYDROGRAPH AT						
+		DD17RE	2.	20.17	1.	0.	0.	.20
	ROUTED TO						
+		D17D19	2.	21.67	1.	0.	0.	.20
	HYDROGRAPH AT						
+		D19	509.	12.33	69.	21.	7.	.51
	DIVERSION TO						
+		RD19	509.	12.33	64.	17.	6.	.51
	HYDROGRAPH AT						
+		DD19RE	52.	13.17	11.	4.	1.	.51
	4 COMBINED AT						
+		CPD19	583.	12.83	258.	91.	30.	16.49
	DIVERSION TO						
+		DD191S	289.	12.83	133.	47.	16.	16.49
	HYDROGRAPH AT						
+		DD191	189.	12.83	96.	36.	12.	16.49
	DIVERSION TO						
+		DD192S	74.	12.83	44.	18.	6.	16.49
	HYDROGRAPH AT						
+		DD192	115.	12.83	52.	18.	6.	16.49
	ROUTED TO						
+		D19D20	107.	14.25	51.	18.	6.	16.49
	HYDROGRAPH AT						
+		D20	587.	12.33	70.	22.	7.	.50
	DIVERSION TO						
+		RD20	587.	12.33	70.	19.	6.	.50
	HYDROGRAPH AT						
+		DD20RE	10.	15.00	6.	2.	1.	.50
	HYDROGRAPH AT						
+		DD111	591.	12.50	49.	14.	5.	.66
	ROUTED TO						
+		D11D20	335.	12.92	46.	14.	5.	.66
	3 COMBINED AT						
+		CPD20	326.	13.00	89.	30.	10.	17.65
	ROUTED TO						
+		D20D21	246.	13.42	86.	30.	10.	17.65
	HYDROGRAPH AT						

+	D21	565.	12.33	72.	22.	7.	.50
	DIVERSION TO						
+	RD21	565.	12.33	72.	20.	7.	.50
	HYDROGRAPH AT						
+	DD21RE	9.	15.92	6.	2.	1.	.50
	HYDROGRAPH AT						
+	DD112	46.	12.50	6.	2.	1.	.66
	ROUTED TO						
+	D11D21	22.	13.33	5.	2.	1.	.66
	HYDROGRAPH AT						
+	DD121	118.	12.75	13.	4.	1.	1.01
	ROUTED TO						
+	D12D21	90.	13.00	13.	4.	1.	1.01
	4 COMBINED AT						
+	CPD21	306.	13.42	99.	35.	12.	18.49
	DIVERSION TO						
+	DD211S	206.	13.42	73.	26.	9.	18.49
	HYDROGRAPH AT						
+	DD211	100.	13.42	26.	9.	3.	18.49
	DIVERSION TO						
+	DD212S	52.	13.42	19.	7.	2.	18.49
	HYDROGRAPH AT						
+	DD212	48.	13.42	7.	2.	1.	18.49
	ROUTED TO						
+	D21D22	35.	13.75	7.	2.	1.	18.49
	HYDROGRAPH AT						
+	D22	562.	12.33	67.	21.	7.	.45
	DIVERSION TO						
+	RD22	562.	12.33	67.	19.	6.	.45
	HYDROGRAPH AT						
+	DD22RE	8.	16.75	5.	2.	1.	.45
	HYDROGRAPH AT						
+	DD122	63.	12.75	11.	3.	1.	1.01
	ROUTED TO						
+	D12D22	45.	13.42	10.	3.	1.	1.01
	3 COMBINED AT						
+	CPD22	67.	13.67	16.	5.	2.	18.94
	ROUTED TO						
+	D22D23	61.	13.83	15.	5.	2.	18.94
	HYDROGRAPH AT						
+	D23	556.	12.42	75.	22.	7.	.54
	DIVERSION TO						
+	RD23	556.	12.42	69.	18.	6.	.54
	HYDROGRAPH AT						
+	DD23RE	75.	13.08	13.	4.	1.	.54
	HYDROGRAPH AT						
+	DD131	210.	12.25	13.	3.	1.	3.65
	ROUTED TO						
+	D13D23	133.	12.50	13.	3.	1.	3.65
	3 COMBINED AT						
+	CPD23	98.	12.50	29.	10.	3.	22.13
	DIVERSION TO						
+	DD231S	10.	12.50	3.	1.	0.	22.13
	HYDROGRAPH AT						
+	DD231	89.	12.50	26.	9.	3.	22.13
	DIVERSION TO						
+	DD232S	11.	12.50	3.	1.	0.	22.13
	HYDROGRAPH AT						
+	DD232	78.	12.50	23.	8.	3.	22.13
	ROUTED TO						
+	D23D24	60.	12.75	23.	8.	3.	22.13
	HYDROGRAPH AT						
+	D24	538.	12.42	71.	21.	7.	.49

+	DIVERSION TO	RD24	538.	12.42	71.	21.	7.	.49
+	HYDROGRAPH AT	DD24RE	4.	21.08	2.	1.	0.	.49
+	HYDROGRAPH AT	DD132	396.	12.25	39.	10.	3.	3.65
+	ROUTED TO	D13D24	301.	12.50	39.	10.	3.	3.65
+	3 COMBINED AT	CPD24	291.	12.58	54.	16.	5.	22.62
+	DIVERSION TO	DD24S	62.	12.58	5.	1.	0.	22.62
+	HYDROGRAPH AT	DD24SE	229.	12.58	49.	15.	5.	22.62
+	ROUTED TO	D24D25	204.	12.75	48.	15.	5.	22.62
+	HYDROGRAPH AT	D25	574.	12.33	72.	22.	7.	.50
+	DIVERSION TO	RD25	574.	12.33	69.	19.	6.	.50
+	HYDROGRAPH AT	DD25RE	21.	13.58	9.	3.	1.	.50
+	2 COMBINED AT	CPD25	204.	12.75	50.	16.	5.	23.12
+	DIVERSION TO	DD251S	190.	12.75	48.	16.	5.	23.12
+	HYDROGRAPH AT	DD251	13.	12.75	1.	0.	0.	23.12
+	DIVERSION TO	DD252S	13.	12.75	1.	0.	0.	23.12
+	HYDROGRAPH AT	DD252	0.	.00	0.	0.	0.	23.12
+	ROUTED TO	D2542A	0.	.00	0.	0.	0.	23.12
+	ROUTED TO	D2542B	0.	.00	0.	0.	0.	23.12
+	HYDROGRAPH AT	D37	119.	12.50	17.	4.	1.	.20
+	HYDROGRAPH AT	DD232	11.	12.50	3.	1.	0.	22.13
+	ROUTED TO	D23D37	6.	15.50	3.	1.	0.	22.13
+	HYDROGRAPH AT	DD251	190.	12.75	48.	16.	5.	23.12
+	ROUTED TO	D25D37	160.	13.25	47.	16.	5.	23.12
+	HYDROGRAPH AT	DD24SE	62.	12.58	5.	1.	0.	22.62
+	ROUTED TO	D24D37	44.	13.00	5.	1.	0.	22.62
+	4 COMBINED AT	CPD37	219.	13.08	68.	22.	7.	23.32
+	DIVERSION TO	DD37S	0.	.00	0.	0.	0.	23.32
+	HYDROGRAPH AT	DD37SE	219.	13.08	68.	22.	7.	23.32
+	ROUTED TO	D37D39	164.	13.42	65.	22.	7.	23.32
+	HYDROGRAPH AT	D35	119.	12.58	18.	5.	2.	.25
+	HYDROGRAPH AT	DD231	10.	12.50	3.	1.	0.	22.13
+	ROUTED TO	D23D35	5.	15.00	3.	1.	0.	22.13

	2 COMBINED AT						
+		CPD35	119.	12.58	22.	6.	2.	22.38
	DIVERSION TO						
+		DD35S	17.	12.58	3.	1.	0.	22.38
	HYDROGRAPH AT						
+		DD35SE	87.	12.58	15.	4.	1.	22.38
	ROUTED TO						
+		D35D38	80.	12.83	15.	4.	1.	22.38
	HYDROGRAPH AT						
+		D38	61.	12.50	9.	2.	1.	.12
	HYDROGRAPH AT						
+		DD37SE	0.	.00	0.	0.	0.	23.32
	ROUTED TO						
+		D37D38	0.	.00	0.	0.	0.	23.32
	3 COMBINED AT						
+		CPD38	122.	12.67	22.	6.	2.	23.69
	DIVERSION TO						
+		DD381S	107.	12.67	20.	5.	2.	23.69
	HYDROGRAPH AT						
+		DD381	15.	12.67	3.	1.	0.	23.69
	DIVERSION TO						
+		DD382S	10.	12.67	2.	1.	0.	23.69
	HYDROGRAPH AT						
+		DD382	4.	12.67	1.	0.	0.	23.69
	ROUTED TO						
+		D38D39	3.	14.33	1.	0.	0.	23.69
	HYDROGRAPH AT						
+		D39	113.	12.50	16.	4.	1.	.18
	HYDROGRAPH AT						
+		DD252	13.	12.75	1.	0.	0.	23.12
	ROUTED TO						
+		D25D39	8.	13.00	1.	0.	0.	23.12
	4 COMBINED AT						
+		CPD39	178.	13.42	78.	26.	9.	23.88
	ROUTED TO						
+		D39D42	172.	13.67	77.	26.	9.	23.88
	HYDROGRAPH AT						
+		D26	982.	12.25	101.	31.	10.	.64
	DIVERSION TO						
+		RD26	982.	12.25	98.	26.	9.	.64
	HYDROGRAPH AT						
+		DD26RE	31.	13.42	13.	5.	2.	.64
	HYDROGRAPH AT						
+		DD142	599.	12.67	122.	35.	12.	4.76
	ROUTED TO						
+		D14D26	470.	12.92	120.	35.	12.	4.76
	2 COMBINED AT						
+		CPD26	464.	12.92	130.	39.	13.	5.40
	ROUTED TO						
+		D26D27	458.	13.00	130.	39.	13.	5.40
	HYDROGRAPH AT						
+		D27	498.	12.17	52.	17.	6.	.32
	DIVERSION TO						
+		RD27	100.	11.92	13.	4.	1.	.32
	HYDROGRAPH AT						
+		DD27RE	498.	12.17	45.	12.	4.	.32
	2 COMBINED AT						
+		CPD27	491.	12.17	169.	51.	17.	5.72
	ROUTED TO						
+		SRD27	491.	12.17	169.	51.	17.	5.72
	ROUTED TO						
+		D27D42	429.	13.25	166.	51.	17.	5.72
	HYDROGRAPH AT						

+	D42	1317.	12.33	151.	46.	15.	.99
	DIVERSION TO						
+	RD42	1317.	12.33	135.	36.	12.	.99
	HYDROGRAPH AT						
+	DD42RE	215.	12.75	31.	10.	3.	.99
	4 COMBINED AT						
+	CPD42	498.	13.42	216.	71.	24.	26.93
	ROUTED TO						
+	SRD42	490.	13.50	196.	71.	24.	26.93
	ROUTED TO						
+	D42D53	480.	13.67	195.	71.	24.	26.93
	HYDROGRAPH AT						
+	D53	180.	12.17	13.	4.	1.	.12
	DIVERSION TO						
+	RD53	180.	12.17	13.	4.	1.	.12
	HYDROGRAPH AT						
+	DD53RE	0.	.00	0.	0.	0.	.12
	2 COMBINED AT						
+	CPD53	480.	13.67	195.	71.	24.	27.05
	ROUTED TO						
+	SRD53	200.	15.42	145.	60.	20.	27.05
	ROUTED TO						
+	D53D54	199.	15.75	144.	60.	20.	27.05
	HYDROGRAPH AT						
+	D43	643.	12.33	74.	23.	8.	.50
	DIVERSION TO						
+	RD43	643.	12.33	66.	18.	6.	.50
	HYDROGRAPH AT						
+	DD43RE	105.	12.75	16.	5.	2.	.50
	ROUTED TO						
+	D43D54	44.	13.67	15.	5.	2.	.50
	HYDROGRAPH AT						
+	D54	338.	12.25	29.	8.	3.	.27
	DIVERSION TO						
+	RD54	67.	12.00	5.	2.	1.	.27
	HYDROGRAPH AT						
+	DD54RE	338.	12.25	26.	7.	2.	.27
	3 COMBINED AT						
+	CPD54	297.	12.25	151.	68.	23.	27.82

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION SRD27
(PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED DURING BREACH FORMATION)

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1142.00	.00	.00
STORAGE	0.	0.	0.
OUTFLOW	52.	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1147.32	1147.32	0.	576.	166.58	13.00	.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1142.00	.00	.00
STORAGE	0.	0.	0.
OUTFLOW	52.	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1146.65	1146.65	0.	494.	166.58	12.17	.00

PLAN 3 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1142.00	.00	.00
STORAGE	0.	0.	0.
OUTFLOW	52.	0.	0.

RATIO	MAXIMUM	MAXIMUM	MAXIMUM	MAXIMUM	DURATION	TIME OF	TIME OF

OF PMF	RESERVOIR W.S.ELEV	DEPTH OVER DAM	STORAGE AC-FT	OUTFLOW CFS	OVER TOP HOURS	MAX OUTFLOW HOURS	FAILURE HOURS
1.00	1146.52	1146.52	0.	478.	166.58	12.17	.00

PLAN 4 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1142.00	.00	.00
STORAGE	0.	0.	0.
OUTFLOW	52.	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1146.39	1146.39	0.	463.	166.58	12.25	.00

PLAN 5 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1142.00	.00	.00
STORAGE	0.	0.	0.
OUTFLOW	52.	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1146.27	1146.27	0.	448.	166.58	12.25	.00

PLAN 6 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1142.00	.00	.00
STORAGE	0.	0.	0.
OUTFLOW	52.	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1146.11	1146.11	0.	429.	166.58	12.17	.00

PLAN 7 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1142.00	.00	.00
STORAGE	0.	0.	0.
OUTFLOW	52.	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1146.02	1146.02	0.	417.	166.58	12.25	.00

PLAN 8 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1142.00	.00	.00
STORAGE	0.	0.	0.
OUTFLOW	52.	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1145.96	1145.96	0.	411.	166.58	12.25	.00

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

Appendix D3

Backup data for revisions to ADMPU-AHA (2009)
Existing Condition without CIP HEC-1 model

Client: Flood Control District of Maricopa County
Project: FCD2008C014, WA#1 - Lower El Mirage Wash DCR, Phase 1
Description: **Existing condition stage-storage-discharge data**
AZTEC Project No.: AZE0913-02
Date: 5/19/10 By: dtp

Stage - Discharge Data for West Cactus Basin

Stage (feet)	Water Surface Elevation	Discharge, in cfs			Storage Volume ac-ft
		Total	Culvert	Weir	
0	1103	0	0	0	0
1	1104	0	0	0	0.66
2	1105	0	0	0	4.1
4.2	1107.2	0	0	0	20
5	1108	25	25	0	27.6
7	1110	225	225	0	47.2
8	1111	375	375	0	57.8
8.7	1111.7	430	430	0	67
9	1112	474	470	4	69.2
9.3	1112.3	526	500	26	74
9.7	1112.7	633	535	98	78
10	1113	737	550	187	81.7
10.2	1113.2	835	565	270	85
10.4	1113.4	955	575	380	87
10.6	1113.6	1117	580	537	90
10.8	1113.8	1362	605	757	93

Elevation datum = NGVD29

Stage - Storage - Discharge Data for West Cactus Basin
CODE into HEC-1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SV	0	0.66	4.1	20	27.6	47.2	57.8	67	69.2	74
SV	78	81.7	85	87	90					
SQ	0	0	0	0	25	225	375	430	474	526
SQ	633	737	835	955	1117					
SE	1103	1104	1105	1107.2	1108	1110	1111	1111.7	1112	1112.3
SE	1112.7	1113	1113.2	1113.4	1113.6					

This data is a result of the following:

Storage data from: existing surface created from 2010 FCDMC survey data, supplemented with basin bottom spot elevation from the 2004 Stanley survey data.

Discharge data from: 2-10'x3' rcb combined with weir overflow data for controlling section as determined from 2010 survey data. Overflow weir data generated using COE uneven weir program.

Client: Flood Control District of Maricopa County
Project: FCD2008C014, WA#1 - Lower El Mirage Wash DCR, Phase 1
Description: **Existing condition stage-storage-discharge data**
AZTEC Project No.: AZE0913-02
Date: 5/19/10 By: dtp

Stage - Discharge Data for Cactus Road

Stage (feet)	Water Surface Elevation	Discharge, in cfs			Storage Volume ac-ft
		Total	Culvert	Weir	
0	1105.16	0	0	0	0
1.84	1107	9	9	0	0.03
4.84	1110	41	41	0	1.63
8.84	1114	81	81	0	11.41
9.02	1114.18	82	82	0	12
9.24	1114.4	118	85	33	12.6
9.44	1114.6	147.5	86.5	61	13.3
9.64	1114.8	184	88	96	14
9.84	1115	230	90	140	14.62
10.04	1115.2	294	92	202	15.3
10.34	1115.5	422	95	327	16.4
10.84	1116	717	98	619	18.09
11.34	1116.5	1123	105	1018	20.2

Elevation datum = NGVD29

Stage - Storage - Discharge Data for Cactus Road
CODE into HEC-1

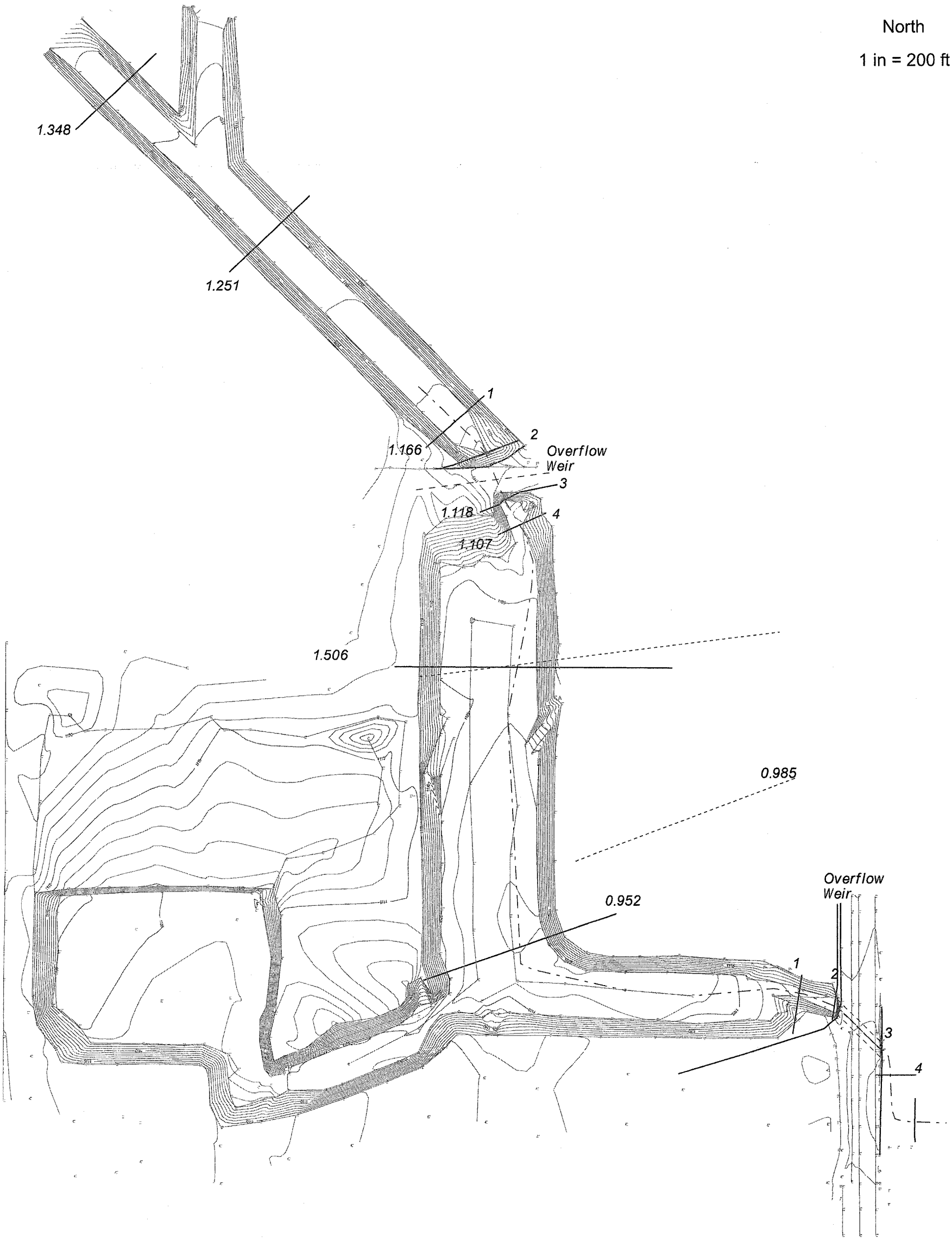
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SV	0	0.03	1.63	11.41	12	12.6	13.3	14	14.62	15.3
SV	16.4	18.09	20.2							
SQ	0	9	41	81	82	118	147.5	184	230	294
SQ	422	717	1123							
SE	1105.2	1107	1110	1114	1114.2	1114.4	1114.6	1114.8	1115	1115.2
SE	1115.5	1116	1116.5							

This data is a result of the following:
Storage data from: existing surface created from 2010 FCDMC survey data, supplemented with 2004 Stanley survey data north of Cactus Road.

Discharge data from: 3-24" rcp combined with weir overflow data for controlling section as determined from 2010 survey data. Overflow weir data generated using COE uneven weir program.

North

1 in = 200 ft



Culvert Designer/Analyzer Report
El Mirage Road 2-10'x3' RCB - no weir

Comments: Custom size box - make sure your data base has a 10'x3' RCB

Analysis Component			
Storm Event	Design	Discharge	440.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	440.00 cfs	Check Discharge	500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.

Discharge	440.00 cfs	Bottom Elevation	1,107.10 ft
Depth	2.78 ft	Velocity	7.80 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-10 x 3 ft Box	440.00 cfs	1,111.72 ft	7.93 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
El Mirage Road 2-10'x3' RCB - no weir

Component:Culvert-1

Culvert Summary					
Computed Headwater Eleva	1,111.72	ft	Discharge	440.00	cfs
Inlet Control HW Elev.	1,111.66	ft	Tailwater Elevation	1,109.88	ft
Outlet Control HW Elev.	1,111.72	ft	Control Type	Outlet Control	
Headwater Depth/Height	1.51				

Grades					
Upstream Invert	1,107.20	ft	Downstream Invert	1,107.10	ft
Length	116.00	ft	Constructed Slope	0.000862	ft/ft

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	2.78	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	2.47	ft
Velocity Downstream	7.93	ft/s	Critical Slope	0.004142	ft/ft

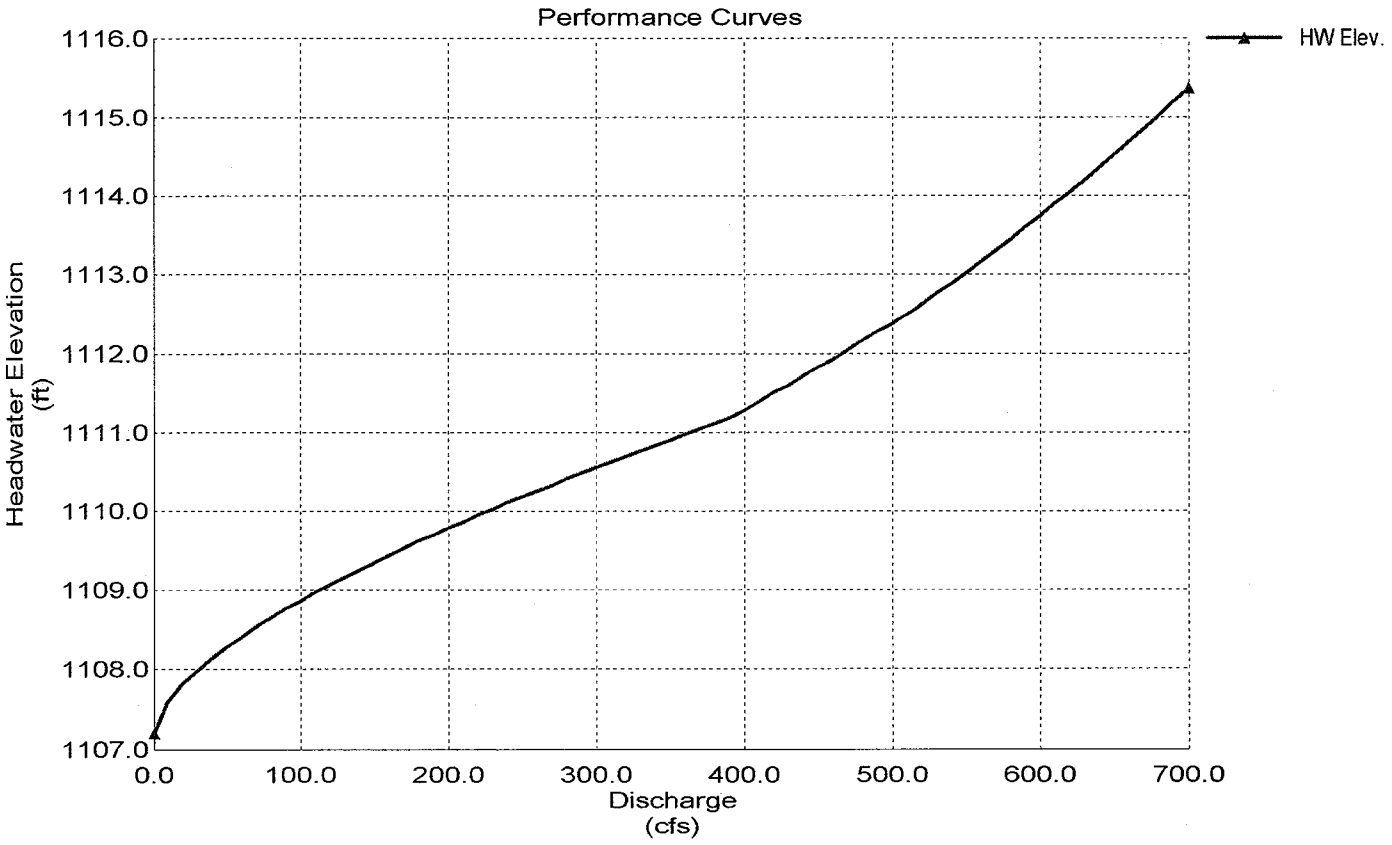
Section					
Section Shape	Box		Mannings Coefficient	0.015	
Section Material	Concrete		Span	10.00	ft
Section Size	10 x 3 ft		Rise	3.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	1,111.72	ft	Upstream Velocity Head	0.84	ft
Ke	0.50		Entrance Loss	0.42	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,111.66	ft	Flow Control	Submerged	
Inlet Type	3/4 in chamfers; 45° skewed headwall		Area Full	60.0	ft²
K	0.54500		HDS 5 Chart	11	
M	0.66700		HDS 5 Scale	1	
C	0.04505		Equation Form	2	
Y	0.68000				

Performance Curves Report
El Mirage Road 2-10'x3' RCB - no weir

Range Data:			
	Minimum	Maximum	Increment
Discharge	0.00	700.00	10.00 cfs



1

****
UNEVEN WEIR FLOW PROGRAM
FORTRAN VERSION 1.0
****

PROJECT: Lower El Mirage Wash @ El Mirage Road
ENGINEER: dtp
DATE: 3/ 3/2010
TIME: 16:30.53

INPUT PARAMETERS

STARTING WSEL:	1112.00
MAXIMUM WSEL:	1114.00
STEP SIZE:	0.10
BREADTH OF WEIR:	30.00

1

****
INPUT ELEVATION/STATION TABLE.
PROJECT: Lower El Mirage Wash @ El Mirage Road
DATE: 3/ 3/2010
TIME: 16:30.53
****

POINT	ELEVATION	STATION
1	1114.00	1000.00
2	1113.37	1087.80
3	1112.89	1139.20
4	1112.27	1176.10
5	1112.03	1189.30
6	1112.02	1201.70
7	1111.71	1220.20
8	1113.20	1253.00
9	1114.00	1550.00

1

****
WEIR COEFFICIENT TABLE
PROJECT: Lower El Mirage Wash @ El Mirage Road
DATE: 3/ 3/2010
TIME: 16:30.53
****

REFERENCE: COE CHART - UPPER CURVE

POINT	HEAD	COEFFICIENT	POINT	HEAD	COEFFICIENT
1	0.00	2.5000	16	1.50	2.6667
2	0.10	2.5111	17	1.60	2.6778
3	0.20	2.5222	18	1.70	2.6889
4	0.30	2.5333	19	1.80	2.7000
5	0.40	2.5444	20	1.90	2.7111
6	0.50	2.5556			
7	0.60	2.5667			
8	0.70	2.5778			
9	0.80	2.5889			
10	0.90	2.6000			
11	1.00	2.6111			
12	1.10	2.6222			
13	1.20	2.6333			
14	1.30	2.6444			
15	1.40	2.6556			

1

****
UNEVEN WEIR FLOW PROGRAM
FORTRAN VERSION 1.0
PROJECT: Lower El Mirage Wash @ El Mirage Road
DATE: 3/ 3/2010
TIME: 16:30.53
****

ELEVATION	DISCHARGE (CFS)	ELEVATION	DISCHARGE (CFS)
1112.00	3.72	1113.50	451.45
1112.10	8.44	1113.60	537.43
1112.20	16.03	1113.70	639.00
1112.30	26.32	1113.80	757.60
1112.40	39.44	1113.90	894.56
1112.50	55.57		
1112.60	74.87		
1112.70	97.52		
1112.80	123.68		
1112.90	153.51		
1113.00	187.43		
1113.10	225.95		
1113.20	269.47		
1113.30	319.59		

1113.40 379.46

1

Culvert Designer/Analyzer Report
3-24" RCP Cactus Road

Analysis Component			
Storm Event	Design	Discharge	50.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	50.00 cfs	Check Discharge	120.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	50.00 cfs	Bottom Elevation	1,104.98 ft
Depth	4.61 ft	Velocity	0.38 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-24 inch Circular	50.00 cfs	1,110.82 ft	5.31 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
3-24" RCP Cactus Road

Component:Culvert-1

Culvert Summary					
Computed Headwater Eleva	1,110.82	ft	Discharge	50.00	cfs
Inlet Control HW Elev.	1,109.59	ft	Tailwater Elevation	1,109.59	ft
Outlet Control HW Elev.	1,110.82	ft	Control Type	Outlet Control	
Headwater Depth/Height	2.83				

Grades					
Upstream Invert	1,105.16	ft	Downstream Invert	1,104.98	ft
Length	97.00	ft	Constructed Slope	0.001856	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	4.61	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	1.47	ft
Velocity Downstream	5.31	ft/s	Critical Slope	0.009089	ft/ft

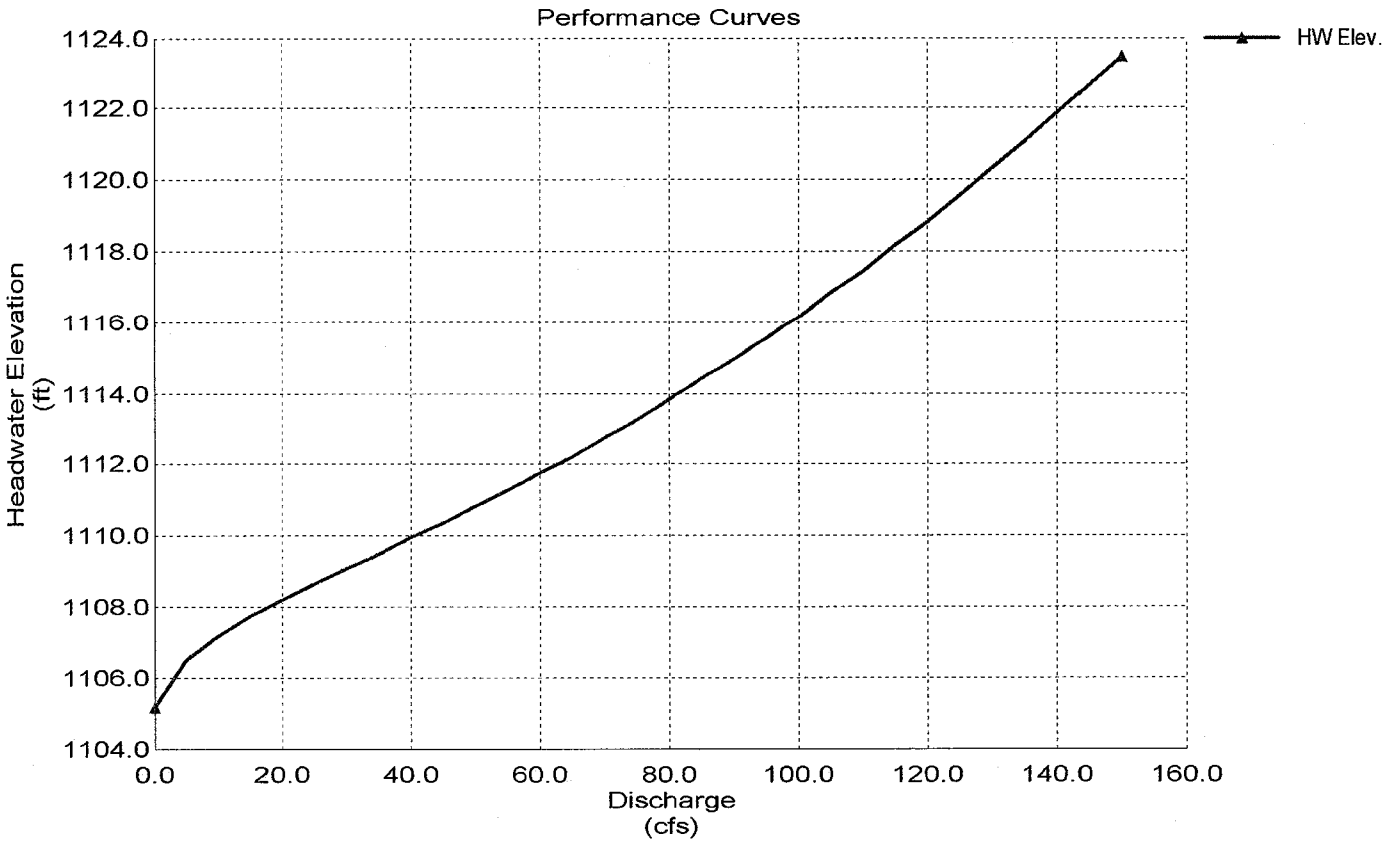
Section					
Section Shape	Circular		Mannings Coefficient	0.015	
Section Material	Concrete		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	1,110.82	ft	Upstream Velocity Head	0.44	ft
Ke	0.20		Entrance Loss	0.09	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,109.59	ft	Flow Control	N/A	
Inlet Type	Groove end w/headwall		Area Full	9.4	ft²
K	0.00180		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

Performance Curves Report
3-24" RCP Cactus Road

Range Data:			
	Minimum	Maximum	Increment
Discharge	0.00	150.00	5.00 cfs



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****
UNEVEN WEIR FLOW PROGRAM
FORTRAN VERSION 1.0
****

PROJECT: Lower El Mirage Wash @ Cactus Rd
ENGINEER: dtp
DATE: 3/ 3/2010
TIME: 15:31.45

INPUT PARAMETERS

STARTING WSEL:	1113.80
MAXIMUM WSEL:	1116.60
STEP SIZE:	0.10
BREADTH OF WEIR:	35.00

1

****
INPUT ELEVATION/STATION TABLE.
PROJECT: Lower El Mirage Wash @ Cactus Rd
DATE: 3/ 3/2010
TIME: 15:31.45
****

POINT	ELEVATION	STATION
1	1116.50	1000.00
2	1115.55	1038.00
3	1115.21	1056.00
4	1115.00	1077.00
5	1114.88	1106.00
6	1114.55	1110.00
7	1114.18	1118.00
8	1113.85	1133.50
9	1113.83	1149.10
10	1114.34	1162.80
11	1115.00	1174.00
12	1116.50	1188.00

1

****
WEIR COEFFICIENT TABLE
PROJECT: Lower El Mirage Wash @ Cactus Rd
DATE: 3/ 3/2010
TIME: 15:31.45
****

REFERENCE: COE CHART - UPPER CURVE

POINT	HEAD	COEFFICIENT	POINT	HEAD	COEFFICIENT
1	0.00	2.5000	16	1.50	2.6429
2	0.10	2.5095	17	1.60	2.6524
3	0.20	2.5190	18	1.70	2.6619
4	0.30	2.5286	19	1.80	2.6714
5	0.40	2.5381	20	1.90	2.6810
6	0.50	2.5476	21	2.00	2.6905
7	0.60	2.5571	22	2.10	2.7000
8	0.70	2.5667	23	2.20	2.7095
9	0.80	2.5762	24	2.30	2.7190
10	0.90	2.5857	25	2.40	2.7286
11	1.00	2.5952	26	2.50	2.7381
12	1.10	2.6048	27	2.60	2.7476
13	1.20	2.6143	28	2.70	2.7571
14	1.30	2.6238			
15	1.40	2.6333			

1

****
UNEVEN WEIR FLOW PROGRAM
FORTRAN VERSION 1.0
PROJECT: Lower El Mirage Wash @ Cactus Rd
DATE: 3/ 3/2010
TIME: 15:31.45
****

ELEVATION	DISCHARGE (CFS)	ELEVATION	DISCHARGE (CFS)
1113.80	0.00	1115.30	239.61
1113.90	0.64	1115.40	281.20
1114.00	3.25	1115.50	327.01
1114.10	7.72	1115.60	377.06
1114.20	14.22	1115.70	431.32
1114.30	22.80	1115.80	489.76
1114.40	33.45	1115.90	552.41
1114.50	46.13	1116.00	619.29
1114.60	60.85	1116.10	690.45
1114.70	77.59	1116.20	765.94
1114.80	96.31	1116.30	845.83

1114.90	117.06	1116.40	930.15
1115.00	140.95	1116.50	1018.98
1115.10	169.40		
1115.20	202.27		

□
1

Appendix D4

Hard Copy of HEC-1 Output: Existing Condition with CIP

Pertitnent portions of the HEC-1 output file are provided herein.

A digital copy of HEC-1 output (hard copy in pdf format) is provided in Appendix G. The corresponding HEC-1 Diagram, including hydrograph operation revisions documented herein, is shown on Figure F4 in Appendix F. Copies of the original ADMPU-AHA (2009) HEC-1 routing diagrams are provided in Appendix G.

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN   1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   01APR10  TIME  16:34:59   *
*                                       *
*****************************************
```

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

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

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

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

1 HEC-1 INPUT PAGE 1

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

  1           ID        Flood Control District of Maricopa County
  2           ID        L303_EX_CIP_MB01 - Loop 303/ White Tanks ADMPU AHA
  3           ID        100 YEAR
  4           ID        24 Hour Storm
  5           ID        Unit Hydrograph: S-Graph
  6           ID        08/18/2009
  7           ID
  8           ID            FCDMC CONTRACT 2007C031
  9           ID            BY HDR ENGINEERING (#79902)
 10           ID            EXISTING CONDITIONS WITH CIP-AUGUST 2009
 11           ID            MAJOR BASIN 01
 12           ID      HDR FILE NAME: ECIP-MB1.DAT
 13           ID
 14           ID      ***************************************************************************
 15           ID
 16           ID      FOLLOWING ARE THE CHANGES BY FCDMC:
 17           ID      1. Removed SRD14. - by JWH 10-16-09
 18           ID      FILE NAME: WT1EC01.DAT
 19           ID
 20           ID      For details concerning changes to this HEC-1 model, please contact
 21           ID      FCDMC, H&H Branch.
 22           ID
 23           ID      ***************************************************************************
 24           ID
 25           ID   AZTEC revisions for FCD2008C014, Work Assignment No. 2 are listed below:
 26           ID   1. Extracted portion of Major Basin D draining to CPD54 (Lower El Mirage)
 27           ID   2. Removed operation SRD42 (model large capacity culvert @ Cactus Rd.)
 28           ID   3. Revised operation SRD53 (model future west cactus basin - prelim effort)
 29           ID      Note - SRD53 (west cactus basin) contains an assumed prelim. future design
 30           ID
 31           ID      Filename: WT1EC01a.ih1         Date: 04/01/2010 - dtp
 32           ID
 33           IT       5       0       0    2000
 34           IN      15
 35           IO       5
              *DIAGRAM
              *
 36           JD   3.480  0.0001
 37           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
 38           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
 39           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
 40           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
 41           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
 42           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
 43           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
 44           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
 45           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
 46           PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
 47           JD   3.393     5.0
 48           JD   3.306    10.0
 49           JD   3.219    20.0
 50           JD   3.132    30.0
 51           JD   3.028    60.0
 52           JD   2.965    90.0
 53           JD   2.927   120.0
              *
              *
```

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

  54          KK     D03BASIN
  55          KM        BASIN BOUNDARY FROM KINGSWOOD PARKE
  56          BA   0.723
  57          LG    0.23    0.25    4.80    0.37      35
  58          UI       0     121     484     719    1140    1220     811     548     245     149
  59          UI      70      36      35       0       0       0       0       0       0       0
  60          UI       0       0       0       0       0       0       0       0       0       0
  61          UI       0       0       0       0       0       0       0       0       0       0
  62          UI       0       0       0       0       0       0       0       0       0       0
              *

  63          KK  DD03REDIVERT
  64          KM        Master Drainage Report Update for Kingswood Parke Phase One
  65          KM        (excess retention provided for future development was
  66          KM        subtracted from total retenttion provided)
  67          DT    RD03    51.7     0.0
  68          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
  69          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
              *
```

DATA REMOVED FROM HARD COPY - Refer to digital copy of output

```
 499          KK     D22BASIN
 500          KM        BASIN BOUNDARY FROM ROYAL RANCH UNIT I AND II
 501          BA   0.454
 502          LG    0.24    0.25    4.70    0.37      32
 503          UI       0      63     233     357     500     764     567     411     284     135
 504          UI      87      50      20      20      20       0       0       0       0       0
 505          UI       0       0       0       0       0       0       0       0       0       0
 506          UI       0       0       0       0       0       0       0       0       0       0
 507          UI       0       0       0       0       0       0       0       0       0       0
              *

 508          KK  DD22REDIVERT
 509          KM        Drainage Report for Royal Ranch Unit 2 (Basins P1&N in D23), Final Drain
 510          KM        Report for Royal Ranch Unit 2, Parcel 5, Final Drainage Report for Royal
 511          KM        Unit 2 Parcel 8, portion estimated by aerial for Del Webb
 512          DT    RD22    37.5     0.0
 513          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
 514          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
              *

 515          KK   DD122RETRIEVE
 516          DR  DD122S
              *

 517          KK  D12D22ROUTE
 518          KM        Cross-section: Cross section determined from aerial
 519          KM        Manning's N Value: street and earth with sparse trees and shrubs
 520          RS       7    FLOW
 521          RC   0.032   0.013   0.013    7744  0.0040    0.00
 522          RX  100.00  105.00  145.00  145.10  160.00  174.00  178.00  180.00
 523          RY  1000.0  999.90  999.50  999.00  999.20  999.50  999.60  999.70
              *
```



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

 524          KK   CPD22COMBINE
 525          HC       3   2.457
              *

 526          KK  D22D23ROUTE
 527          KM        Cross-section: Cross-section determined from aerial
 528          KM        Manning's N Value: earth with sparse trees and shrubs/ riprap
 529          RS       2    FLOW
 530          RC   0.032   0.032   0.032    2705  0.0037    0.00
 531          RX  100.00  104.00  106.00  110.00  118.00  122.00  126.00  138.00
 532          RY  1161.0 1160.00 1159.00 1158.00 1158.10 1159.00 1160.00 1161.00
              *

 533          KK     D23BASIN
 534          KM        BASIN BOUNDARY FROM SIERRA VERDE
 535          BA   0.541
 536          LG    0.27    0.27    5.00    0.32      26
 537          UI       0      59     138     272     346     448     673     629     483     371
 538          UI     284     172     101      76      56      17      18      18      18       0
 539          UI       0       0       0       0       0       0       0       0       0       0
 540          UI       0       0       0       0       0       0       0       0       0       0
 541          UI       0       0       0       0       0       0       0       0       0       0
              *

 542          KK  DD23REDIVERT
 543          KM        Final Drainage Report for Sierra Verde Parcel 5, Infrastructure Drainage
 544          KM        Sierra Verde (temporary basins removed), Final Drainage Report for Sierr
```

```
545          KM        Final Drainage Report for Harmony Apartments, Drainage Report for Royal
546          KM        Final Drainage Report for Sierra Verde Parcel 9, Final Drainage Report f
547          KM        Parcel 3, Final Drainage Report for Sierra Verde Parcel 2, Final Drainag
548          KM        Sierra Verde Parcel 1, Drainage Report for Fry's at Waddell and Litchfie
549          DT    RD23    36.3     0.0
550          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
551          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
             *

552          KK   DD131RETRIEVE
553          DR  DD131S
             *

554          KK  D13D23ROUTE
555          KM        Cross-section: Cross-section determined from aerial 1/2 street section
556          KM        Manning's N Value: street, earth with sparse trees and shrubs
557          RS       3    FLOW
558          RC   0.032   0.013   0.032    5460  0.0044    0.00
559          RX  100.00  100.00  109.00  109.00  148.00  148.00  197.00  198.00
560          RY  1180.0 1176.30 1176.30 1175.80 1175.00 1175.50 1177.00 1177.10
             *
```



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

561          KK   CPD23COMBINE
562          HC       3   5.642
             *

563          KK   DD231DIVERT
564          KM        Waddell at Litchfield split flow
565          DT  DD231S     0.0     0.0
566          DI     0.0   518.8   867.4  1680.6  2985.0     0.0     0.0     0.0     0.0     0.0
567          DQ     0.0    51.3   223.3   727.6  1503.5     0.0     0.0     0.0     0.0     0.0
             *

568          KK   DD232DIVERT
569          KM        Waddell at Litchfield split flow
570          DT  DD232S     0.0     0.0
571          DI     0.0   467.5   644.1   953.0  1481.6     0.0     0.0     0.0     0.0     0.0
572          DQ     0.0    55.8   138.4   242.9   365.2     0.0     0.0     0.0     0.0     0.0
             *

573          KK  D23D24ROUTE
574          KM        Cross-section: Cross-section determined from Waddell
575          KM        Road Drainage Improvement CAR Final by HDR
576          KM        dated April 10, 2009, R137
577          RS       3    FLOW
578          RC   0.035   0.035   0.035    2646  0.0044    0.00
579          RX  894.00  906.00  912.00  918.00  926.00  930.00  934.00  942.00
580          RY  1157.0 1155.00 1154.00 1153.00 1153.00 1154.00 1155.00 1157.00
             *

581          KK     D24BASIN
582          KM        BASIN BOUNDARY FROM LITCHFIELD MANOR
583          BA   0.492
584          LG    0.27    0.25    5.10    0.31      28
585          UI       0      56     145     267     346     467     677     539     421     315
586          UI     227     116      89      56      26      17      17      17       0       0
587          UI       0       0       0       0       0       0       0       0       0       0
588          UI       0       0       0       0       0       0       0       0       0       0
589          UI       0       0       0       0       0       0       0       0       0       0
             *

590          KK  DD24REDIVERT
591          KM        Final Drainage Report for Litchfield Manor (excess retention per report)
592          DT    RD24    40.9     0.0
593          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
594          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
             *

595          KK   DD132RETRIEVE
596          DR  DD132S
             *
```



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

597          KK  D13D24ROUTE
598          KM        Cross-section: Cross-section determined from aerial 1/2 street section
599          KM        Manning's N Value: street, earth with sparse trees and shrubs
600          RS       3    FLOW
601          RC   0.032   0.013   0.013    5460  0.0044    0.00
602          RX  100.00  100.10  145.00  145.10  175.00  175.10  184.90  185.00
603          RY  1178.0 1176.50 1175.50 1175.00 1175.80 1176.30 1176.30 1180.00
             *

604          KK   CPD24COMBINE
605          HC       3   6.134
             *

606          KK  D24D25ROUTE
607          KM        Cross-section: Cross-section determined from Waddell
```

```
608          KM        Road Drainage Improvement CAR Final by HDR
609          KM        dated April 10, 2009, R138
610          RS      2    FLOW
611          RC   0.030   0.030   0.030    2701  0.0020    0.00
612          RX  1000.0 1018.00 1019.00 1020.00 1026.00 1027.00 1028.00 1046.00
613          RY  1100.0 1094.00 1094.00 1094.00 1094.00 1094.00 1094.00 1100.00
             *

614          KK     D25BASIN
615          KM        BASIN BOUNDARY FROM ROSEVIEW MULTI PHASE
616          BA   0.497
617          LG    0.25    0.25    4.80    0.35      30
618          UI       0      63     200     335     439     678     685     499     371     247
619          UI     120      87      53      19      20      19       0       0       0       0
620          UI       0       0       0       0       0       0       0       0       0       0
621          UI       0       0       0       0       0       0       0       0       0       0
622          UI       0       0       0       0       0       0       0       0       0       0
             *

623          KK  DD25REDIVERT
624          KM        Drainage Report for Roseview - Parcels 1-6, Master Drainage
625          KM        Report for Roseview, Retention for Parcels 7 and 8 were estimated
626          KM        based on aerial, Parcel 5a has no retention
627          DT    RD25    37.1     0.0
628          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
629          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
             *

630          KK   CPD25COMBINE
631          HC       2   6.631
             *

632          KK  D25D39ROUTE
633          KM        Cross-section: Cross-section determined from Waddell Road
634          KM        Drainage Improvement CAR Final by HDR dated April 10, 2009, RLLE
635          RS       1    FLOW
636          RC   0.030   0.030   0.030    2020  0.0040    0.00
637          RX    0.00   20.00   25.00   30.00   35.00   41.50   51.10   82.30
638          RY   10.00    0.00    0.00    0.00    0.00    0.00    4.80   10.00
             *
1                                        HEC-1 INPUT                                    PAGE 17

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

639          KK     D39BASIN
640          KM        BASIN BOUNDARY FROM  AG LAND, 1990 TOPO AND BNSF RR ALIGNMENT
641          BA   0.182
642          LG    0.50    0.25    5.60    0.32       0
643          UI       0      17      25      56      97     121     137     146     140     125
644          UI     112      98      69      53      50      32      26      21      16      14
645          UI      10      10       7       2       2       2       2       3       2       2
646          UI       2       2       2       3       2       0       0       0       0       0
647          UI       0       0       0       0       0       0       0       0       0       0
             *

648          KK   CPD39COMBINE
649          HC       2   6.813
             *

650          KK  D39D42ROUTE
651          KM        Cross-section: Cross-section determined from Waddell
652          KM        Road Drainage Improvement CAR Final
653          KM        by HDR dated April 10, 2009, RLLE1
654          RS       3    FLOW
655          RC   0.030   0.030   0.030    5691  0.0039    0.00
656          RX    0.00   30.00   38.00   54.00   76.50  104.00  139.00  154.00
657          RY   10.00    4.00    4.00    0.00    0.00    0.00    7.00   10.00
             *

658          KK     D42BASIN
659          KM        BASIN BOUNDARY FROM PARQUE VERDE MULTI PHASE
660          KM        DYSART SCHOOL DISTRICT, AND BUENA VISTA
661          BA   0.994
662          LG    0.24    0.24    5.20    0.29      32
663          UI       0     150     594     890    1330    1722    1186     816     463     246
664          UI     148      46      46      45       0       0       0       0       0       0
665          UI       0       0       0       0       0       0       0       0       0       0
666          UI       0       0       0       0       0       0       0       0       0       0
667          UI       0       0       0       0       0       0       0       0       0       0
             *

668          KK  DD42REDIVERT
669          KM        Retention volume estimated based on aerial, Cactus and Dysart
670          KM        Subdivision and Parque Verde - No Reports available
671          DT    RD42    71.8     0.0
672          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
673          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
             *

674          KK   CPD42COMBINE
675          HC       3    9.87
             *
             * Storage behind Cactus Road - 2009 ADMPU data REMOVED by AZTEC
             * To account for future Cactus Culvert (large capacity - no attenuation)
```

```
* KK SRD42STORAGE
* KM       Storage behind Cactus Road
* KO
* RS     1    STOR
* SV          0.64    4.60   17.30   27.60   56.30
* SQ                139.00  426.00  827.00 1295.00
* SE1105.3 1108.00 1110.00 1112.00 1114.00 1116.00
*
```



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

 676      KK  D42D53ROUTE
 677      KM        Cross-section: Cross-section determined from
 678      KM        Waddell Road Drainage Improvement CAR Final
 679      KM        by HDR dated April 10, 2009, RLE3
 680      RS       1    FLOW
 681      RC   0.030   0.030   0.030    1558  0.0020    0.00
 682      RX    0.00   10.00   22.00   97.00  171.00  172.00  184.00  194.00
 683      RY    3.50    3.00    0.00    0.00    0.00    0.00    3.00    3.50
          *

 684      KK     D53BASIN
 685      KM        BASIN BOUNDARY FROM EL MIRAGE MARKET PLACE, RANCHO MIRAGE UNIT 3
 686      BA   0.118
 687      LG    0.31    0.32    4.60    0.36      11
 688      UI       0      55     169     306     215     107      39      12       9       0
 689      UI       0       0       0       0       0       0       0       0       0       0
 690      UI       0       0       0       0       0       0       0       0       0       0
 691      UI       0       0       0       0       0       0       0       0       0       0
 692      UI       0       0       0       0       0       0       0       0       0       0
          *

 693      KK  DD53REDIVERT
 694      KM        Retention volume estimated based on aerial
 695      DT    RD53    12.1     0.0
 696      DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
 697      DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
          *

 698      KK   CPD53COMBINE
          *  KO     1       2
 699      HC       2   9.988
          *

 700      KK   SRD53STORAGE
 701      KM        West Cactus Basin - 2009 ADMPU data revised by AZTEC
 702      KM        Assumed 6:1 basin side slopes, confined to City parcel
 703      KM            Outlet = 1-8'x 6' rcbc
          *  KO     1       2
 704      RS       1    STOR
 705      SV       0     0.3     5.0     9.7    22.6    32.3    42.5    53.6    66.4    80.0
 706      SV      85      90      95
 707      SQ       0       0       0      10      70     110     160     210     265     315
 708      SQ     329     359     443
 709      SE    1104    1105  1107.2    1108    1110    1111    1112    1113    1114    1115
 710      SE  1115.3  1115.6    1116
          *

 711      KK  D53D54ROUTE
 712      KM        Cross-section: Cross-section determined from
 713      KM        Waddell Road Drainage Improvement CAR Final
 714      KM        by HDR dated April 10, 2009, RLE4
 715      RS       4    FLOW
 716      RC   0.030   0.030   0.030    3999  0.0038    0.00
 717      RX    0.00   36.00   39.00   42.00   45.00   48.00   51.00   87.00
```



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

 718      RY  1102.8 1096.80 1096.80 1096.80 1096.80 1096.80 1096.80 1102.80
          *

 719      KK     D43BASIN
 720      KM        BASIN BOUNDARY FROM MONTA BLANCA ESTATES, SUNNYVALE AND SUNDIAL
 721      BA   0.500
 722      LG    0.25    0.25    4.70    0.37      33
 723      UI       0      75     299     448     669     867     596     410     233     124
 724      UI      75      23      23      23       0       0       0       0       0       0
 725      UI       0       0       0       0       0       0       0       0       0       0
 726      UI       0       0       0       0       0       0       0       0       0       0
 727      UI       0       0       0       0       0       0       0       0       0       0
          *

 728      KK  DD43REDIVERT
 729      KM        Retention volume estimated based on aerial
 730      DT    RD43    35.5     0.0
 731      DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
 732      DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
          *

 733      KK  D43D54ROUTE
 734      KM        Cross-section: Golf course, assumed 0.5%
 735      KM        side slopes, V-ditch / Manning's N Value: grass - golf course
```

```
  736          RS      14    FLOW
  737          RC   0.025   0.025   0.025    3872  0.0023    0.00
  738          RX  100.00  200.00  400.00  500.00  550.00  600.00  800.00  900.00
  739          RY  1000.0  999.50  998.50  998.00  998.30  998.50  999.50 1000.00
               *

  740          KK     D54BASIN
  741          KM         BASIN BOUNDARY FROM FAIRWAYS GOLF COURSE DIVISION
  742          KM         AND PUEBLO EL MIRAGE RV RESORT
  743          BA   0.271
  744          LG    0.20    0.27    4.45    0.49      14
  745          UI       0      65     226     345     557     406     260     119      64      25
  746          UI      15      15       0       0       0       0       0       0       0       0
  747          UI       0       0       0       0       0       0       0       0       0       0
  748          UI       0       0       0       0       0       0       0       0       0       0
  749          UI       0       0       0       0       0       0       0       0       0       0
               *

  750          KK  DD54REDIVERT
  751          KM         NO REPORTS - ESTIMATED FIRST FLUSH RETENTION FROM AERIAL
  752          KM         DUE TO LOCATION OF DEVELOPMENT TO THE RIVER
  753          DT    RD54     3.0     0.0
  754          DI     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
  755          DQ     0.0   500.0  5000.0 50000.0     0.0     0.0     0.0     0.0     0.0     0.0
               *
1                                            HEC-1 INPUT                                        PAGE 20

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


  756          KK   CPD54COMBINE
  757          HC       3  10.759
               *
               *
  758          ZZ
1
             SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   54         D03
               .
               .
   67          .------->   RD03
   63      DD03RE
               V
               V
   70      D03D04
               .
               .
   77          .          D04
               .           .
               .           .
   93          .           .------->   RD04
   88          .       DD04RE
               .           .
               .           .
   96        CPD04............
               .
               .
  100          .------->  DD04S
   98      DD04SE
               V
               V
  103      D04D05
               .
               .
  110          .          D05
               .           .
               .           .
  122          .           .------->   RD05
  120          .       DD05RE
               .           .
               .           .
  125        CPD05............
               V
               V
  127      D05D14
               .
               .
  136          .------->  DD141S
  134        DD141
               V
               V
  139      D05D15
               .
               .
  146          .          D11
               .           .
               .           .
  161          .           .------->   RD11
  156          .       DD11RE
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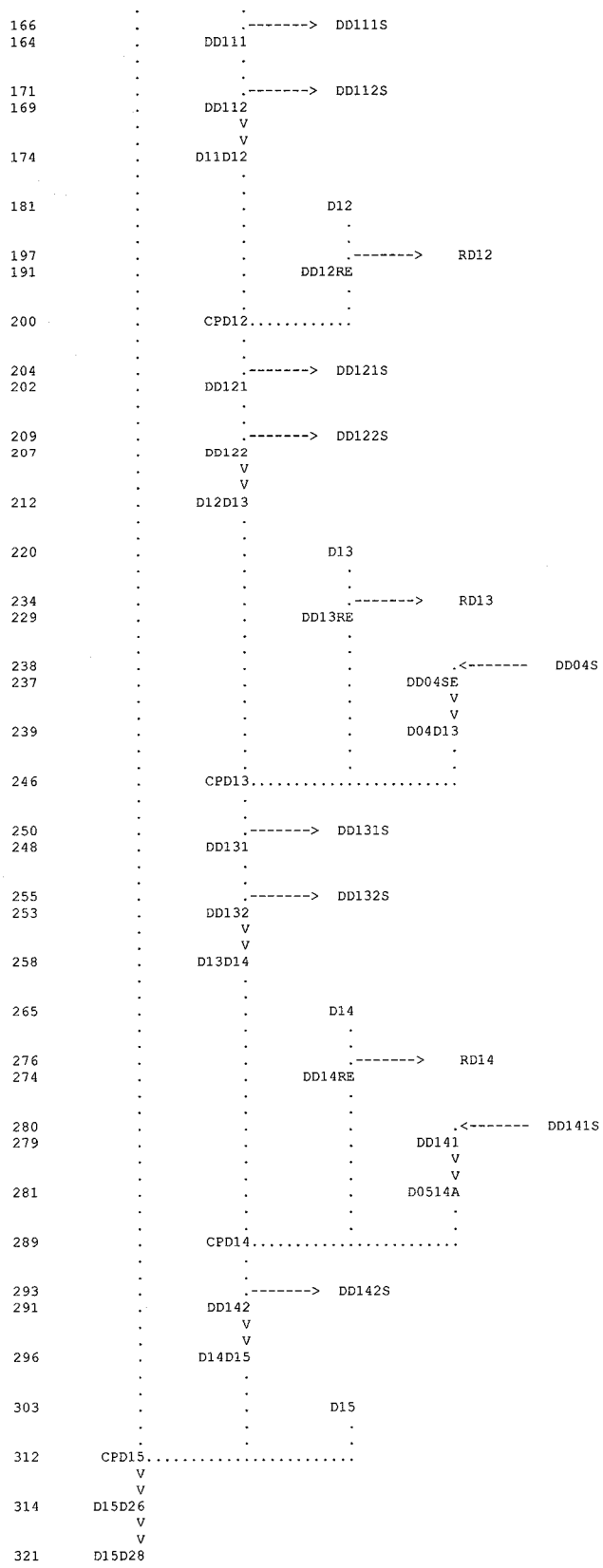
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DD111S
171
169
DD112
DD112S
174
D11D12
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D12
197
191
DD12RE
RD12
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CPD12
204
202
DD121
DD121S
209
207
DD122
DD122S
212
D12D13
220
D13
234
229
DD13RE
RD13
238
237
DD04S
DD04SE
239
D04D13
246
CPD13
250
248
DD131
DD131S
255
253
DD132
DD132S
258
D13D14
265
D14
276
274
DD14RE
RD14
280
279
DD141S
DD141
281
D0514A
289
CPD14
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DD142
DD142S
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D14D15
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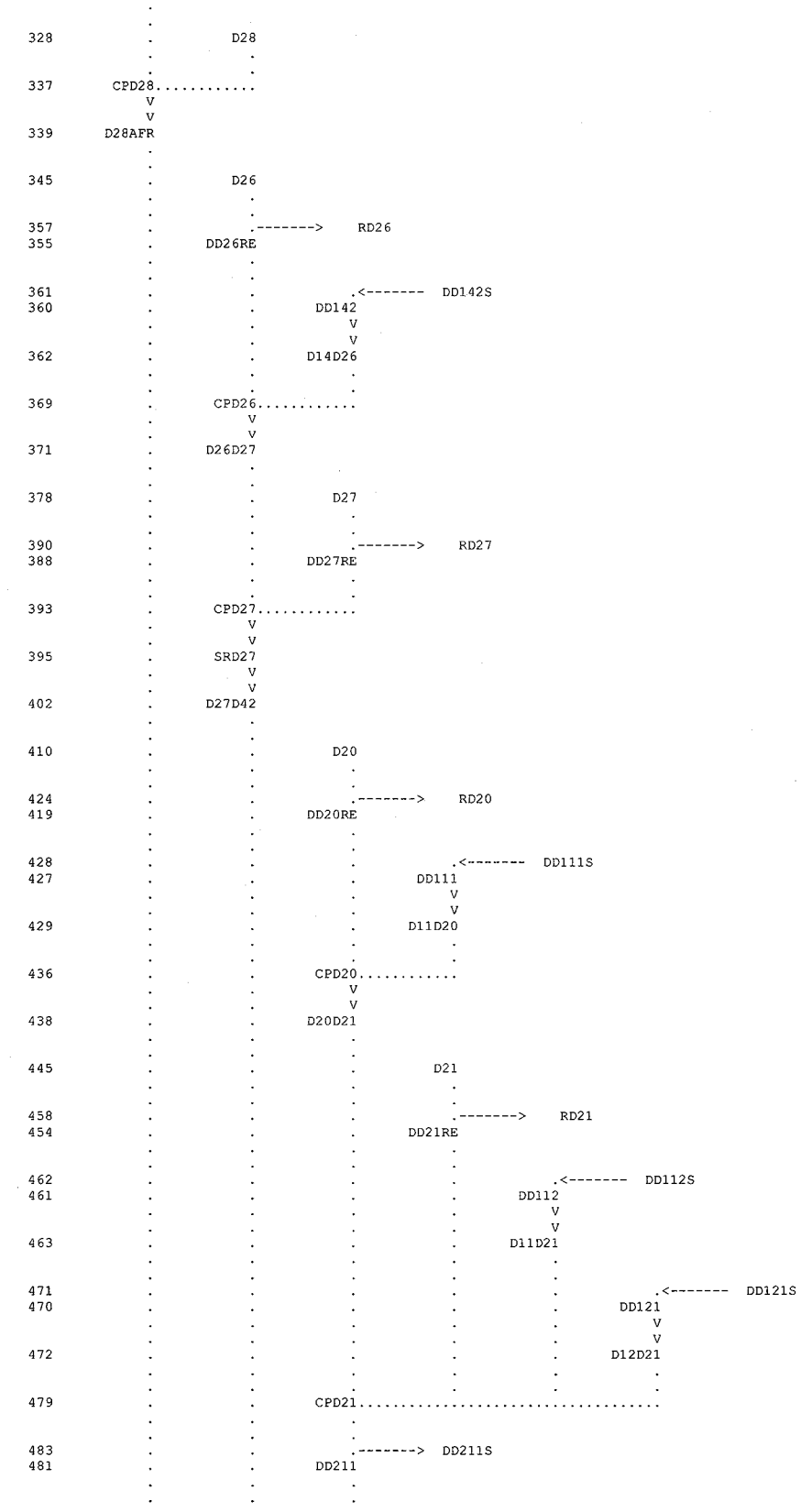
D15
312
CPD15
314
D15D26
321
D15D28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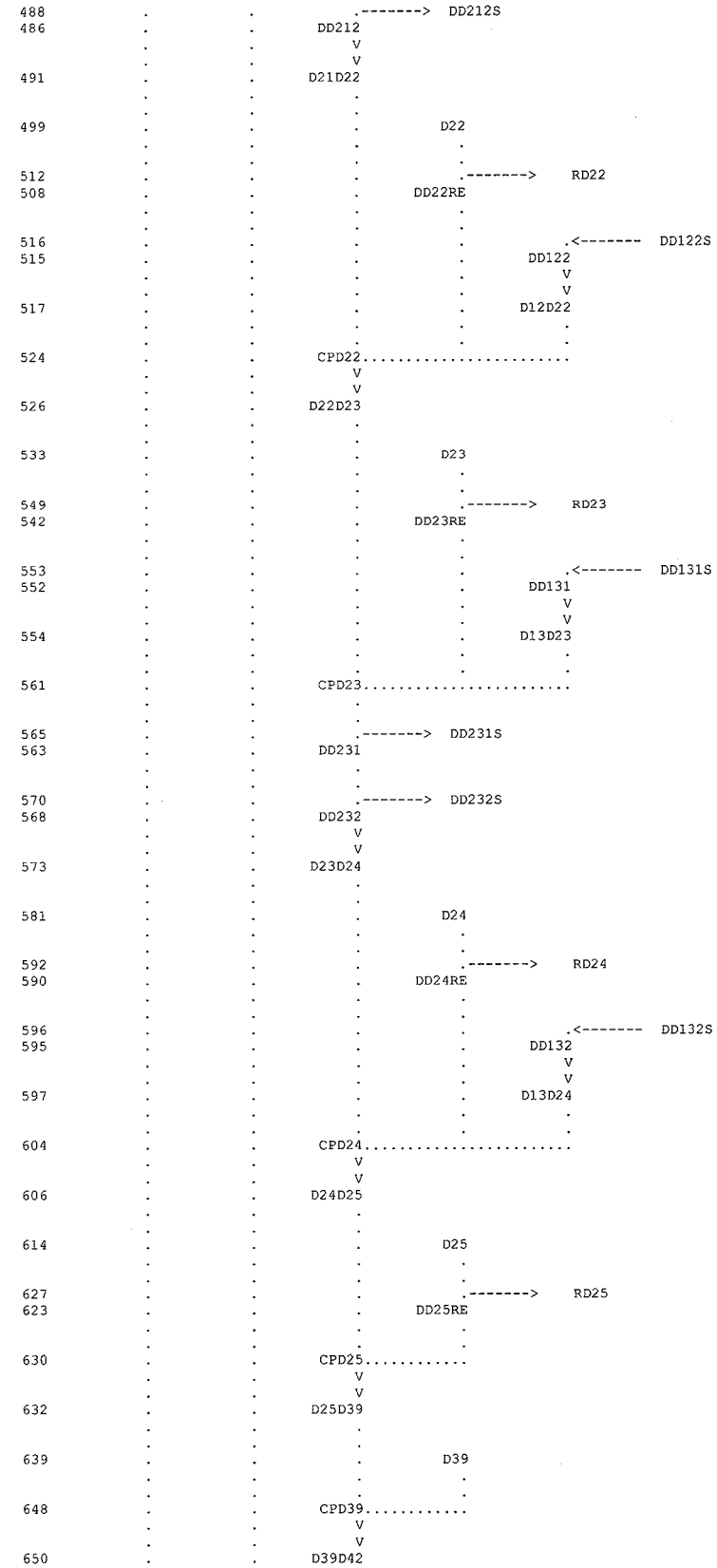
337 CPD28
339 D28AFR
345 D26
357 RD26
355 DD26RE
361 DD142S
360 DD142
362 D14D26
369 CPD26
371 D26D27
378 D27
390 RD27
388 DD27RE
393 CPD27
395 SRD27
402 D27D42
410 D20
424 RD20
419 DD20RE
428 DD111S
427 DD111
429 D11D20
436 CPD20
438 D20D21
445 D21
458 RD21
454 DD21RE
462 DD112S
461 DD112
463 D11D21
471 DD121S
470 DD121
472 D12D21
479 CPD21
483 DD211S
481 DD211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DD212
D21D22
D22
RD22
DD22RE
DD122S
DD122
D12D22
CPD22
D22D23
D23
RD23
DD23RE
DD131S
DD131
D13D23
CPD23
DD231S
DD231
DD232S
DD232
D23D24
D24
RD24
DD24RE
DD132S
DD132
D13D24
CPD24
D24D25
D25
RD25
DD25RE
CPD25
D25D39
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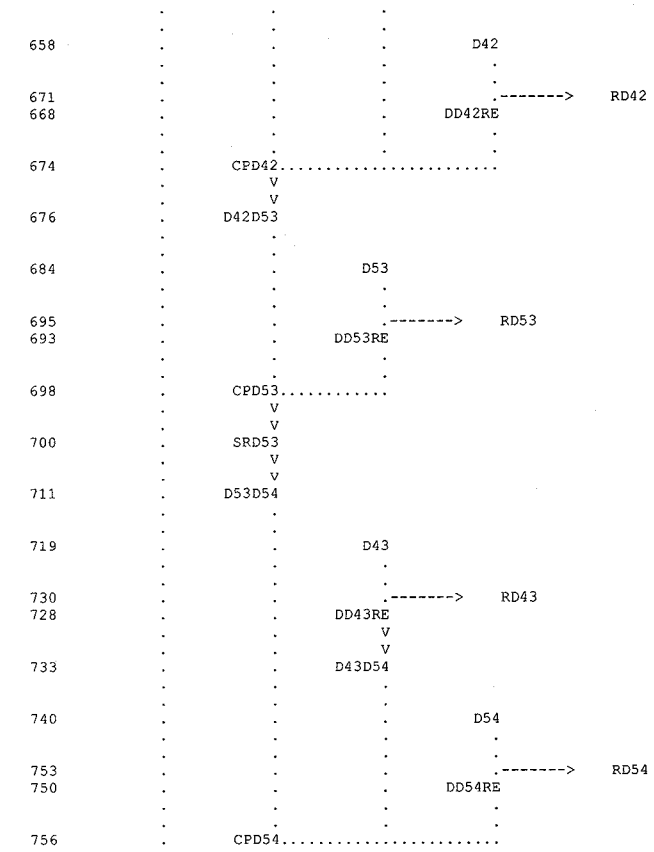
CPD39
D39D42



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   01APR10  TIME  16:34:59   *
*                                       *
*****************************************
```

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

```
  Flood Control District of Maricopa County
  L303_EX_CIP_MB01 - Loop 303/ White Tanks ADMPU AHA
  100 YEAR
  24 Hour Storm
  Unit Hydrograph: S-Graph
  08/18/2009

FCDMC CONTRACT 2007C031
BY HDR ENGINEERING (#79902)
EXISTING CONDITIONS WITH CIP-AUGUST 2009
MAJOR BASIN 01
 HDR FILE NAME: ECIP-MB1.DAT

 ****************************************************************************

 FOLLOWING ARE THE CHANGES BY FCDMC:
 1. Removed SRD14. - by JWH 10-16-09
 FILE NAME: WT1EC01.DAT

 For details concerning changes to this HEC-1 model, please contact
 FCDMC, H&H Branch.

 ****************************************************************************

AZTEC revisions for FCD2008C014, Work Assignment No. 2 are listed below:
1. Extracted portion of Major Basin D draining to CPD54 (Lower El Mirage)
2. Removed operation SRD42 (model large capacity culvert @ Cactus Rd.)
3. Revised operation SRD53 (model future west cactus basin - prelim effort)
   Note - SRD53 (west cactus basin) contains an assumed prelim. future design
```

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

   IT         HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1    0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     7    0  ENDING DATE
                   NDTIME       2235  ENDING TIME
                    ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL      .08 HOURS
                     TOTAL TIME BASE   166.58 HOURS

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

36 JD           INDEX STORM NO. 1
                    STRM        3.48  PRECIPITATION DEPTH
                    TRDA         .00  TRANSPOSITION DRAINAGE AREA

37 PI           PRECIPITATION PATTERN
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .01     .00     .01
                 .01     .01     .01     .01     .01     .01     .01     .01     .03     .03
                 .03     .09     .09     .09     .01     .01     .01     .01     .01     .01
                 .01     .01     .01     .01     .01     .01     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00

47 JD           INDEX STORM NO. 2
                    STRM        3.39  PRECIPITATION DEPTH
                    TRDA        5.00  TRANSPOSITION DRAINAGE AREA

 0 PI           PRECIPITATION PATTERN
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .01     .00     .01
                 .01     .01     .01     .01     .01     .01     .01     .01     .03     .03
                 .03     .09     .09     .09     .01     .01     .01     .01     .01     .01
                 .01     .01     .01     .01     .01     .01     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00

 48 JD        INDEX STORM NO. 3
                    STRM        3.31  PRECIPITATION DEPTH
                    TRDA       10.00  TRANSPOSITION DRAINAGE AREA

  0 PI          PRECIPITATION PATTERN
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .01       .00       .01
                  .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                  .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                  .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00

 49 JD        INDEX STORM NO. 4
                    STRM        3.22  PRECIPITATION DEPTH
                    TRDA       20.00  TRANSPOSITION DRAINAGE AREA

  0 PI          PRECIPITATION PATTERN
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .01       .00       .01
                  .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                  .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                  .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00

 50 JD        INDEX STORM NO. 5
                    STRM        3.13  PRECIPITATION DEPTH
                    TRDA       30.00  TRANSPOSITION DRAINAGE AREA

  0 PI          PRECIPITATION PATTERN
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .01       .00       .01
                  .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                  .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                  .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
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               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00

 51 JD        INDEX STORM NO. 6
                   STRM      3.03  PRECIPITATION DEPTH
                   TRDA     60.00  TRANSPOSITION DRAINAGE AREA

  0 PI          PRECIPITATION PATTERN
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .01     .00     .01
               .01     .01     .01     .01     .01     .01     .01     .01     .03     .03
               .03     .09     .09     .09     .01     .01     .01     .01     .01     .01
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               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00

 52 JD        INDEX STORM NO. 7
                   STRM      2.96  PRECIPITATION DEPTH
                   TRDA     90.00  TRANSPOSITION DRAINAGE AREA

  0 PI          PRECIPITATION PATTERN
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
               .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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               .03     .09     .09     .09     .01     .01     .01     .01     .01     .01
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 53 JD        INDEX STORM NO. 8
                   STRM      2.93  PRECIPITATION DEPTH
                   TRDA    120.00  TRANSPOSITION DRAINAGE AREA

  0 PI          PRECIPITATION PATTERN
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.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
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WARNING --- ROUTED OUTFLOW (393.) IS GREATER THAN MAXIMUM OUTFLOW (359.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (370.) IS GREATER THAN MAXIMUM OUTFLOW (359.) IN STORAGE-OUTFLOW TABLE

1

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

+	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	D03	960.	12.25	110.	34.	11.	.72		
+	DIVERSION TO	RD03	960.	12.25	96.	26.	9.	.72		
+	HYDROGRAPH AT	DD03RE	177.	12.67	25.	8.	3.	.72		
+	ROUTED TO	D03D04	110.	12.92	24.	8.	3.	.72		
+	HYDROGRAPH AT	D04	1149.	12.33	142.	44.	15.	.89		
+	DIVERSION TO	RD04	1118.	12.33	85.	24.	8.	.89		
+	HYDROGRAPH AT	DD04RE	1065.	12.42	72.	20.	7.	.89		
+	2 COMBINED AT	CPD04	1062.	12.42	95.	28.	9.	1.61		
+	DIVERSION TO	DD04S	647.	12.42	30.	7.	2.	1.61		
+	HYDROGRAPH AT	DD04SE	414.	12.42	65.	21.	7.	1.61		
+	ROUTED TO	D04D05	308.	12.67	64.	21.	7.	1.61		
+	HYDROGRAPH AT	D05	325.	12.17	35.	12.	4.	.16		
+	DIVERSION TO	RD05	137.	11.92	13.	4.	1.	.16		
+	HYDROGRAPH AT	DD05RE	325.	12.17	27.	8.	3.	.16		
+	2 COMBINED AT	CPD05	337.	12.67	89.	28.	9.	1.78		
+	ROUTED TO	D05D14	272.	12.83	88.	28.	9.	1.78		
+	DIVERSION TO	DD141S	150.	12.83	17.	4.	1.	1.78		
+	HYDROGRAPH AT	DD141	122.	12.17	71.	24.	8.	1.78		
+	ROUTED TO	D05D15	128.	12.50	70.	24.	8.	1.78		
+	HYDROGRAPH AT	D11	780.	12.42	107.	33.	11.	.66		

	DIVERSION TO						
+		RD11	750.	12.33	58.	16.	5.	.66
	HYDROGRAPH AT						
+		DD11RE	719.	12.50	60.	17.	6.	.66
	DIVERSION TO						
+		DD111S	591.	12.50	49.	14.	5.	.66
	HYDROGRAPH AT						
+		DD111	128.	12.50	12.	3.	1.	.66
	DIVERSION TO						
+		DD112S	46.	12.50	6.	2.	1.	.66
	HYDROGRAPH AT						
+		DD112	82.	12.50	6.	2.	1.	.66
	ROUTED TO						
+		D11D12	52.	12.67	6.	2.	1.	.66
	HYDROGRAPH AT						
+		D12	241.	12.58	53.	16.	5.	.35
	DIVERSION TO						
+		RD12	241.	12.58	28.	8.	3.	.35
	HYDROGRAPH AT						
+		DD12RE	225.	12.75	31.	9.	3.	.35
	2 COMBINED AT						
+		CPD12	272.	12.75	36.	10.	3.	1.01
	DIVERSION TO						
+		DD121S	118.	12.75	13.	4.	1.	1.01
	HYDROGRAPH AT						
+		DD121	154.	12.75	23.	7.	2.	1.01
	DIVERSION TO						
+		DD122S	63.	12.75	11.	3.	1.	1.01
	HYDROGRAPH AT						
+		DD122	91.	12.75	13.	4.	1.	1.01
	ROUTED TO						
+		D12D13	52.	13.67	12.	4.	1.	1.01
	HYDROGRAPH AT						
+		D13	1138.	12.25	124.	36.	12.	1.03
	DIVERSION TO						
+		RD13	431.	12.00	30.	9.	3.	1.03
	HYDROGRAPH AT						
+		DD13RE	1138.	12.25	103.	27.	9.	1.03
	HYDROGRAPH AT						
+		DD04SE	647.	12.42	30.	7.	2.	1.61
	ROUTED TO						
+		D04D13	189.	13.50	30.	7.	2.	1.61
	3 COMBINED AT						
+		CPD13	1138.	12.25	144.	38.	13.	3.65
	DIVERSION TO						
+		DD131S	210.	12.25	13.	3.	1.	3.65
	HYDROGRAPH AT						
+		DD131	923.	12.25	130.	34.	11.	3.65
	DIVERSION TO						
+		DD132S	396.	12.25	39.	10.	3.	3.65
	HYDROGRAPH AT						
+		DD132	527.	12.25	91.	24.	8.	3.65
	ROUTED TO						
+		D13D14	449.	12.67	89.	24.	8.	3.65
	HYDROGRAPH AT						
+		D14	1097.	12.42	148.	46.	15.	.94
	DIVERSION TO						
+		RD14	1097.	12.42	117.	32.	11.	.94
	HYDROGRAPH AT						
+		DD14RE	490.	12.67	47.	14.	5.	.94
	HYDROGRAPH AT						
+		DD141	150.	12.83	17.	4.	1.	1.78
	ROUTED TO						

+		D0514A	122.	13.08	17.	4.	1.	1.78
+	3 COMBINED AT	CPD14	980.	12.67	151.	42.	14.	4.76
+	DIVERSION TO	DD142S	599.	12.67	122.	35.	12.	4.76
+	HYDROGRAPH AT	DD142	381.	12.67	30.	8.	3.	4.76
+	ROUTED TO	D14D15	331.	12.83	29.	8.	3.	4.76
+	HYDROGRAPH AT	D15	420.	12.17	44.	14.	5.	.22
+	3 COMBINED AT	CPD15	481.	12.83	137.	45.	15.	4.98
+	ROUTED TO	D15D26	393.	13.00	136.	45.	15.	4.98
+	ROUTED TO	D15D28	371.	13.17	135.	45.	15.	4.98
+	HYDROGRAPH AT	D28	425.	12.17	38.	12.	4.	.25
+	2 COMBINED AT	CPD28	475.	12.25	168.	57.	19.	5.23
+	ROUTED TO	D28AFR	462.	12.25	168.	57.	19.	5.23
+	HYDROGRAPH AT	D26	982.	12.25	101.	31.	10.	.64
+	DIVERSION TO	RD26	982.	12.25	98.	26.	9.	.64
+	HYDROGRAPH AT	DD26RE	31.	13.42	13.	5.	2.	.64
+	HYDROGRAPH AT	DD142	599.	12.67	122.	35.	12.	4.76
+	ROUTED TO	D14D26	498.	12.92	120.	35.	12.	4.76
+	2 COMBINED AT	CPD26	492.	12.92	131.	39.	13.	5.40
+	ROUTED TO	D26D27	462.	13.00	130.	39.	13.	5.40
+	HYDROGRAPH AT	D27	498.	12.17	52.	17.	6.	.32
+	DIVERSION TO	RD27	100.	11.92	13.	4.	1.	.32
+	HYDROGRAPH AT	DD27RE	498.	12.17	45.	12.	4.	.32
+	2 COMBINED AT	CPD27	491.	12.17	169.	51.	17.	5.72
+	ROUTED TO	SRD27	491.	12.17	169.	51.	17.	5.72
+	ROUTED TO	D27D42	423.	13.42	165.	51.	17.	5.72
+	HYDROGRAPH AT	D20	587.	12.33	70.	22.	7.	.50
+	DIVERSION TO	RD20	587.	12.33	70.	19.	6.	.50
+	HYDROGRAPH AT	DD20RE	10.	15.00	6.	2.	1.	.50
+	HYDROGRAPH AT	DD111	591.	12.50	49.	14.	5.	.66
+	ROUTED TO	D11D20	335.	12.92	46.	14.	5.	.66
+	2 COMBINED AT	CPD20	334.	12.92	51.	16.	5.	1.16
+	ROUTED TO	D20D21	250.	13.33	49.	16.	5.	1.16

+	HYDROGRAPH AT D21	565.	12.33	72.	22.	7.	.50
+	DIVERSION TO RD21	565.	12.33	72.	20.	7.	.50
+	HYDROGRAPH AT DD21RE	9.	15.92	6.	2.	1.	.50
+	HYDROGRAPH AT DD112	46.	12.50	6.	2.	1.	.66
+	ROUTED TO D11D21	22.	13.33	5.	2.	1.	.66
+	HYDROGRAPH AT DD121	118.	12.75	13.	4.	1.	1.01
+	ROUTED TO D12D21	90.	13.00	13.	4.	1.	1.01
+	4 COMBINED AT CPD21	327.	13.33	70.	23.	8.	2.00
+	DIVERSION TO DD211S	218.	13.33	51.	17.	6.	2.00
+	HYDROGRAPH AT DD211	109.	13.33	19.	6.	2.	2.00
+	DIVERSION TO DD212S	54.	13.33	13.	4.	1.	2.00
+	HYDROGRAPH AT DD212	55.	13.33	5.	2.	1.	2.00
+	ROUTED TO D21D22	39.	13.67	5.	2.	1.	2.00
+	HYDROGRAPH AT D22	562.	12.33	67.	21.	7.	.45
+	DIVERSION TO RD22	562.	12.33	67.	19.	6.	.45
+	HYDROGRAPH AT DD22RE	8.	16.75	5.	2.	1.	.45
+	HYDROGRAPH AT DD122	63.	12.75	11.	3.	1.	1.01
+	ROUTED TO D12D22	45.	13.42	10.	3.	1.	1.01
+	3 COMBINED AT CPD22	79.	13.58	18.	6.	2.	2.46
+	ROUTED TO D22D23	71.	13.75	18.	6.	2.	2.46
+	HYDROGRAPH AT D23	556.	12.42	75.	22.	7.	.54
+	DIVERSION TO RD23	556.	12.42	69.	18.	6.	.54
+	HYDROGRAPH AT DD23RE	75.	13.08	13.	4.	1.	.54
+	HYDROGRAPH AT DD131	210.	12.25	13.	3.	1.	3.65
+	ROUTED TO D13D23	133.	12.50	13.	3.	1.	3.65
+	3 COMBINED AT CPD23	130.	12.50	39.	13.	4.	5.64
+	DIVERSION TO DD231S	13.	12.50	4.	1.	0.	5.64
+	HYDROGRAPH AT DD231	117.	12.50	35.	12.	4.	5.64
+	DIVERSION TO DD232S	14.	12.50	4.	1.	0.	5.64
+	HYDROGRAPH AT DD232	103.	12.50	31.	10.	3.	5.64
+	ROUTED TO D23D24	86.	12.75	31.	10.	3.	5.64
+	HYDROGRAPH AT D24	538.	12.42	71.	21.	7.	.49

+	DIVERSION TO	RD24	538.	12.42	71.	21.	7.	.49
+	HYDROGRAPH AT	DD24RE	4.	21.08	2.	1.	0.	.49
+	HYDROGRAPH AT	DD132	396.	12.25	39.	10.	3.	3.65
+	ROUTED TO	D13D24	300.	12.50	39.	10.	3.	3.65
+	3 COMBINED AT	CPD24	343.	12.58	67.	21.	7.	6.13
+	ROUTED TO	D24D25	309.	12.75	67.	21.	7.	6.13
+	HYDROGRAPH AT	D25	574.	12.33	72.	22.	7.	.50
+	DIVERSION TO	RD25	574.	12.33	69.	19.	6.	.50
+	HYDROGRAPH AT	DD25RE	21.	13.58	9.	3.	1.	.50
+	2 COMBINED AT	CPD25	309.	12.75	74.	23.	8.	6.63
+	ROUTED TO	D25D39	287.	12.83	72.	23.	8.	6.63
+	HYDROGRAPH AT	D39	113.	12.50	16.	4.	1.	.18
+	2 COMBINED AT	CPD39	356.	12.83	85.	27.	9.	6.81
+	ROUTED TO	D39D42	291.	13.08	84.	27.	9.	6.81
+	HYDROGRAPH AT	D42	1317.	12.33	151.	46.	15.	.99
+	DIVERSION TO	RD42	1317.	12.33	135.	36.	12.	.99
+	HYDROGRAPH AT	DD42RE	215.	12.75	31.	10.	3.	.99
+	3 COMBINED AT	CPD42	661.	13.33	254.	80.	27.	9.87
+	ROUTED TO	D42D53	642.	13.42	251.	80.	27.	9.87
+	HYDROGRAPH AT	D53	180.	12.17	13.	4.	1.	.12
+	DIVERSION TO	RD53	180.	12.17	13.	4.	1.	.12
+	HYDROGRAPH AT	DD53RE	0.	.00	0.	0.	0.	.12
+	2 COMBINED AT	CPD53	642.	13.42	251.	80.	27.	9.99
+	ROUTED TO	SRD53	228.	15.42	186.	77.	26.	9.99
+	ROUTED TO	D53D54	227.	15.67	186.	76.	26.	9.99
+	HYDROGRAPH AT	D43	643.	12.33	74.	23.	8.	.50
+	DIVERSION TO	RD43	643.	12.33	66.	18.	6.	.50
+	HYDROGRAPH AT	DD43RE	105.	12.75	16.	5.	2.	.50
+	ROUTED TO	D43D54	44.	13.75	15.	5.	2.	.50
+	HYDROGRAPH AT	D54	338.	12.25	29.	8.	3.	.27
+	DIVERSION TO	RD54	67.	12.00	5.	2.	1.	.27
	HYDROGRAPH AT							

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+                       DD54RE       338.   12.25          26.          7.          2.         .27

     3 COMBINED AT
+                       CPD54        319.   12.25         197.         86.         29.       10.76
1                    SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION    SRD27
                   (PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED  DURING BREACH FORMATION)


 PLAN  1 .............                  INITIAL VALUE     SPILLWAY CREST     TOP OF DAM
                          ELEVATION         1142.00             .00             .00
                          STORAGE              0.               0.              0.
                          OUTFLOW             52.               0.              0.

          RATIO     MAXIMUM      MAXIMUM     MAXIMUM     MAXIMUM     DURATION      TIME OF      TIME OF
            OF     RESERVOIR      DEPTH      STORAGE     OUTFLOW     OVER TOP    MAX OUTFLOW    FAILURE
           PMF      W.S.ELEV    OVER DAM      AC-FT         CFS         HOURS         HOURS        HOURS

          1.00      1147.38     1147.38          0.         582.     166.58         13.00          .00


 PLAN  2 .............                  INITIAL VALUE     SPILLWAY CREST     TOP OF DAM
                          ELEVATION         1142.00             .00             .00
                          STORAGE              0.               0.              0.
                          OUTFLOW             52.               0.              0.

          RATIO     MAXIMUM      MAXIMUM     MAXIMUM     MAXIMUM     DURATION      TIME OF      TIME OF
            OF     RESERVOIR      DEPTH      STORAGE     OUTFLOW     OVER TOP    MAX OUTFLOW    FAILURE
           PMF      W.S.ELEV    OVER DAM      AC-FT         CFS         HOURS         HOURS        HOURS

          1.00      1146.68     1146.68          0.         498.     166.58         13.00          .00


 PLAN  3 .............                  INITIAL VALUE     SPILLWAY CREST     TOP OF DAM
                          ELEVATION         1142.00             .00             .00
                          STORAGE              0.               0.              0.
                          OUTFLOW             52.               0.              0.

          RATIO     MAXIMUM      MAXIMUM     MAXIMUM     MAXIMUM     DURATION      TIME OF      TIME OF
            OF     RESERVOIR      DEPTH      STORAGE     OUTFLOW     OVER TOP    MAX OUTFLOW    FAILURE
           PMF      W.S.ELEV    OVER DAM      AC-FT         CFS         HOURS         HOURS        HOURS

          1.00      1146.52     1146.52          0.         478.     166.58         12.17          .00


 PLAN  4 .............                  INITIAL VALUE     SPILLWAY CREST     TOP OF DAM
                          ELEVATION         1142.00             .00             .00
                          STORAGE              0.               0.              0.
                          OUTFLOW             52.               0.              0.

          RATIO     MAXIMUM      MAXIMUM     MAXIMUM     MAXIMUM     DURATION      TIME OF      TIME OF
            OF     RESERVOIR      DEPTH      STORAGE     OUTFLOW     OVER TOP    MAX OUTFLOW    FAILURE
           PMF      W.S.ELEV    OVER DAM      AC-FT         CFS         HOURS         HOURS        HOURS

          1.00      1146.39     1146.39          0.         463.     166.58         12.25          .00


 PLAN  5 .............                  INITIAL VALUE     SPILLWAY CREST     TOP OF DAM
                          ELEVATION         1142.00             .00             .00
                          STORAGE              0.               0.              0.
                          OUTFLOW             52.               0.              0.

          RATIO     MAXIMUM      MAXIMUM     MAXIMUM     MAXIMUM     DURATION      TIME OF      TIME OF
            OF     RESERVOIR      DEPTH      STORAGE     OUTFLOW     OVER TOP    MAX OUTFLOW    FAILURE
           PMF      W.S.ELEV    OVER DAM      AC-FT         CFS         HOURS         HOURS        HOURS

          1.00      1146.27     1146.27          0.         448.     166.58         12.25          .00


 PLAN  6 .............                  INITIAL VALUE     SPILLWAY CREST     TOP OF DAM
                          ELEVATION         1142.00             .00             .00
                          STORAGE              0.               0.              0.
                          OUTFLOW             52.               0.              0.

          RATIO     MAXIMUM      MAXIMUM     MAXIMUM     MAXIMUM     DURATION      TIME OF      TIME OF
            OF     RESERVOIR      DEPTH      STORAGE     OUTFLOW     OVER TOP    MAX OUTFLOW    FAILURE
           PMF      W.S.ELEV    OVER DAM      AC-FT         CFS         HOURS         HOURS        HOURS

          1.00      1146.11     1146.11          0.         429.     166.58         12.17          .00


 PLAN  7 .............                  INITIAL VALUE     SPILLWAY CREST     TOP OF DAM
                          ELEVATION         1142.00             .00             .00
                          STORAGE              0.               0.              0.
                          OUTFLOW             52.               0.              0.

          RATIO     MAXIMUM      MAXIMUM     MAXIMUM     MAXIMUM     DURATION      TIME OF      TIME OF
            OF     RESERVOIR      DEPTH      STORAGE     OUTFLOW     OVER TOP    MAX OUTFLOW    FAILURE
           PMF      W.S.ELEV    OVER DAM      AC-FT         CFS         HOURS         HOURS        HOURS
```

1.00	1146.02	1146.02	0.	417.	166.58	12.25	.00

PLAN 8 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1142.00	.00	.00
STORAGE	0.	0.	0.
OUTFLOW	52.	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1145.96	1145.96	0.	411.	166.58	12.25	.00

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

Appendix D5

Backup data for revisions to ADMPU-AHA (2009)
Existing Condition with CIP HEC-1 model

Client: Flood Control District of Maricopa County
Project: FCD2008C014, WA#1 - Lower El Mirage Wash DCR, Phase 1
Description: **Preliminary Concept basin - 1st (refer to Exhibit F6)**
AZTEC Project No.: AZE0913-02
Date: 5/19/10 By: dtp

Stage - Discharge Data for West Cactus Basin

Stage (feet)	Water Surface Elevation	Discharge, in cfs			Storage Volume ac-ft
		Total	Culvert	Weir	
0	1104	0	0	0	0
1	1105	0	0	0	0.3
3.2	1107.2	0	0	0	5
4	1108	10	10	0	9.7
6	1110	70	70	0	22.6
7	1111	110	110	0	32.3
8	1112	160	160	0	42.5
9	1113	210	210	0	53.6
10	1114	265	265	0	66.4
11	1115	315	315	0	80
11.3	1115.3	329	325	4	85
11.6	1115.6	359	333	26	90
12	1116	443	345	98	95

Elevation datum = NGVD29

PRELIMINARY CONCEPT DATA

Stage - Storage - Discharge Data for West Cactus Basin
CODE into HEC-1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SV	0	0.3	5	9.7	22.6	32.3	42.5	53.6	66.4	80
SV	85	90	95	0	0					
SQ	0	0	0	10	70	110	160	210	265	315
SQ	329	359	443	0	0					
SE	1104	1105	1107.2	1108	1110	1111	1112	1113	1114	1115
SE	1115.3	1115.6	1116	0	0					

Note: Data from concept grading basin, 6:1 sides, confined on City Parcel and 1-6x6 rcb or equivalent outlet shown on Exhibit F6.
The storage volume includes level pool ponding for the channel area upstream of Cactus Road.

This concept will be further refined during Phase 2.

APPENDIX E

Floodplain Modeling Using HEC-RAS

Appendix E1 – Effective HEC-RAS output (hard copy)

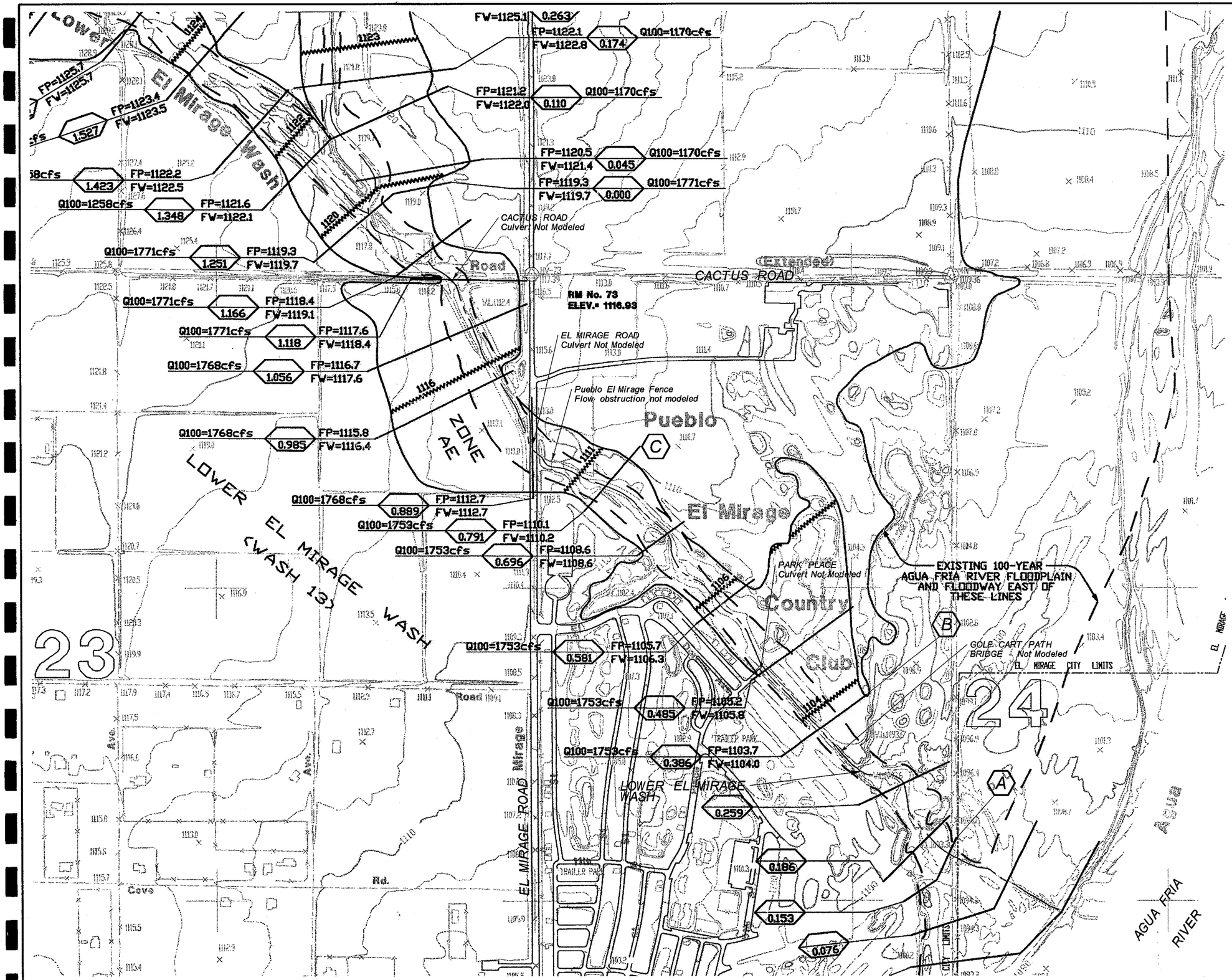
Appendix E2 – Corrected Effective HEC-RAS output (hard copy)

Appendix E3 – Pictures of Existing Structures

Appendix E1

Effective HEC-RAS output (hard copy)

Digital data is provided in Appendix G.



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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER EL MIRAGE WASH DCR

Phase 1
Analysis and Recommendations
FCD 2008C014 WA #2

LEGEND

- 0.581 — *HEC-RAS CROSS SECTION ID*
  In miles above confluence
- A — *FEMA CROSS SECTION ID*
  Location per Effective FIRM

EFFECTIVE MAPPING INFORMATION:

- *1" = 400', 2-ft CI provided by FCDMC*
- *Flight Date: December 1989 and February 1990*
- *Horz Datum: State plane NAD83*
- *Vertical Datum: NGVD29*

NOTE: The Effective Mapping is Outdated

N

150 0 150 300
Scale in Feet

AZTEC
TYPSA Group www.typsa.es
www.aztec.us
4561 E. McDowell Road
Phoenix, AZ 85008-4505
Tel (602) 454-0402
Fax (602) 454-0403

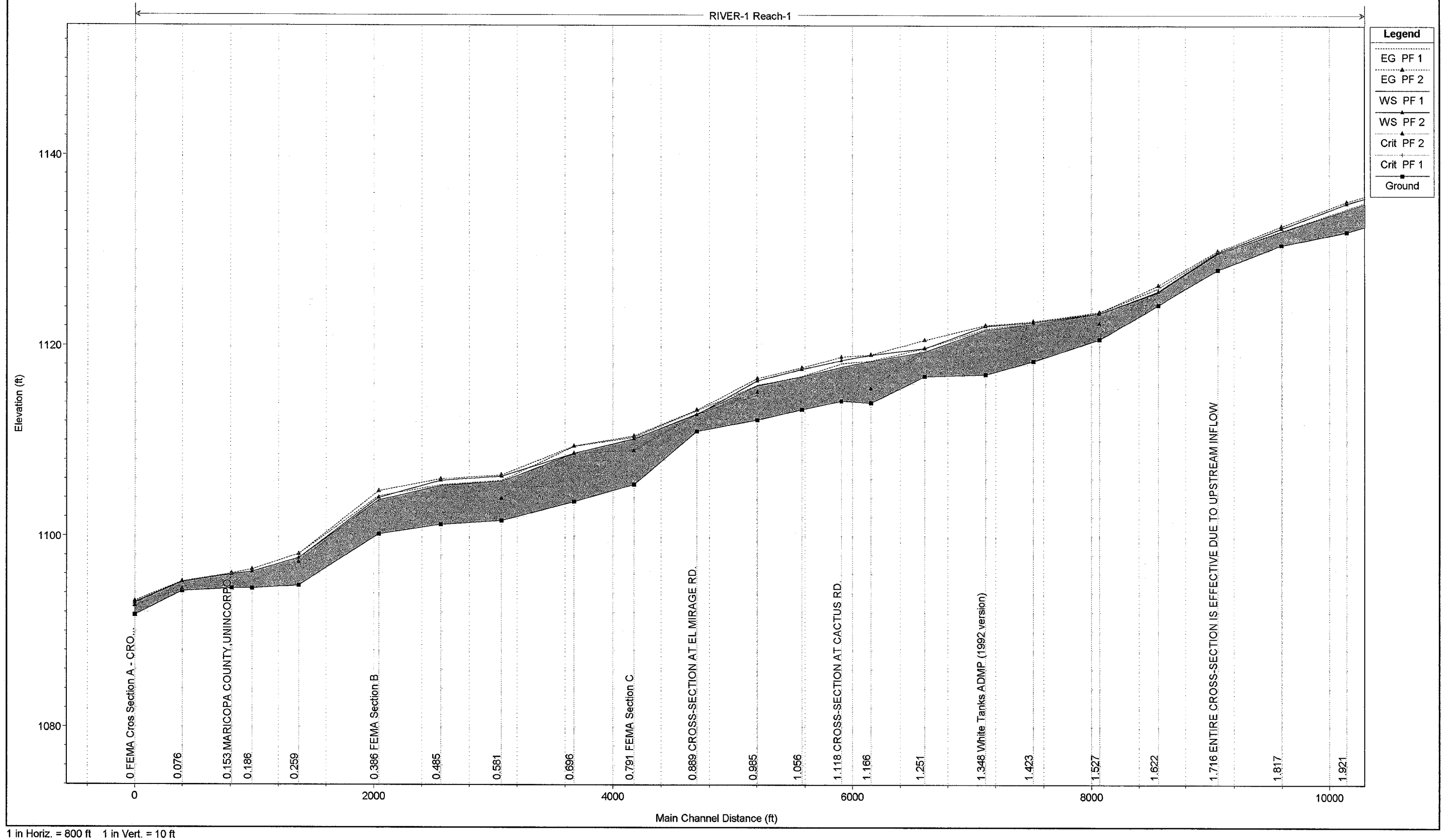
EXHIBIT E1

EFFECTIVE HEC-RAS
CROSS SECTION LOCATION MAP

	BY	DATE
DESIGNED	D.Phelps	5/20/10
DRAWN	K.Leahy	5/20/10
CHECKED	T.Bokich	5/20/10

Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010

Geom: HEC2 GR data - NGVD29



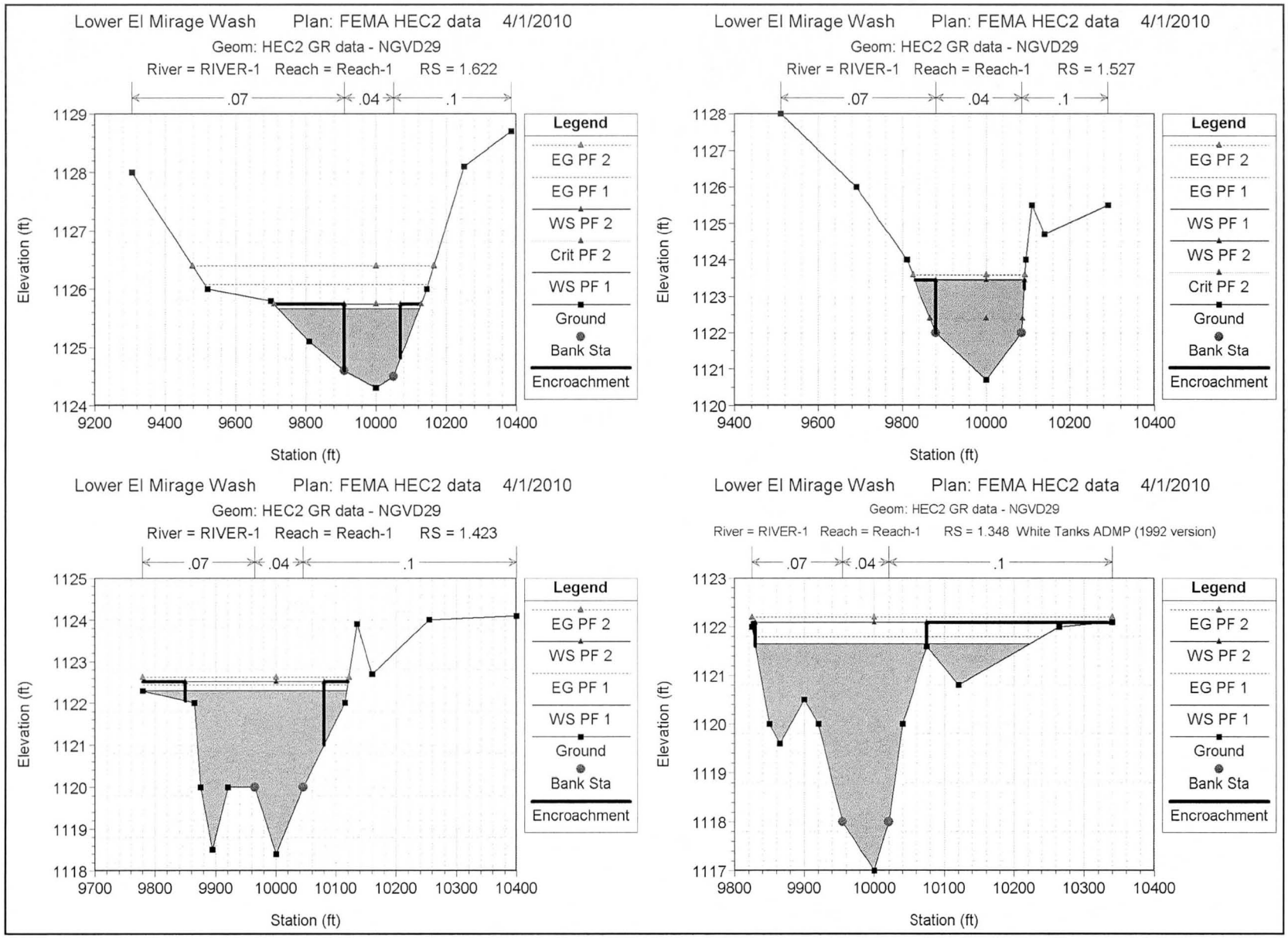
1 in Horiz. = 800 ft 1 in Vert. = 10 ft

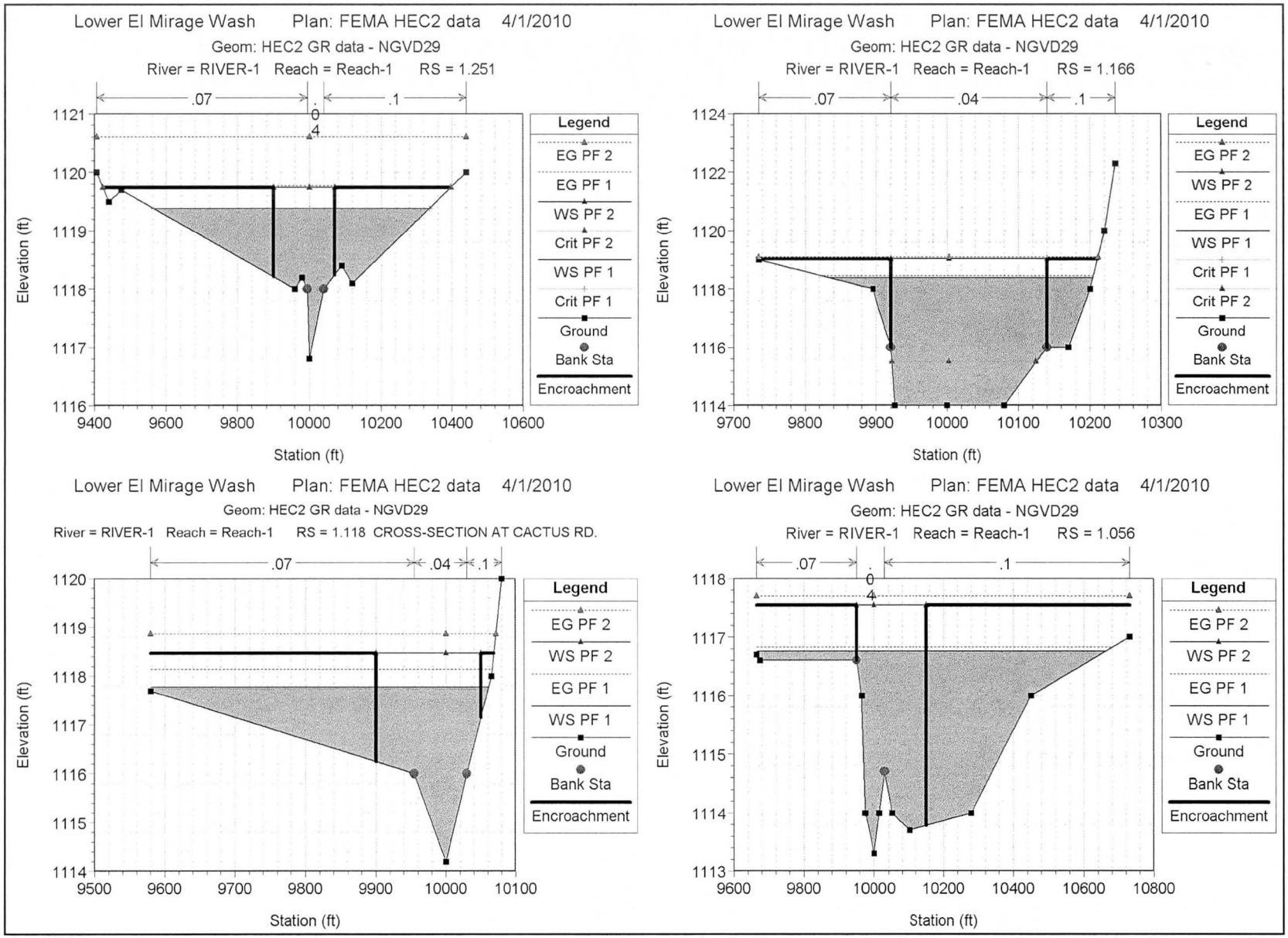
HEC-RAS Plan: Effective River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	2.571	PF 1	845.00	1145.00	1146.60	1146.25	1146.65	0.004677	2.75	738.24	989.46	0.42
Reach-1	2.571	PF 2	845.00	1145.00	1147.25	1146.38	1147.36	0.003314	3.02	414.37	240.00	0.38
Reach-1	2.469	PF 1	845.00	1143.20	1145.10		1145.13	0.002363	2.17	1037.28	1486.38	0.30
Reach-1	2.469	PF 2	845.00	1143.20	1145.68		1145.79	0.002859	2.94	369.54	185.00	0.35
Reach-1	2.35	PF 1	845.00	1141.80	1142.91		1142.95	0.006426	2.37	705.28	1067.90	0.45
Reach-1	2.35	PF 2	845.00	1141.80	1143.75		1143.84	0.003382	2.72	425.75	270.00	0.37
Reach-1	2.284	PF 1	845.00	1140.30	1140.48		1140.51	0.009944	0.64	590.93	656.01	0.37
Reach-1	2.284	PF 2	845.00	1140.30	1140.93		1141.16	0.046679	2.15	221.85	199.63	0.92
Reach-1	2.208	PF 1	845.00	1137.30	1138.91		1138.96	0.002978	2.24	703.79	775.32	0.34
Reach-1	2.208	PF 2	845.00	1137.30	1139.33		1139.38	0.001902	2.12	540.45	315.00	0.28
Reach-1	2.104	PF 1	1258.00	1135.20	1137.72		1137.77	0.001808	2.30	1058.54	973.51	0.28
Reach-1	2.104	PF 2	1258.00	1135.20	1138.22		1138.33	0.001912	2.69	468.20	180.00	0.29
Reach-1	2.009	PF 1	1258.00	1133.70	1136.24		1136.40	0.004603	3.66	617.06	586.97	0.45
Reach-1	2.009	PF 2	1258.00	1133.70	1136.67		1136.92	0.004448	3.99	315.28	125.00	0.44
Reach-1	1.921	PF 1	1258.00	1132.00	1134.29		1134.40	0.003972	3.21	708.53	608.76	0.41
Reach-1	1.921	PF 2	1258.00	1132.00	1135.00		1135.18	0.003102	3.43	367.29	140.00	0.37
Reach-1	1.817	PF 1	1258.00	1130.60	1132.05		1132.11	0.004349	2.56	1049.14	1363.98	0.40
Reach-1	1.817	PF 2	1258.00	1130.60	1132.38		1132.62	0.007713	3.93	320.07	200.00	0.55
Reach-1	1.716	PF 1	1258.00	1128.00	1129.71		1129.88	0.004084	3.26	412.16	409.21	0.45
Reach-1	1.716	PF 2	1258.00	1128.00	1129.83		1129.98	0.003420	3.11	404.09	235.00	0.42
Reach-1	1.622	PF 1	1258.00	1124.30	1125.66		1126.08	0.018429	5.78	319.53	401.12	0.92
Reach-1	1.622	PF 2	1258.00	1124.30	1125.74	1125.74	1126.39	0.022257	6.60	204.93	160.00	1.02
Reach-1	1.527	PF 1	1258.00	1120.70	1123.45		1123.57	0.002181	2.85	472.83	263.04	0.35
Reach-1	1.527	PF 2	1258.00	1120.70	1123.44	1122.39	1123.58	0.002332	2.92	434.41	211.00	0.36
Reach-1	1.423	PF 1	1258.00	1118.40	1122.30		1122.44	0.001966	3.50	606.11	338.16	0.35
Reach-1	1.423	PF 2	1258.00	1118.40	1122.52		1122.62	0.001332	3.01	619.23	230.00	0.29
Reach-1	1.348	PF 1	1258.00	1117.00	1121.65		1121.80	0.001334	3.50	637.25	393.11	0.30
Reach-1	1.348	PF 2	1258.00	1117.00	1122.09		1122.20	0.000854	3.00	682.54	245.00	0.25
Reach-1	1.251	PF 1	1771.00	1116.80	1119.38	1119.38	1119.77	0.016950	7.61	636.44	769.30	0.95
Reach-1	1.251	PF 2	1771.00	1116.80	1119.74	1119.74	1120.60	0.020345	9.33	310.01	170.00	1.07
Reach-1	1.166	PF 1	1771.00	1114.00	1118.39	1115.50	1118.44	0.000400	1.90	1060.30	370.58	0.17
Reach-1	1.166	PF 2	1771.00	1114.00	1119.04	1115.50	1119.08	0.000273	1.70	1042.71	220.00	0.14
Reach-1	1.118	PF 1	1771.00	1114.20	1117.77		1118.14	0.006717	5.86	572.68	480.98	0.63
Reach-1	1.118	PF 2	1771.00	1114.20	1118.47		1118.86	0.004437	5.55	419.33	150.00	0.53
Reach-1	1.056	PF 1	1768.00	1113.30	1116.76		1116.83	0.002436	3.20	1327.74	997.80	0.37
Reach-1	1.056	PF 2	1768.00	1113.30	1117.54		1117.70	0.002634	4.01	685.65	200.00	0.40
Reach-1	0.985	PF 1	1768.00	1112.20	1115.80	1114.82	1115.89	0.002575	3.74	1281.87	769.56	0.39
Reach-1	0.985	PF 2	1768.00	1112.20	1116.34	1115.14	1116.57	0.003524	4.93	665.97	238.00	0.47
Reach-1	0.889	PF 1	1768.00	1111.00	1112.80	1112.80	1113.20	0.008788	6.22	420.06	500.32	0.88
Reach-1	0.889	PF 2	1768.00	1111.00	1112.74	1112.74	1113.25	0.010695	6.69	340.58	320.00	0.96
Reach-1	0.791	PF 1	1753.00	1105.40	1110.17	1109.11	1110.37	0.001117	4.49	672.63	402.47	0.37
Reach-1	0.791	PF 2	1753.00	1105.40	1110.21	1108.96	1110.52	0.001442	5.13	452.61	160.00	0.43
Reach-1	0.696	PF 1	1753.00	1103.60	1108.70	1108.70	1109.43	0.003239	7.47	357.13	306.19	0.63
Reach-1	0.696	PF 2	1753.00	1103.60	1108.69	1108.69	1109.44	0.003280	7.51	338.80	245.00	0.63
Reach-1	0.581	PF 1	1753.00	1101.60	1105.71	1103.96	1105.82	0.000723	3.30	756.55	334.89	0.29
Reach-1	0.581	PF 2	1753.00	1101.60	1106.28	1103.90	1106.42	0.000594	3.28	613.30	150.00	0.27
Reach-1	0.485	PF 1	1753.00	1101.20	1105.26		1105.36	0.001136	3.55	895.45	720.03	0.35
Reach-1	0.485	PF 2	1753.00	1101.20	1105.81		1105.99	0.001243	4.13	576.20	248.00	0.38
Reach-1	0.386	PF 1	1753.00	1100.20	1103.73	1103.73	1104.19	0.005825	7.20	429.18	412.30	0.78
Reach-1	0.386	PF 2	1753.00	1100.20	1104.03	1104.03	1104.71	0.006198	7.97	317.55	198.00	0.82
Reach-1	0.259	PF 1	1753.00	1094.80	1097.68	1097.25	1098.10	0.003950	6.15	394.08	248.22	0.65

HEC-RAS Plan: Effective River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	0.259	PF 2	1753.00	1094.80	1097.68	1097.25	1098.10	0.003927	6.13	394.68	247.87	0.65
Reach-1	0.186	PF 1	1753.00	1094.50	1096.21		1096.48	0.004204	4.19	422.52	328.31	0.60
Reach-1	0.186	PF 2	1753.00	1094.50	1096.20		1096.47	0.004256	4.21	419.95	308.00	0.61
Reach-1	0.153	PF 1	1753.00	1094.50	1095.97		1096.05	0.001245	2.09	783.49	402.25	0.32
Reach-1	0.153	PF 2	1753.00	1094.50	1095.96		1096.04	0.001242	2.10	780.93	397.00	0.32
Reach-1	0.076	PF 1	1753.00	1094.20	1095.13	1094.40	1095.22	0.003868	2.22	759.18	683.92	0.50
Reach-1	0.076	PF 2	1753.00	1094.20	1095.15	1094.41	1095.23	0.003663	2.28	769.05	675.00	0.49
Reach-1	0	PF 1	1753.00	1091.70	1093.00	1092.65	1093.19	0.007500	4.71	515.05	505.65	0.77
Reach-1	0	PF 2	1753.00	1091.70	1092.94	1092.67	1093.16	0.008641	4.88	485.46	489.74	0.82


Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 1.622
.07
.04
.1
Elevation (ft)
Station (ft)
Legend
EG PF 2
EG PF 1
WS PF 2
Crit PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 1.527
Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 1.423
Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 1.348 White Tanks ADMP (1992 version)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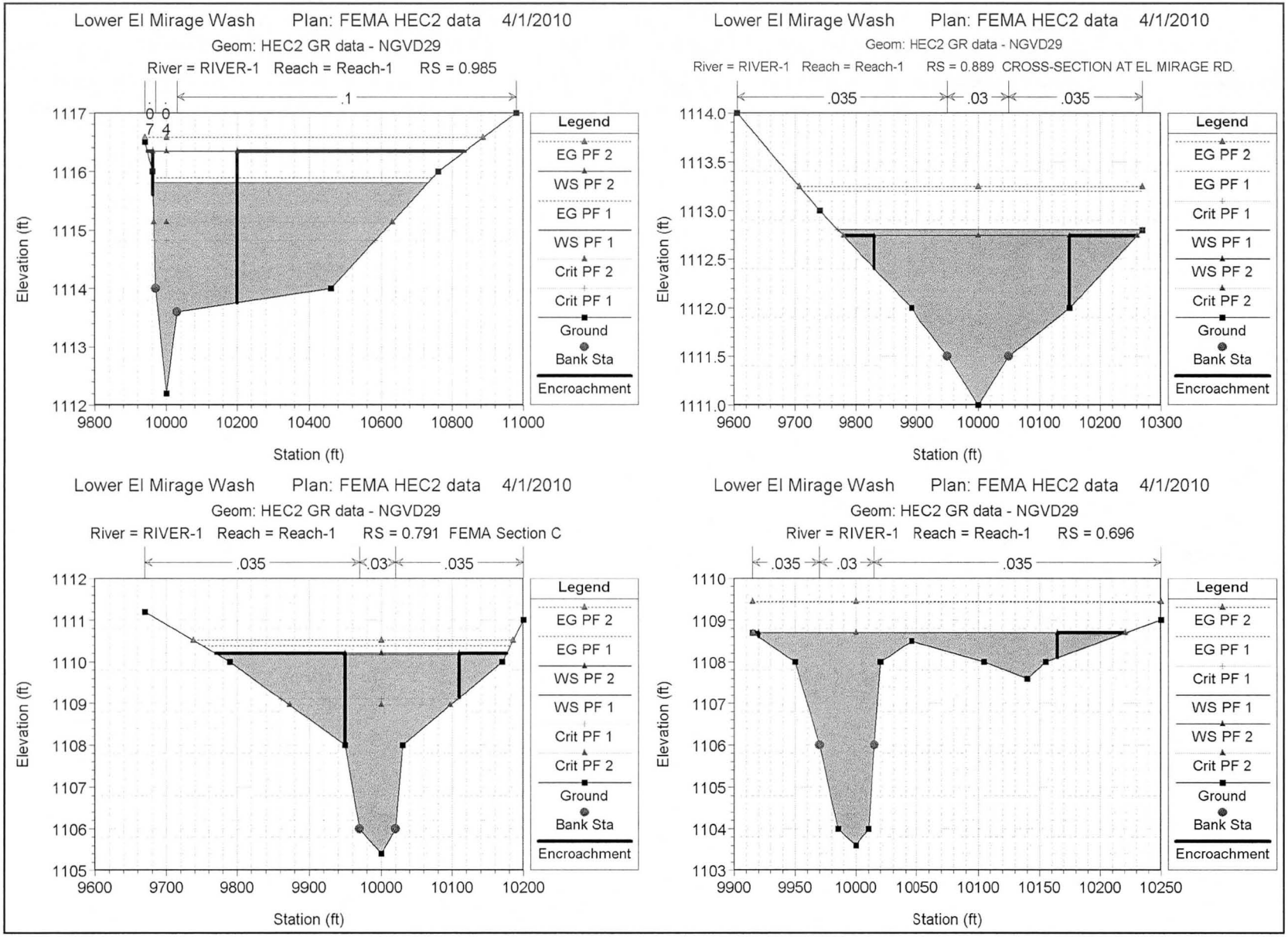
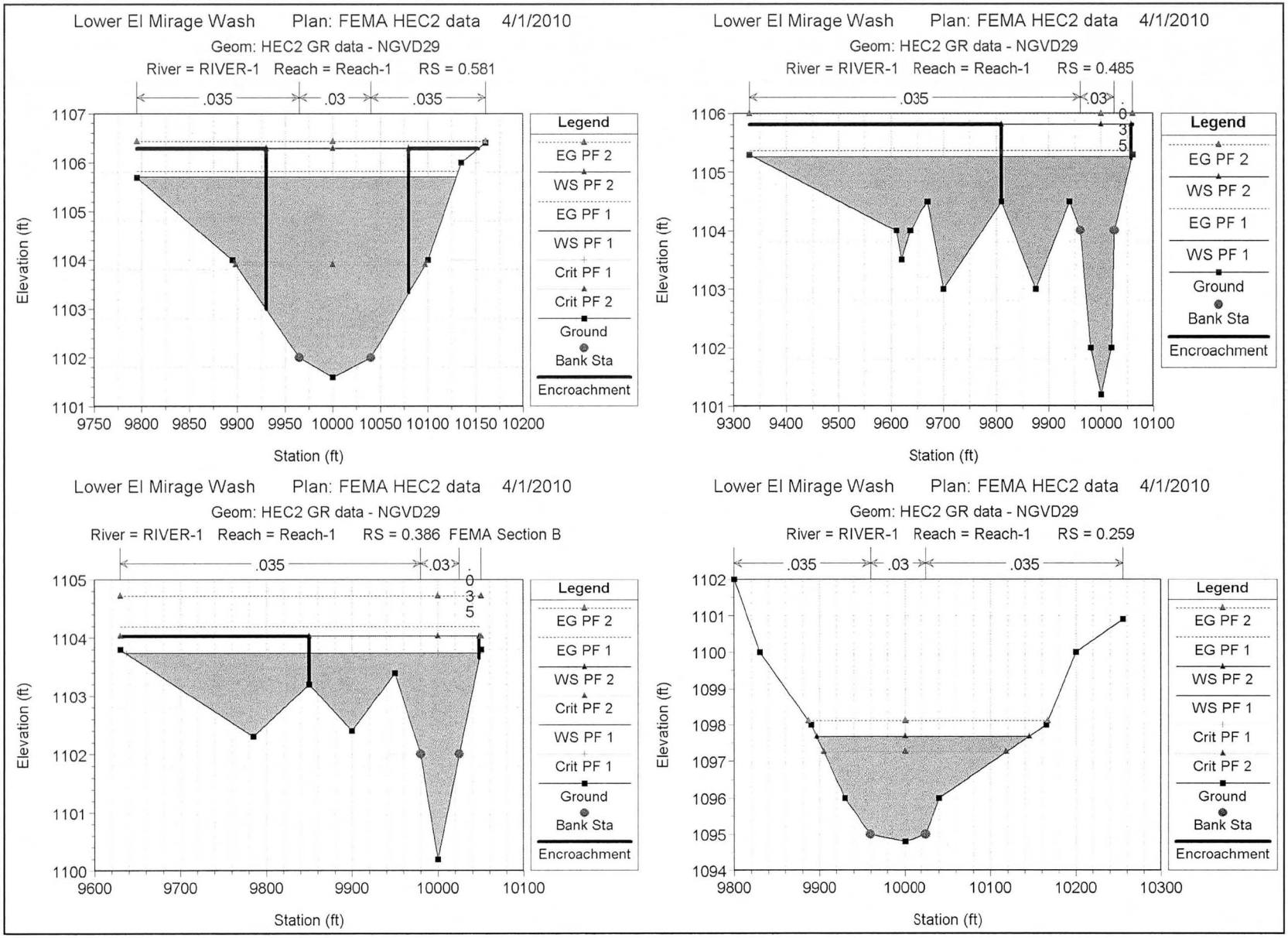
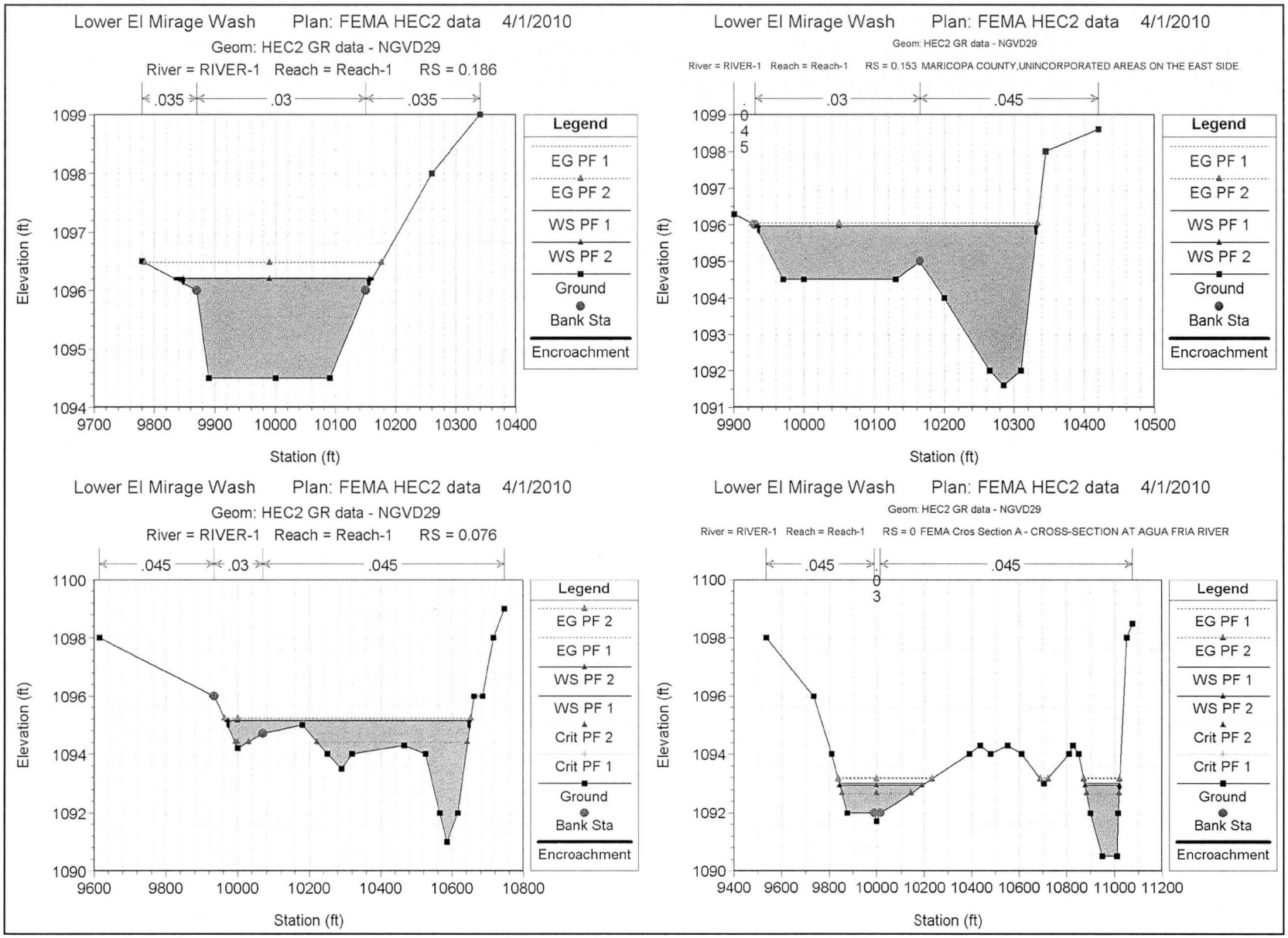
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 1.251
.07
.1
.04
Elevation (ft)
Station (ft)
Legend
EG PF 2
EG PF 1
WS PF 2
Crit PF 2
WS PF 1
Crit PF 1
Ground
Bank Sta
Encroachment
Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 1.166
.07
.04
.1
Elevation (ft)
Station (ft)
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Crit PF 1
Crit PF 2
Ground
Bank Sta
Encroachment
Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 1.118 CROSS-SECTION AT CACTUS RD.
.07
.04
.1
Elevation (ft)
Station (ft)
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 1.056
.07
.1
Elevation (ft)
Station (ft)
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment


Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 0.985
.1
.07
.04
Elevation (ft)
Station (ft)
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Crit PF 2
Crit PF 1
Ground
Bank Sta
Encroachment
Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 0.889 CROSS-SECTION AT EL MIRAGE RD.
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG PF 2
EG PF 1
Crit PF 1
WS PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta
Encroachment
Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 0.791 FEMA Section C
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG PF 2
EG PF 1
WS PF 2
WS PF 1
Crit PF 1
Crit PF 2
Ground
Bank Sta
Encroachment
Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 0.696
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG PF 2
EG PF 1
Crit PF 1
WS PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta
Encroachment

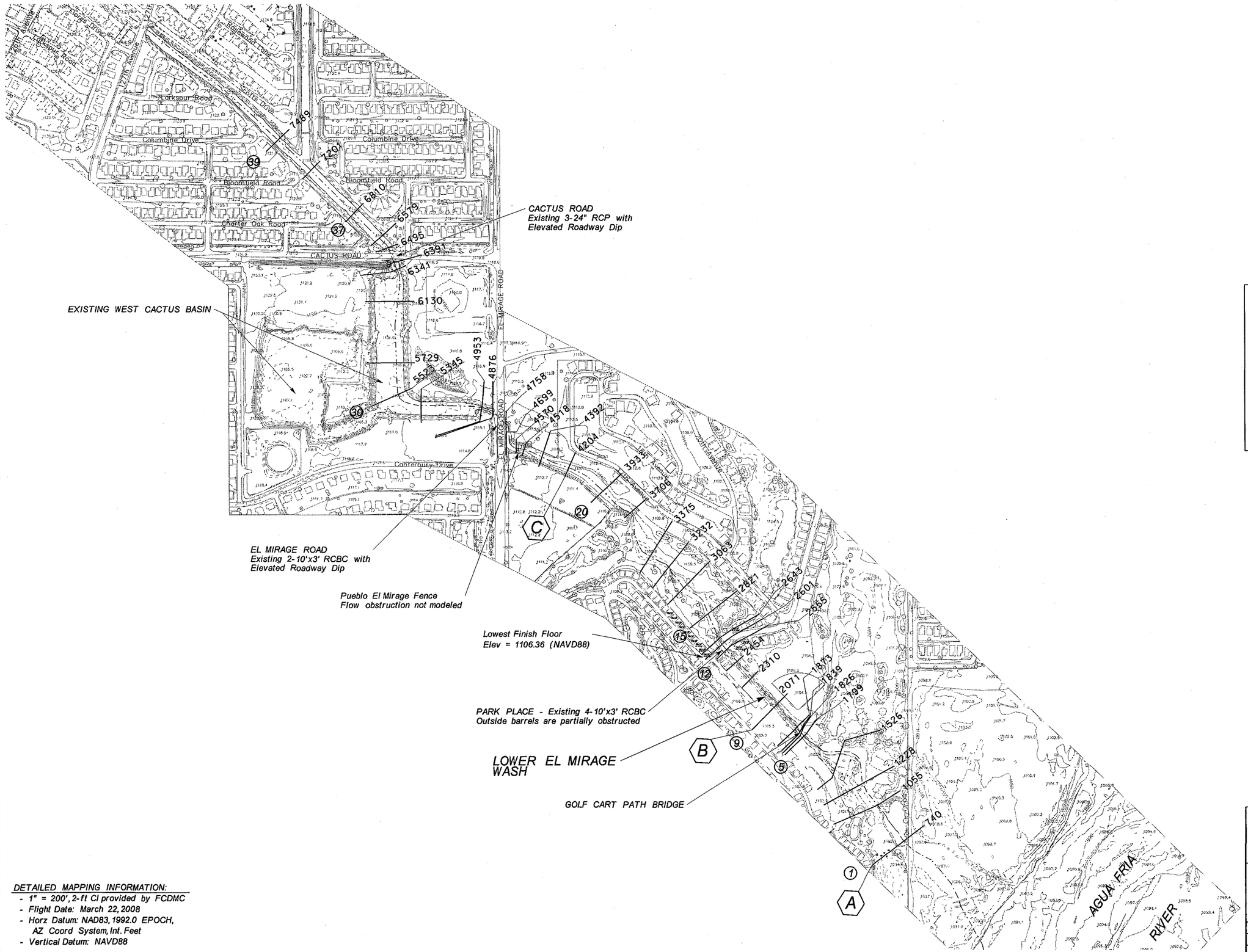

Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 0.581
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Crit PF 1
Crit PF 2
Ground
Bank Sta
Encroachment
Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 0.485
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 0.386 FEMA Section B
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG PF 2
EG PF 1
WS PF 2
Crit PF 2
WS PF 1
Crit PF 1
Ground
Bank Sta
Encroachment
Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 0.259
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG PF 2
EG PF 1
WS PF 2
WS PF 1
Crit PF 1
Crit PF 2
Ground
Bank Sta
Encroachment


Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 0.186
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG PF 1
EG PF 2
WS PF 1
WS PF 2
Ground
Bank Sta
Encroachment
Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 0.153 MARICOPA COUNTY,UNINCORPORATED AREAS ON THE EAST SIDE.
.045
.03
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
EG PF 2
WS PF 1
WS PF 2
Ground
Bank Sta
Encroachment
Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 0.076
.045
.03
.045
Elevation (ft)
Station (ft)
Legend
EG PF 2
EG PF 1
WS PF 2
WS PF 1
Crit PF 2
Crit PF 1
Ground
Bank Sta
Encroachment
Lower El Mirage Wash Plan: FEMA HEC2 data 4/1/2010
Geom: HEC2 GR data - NGVD29
River = RIVER-1 Reach = Reach-1 RS = 0 FEMA Cros Section A - CROSS-SECTION AT AGUA FRIA RIVER
.045
.045
Elevation (ft)
Station (ft)
Legend
EG PF 1
EG PF 2
WS PF 1
WS PF 2
Crit PF 2
Crit PF 1
Ground
Bank Sta
Encroachment

Appendix E2

Corrected Effective HEC-RAS output (hard copy)

Digital data is provided in Appendix G.



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER EL MIRAGE WASH DCR

Phase 1
Analysis and Recommendations
FCD 2008C014 WA #2

LEGEND

2071	*HEC-RAS CROSS SECTION ID* *In feet above confluence*
(A)	*FEMA CROSS SECTION ID* *Location per Effective FIRM*
(9)	*SECTION NUMBER* *Consecutively increasing in upstream order*

N

150 0 150 300
Scale in Feet

DETAILED MAPPING INFORMATION:
- *1" = 200', 2-ft CI provided by FCDMC*
- *Flight Date: March 22, 2008*
- *Horz Datum: NAD83, 1992.0 EPOCH, AZ Coord System, Int. Feet*
- *Vertical Datum: NAVD88*

AZTEC
TYPSA Group www.typsa.es
4561 E. McDowell Road
Phoenix, AZ 85008-4505
Tel (602) 454-0402
Fax (602) 454-0403
www.aztec.us

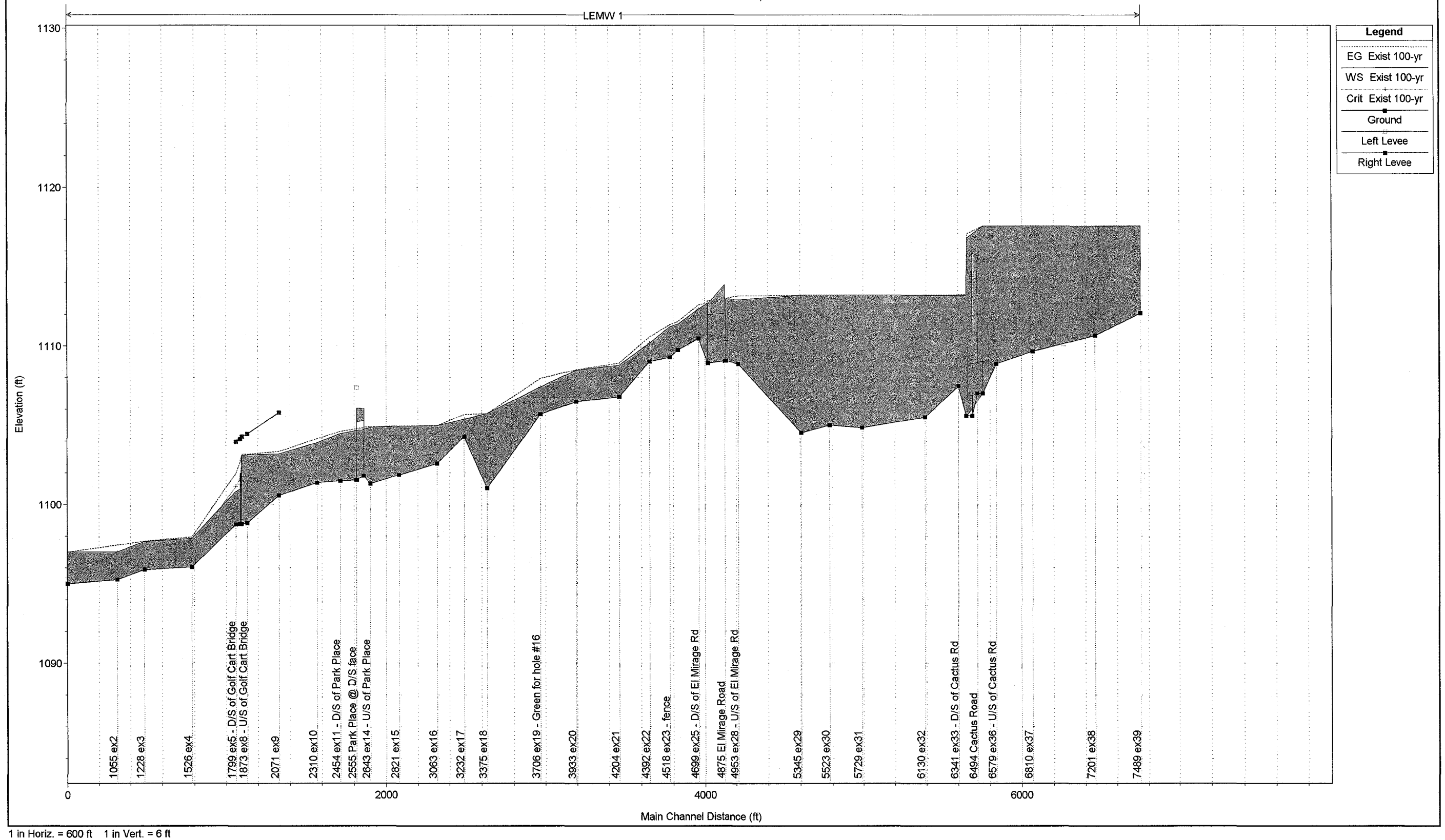
EXHIBIT E2
CORRECTED EFFECTIVE HEC-RAS
CROSS SECTION LOCATION MAP

	BY	DATE
DESIGNED	D.Phelps	5/20/10
DRAWN	K.Leahy	5/20/10
CHECKED	T.Bokich	5/20/10

R:\Phoenix\Projects\AZE0913_FCD_On-Call\02_LowerElMirageWashDCR\CADD\Sheets\Exhibits\Drainage\Exhibit_E2.dgn

ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010

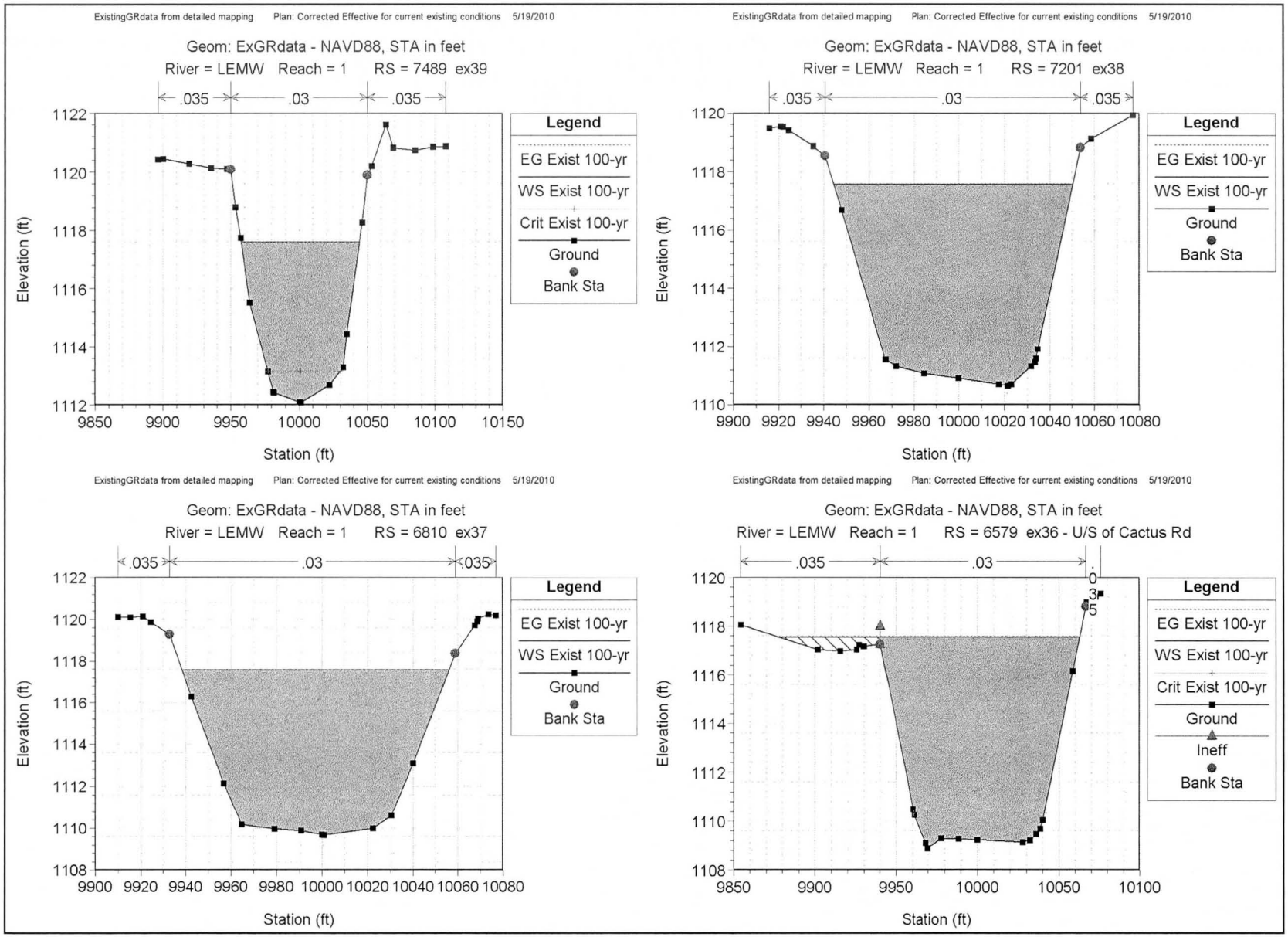
Geom: ExGRdata - NAVD88, STA in feet

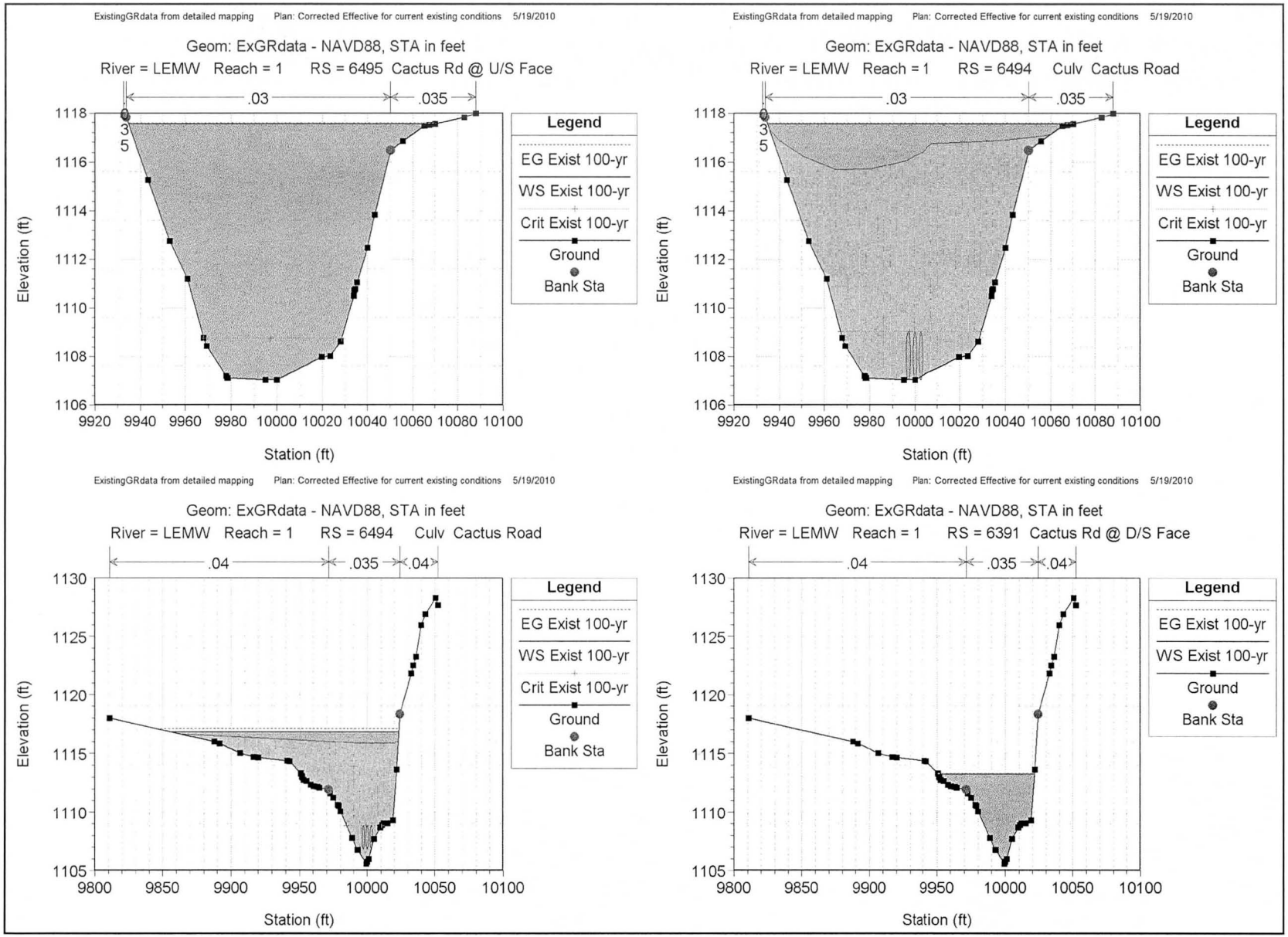


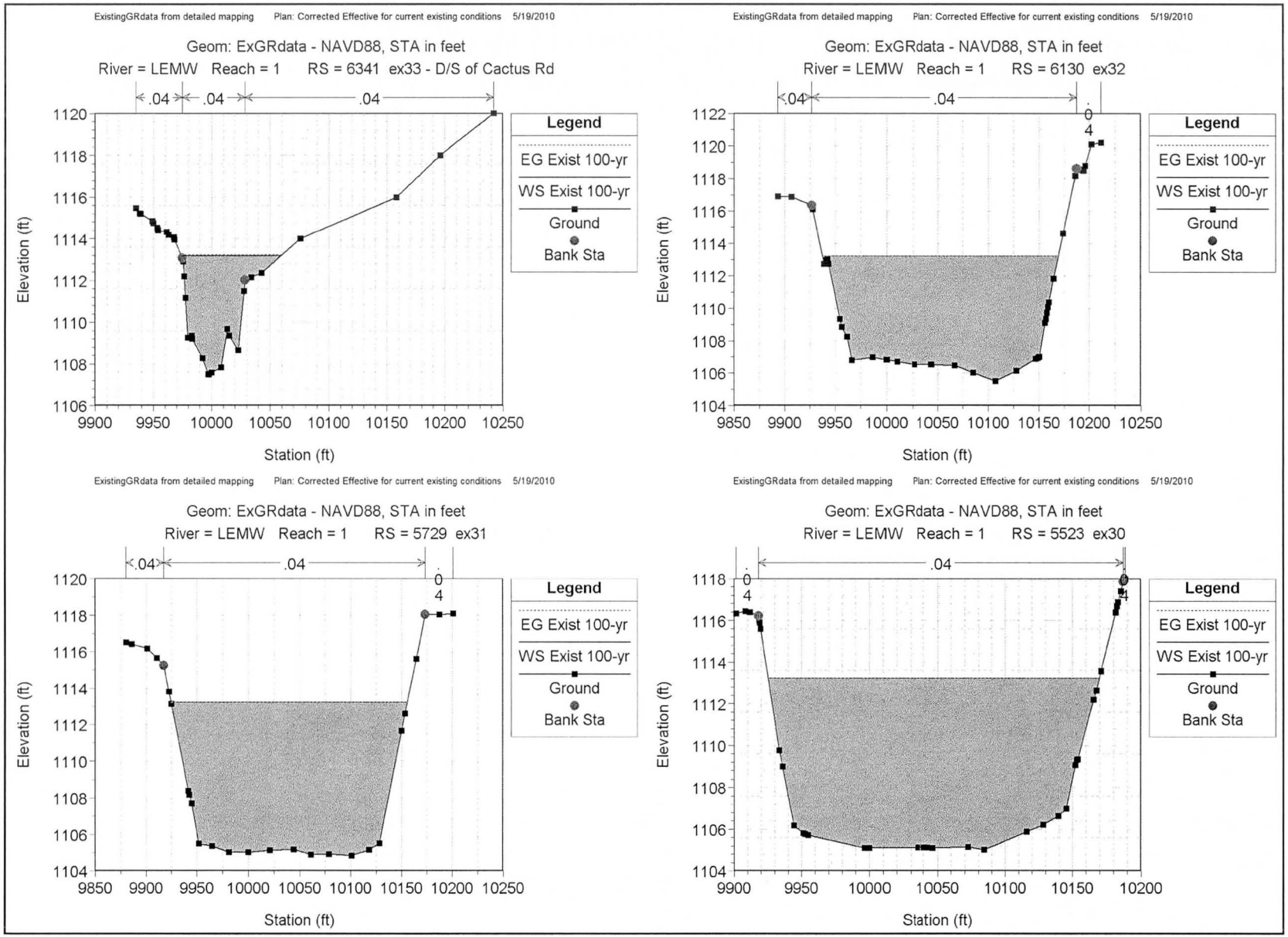
1 in Horiz. = 600 ft 1 in Vert. = 6 ft

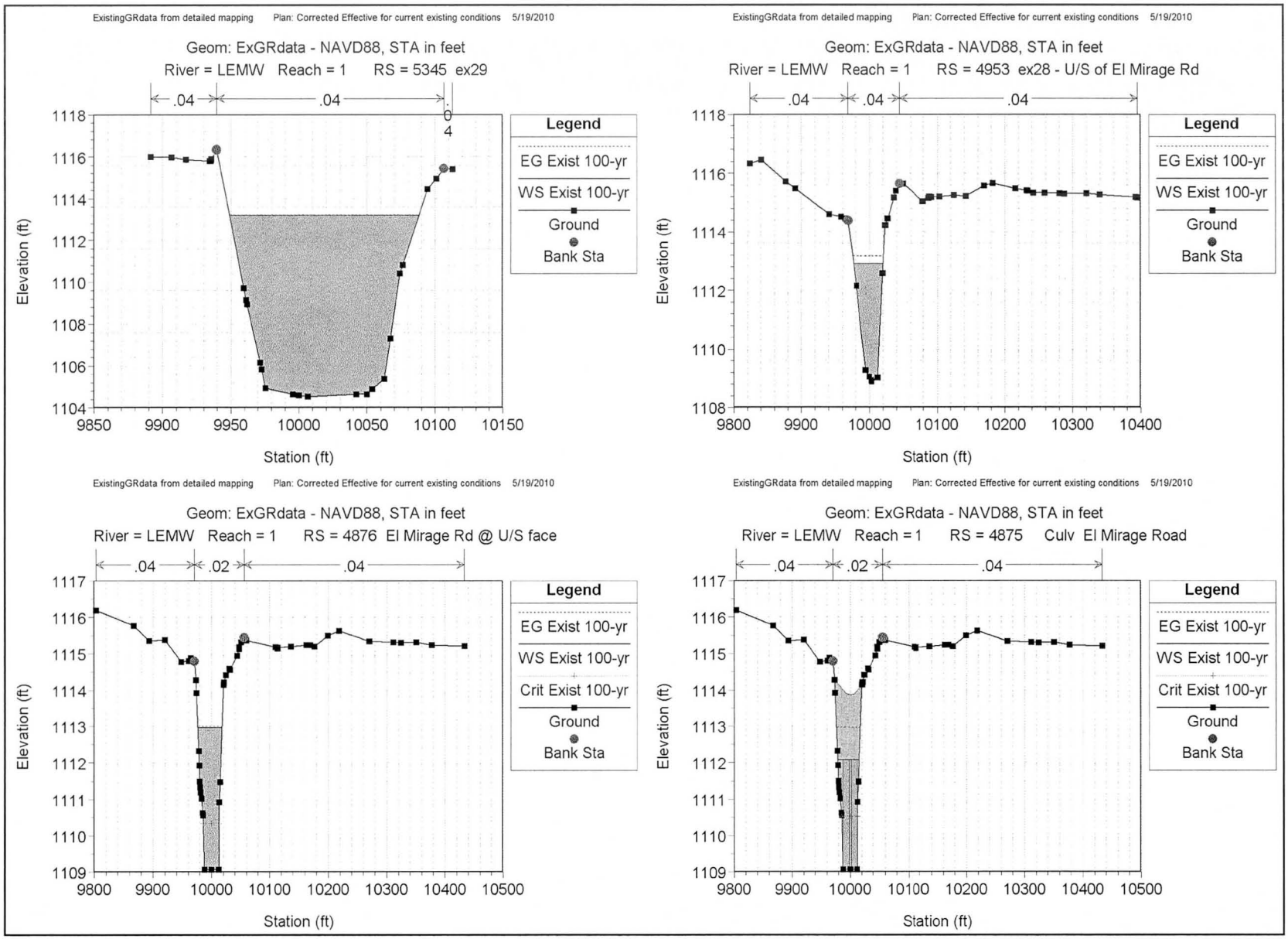
HEC-RAS Plan: CorrExist River: LEMW Reach: 1 Profile: Exist 100-yr

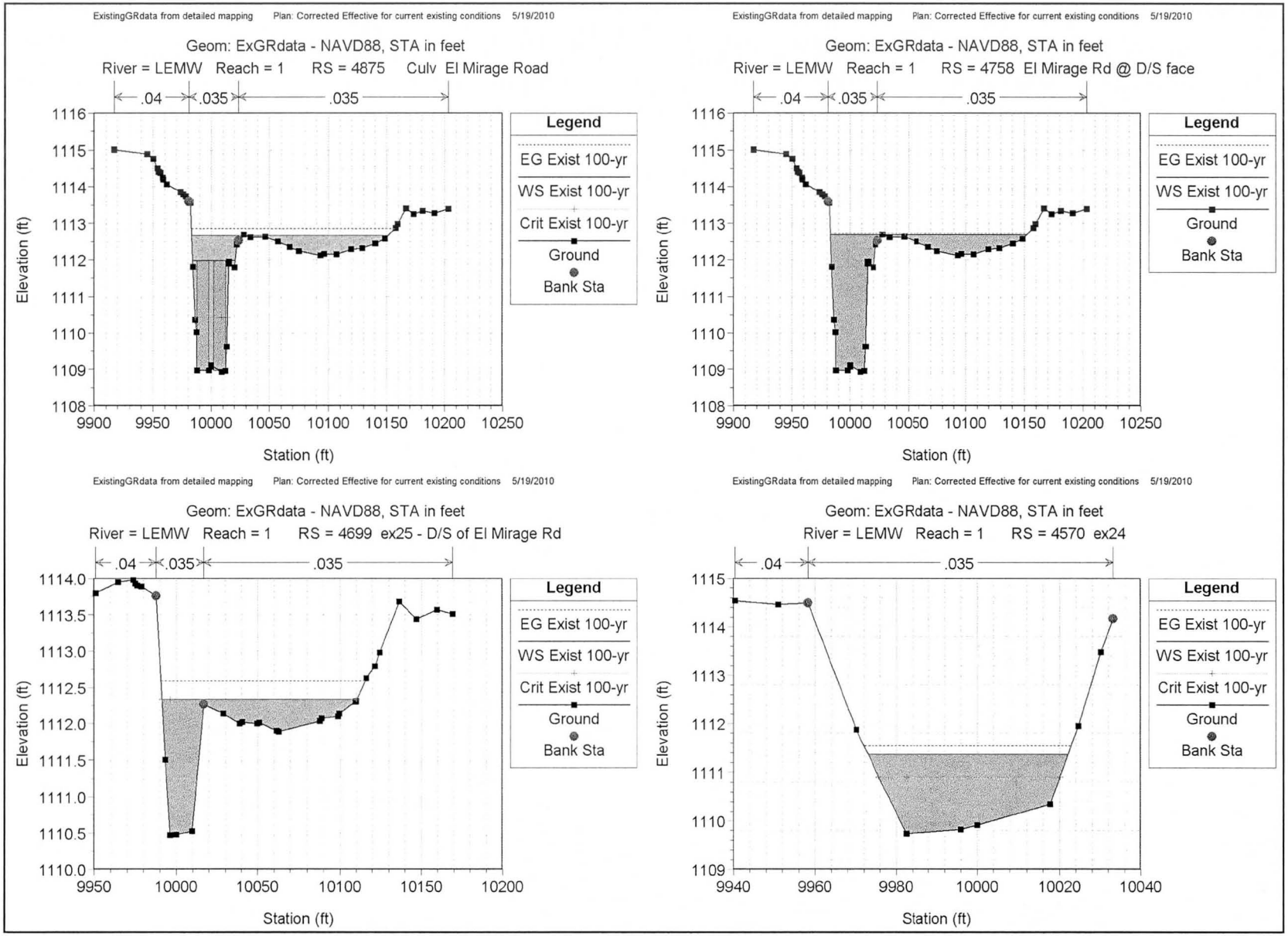
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	7489	Exist 100-yr	180.00	1112.08	1117.58	1113.16	1117.59	0.000016	0.51	354.46	86.32	0.04
1	7201	Exist 100-yr	490.00	1110.66	1117.56		1117.58	0.000036	0.89	553.17	105.72	0.07
1	6810	Exist 100-yr	490.00	1109.67	1117.56		1117.57	0.000020	0.71	691.10	117.62	0.05
1	6579	Exist 100-yr	490.00	1108.88	1117.56	1110.33	1117.56	0.000012	0.60	818.00	185.23	0.04
1	6495	Exist 100-yr	490.00	1107.03	1117.56	1108.77	1117.56	0.000009	0.57	868.22	135.58	0.04
1	6494		Culvert									
1	6391	Exist 100-yr	480.00	1105.58	1113.20		1113.26	0.000332	2.04	247.40	70.45	0.17
1	6341	Exist 100-yr	480.00	1107.49	1113.17		1113.24	0.000488	2.07	246.21	84.85	0.18
1	6130	Exist 100-yr	480.00	1105.50	1113.21		1113.21	0.000008	0.34	1391.89	232.12	0.02
1	5729	Exist 100-yr	480.00	1104.84	1113.21		1113.21	0.000005	0.29	1645.19	231.21	0.02
1	5523	Exist 100-yr	480.00	1105.00	1113.21		1113.21	0.000004	0.28	1704.43	244.50	0.02
1	5345	Exist 100-yr	480.00	1104.53	1113.21		1113.21	0.000015	0.51	934.35	139.20	0.03
1	4953	Exist 100-yr	480.00	1108.89	1112.90		1113.16	0.003473	4.14	115.98	43.27	0.45
1	4876	Exist 100-yr	200.00	1109.07	1112.96	1110.33	1113.00	0.000120	1.63	122.76	41.24	0.17
1	4875		Culvert									
1	4758	Exist 100-yr	200.00	1108.93	1112.68		1112.72	0.000443	1.67	149.17	167.52	0.18
1	4699	Exist 100-yr	200.00	1110.47	1112.33	1112.33	1112.59	0.007240	4.48	61.53	118.70	0.66
1	4570	Exist 100-yr	200.00	1109.74	1111.36	1110.91	1111.54	0.005031	3.39	58.93	48.98	0.55
1	4518	Exist 100-yr	200.00	1109.28	1111.17		1111.33	0.003130	3.13	63.82	52.87	0.50
1	4392	Exist 100-yr	200.00	1109.03	1110.17	1110.17	1110.56	0.014738	4.98	40.16	53.19	1.01
1	4204	Exist 100-yr	200.00	1106.81	1108.79	1108.17	1108.93	0.002591	2.94	68.03	53.82	0.46
1	3933	Exist 100-yr	200.00	1106.48	1108.46		1108.51	0.000918	1.89	105.79	74.65	0.28
1	3706	Exist 100-yr	200.00	1105.69	1107.39	1107.39	1107.93	0.013318	5.90	33.92	32.05	1.01
1	3375	Exist 100-yr	200.00	1101.02	1105.72	1102.88	1105.73	0.000086	1.00	242.71	133.28	0.10
1	3232	Exist 100-yr	200.00	1104.28	1105.37	1105.37	1105.66	0.016243	4.34	46.07	80.74	1.01
1	3063	Exist 100-yr	200.00	1102.58	1104.96	1103.30	1104.97	0.000172	1.04	212.31	149.87	0.13
1	2821	Exist 100-yr	200.00	1101.87	1104.92	1102.72	1104.94	0.000135	1.03	217.09	184.46	0.12
1	2643	Exist 100-yr	200.00	1101.30	1104.84		1104.89	0.000426	2.00	118.66	67.61	0.21
1	2601	Exist 100-yr	200.00	1101.80	1104.74	1103.29	1104.86	0.000447	2.76	81.69	48.92	0.31
1	2600		Culvert									
1	2555	Exist 100-yr	200.00	1101.55	1104.65	1103.10	1104.75	0.001031	2.63	76.03	34.45	0.31
1	2454	Exist 100-yr	200.00	1101.48	1104.46		1104.60	0.002185	3.02	66.12	43.45	0.43
1	2310	Exist 100-yr	200.00	1101.37	1103.87		1104.15	0.004506	4.21	47.55	32.22	0.61
1	2071	Exist 100-yr	200.00	1100.57	1103.17	1102.32	1103.35	0.002427	3.32	60.34	39.27	0.46
1	1873	Exist 100-yr	200.00	1098.83	1103.11	1100.89	1103.17	0.000332	2.24	130.12	66.69	0.19
1	1839	Exist 100-yr	200.00	1098.79	1103.09	1101.79	1103.15	0.000672	2.94	122.14	83.67	0.26
1	1838		Bridge									
1	1826	Exist 100-yr	200.00	1098.77	1100.95	1101.55	1102.60	0.022767	10.67	21.86	21.80	1.36
1	1799	Exist 100-yr	200.00	1098.74	1100.80	1101.12	1101.94	0.015977	8.70	24.95	20.76	1.15
1	1526	Exist 100-yr	300.00	1096.05	1097.85	1097.23	1097.94	0.001668	2.57	142.52	138.62	0.38
1	1228	Exist 100-yr	300.00	1095.88	1097.66		1097.69	0.000413	1.35	278.90	208.12	0.19
1	1055	Exist 100-yr	300.00	1095.27	1097.01	1097.01	1097.44	0.014229	5.26	57.75	73.87	1.01
1	740	Exist 100-yr	300.00	1095.00	1097.00	1095.39	1097.01	0.000214	1.07	352.27	236.87	0.14

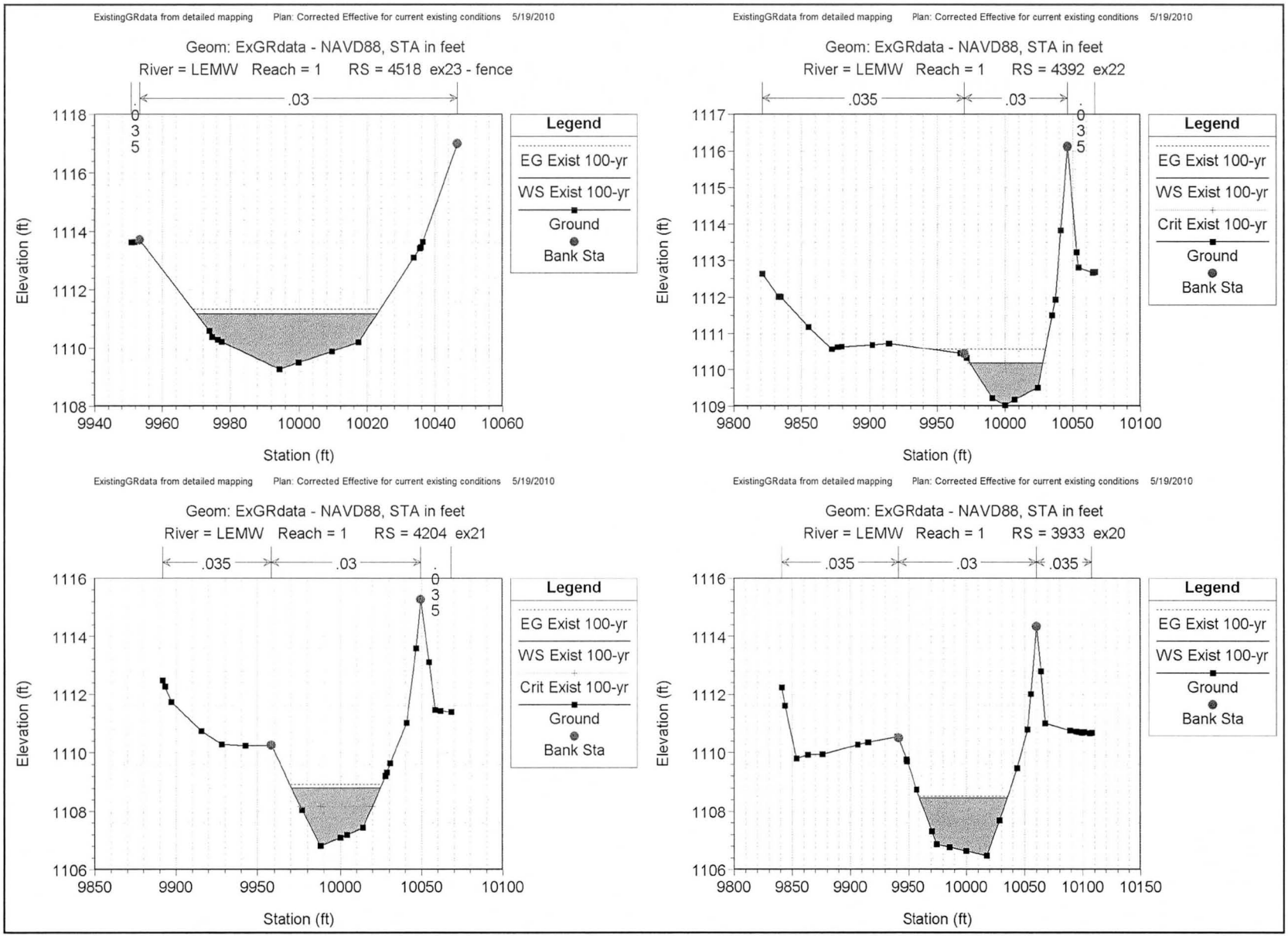

ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 7489 ex39
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 7201 ex38
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Ground
Bank Sta
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 6810 ex37
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Ground
Bank Sta
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 6579 ex36 - U/S of Cactus Rd
.035
.03
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Ineff
Bank Sta

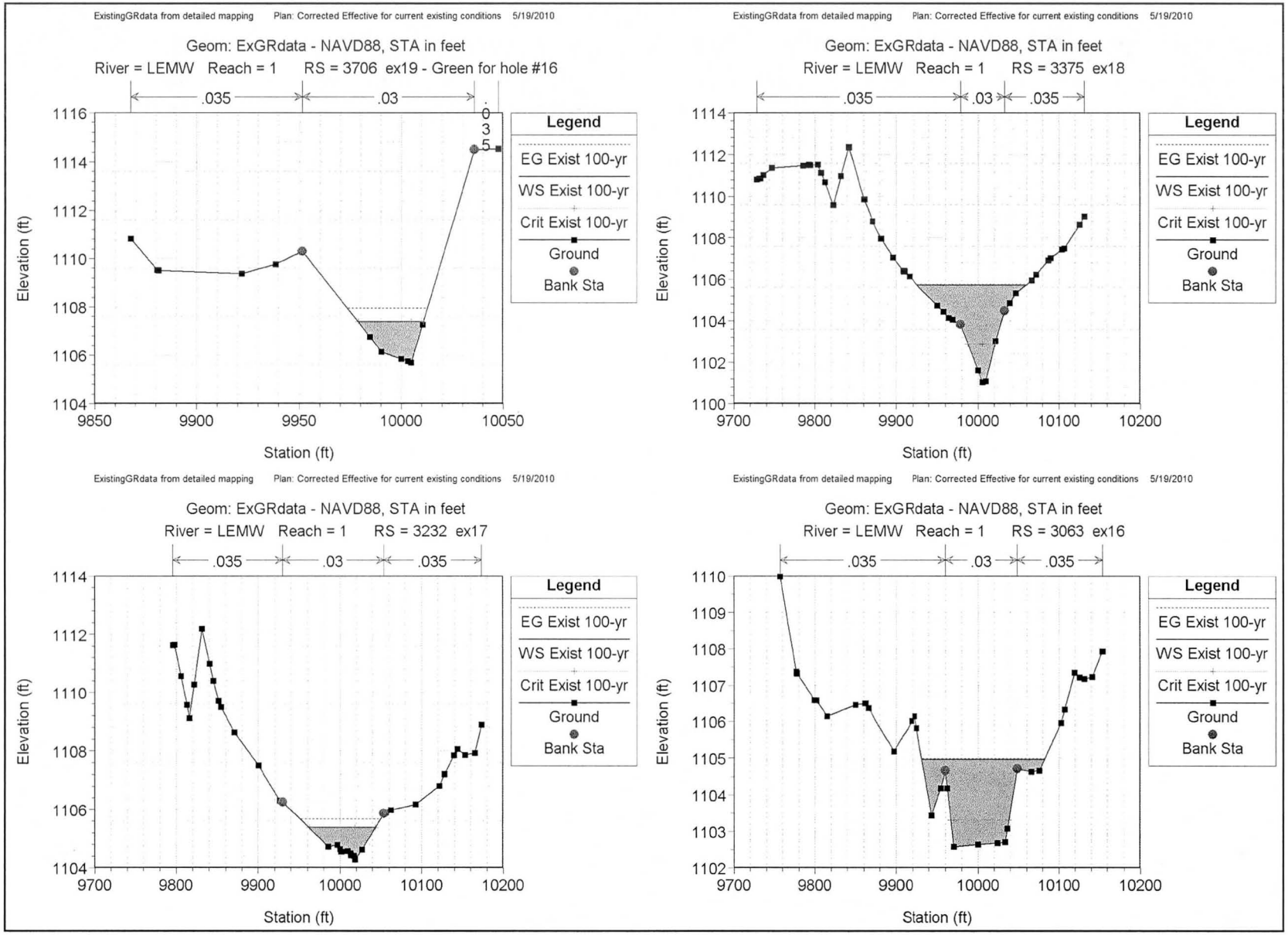

ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 6495 Cactus Rd @ U/S Face
.03
.035
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 6494 Culv Cactus Road
.03
.035
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 6494 Culv Cactus Road
.04
.035
.04
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 6391 Cactus Rd @ D/S Face
.04
.035
.04
Legend
EG Exist 100-yr
WS Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

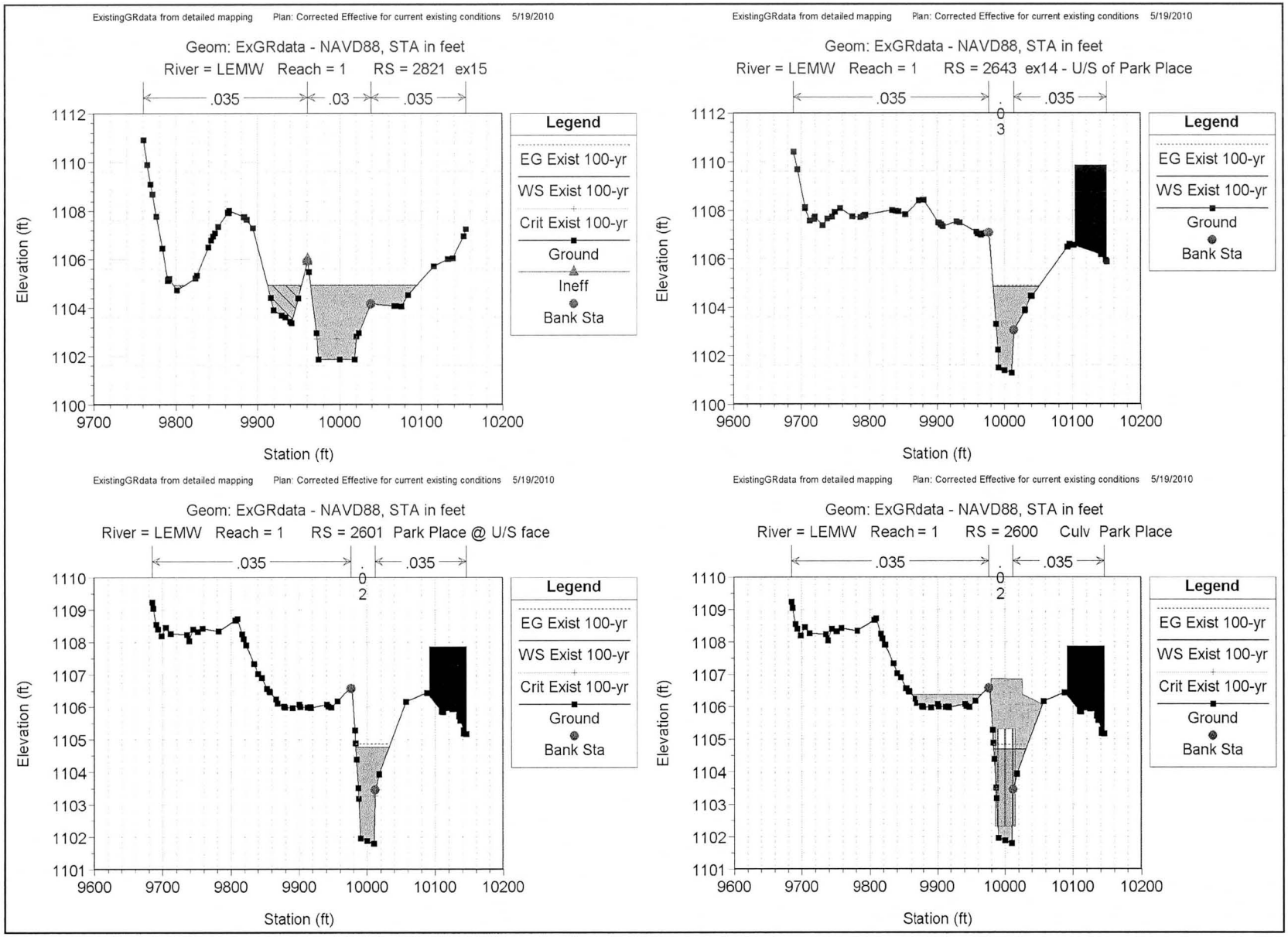

ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 6341 ex33 - D/S of Cactus Rd
.04 .04 .04
Legend
EG Exist 100-yr
WS Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 6130 ex32
.04 .04 .04
Legend
EG Exist 100-yr
WS Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 5729 ex31
.04 .04 .04
Legend
EG Exist 100-yr
WS Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 5523 ex30
.04 .04 .04
Legend
EG Exist 100-yr
WS Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

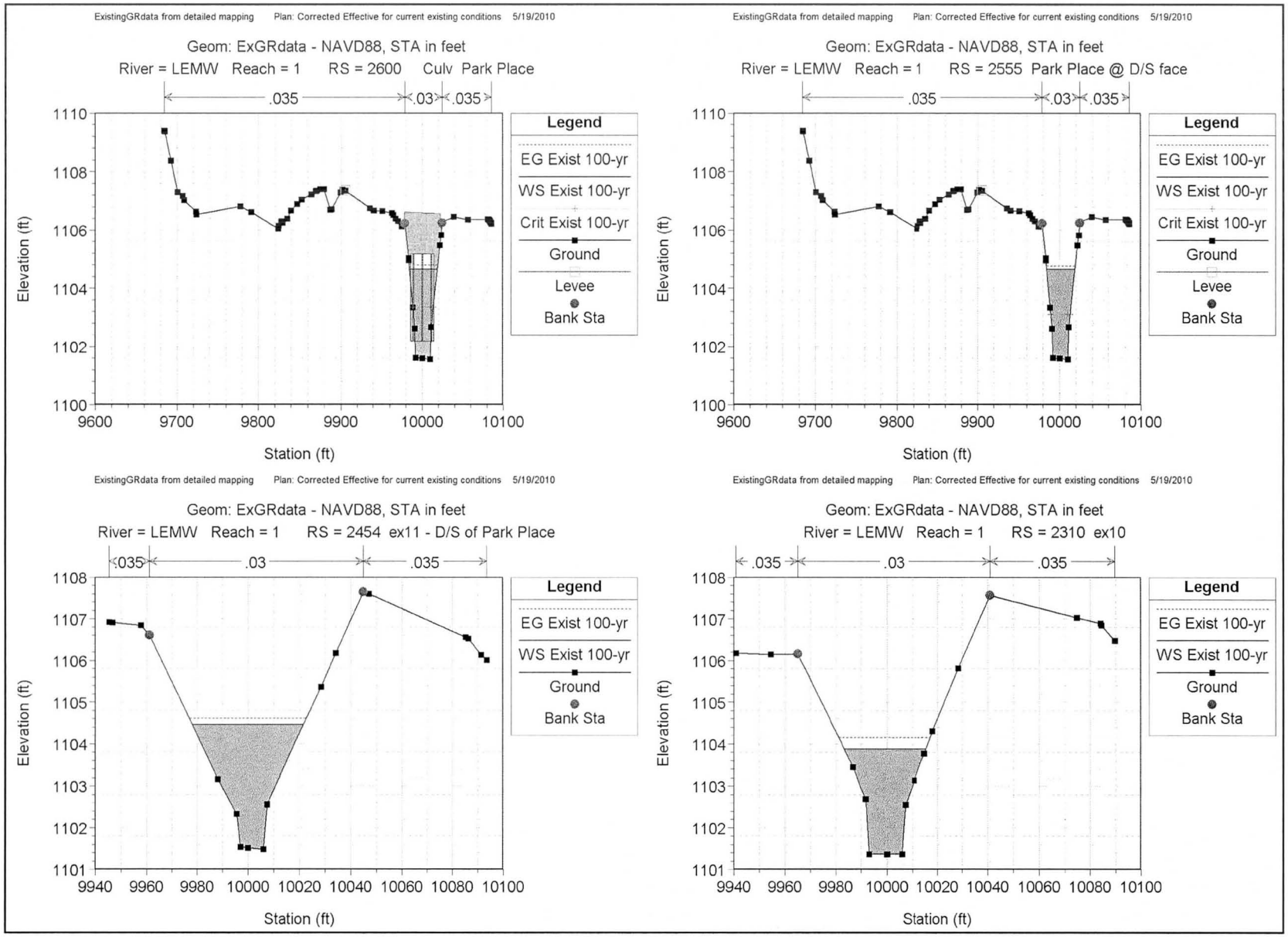

ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 5345 ex29
.04
.04
.04
Legend
EG Exist 100-yr
WS Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 4953 ex28 - U/S of El Mirage Rd
.04
.04
.04
Legend
EG Exist 100-yr
WS Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 4876 El Mirage Rd @ U/S face
.04
.02
.04
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 4875 Culv El Mirage Road
.04
.02
.04
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 4875 Culv El Mirage Road
.04
.035
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 4758 El Mirage Rd @ D/S face
.04
.035
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Ground
Bank Sta
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 4699 ex25 - D/S of El Mirage Rd
.04
.035
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 4570 ex24
.04
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta


ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 4518 ex23 - fence
.03
.035
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 4392 ex22
.035
.03
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 4204 ex21
.035
.03
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 3933 ex20
.035
.03
.035
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 3706 ex19 - Green for hole #16
.035
.03
.035
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 3375 ex18
.035
.03
.035
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 3232 ex17
.035
.03
.035
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 3063 ex16
.035
.03
.035
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


ExistingGRdata from detailed mapping
Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 2821 ex15
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Ineff
Bank Sta
ExistingGRdata from detailed mapping
Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 2643 ex14 - U/S of Park Place
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Ground
Bank Sta
ExistingGRdata from detailed mapping
Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 2601 Park Place @ U/S face
.035
.02
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
ExistingGRdata from detailed mapping
Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 2600 Culv Park Place
.035
.02
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta


ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 2600 Culv Park Place
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Levee
Bank Sta
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 2555 Park Place @ D/S face
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Levee
Bank Sta
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 2454 ex11 - D/S of Park Place
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Ground
Bank Sta
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 2310 ex10
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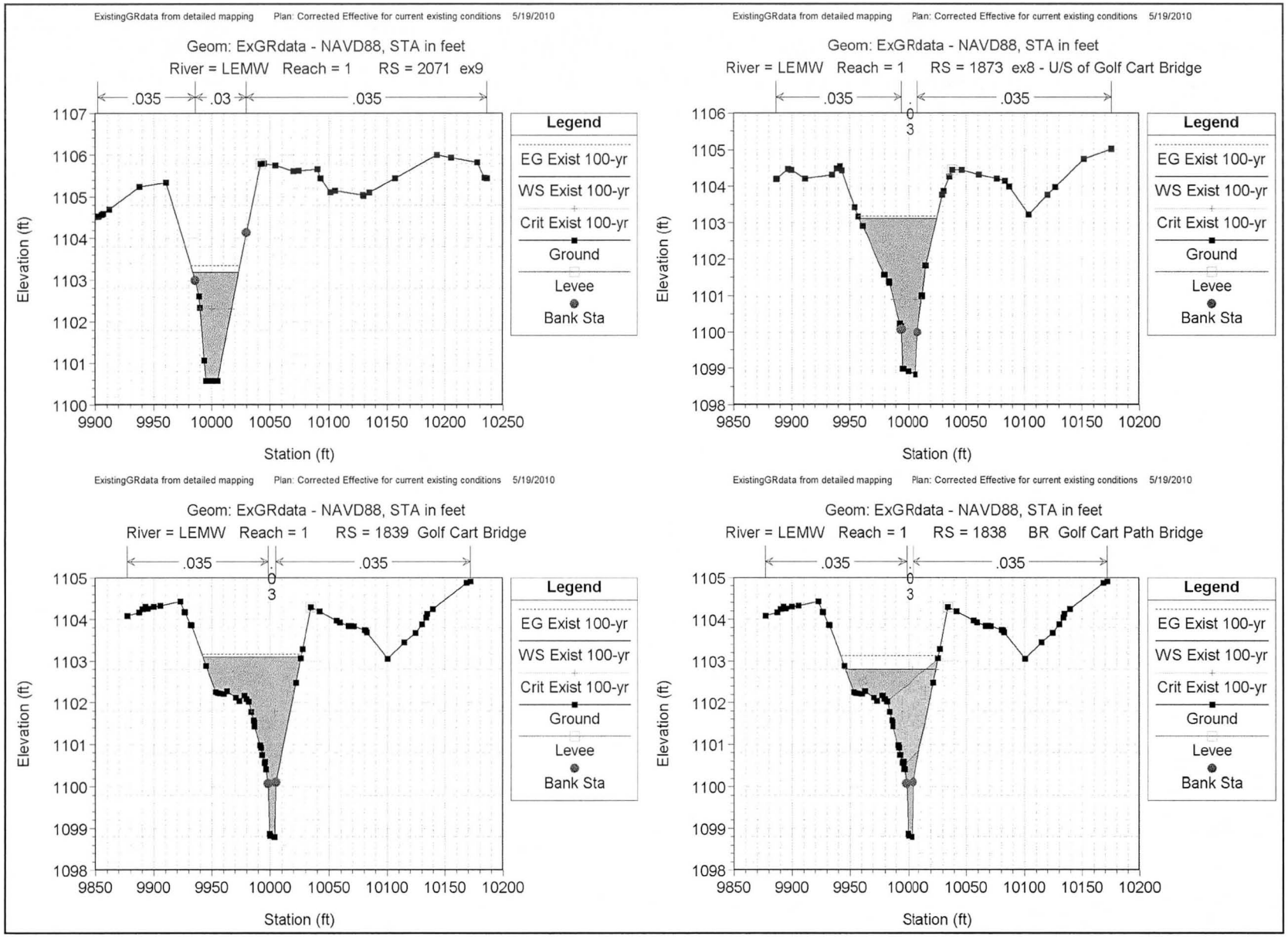
.03
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Ground
Bank Sta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.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Levee
Bank Sta
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 1873 ex8 - U/S of Golf Cart Bridge
.035
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Levee
Bank Sta
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 1839 Golf Cart Bridge
.035
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Levee
Bank Sta
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 1838 BR Golf Cart Path Bridge
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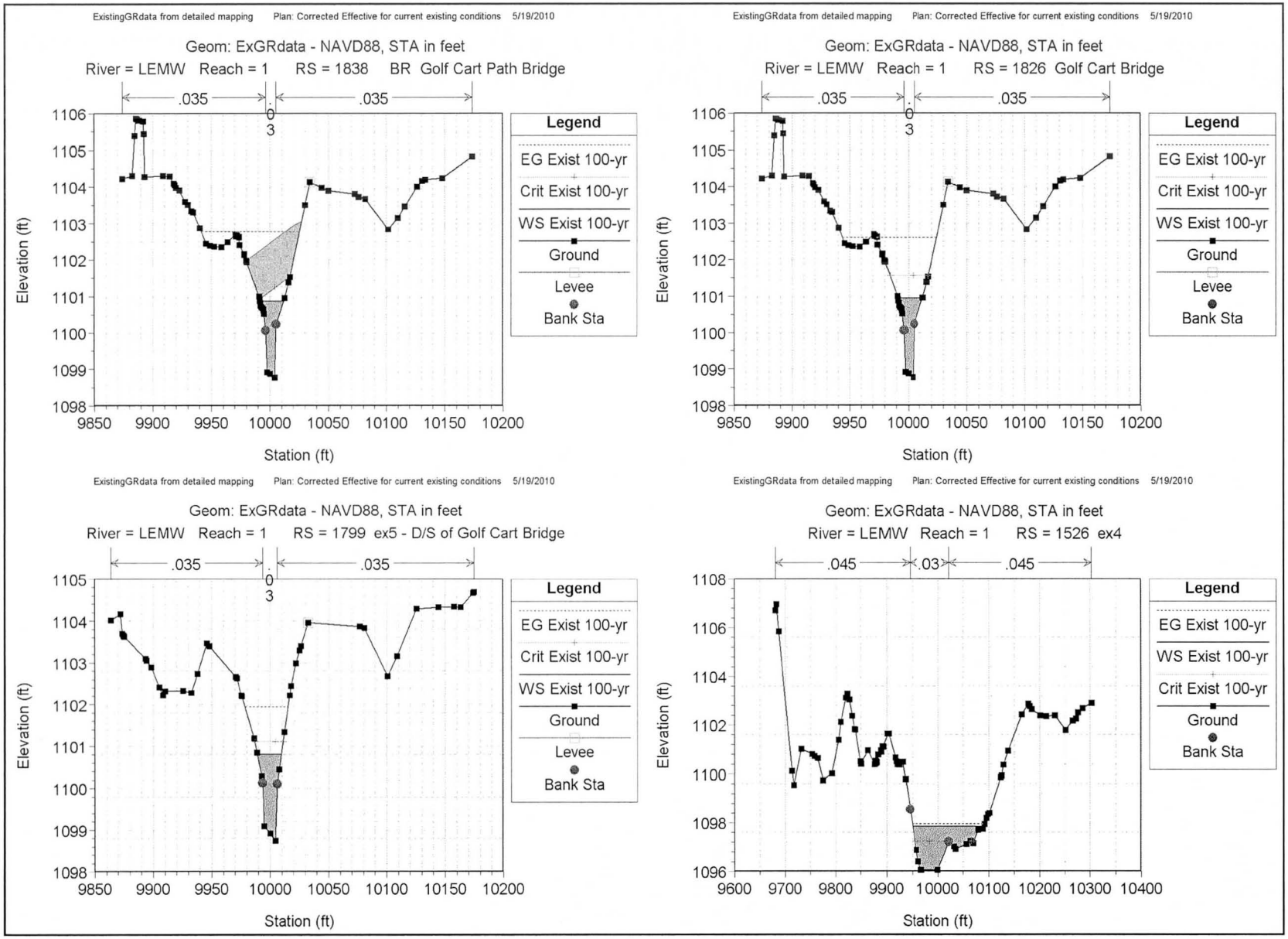
.035
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Levee
Bank Sta


ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 1838 BR Golf Cart Path Bridge
.035
.035
.03
Legend
EG Exist 100-yr
Crit Exist 100-yr
WS Exist 100-yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 1826 Golf Cart Bridge
.035
.035
.03
Legend
EG Exist 100-yr
Crit Exist 100-yr
WS Exist 100-yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 1799 ex5 - D/S of Golf Cart Bridge
.035
.035
.03
Legend
EG Exist 100-yr
Crit Exist 100-yr
WS Exist 100-yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 1526 ex4
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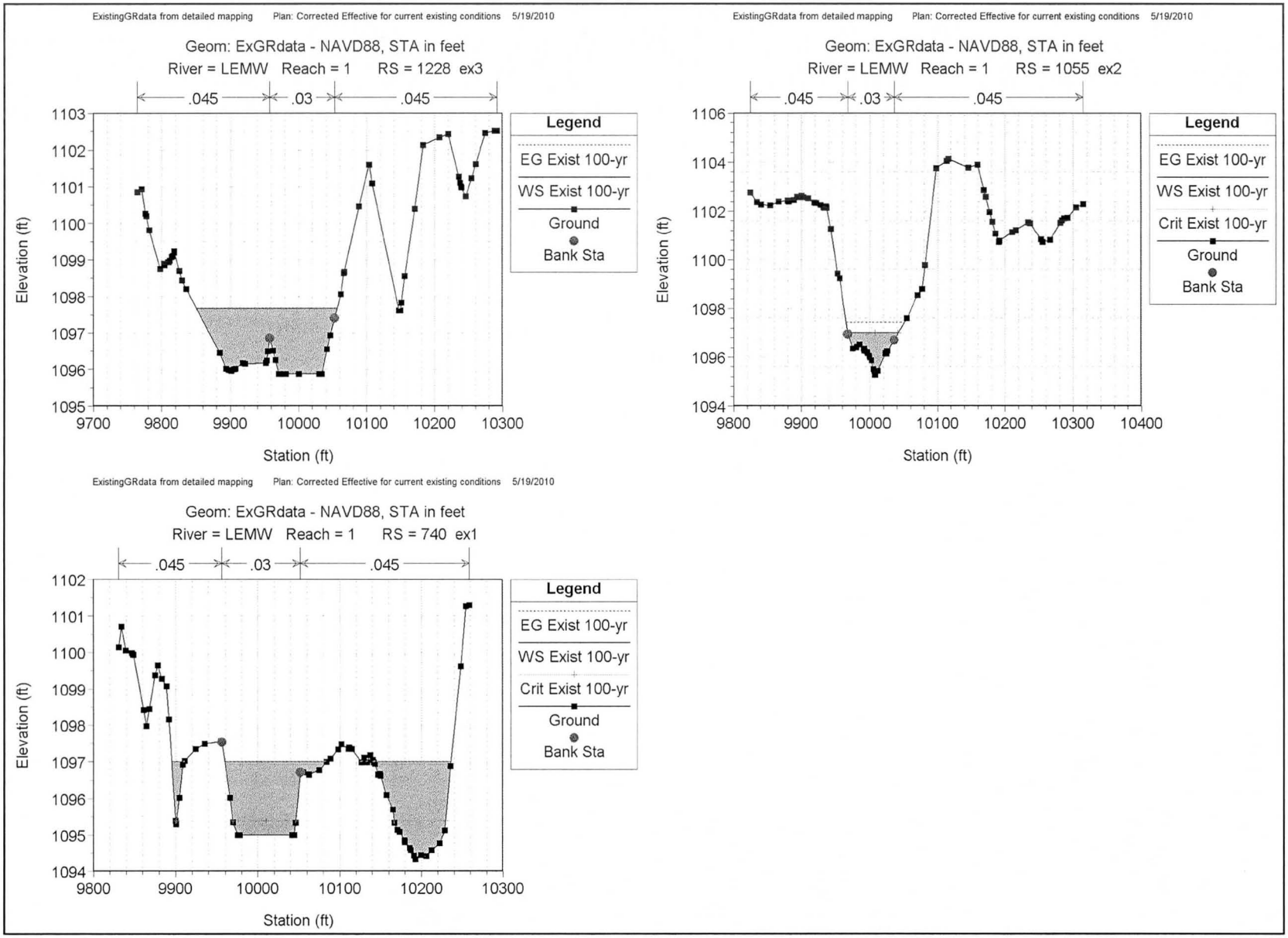
.03
.045
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
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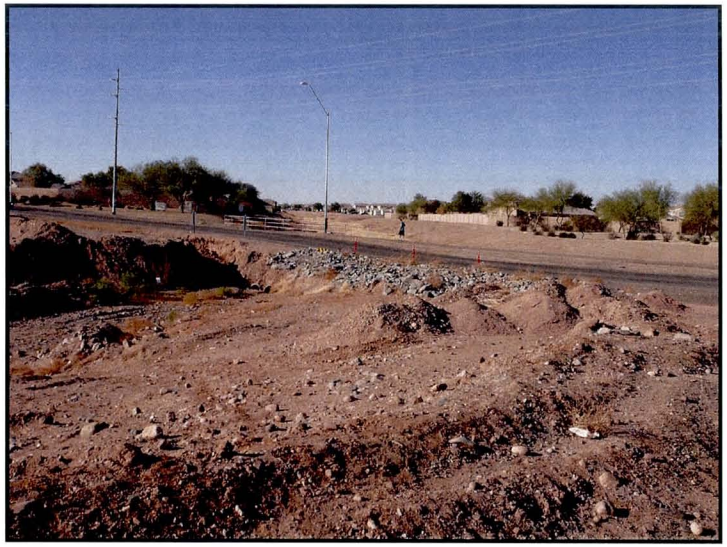
.03
.045
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Ground
Bank Sta
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 1055 ex2
.045
.03
.045
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta
ExistingGRdata from detailed mapping Plan: Corrected Effective for current existing conditions 5/19/2010
Geom: ExGRdata - NAVD88, STA in feet
River = LEMW Reach = 1 RS = 740 ex1
.045
.03
.045
Elevation (ft)
Station (ft)
Legend
EG Exist 100-yr
WS Exist 100-yr
Crit Exist 100-yr
Ground
Bank Sta

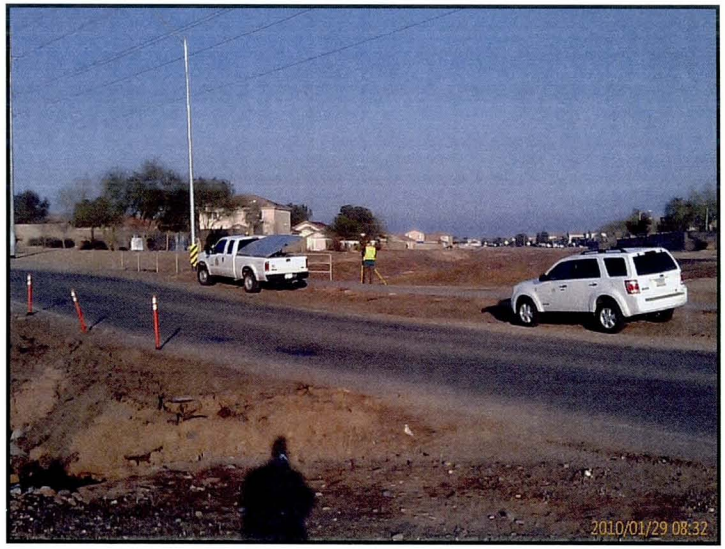
Appendix E3

Pictures of existing structures

Digital data is provided in Appendix G.



Lower El Mirage Wash at Cactus Road – looking NW across dip section (December 23, 2009).



Lower El Mirage Wash at Cactus Road – looking NW across dip section (January 29, 2010).

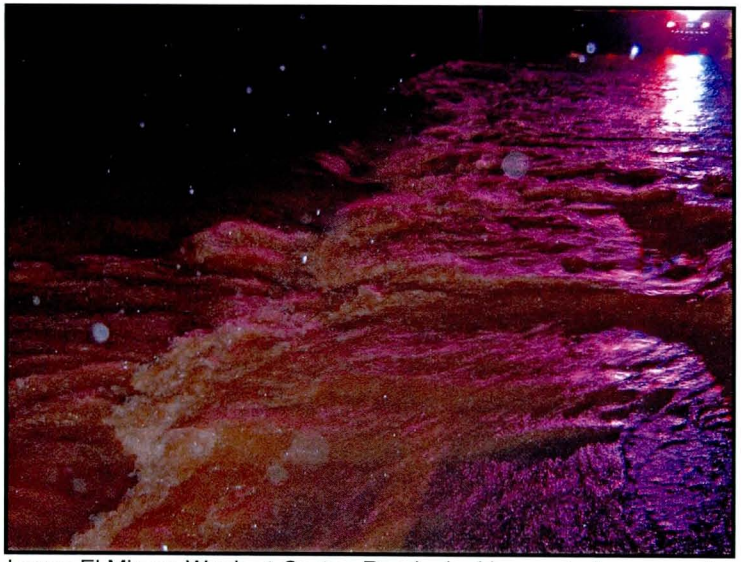
Lower El Mirage Wash at Cactus Road – looking downstream at 3-24" pipes (January 29, 2010).

Lower El Mirage Wash at Cactus Road – looking westerly across dip section and at downstream embankment (January 29, 2010).

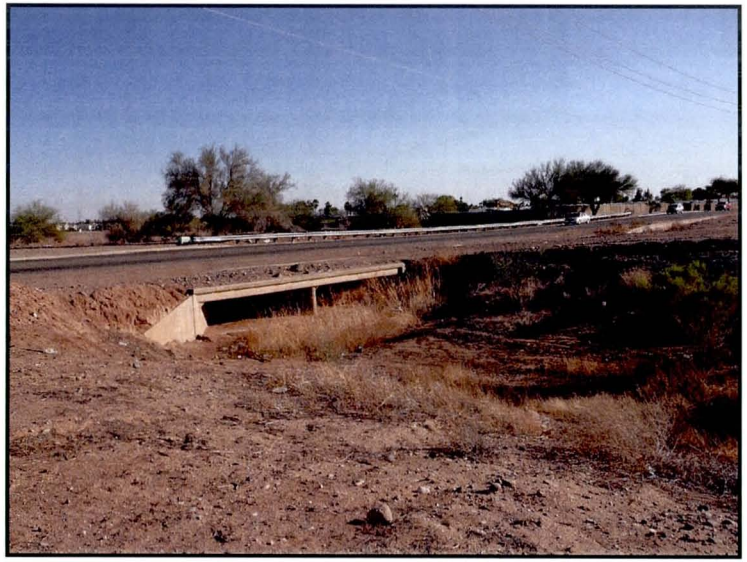
Lower El Mirage Wash at Cactus Road – looking at 3-24" pipe outlet (December 23, 2009).

Lower El Mirage Wash at Cactus Road – looking upstream (northwest) from dip section (January 20, 2010).

Lower El Mirage Wash at Cactus Road – looking easterly across dip section (January 20, 2010).



Lower El Mirage Wash at Cactus Road – looking easterly across dip section at northern roadway edge (January 20, 2010).



Lower El Mirage Wash at El Mirage Road – looking southeasterly at 2-10'x3' box culvert and across dip section (December 23, 2009).

Lower El Mirage Wash at El Mirage Road – looking southeasterly at dip section, which is lower than surrounding grading (December 23, 2009).

Lower El Mirage Wash at El Mirage Road – looking south at outlet (December 23, 2009).

Lower El Mirage Wash, east of El Mirage Rd – looking easterly at Pueblo El Mirage fence across the wash (December 23, 2009).

Lower El Mirage Wash at El Mirage Road – looking NW (upstresm) across dip section (January 29, 2010).

Lower El Mirage Wash, east of El Mirage Rd – looking easterly at Pueblo El Mirage fence across the wash (January 29, 2010).

Lower El Mirage Wash, east of El Mirage Rd – looking SW at southern Pueblo El Mirage fence corner (January 29, 2010).

Lower El Mirage Wash, east of El Mirage Rd – looking SW at northern Pueblo El Mirage fence corner (January 29, 2010).

Lower El Mirage Wash at Park Place – looking downstresm at 4-10'x3' box inlet. Outer two cells are mostly blocked (December 23, 2009).

Lower El Mirage Wash at Park Place – looking upstream of Park Place (December 23, 2009).

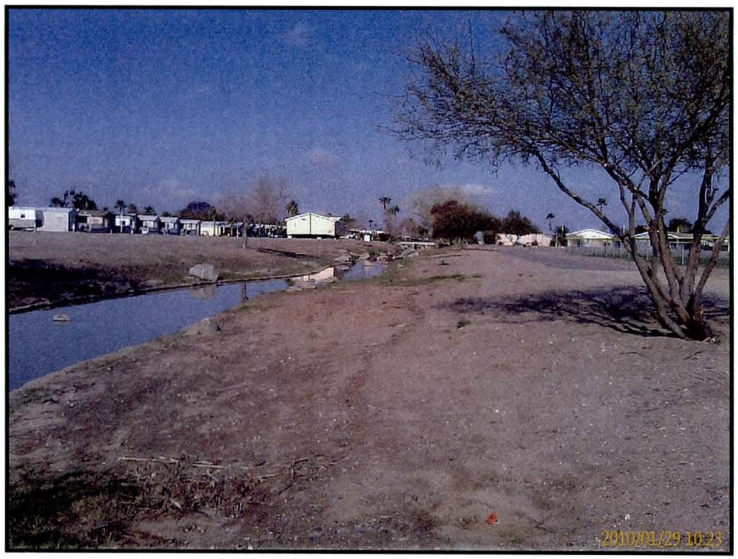
Lower El Mirage Wash at Park Place – looking upstresm at D/S face of 4-10'x3' box. Outer two cells are mostly blocked. (December 23, 2009).

Note: During the January 29, 2010 site visit, the golf course maintenance manager was contacted. The golf cource recirculates water from the southern ponds to the north. It was stated that the maximum pumping rate of the recirculation system 500,000 gpd (0.3 cfs). The recirculation rate is usually split between two or three distribution pipes.

Lower El Mirage Wash, at Golf Cart Bridge – looking SE left bank overflow area across the tee and high water debris (January 29, 2010).

Lower El Mirage Wash at Golf Cart Bridge – looking SE (downstream) at the path and bridge (January 29, 2010).

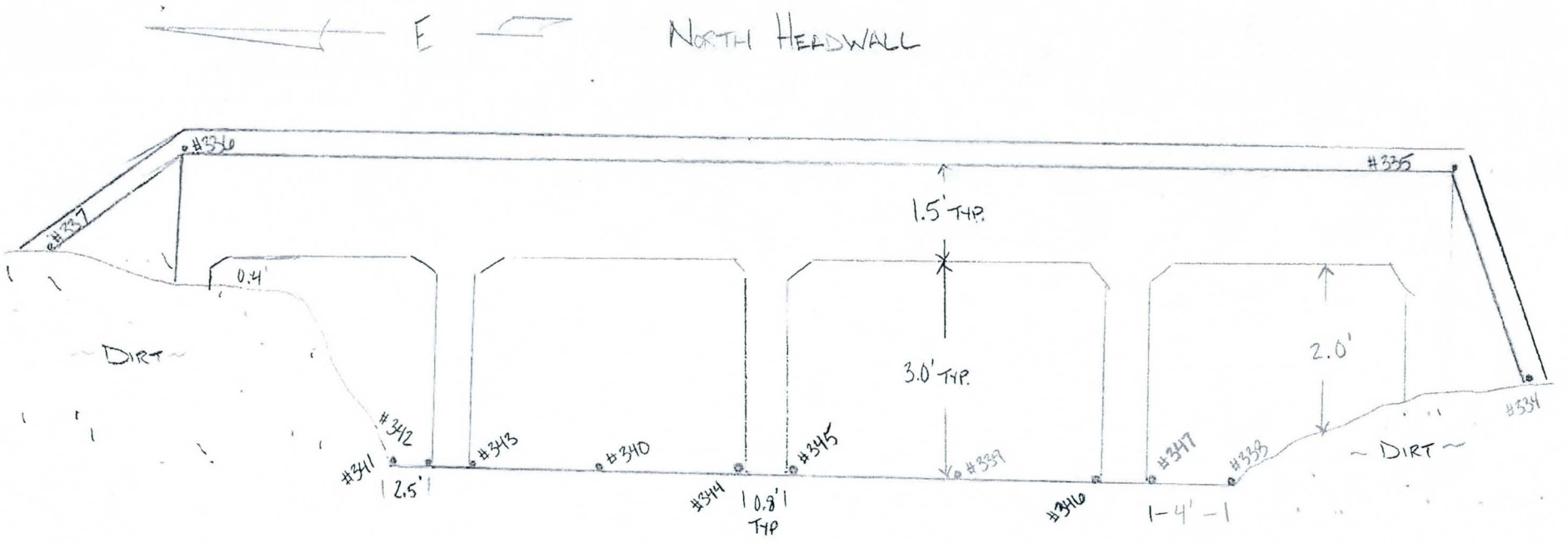
Lower El Mirage Wash at Golf Cart Bridge – looking SE (downstream) at bridge. Water is negligible flow due to recirculation (Jan 29, 2010).

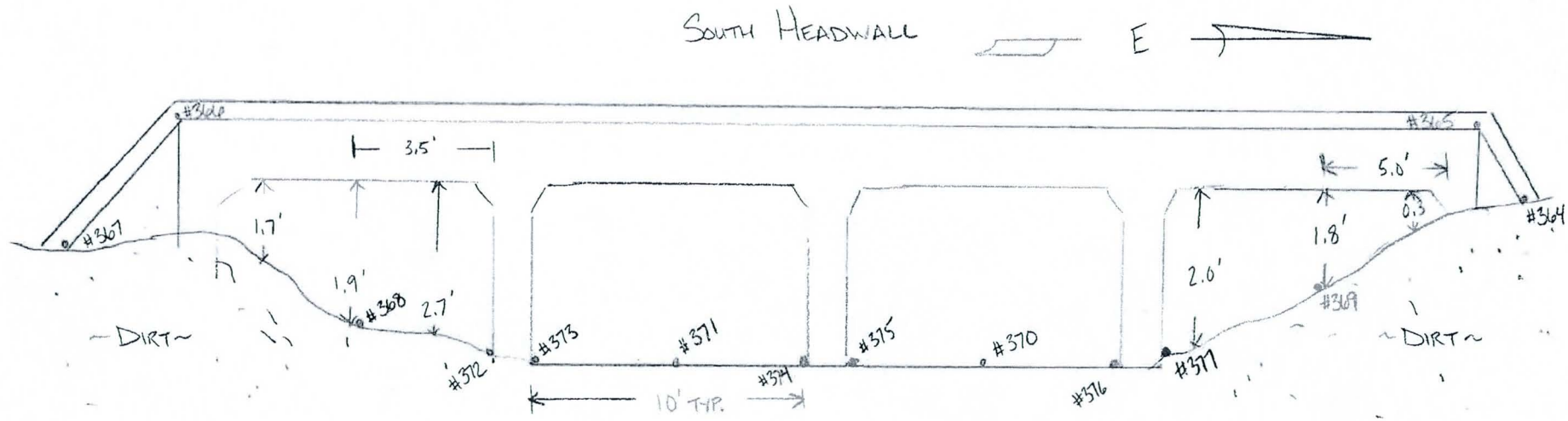


Lower El Mirage Wash at Golf Cart Bridge – looking northwesterly (upstream) from left bank at high water debris (January 29, 2010).

DATE: 2/2/10

PARK PLACE

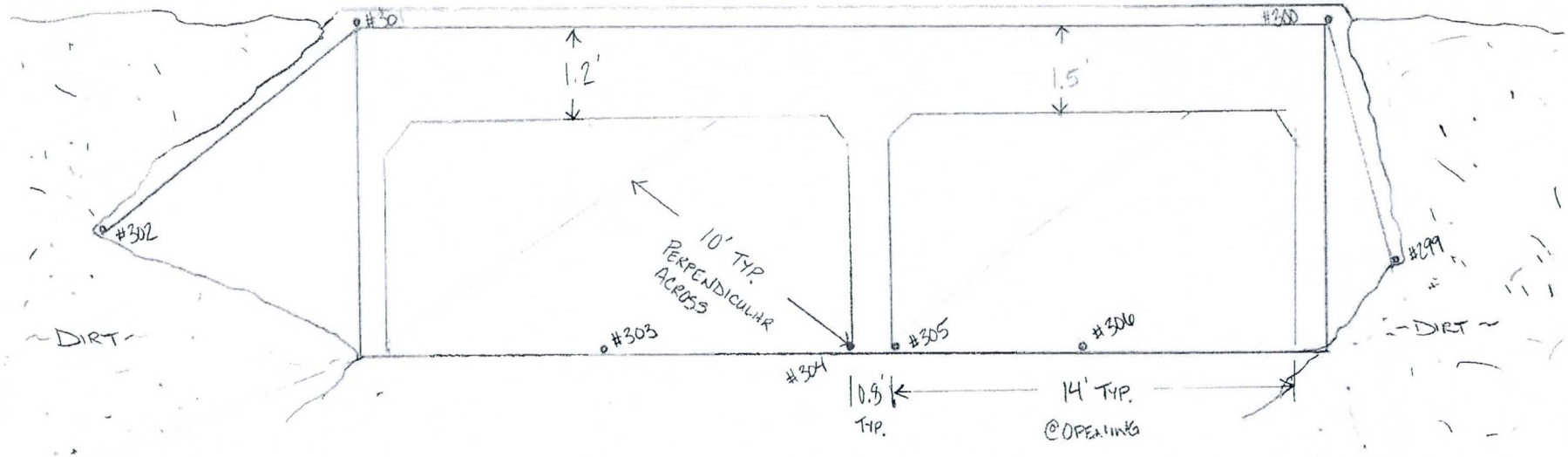




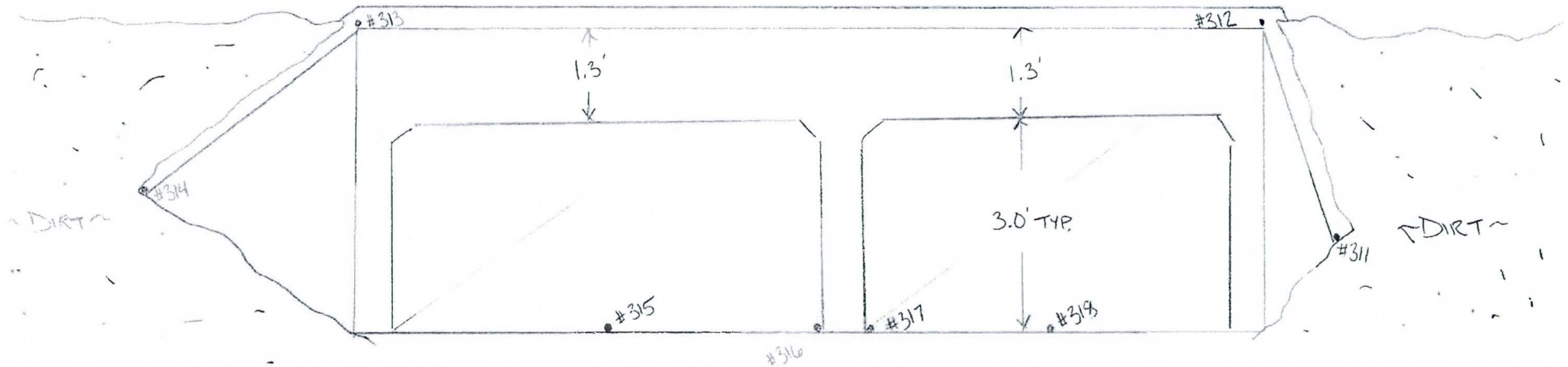
DATE: 2/1/10

EL MIRAGE RD

EAST HEADWALL

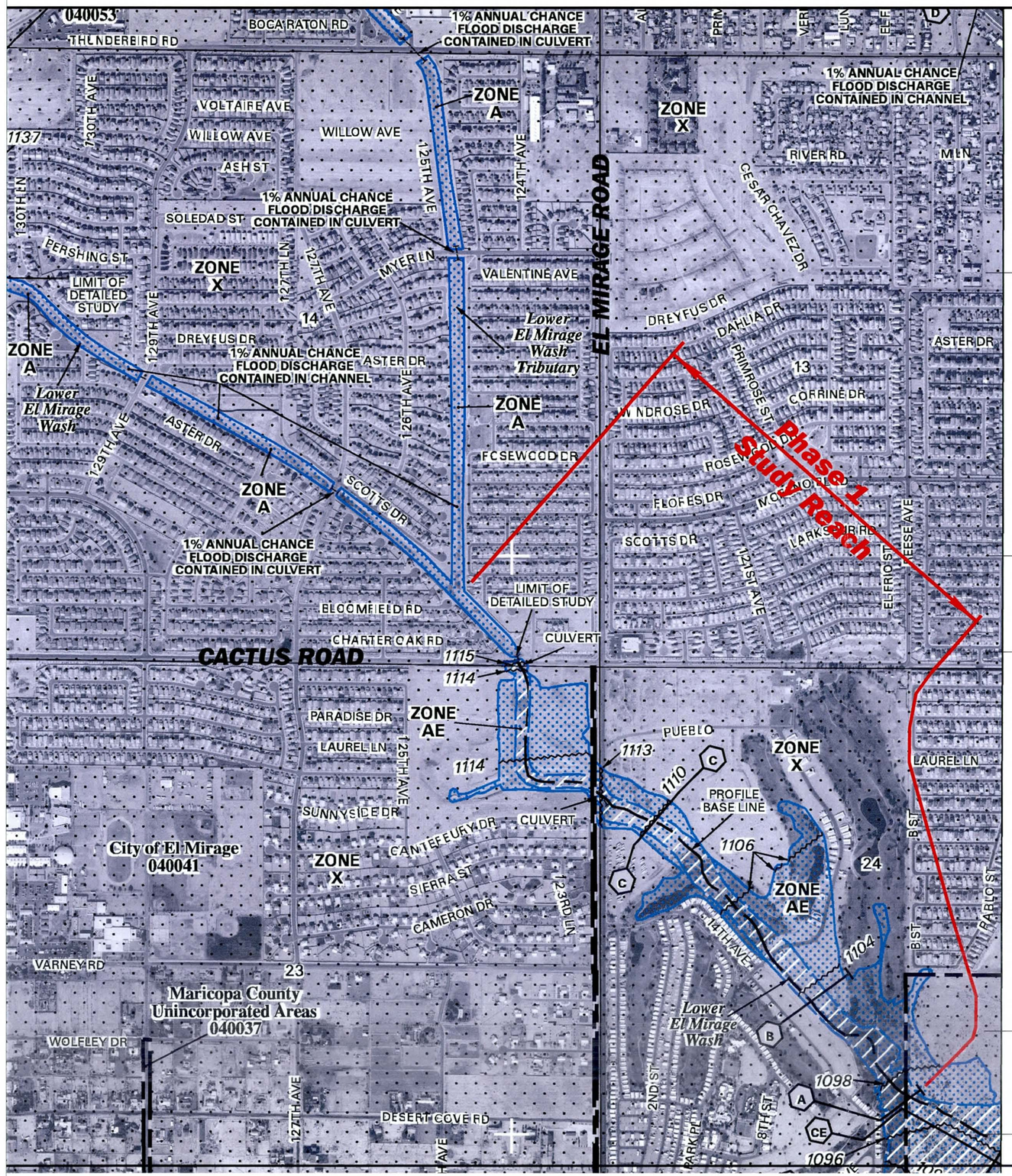


WEST HEADWALL



APPENDIX F

Project Exhibits



MAP SCALE 1" = 1000'

0 1000 2000 FEET

0 300 600 METERS

NFIP

PANEL 1605J

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 1605 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL MIRAGE, CITY OF	040041	1605	J
GLENDALE, CITY OF	040045	1605	J
MARICOPA COUNTY	040037	1605	J
SURPRISE, CITY OF	040053	1605	J

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1605J
MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

VERTICAL DATUM: ***NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29)***

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER EL MIRAGE WASH DCR

Phase 1
Analysis and Recommendations
FCD 2008C014 WA #2

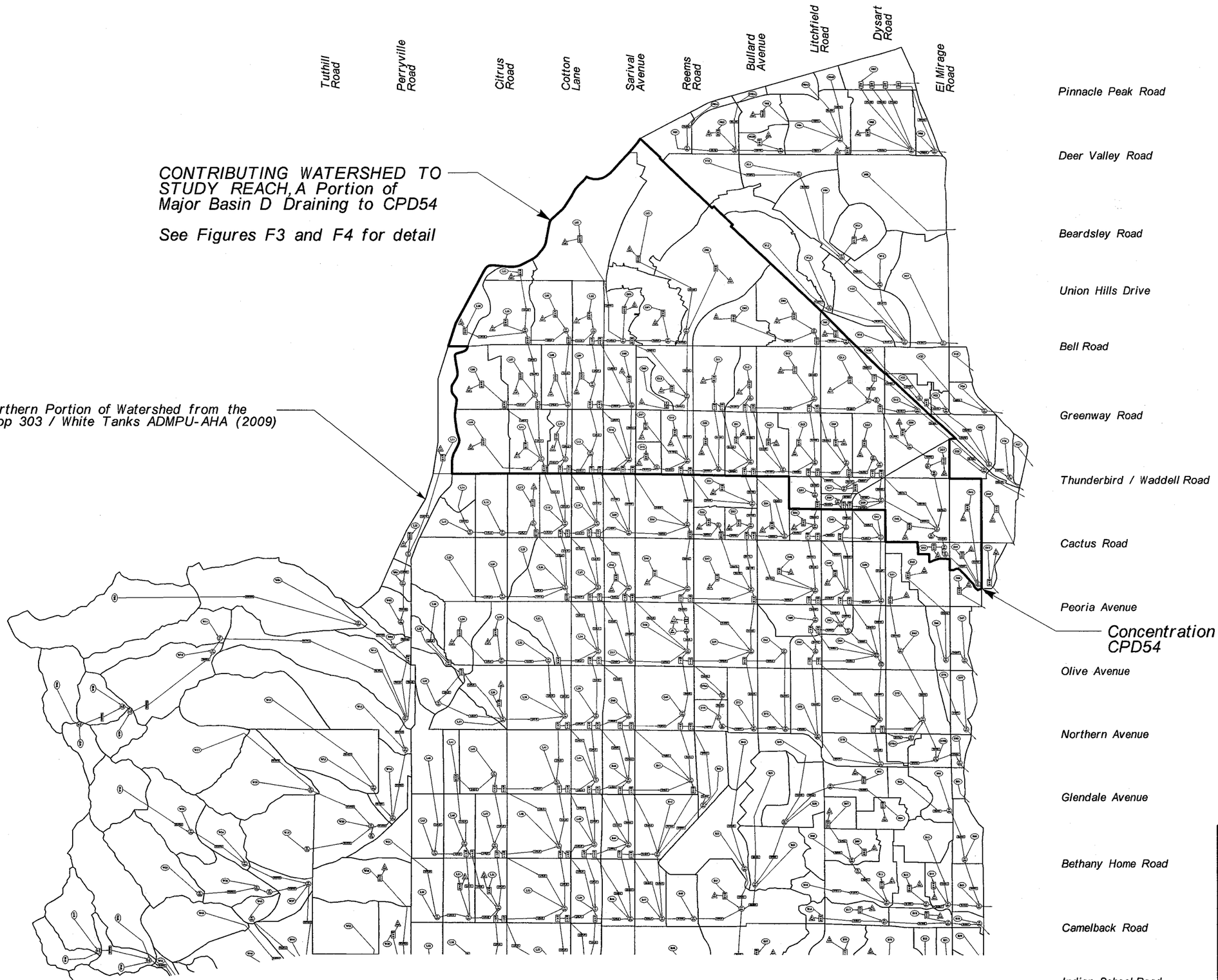
AZTEC
TYPSA Group www.typsa.es www.aztec.us
4561 E. McDowell Road
Phoenix, AZ 85008-4505
Tel (602) 454-0402
Fax (602) 454-0403

EXHIBIT F1

PORTION OF FEMA FIRM PANEL
04013C1605J

	BY	DATE
DESIGNED	D.Phelps	5/20/10
DRAWN	K.Leahy	5/20/10
CHECKED	T.Bokich	5/20/10

R:\Phoenix\Projects\AZE0913 FCD On-Call\02 LowerElMirageWashDCR\CADD\Sheets\Exhibits\Drainage\Exhibit F1.dgn



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER EL MIRAGE WASH DCR

Phase 1
Analysis and Recommendations
FCD 2008C014 WA #2

AZTEC
TYPSA Group www.typsa.es
www.aztec.us
4581 E. McDowell Road
Phoenix, AZ 85008-4505
Tel (602) 454-0402
Fax (602) 454-0403

EXHIBIT F2

NORTHERN PORTION OF HEC-1 ROUTING DIAGRAM FROM THE LOOP 303 / WHITE TANKS ADMPU-AHA (2009)

	BY	DATE
DESIGNED	D.Phelps	5/20/10
DRAWN	K.Leahy	5/25/10
CHECKED	T.Bokich	5/25/10

R:\Phoenix\Projects\AZE0913_FCD_On-Call\02_LowerElMirageWashDCR\CADD\Sheets\Exhibits\Drainage\Exhibit_F2.dgn

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER EL MIRAGE WASH DCR
Phase 1
Analysis and Recommendations
FCD 2008C014 WA #2

Sarival Avenue
Reems Road
Grand Avenue (US 60)
Deer Valley Road
Perryville Road
Citrus Road
Cotton Lane
Bullard Avenue
Beardsley Road
Litchfield Road
Union Hills Drive
Dysart Road
Bell Road
El Mirage Road
Greenway Road
Thunderbird / Waddell Road
Cactus Road
Peoria Avenue

CONTRIBUTING WATERSHED TO STUDY REACH, A Portion of Major Basin D Draining to CPD54

Existing Condition Without CIP
HEC-1 filename = "WT1E01a."*

LEGEND

- D04 — Sub Basin Label
- D12D13 — Hydrograph Route Label
- Hydrograph Route Direction
- DD 25 RE — Diversion Label
- R D13 — Retention Label
- SR D53 — Storage Route Label
- CP D13 — Concentration Point Label
- Sub Basin Boundary

N

1000 0 1000 2000
Scale in Feet

AZTEC
TYPSA Group www.typsa.es
4561 E. McDowell Road
Phoenix, AZ 85008-6505
Tel (602) 454-0402
Fax (602) 454-0403

EXHIBIT F3
NORTHERN PORTION OF HEC-1 ROUTING DIAGRAM
LOOP 303 / WHITE TANKS ADMPU-AHA (2009)
EXISTING CONDITION WITHOUT CIP

	BY	DATE
DESIGNED	D.Phelps	5/20/10
DRAWN	K.Leahy	5/25/10
CHECKED	T.Bokich	5/25/10

R:\Phoenix\Projects\AZE0913_FCD_On-Call\02_LowerElMirageWashDCR\CADD\Sheets\Exhibits\Drainage\Exhibit_F3.dgn

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER EL MIRAGE WASH DCR
Phase 1
Analysis and Recommendations
FCD 2008C014 WA #2

Sarival Avenue
Reems Road
Grand Avenue (US 60)
Deer Valley Road
Perryville Road
Citrus Road
Cotton Lane
Bullard Avenue
Beardsley Road
Litchfield Road
Union Hills Drive
Dysart Road
Bell Road
El Mirage Road
Greenway Road
Thunderbird / Waddell Road
Cactus Road
Peoria Avenue

CONTRIBUTING WATERSHED TO STUDY REACH, A Portion of Major Basin D Draining to CPD54

Existing Condition With CIP
HEC-1 filename = "WT1EC01a."*

LEGEND

- D04 — Sub Basin Label
- D12D13 — Hydrograph Route Label
- Hydrograph Route Direction
- DD 25 RE — Diversion Label
- R D13 — Retention Label
- SR D53 — Storage Route Label
- CP D13 — Concentration Point Label
- Sub Basin Boundary

N

1000 0 1000 2000
Scale in Feet

AZTEC
TYPSA Group www.typsa.es
4561 E. McDowell Road
Phoenix, AZ 85008-4505
Tel (602) 454-0402
Fax (602) 454-0403

EXHIBIT F4
NORTHERN PORTION OF HEC-1 ROUTING DIAGRAM
LOOP 303 / WHITE TANKS ADMPU-AHA (2009)
EXISTING CONDITION WITH CIP

	BY	DATE
DESIGNED	D.Phelps	5/20/10
DRAWN	K.Leahy	5/25/10
CHECKED	T.Bokich	5/25/10

R:\Phoenix\Projects\AZE0913_FCD_On-Call\02_LowerElMirageWashDCR\CADD\Sheets\Exhibits\Drainage\Exhibit_F4.dgn

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER EL MIRAGE WASH DCR

Phase 1
Analysis and Recommendations
FCD 2008C014 WA #2

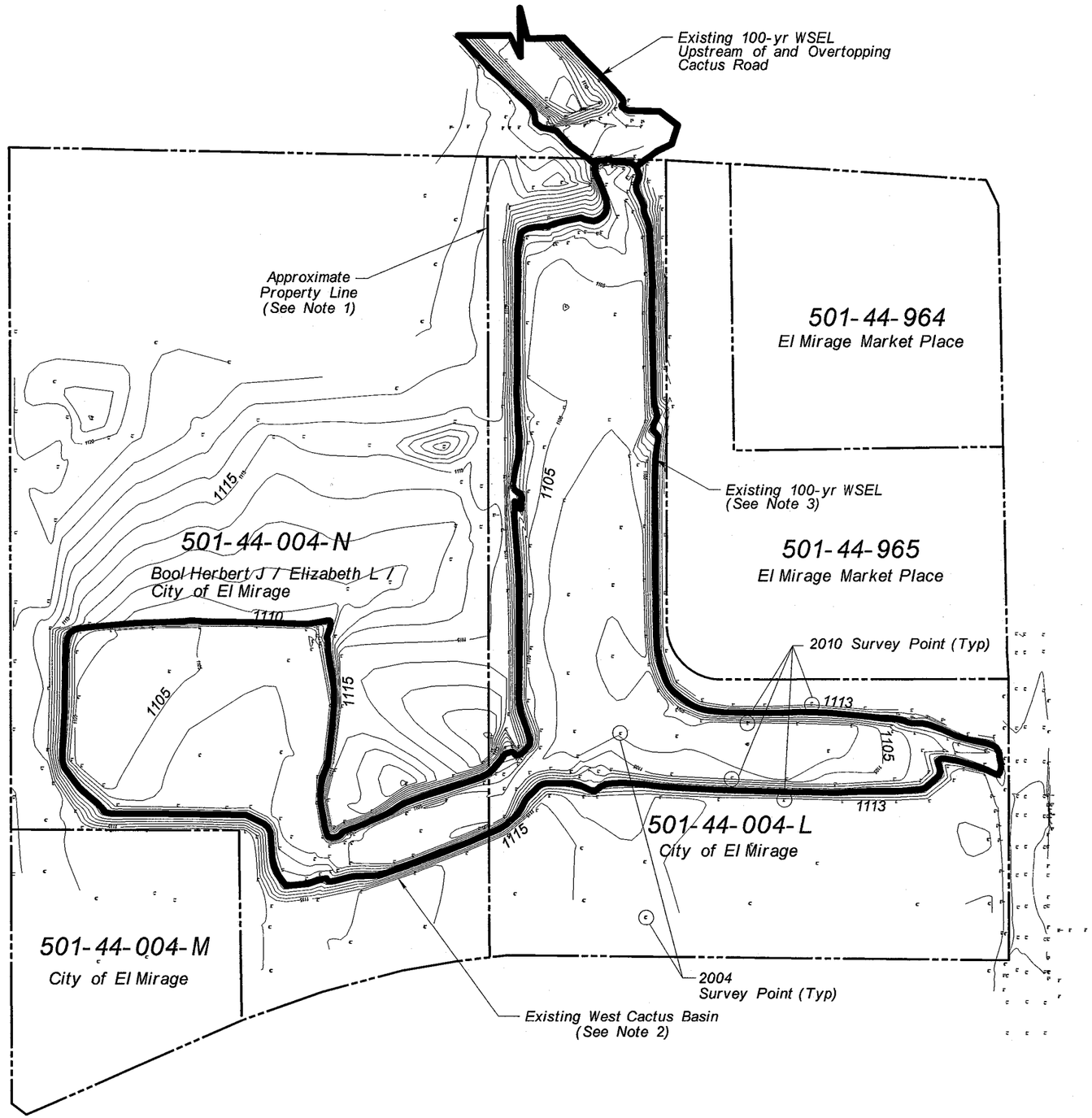


Exhibit Notes:

1. *Property boundaries shown are approximate.*

2. *Existing contours generated from surface model produced by AZTEC @ 1-ft CI*
   Survey data used to create surface:
   - *2010 FCDMC points at top and bottom toe of basin, converted to NGVD29.*
   - *2004 Stanley points were used to further define the interior of the basin bottom and the perimeter grades.*
   - *Vertical datum = NGVD29*

3. *The modified Existing Condition without CIP ADMPU-AHA (2009) HEC-1 model operation is:*
   Inflow = 480 cfs
   Outflow = 200 cfs
   Peak Stage = 1109.75 (NGVD29)

N

50 0 50 100
Scale in Feet

AZTEC
TYPSA Group www.typsa.es
www.aztec.us
4561 E. McDowell Road
Phoenix, AZ 85008-4505
Tel (602) 454-0402
Fax (602) 454-0403

EXHIBIT F5
WEST CACTUS BASIN
EXISTING SURFACE

	BY	DATE
DESIGNED	D.Phelps	5/20/10
DRAWN	K.Leahy	5/25/10
CHECKED	T.Bokich	5/25/10

R:\Phoenix\Projects\AZE0913_FCD_On-Call\02_LowerElMirageWashDCR\CADD\Sheets\Exhibits\Drainage\Exhibit_F5.dgn

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER EL MIRAGE WASH DCR

Phase 1
Analysis and Recommendations
FCD 2008C014 WA #2

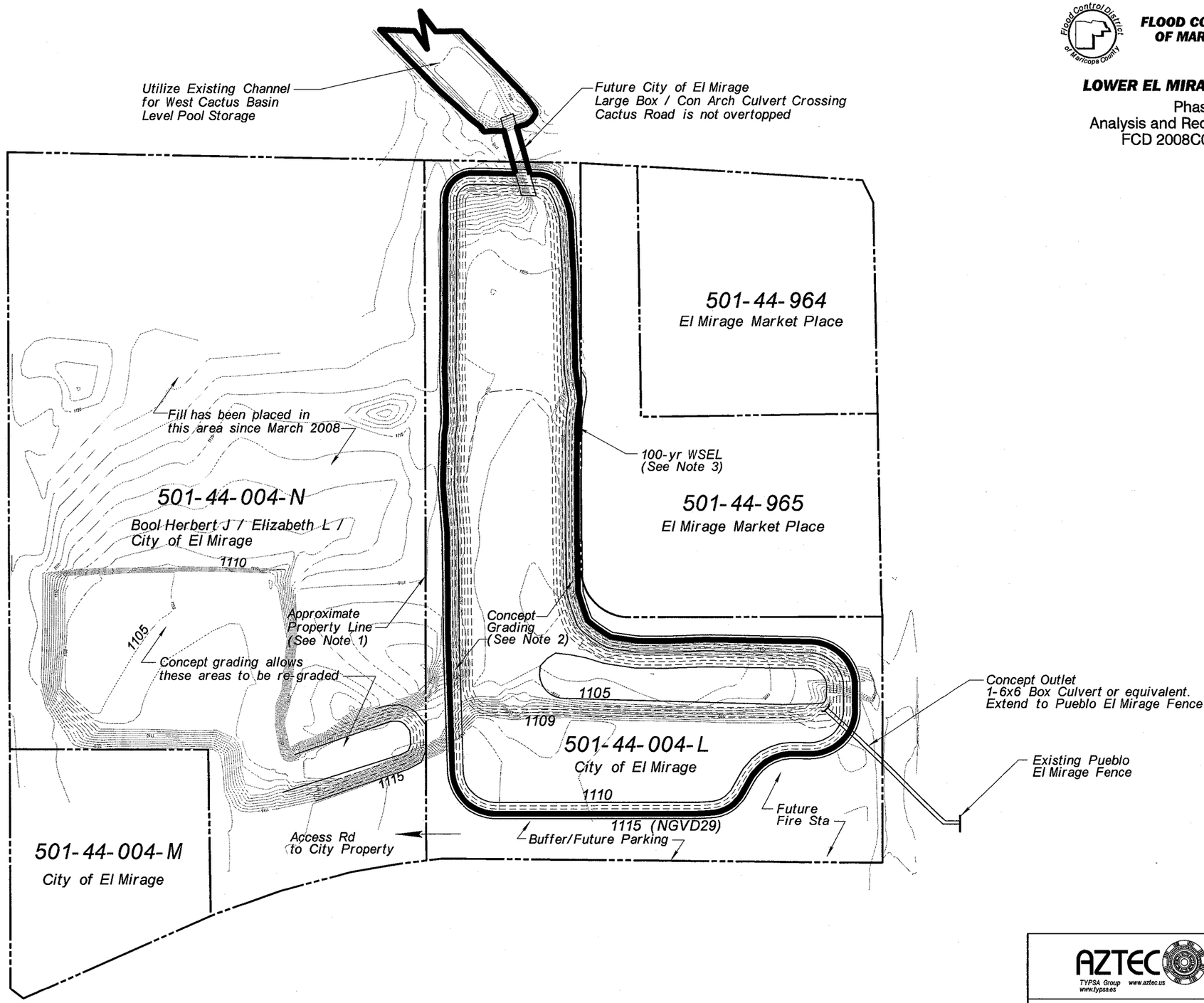


Exhibit Notes:

1. *Property boundaries shown are approximate.*

2. *Preliminary concept grading contours (NGVD29). Concept grading provided to illustrate proposed concept. City desires basin improvements remain on Parcel 801-44-004-L.*

3. *Based on concept grading shown, the modified Existing Condition with CIP ADMPU-AHA (2009) HEC-1 model operation is:*
   Inflow = 640 cfs
   Outflow = 230 cfs
   Peak Stage = 1113.5 ft (NGVD 29)

4. *Vertical Datum of Detailed Mapping is NAVD88. Mapping Contours shown (2-ft CI) were intended to be used during Phase 2. The mapping became available near the end of Phase 1 and is provided here to illustrate a potential concept. Flight date = March 22, 2008.*

AZTEC
TYPSA Group www.typsa.es
www.aztec.us
4561 E. McDowell Road
Phoenix, AZ 85008-4505
Tel (602) 454-0402
Fax (602) 454-0403

EXHIBIT F6
WEST CACTUS BASIN
PRELIMINARY CONCEPT GRADING

	BY	DATE
DESIGNED	D.Phelps	5/20/10
DRAWN	K.Leahy	5/25/10
CHECKED	T.Bokich	5/25/10

R:\Phoenix\Projects\AZE0913 FCD On-Call\02 LowerElMirageWashDCR\CADD\Sheets\Exhibits\Drainage\Exhibit F6.dgn

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER EL MIRAGE WASH DCR

Phase 1
Analysis and Recommendations
FCD 2008C014 WA #2

N. Park Place

Pad Elev 1107.48

Pad Elev 1107.23

Pad Elev 1107.34

Pad Elev 1196.97 FF @ 8.37

Pad Elev 1106.60 FF @ 8.75

Pad Elev 1106.26 FF @ 6.36

Pad Elev 1107.78 FF @ 7.98

Pad Elev 1108.29 FF @ 11.19

Pad Elev 1106.88 FF @ 9.78

1

2

3

4

0.485

0.386

FEMA Section B

Survey Point (Typ)

Golf Cart Path (Approx Location)

Golf Cart Path Bridge

1106.5

1105.2

1107.3

1104.2

1104.8

1104.5

1104.0

1105.3

1105.0

1100

20 0 20 40
Scale in Feet

AZTEC
TYPSA Group www.typsa.es
www.aztec.us
4561 E. McDowell Road
Phoenix, AZ 85008-4505
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EXHIBIT F7

LOWER EL MIRAGE WASH WORK MAP
EXISTING PARK PLACE CULVERT AND
GOLF CART PATH BRIDGE

	BY	DATE
DESIGNED	D.Phelps	5/20/10
DRAWN	K.Leahy	5/20/10
CHECKED	T.Bokich	5/20/10

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APPENDIX G

Digital Data