



**EAST MESA AREA DRAINAGE
MASTER PLAN UPDATE**

**DATA COLLECTION
AND ANALYSIS
VOLUME DC**

Contract FCD 2011C017

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EAST MESA AREA DRAINAGE MASTER PLAN UPDATE

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DATA COLLECTION AND ANALYSIS

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EAST MESA AREA DRAINAGE MASTER PLAN UPDATE

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SECTION DC-1: INTRODUCTION

This report was prepared as part of the East Mesa Area Drainage Master Plan (ADMP) Update project and presents updated and additional information developed since the *2011 East Mesa Area Drainage Master Plan Hydrology Update (Hydrology Update)* (Reference 5), which was prepared by the Flood Control District of Maricopa County (District) and included a comprehensive data collection effort.

1.1 PROJECT AUTHORIZATION AND PURPOSE

The East Mesa ADMP Update was initiated to develop and recommend context-sensitive and cost-effective strategies to reduce flood hazards and protect public safety in a 58-square-mile portion of southeastern Maricopa County. Entellus, Inc., was retained under Contract FCD 2011C017 to update the previous 1998 ADMP (*1998 ADMP*) prepared by others (Reference 234).

1.2 STUDY AREA

As shown in Figure 1.1, the study area is bounded on the west by the East Maricopa Floodway (EMF), on the north by Elliot Road, on the east by the Powerline, Vineyard Road, and Rittenhouse Flood Retarding Structures (PVR Structures), and on the south by the Rittenhouse Channel and Ocotillo Road.

As shown in Figure 1.2, the study area includes portions of Mesa, Queen Creek, Gilbert, and unincorporated areas of Maricopa and Pinal Counties.

The study area includes a mix of residential, industrial and agricultural development. Limited undeveloped desert land remains within the Maricopa County portion of the study area. Conversely, most of the area within Pinal County is undeveloped.

Portions of the study area are experiencing rapid changes in growth, with agricultural and industrial uses being converted to residential and commercial developments. The most significant is the conversion of the GM Desert Proving Grounds to master-planned communities.

1.3 PROJECT GOALS

The goals of this project are to update the *1998 ADMP* and develop recommendations that would provide an adequate regional drainage system that maximizes the use of existing infrastructure.

The northern portion of the original 1998 ADMP study area (north of Elliot Road) was excluded from this update because the recommended improvements have been constructed and there are no apparent regional drainage issues remaining. This study focuses on areas south of Elliot Road where significant changes to the watershed are occurring. Physical changes include the first phase of the new SR-24 (Gateway Freeway), currently under construction between SR-202 and Ellsworth Road. Its second phase is under design and will extend the freeway to Ironwood Road. The new freeway will intercept a substantial amount of runoff and alter drainage patterns in the study area.

Another change is the publication of *NOAA Atlas 14 - Precipitation-Frequency Atlas of the United States, Volume 1 Version 4.0: Semiarid Southwest (Arizona, Southeast California, Nevada, New Mexico, Utah)*, which supersedes *NOAA Atlas II* used in the development of the original hydrology. The net effect of *NOAA Atlas 14* is a decrease in runoff volume estimated for the 100-year, 2-hour storm. Most local jurisdictions use this document as the basis for retention/detention requirements for new development; therefore, future conditions assumed for the *1998 ADMP* must be modified accordingly.

Finally, the *1998 ADMP* included two regional detention basins to be located in Pinal County. Because the District prefers to locate infrastructure within Maricopa County where practicable, the location of these basins will be revisited.

1.4 PREVIOUS STUDIES

Since the *1998 ADMP*, the District completed the *Hydrology Update* for the study area that generated a new runoff model using the latest information available for the watershed, including planned future improvements. This hydrologic model is being used as the basis for the development of solutions for the project area. The hydrologic update also evaluated the effect of the new peak discharges on existing infrastructure for both existing and future conditions. Based on the *Hydrology Update*, it appears that most of the existing infrastructure will not meet current District freeboard policies. Additionally, infrastructure may be overtopped by the 100-year peak discharges at some locations.

SECTION DC-2: FLOODING AND DRAINAGE ISSUES

2.1 KNOWN DRAINAGE PROBLEMS



Mountain Rd. north of Williams Field Rd.



Home near intersection of Mountain Rd. and Williams Field Rd.



Pecos Road near Signal Butte Road

The hydrologic models from the *Hydrology Update* revealed several system deficiencies along the three regional channels within the study area (Powerline Floodway, Ellsworth Channel, and Rittenhouse Channel) under existing and/or future conditions. The deficiencies ranged from minor freeboard shortages to predicted overtopping of short reaches of the channels. Another issue identified was the increase of runoff along Germann Road under future conditions. A more detailed discussion of deficiencies is provided in Section 3.

Additionally, drainage complaints were collected from the City of Mesa, the Town of Queen Creek, the Maricopa County Department of Transportation (MCDOT), and Maricopa County Department of Planning and Development. Most complaints are concentrated in two areas. The first is the Mountain/Erie neighborhood where the roads are frequently inundated during even minor storms. The second location is on and along Pecos Road where runoff ponds and floods the area.

The modeled deficiencies and public complaints are presented in Figure 2.1a - Drainage Issues, Figure 2.1b – Mountain / Erie Drainage Issues, and Table 2.1 – Drainage Issues.

East Mesa ADMP Update - Data Collection and Analysis Report
TABLE 2.1 - Drainage Issues

Map ID*	Description	Photo 1 (Included Electronically DC Report)	Photo 1 (Included Electronically DC Report)	Date	Source
1	Ellsworth Channel overtopping				Hydrology Update model, existing conditions
2	Ellsworth Channel freeboard deficiency (Future conditions)				Hydrology Update model, existing & future conditions
3	Erosion and fence damage at Pecos Road west of Ellsworth Road	Looking_E_on_North_Side_of_Pecos.JPG	Looking_East_standing_approx_125_ft_east_of_intersection.JPG	12/10/2007	City of Mesa complaints
4	City of Mesa PD roadway flooding at Pecos and Crismon from helicopter	Pecos_and_Crismon_1.JPG	Pecos_and_Crismon_2.JPG	1/21/2010	City of Mesa complaints
5	City of Mesa PD street flooding at Mountain Road from helicopter	Meridian_and_Pecos_1.JPG	Meridian_and_Pecos_2.JPG	1/21/2010	City of Mesa complaints
5	City of Mesa PD roadway flooding at Pecos Road & 222 Street from helicopter	10646_E_Pecos_1.JPG	10646_E_Pecos_2.JPG	1/21/2010	City of Mesa complaints
6	City of Mesa PD street flooding at Mountain Road from helicopter	Meridian_and_Pecos_1.JPG	Meridian_and_Pecos_2.JPG	1/21/2010	City of Mesa complaints
6	Culvert clogged at 222 Street north of Pecos Road			9/11/2006	City of Mesa complaints
7	Powerline Floodway deficient culvert capacity at Meridian Road				ADMPU model, future and existing conditions
8	Powerline Floodway culvert capacity issues: breakout to the south at Ironwood Road				ADMPU HEC-RAS model, existing and future conditions
9	Rittenhouse freeboard deficiencies (future conditions)				Hydrology Update model, future condition
10	Rittenhouse Channel overtopping (future conditions)				Hydrology Update modeling Future condition
11	Rittenhouse Channel freeboard deficiency (future conditions)				Hydrology Update model, future condition
12	Breach of non-engineered berm or levee-like embankment	Embankment_Breach_Meridian_1.jpg	Embankment_Breach_Meridian_2.jpg	Early 1990s	Hydrology Update
13	Uncontrolled wash through neighborhood				ADMPU aerial
14	Uncontrolled Wash through neighborhood				ADMPU aerial
15	Flooding a couple of times a year				Public Meeting
16	Powerline Floodway deficient culvert capacity				ADMPU modeling future and existing conditions
17	Powerline Floodway freeboard issues				ADMPU modeling future and existing conditions
18	Wash ponds on Mountain Road				Public meeting
19	Culvert lacks capacity				Public meeting
20	Drainage across roadway				Public meeting
21	Flow accumulates on street				Public meeting
22	Wash was filled by landowner				Public meeting
23	Flow from Meridian Road concentrates along Ivanhoe Street				Public meeting
24	Wash flows through neighborhood				Public meeting
25	Erosion damaging fences - wash is 3 to 6 feet deep				Public meeting
26	Flooding blocks driveways				Public meeting
27	Floods often				Public meeting
28	Two culverts clog				Public meeting

* See Figures 2.1a and 2.1b.

2.2 LAND SUBSIDENCE AND EARTH FISSURES

The study team collected and reviewed data pertaining to the project area from the District, Central Arizona Project (CAP), Arizona Department of Transportation (ADOT), Arizona Geological Survey (AZGS), Arizona Department of Water Resources (ADWR), MCDOT, Arizona State Land Department (ASLD), Pinal County, and United States Geological Survey (USGS).

A technical memorandum was prepared by Ninyo & Moore for this study that summarizes the reviewed documents, as well as the land subsidence and earth fissure trends in and around the project area (Appendix C). The technical memorandum also contains figures depicting recent land subsidence (Figure 2.2a), and documented earth fissures (Figure 2.2b).

SECTION DC-3: EXISTING FACILITIES

The four major drainage facilities within the study area are the EMF, Powerline Floodway, Ellsworth Channel, and Rittenhouse Channel. In addition, many smaller channels and berms convey or direct runoff throughout the watershed. Most of these are non-engineered structures that may or may not fail when exposed to runoff, and some may adversely impact surrounding areas.

3.1 EAST MARICOPA FLOODWAY

Structure Type: Earthen channel

Flood Protection Method: Semi-hard

Landscape: Turf-lined

Description: The EMF collects runoff from eastern of Maricopa County and conveys it south to the Gila River. A concrete-lined, low-flow channel conveys nuisance flows and frequently contains water.



The EMF is the outfall for the entire study area. Runoff is conveyed to the EMF mainly through the Powerline Floodway and the Rittenhouse Channel. Additionally, two smaller channels convey runoff from the Phoenix-Mesa Gateway Airport to the EMF.

3.2 POWERLINE FLOODWAY

Structure Type: Concrete channel

Flood Protection Method: Hard

Landscape: Trail designation only

Description: The Powerline Floodway is a trapezoidal channel that originates at the PVR Structures, angles through Pinal County, and roughly parallels Ray Road in Maricopa County to the EMF.



No landscape features (e.g., vegetation) are directly associated with the channel itself, but a

segment of the Maricopa Regional Trail has been designated to follow the alignment. In most locations where the channel crosses existing developments, the trail system runs parallel to but outside screen walls and maintenance roads adjacent to the channel.

As part of this study, the Powerline Floodway has been modeled using the U.S. Army Corps of Engineers HEC-RAS version 4.1.0. Topographic information was obtained from a triangulated irregular network (TIN) and structural survey provided by the District. The model was developed for the controlling (6-hour or 24-hour duration) 100-year storm plus a base flow of 600 cubic feet per second (cfs) from the PVR structures.

The model shows that the channel flow is supercritical through most of its length and overtops the channel bank liner at several road crossings. Detailed discussions of the model and the results are included in the Powerline Floodway Hydraulic Analysis Technical Memorandum, included in Appendix D.

3.3 ELLSWORTH CHANNEL

Structure Type: Earthen channel

Flood Protection Method: Semi-soft

Landscape: Riprap and vegetated banks (gravel mulch)

Description: The Ellsworth Channel parallels Ellsworth Road and outfalls into the Powerline Floodway.



The majority of the channel has been landscaped with desert plant material, similar to what is used on municipal streetscape projects, and has an automatic irrigation system. The channel appears to be well-maintained,

although side-slope erosion, especially along maintenance road access ramps, blocked inlets, and invasive plant material were observed during project site visits. The maintenance road is accessible to the public, allowing it to function as a multi-use trail, though the trail does not appear to connect to any existing destinations.

The Ellsworth Channel was identified as a first-priority recommended facility in the 1998 ADMP from Pecos Road to its confluence with the Powerline Floodway. The Ellsworth Channel was designed and constructed on behalf of the District in partnership with the City of Mesa and MCDOT as part of the Ellsworth Road Improvements Project. A third-priority extension was recommended from Pecos Road to Germann Road. However, the channel extension south of Pecos Road was only constructed to approximately 1/2 mile north of Germann Road.

The design was based on full implementation of the East Mesa ADMP, which included construction of a channel along Pecos Road and two upstream detention basins situated east of Meridian Road in Pinal County. The Pecos North and Pecos South Detention Basins would have intercepted substantial runoff originating in Pinal County and reduced peak

discharges entering Maricopa County by 80 to 90 percent. However, the Pecos North and South Detention Basins and Pecos Channel have not been constructed. As a result, the Ellsworth Channel under both existing and future development conditions without the Pecos system in place has inadequate capacity for the 100-year runoff.

The *Hydrology Update* shows that the channel would be overtopped by the 100-year storm under existing conditions and has inadequate freeboard under future conditions.

The following table shows the channel design flow, design freeboard, and existing 100-year flow reaching the Ellsworth Channel.

Table 3.3 - Ellsworth Channel Capacity

Ellsworth Channel Location	Channel Design Flow (cfs)	Design Freeboard (ft)	ADMPHU Existing 100-Year Discharge (cfs)
South of Pecos Rd.	600	1.2-1.5	1510
Pecos Rd. to Williams Field Rd.	1170	1.4-1.5	1500
Williams Field Rd. to Powerline Floodway	1740	1.0-2.0	2015

3.4 RITTENHOUSE CHANNEL AND DETENTION BASIN

Structure Type: Trapezoidal earthen channel and basin

Flood Protection Method: Semi-hard (channel); semi-soft (basin)

Landscape: Channel has rip-rap; earthen basin is minimally vegetated

Description: The Rittenhouse

Channel conveys runoff along the south edge of the study area to the EMF. The Rittenhouse Basin serves to reduce peak discharges to the EMF. In most locations, the channel lacks vegetation and is fenced to prevent public access.

The basin vegetation is similarly limited. At the intersection of Sossaman and Germann roads, a tail water or dewatering drainage conveyance creates semi-perennial flows that sustain invasive volunteer vegetation from this location to the outfall. The Town of Gilbert has plans for future active recreation at the basin site.



The Rittenhouse Channel is situated along the upstream side of the Union Pacific Railroad (UPRR), parallel to Rittenhouse Road. The channel extends from the EMF west of Power Road to Queen Creek Road. The Rittenhouse Channel continues east along Queen Creek Road to Ellsworth Road where it is conveyed via twin 72" cast-in-place concrete culverts. The Rittenhouse Channel is the primary collector for drainage in the southern part of the project study area.



The *Hydrology Update* shows that, under future conditions, the channel won't have adequate freeboard and may be overtopped near Germann and Sossaman Roads.

The following table shows the design flow, design freeboard, and existing 100-year flow reaching the Rittenhouse Channel.

Table 3.4 - Rittenhouse Channel Capacity

Rittenhouse Channel Location	Channel Design Flow (cfs)	Design Freeboard (ft)	ADMPHU Existing 100-year Discharge (cfs)
East of Ellsworth Rd	520	1.5	680
Ellsworth Rd to near Hawes Rd alignment	810	1.5	690
Near Hawes Rd alignment to Germann Rd to	1050	1.5	870
Germann Rd to south of Pecos Rd	1400	1.4	910
Power Rd and Pecos Rd to EMF	1500	1.4	1050

3.5 OTHER EXISTING FACILITIES

Figure 3.7a – Existing Land Use and Facilities shows the locations of some of the existing channels and berms identified during the data collection. The figure differentiates channels and berms that appear to be well-maintained and functional from those of unknown condition, i.e., that appear to be non-engineered, unmaintained, and/or abandoned.

3.6 EXISTING UTILITIES

Entellus and the District obtained utility information from the City of Mesa and the Town of Queen Creek in GIS format. Significant utilities that could impact the evaluation, recommendation, and implementation of drainage alternatives throughout the study area are

shown on Figure 3.6 – Existing Utilities. A more detailed utility investigation will occur later in the project during the refinement of the alternatives.

3.7 EXISTING LAND USE AND OWNERSHIP

Existing land use was determined using aerial photography and field visits and is shown in Figure 3.7a – Existing Land Use and Facilities. Existing land ownership was collected from Maricopa County and Pinal County assessors' data and is shown in Figure 3.7b – Land Ownership.

SECTION DC-4: PLANNED FACILITIES

4.1 FUTURE LAND USE AND PLANNED FACILITIES

Anticipated land use and locations of planned facilities were determined using local jurisdiction zoning maps (general plans of local jurisdictions), development plans, and information provided by the District and are shown in Figure 4.1 – Future Land use and Planned Facilities.

4.2 DRAINAGE PLANS

Several transportation and private development projects in various stages of progress are relying on the *1998 ADMP* as the guiding document to develop their drainage plans. Some more recent projects within the study area are using the *Hydrology Update* models and results. Pinal County also completed two studies with information that was used during this study: *Pinal County ADMP Phase C - Queen Creek Watershed* (Reference 256) and *Pinal County ADMP Phase A – Apache Junction Watershed* (Reference 255). The following paragraphs describe the plans most relevant to this study.

4.3 TRANSPORTATION PLANS

Transportation plans affecting the study area have been or are currently being developed for several arterial roads and for SR 24. These plans are discussed in the following sections.

4.3.1 SR 24

The drainage infrastructure for the first segment of SR 24 (SR 202 to Ellsworth Road) consists of a channel along the east side of the new roadway and detention basins. The drainage for this one-mile reach will eventually outfall into the SR 202 Channel. The next phase, between Ellsworth Road and Ironwood Road, is still in the conceptual design stages. Based on information obtained from the design concept report, the freeway will have a channel along the north side to intercept all upstream runoff from the 100-year storm and convey it to the Powerline Floodway. The alignment of this proposed freeway will cut off a significant portion of the contributing area to the Ellsworth Channel and will play a significant role in the final drainage solution for the area.

East of Ironwood Road, the alignment of SR 24 has not been established at this time. Three alignments have been proposed and are very close to each other. The resulting drainage conditions within Maricopa County will not likely vary among the different potential alignments.

4.3.2 Meridian Road

MCDOT prepared the *Meridian Road Control and Corridor Improvement Study* (Reference 250) for the portion of Meridian Road within the study area in 2006. This corridor study uses the recommendations of the *1998 ADMP* for the drainage features of the corridor. The study calls for a six-lane arterial road within the project area with cross-drainage structures sized to pass the 50-year storm. Timely implementation of the six-lane arterial road is unlikely due to funding issues and lack of development in Pinal County along the Meridian Road corridor.

As part of the Planning Assistance for Rural Areas (PARA) program, ADOT is initiating the Meridian Road Corridor Study: Germann Road to McDowell Road. This study is scheduled to begin during the summer of 2012 and completed by December 2012.

4.3.3 Germann Road

ADOT is currently in the preliminary stages of establishing an alignment for Germann Road from Power Road to Ironwood Road and has produced a preliminary drainage report, *Germann Road Corridor Improvement Study Power Road to Ironwood Road* (Reference 240). This report does not include any specific drainage infrastructure but refers to the *Hydrology Update* as the basis for drainage design. The final report for this study is schedule to be completed in August 2012.

4.3.4 Other

ADOT and Pinal County are working on a corridor study for the North/South Parkway that will provide a new major roadway connection between I-10 and US-60. One of the proposed alignments traverses the eastern portion of the watershed within Pinal County. This is one of many alignments being considered; some of the other alignments could affect the watershed drainage conditions as well. However, at this time there is not enough information available for evaluation.

MCDOT is designing roadside improvements to alleviate drainage issues along Mountain Road and Erie Street. At this time, no recommendations or plans have been submitted. The District is coordinating with MCDOT to ensure that the design is compatible with a drainage solution that addresses both local and regional drainage issues in this area.

4.4 DEVELOPMENT PLANS

DMB and Pacific Proving Grounds are both planning large-scale residential development at the former GM Desert Proving Grounds, located between Elliot Road and Pecos Road and from Ellsworth Road to Signal Butte Road. Most of the planned development in the area had been suspended in recent years, but it appears that some projects are starting to move forward.

4.4.1 Eastmark

Eastmark, a planned community on the north portion of the former GM Desert Proving Grounds, has recently prepared a modified drainage master. The main drainage issues associated with Eastmark are the existing culverts at the Proving Grounds West Track and Proving Grounds East Track, and how the new development will discharge to the Powerline Floodway. Eastmark wishes to relocate and replace them with other structures more suited for its development plan.

4.4.2 Pacific Proving Grounds

Harvard Investments is developing the southern portion of the former GM Desert Proving Grounds between the proposed SR 24 and the Eastmark development. It has submitted a preliminary drainage report, which shows the channel along the proposed SR 24 as the main drainage outfall for the development. In the interim, before this channel is constructed, the development will discharge into the existing channel located at the Crismon Road alignment and ultimately to the Ellsworth Channel

4.4.3 Other

There are several smaller-scale developments within the study area, including La Jara Farms, a planned 142-acre residential subdivision located on the southwest corner of Germann and Hawes Roads. A planned extension of Ryan Road will border the south and western sides of the subdivision. The development's drainage report proposes an earthen drainage channel along Germann to convey a 100-year peak flow of 353 cfs between Hawes Road and the Ryan Road alignment. A box culvert would be constructed at Ryan Road and 198th Street to pass flow in the proposed channel through the proposed roadway embankments. The culvert would be temporarily filled with native soil after its construction until the channel is continued downstream by future development.

SECTION DC-5: REGULATORY INVENTORY

The study area encompasses the jurisdictions of the City of Mesa, Town of Queen Creek, and portions of unincorporated Maricopa County and Pinal County. To characterize the regulatory environment within the study area, planning studies, regulations, design guidelines, retention requirements and ordinances were collected and reviewed for each jurisdiction. In addition, the Community Plan and Master Drainage Plan for Eastmark were included in the review. The regulatory inventory will help project planners to anticipate the conditions within the watershed after development has taken place that will influence the character of runoff under future conditions.

The inventory may further identify opportunities for new or modified regulatory measures that may be incorporated into flood mitigation alternatives as part of this project. As part of the characterization of the regulatory environment, particular attention was paid to regulations and guidelines that might influence the identification and development of flood control alternatives. The documents reviewed are identified in Table 5.1 – Regulatory Environment Analysis Summary (see pages 5-3 through 5-5), along with a summary description of pertinent drainage guidance within each document. The results of the review indicate that for the jurisdictions in Maricopa County, most regulations make reference to a small number of guidance documents which are all promulgated by Maricopa County:

- *Floodplain Regulations for Maricopa County*
- *Drainage Policies and Standards for Maricopa County*
- *Drainage Design Manual for Maricopa County, Volumes 1, 2, & 3*

As a result, there is very little variation in drainage requirements within the study area.

In its Subdivision Ordinance, Queen Creek includes a requirement that post development conditions cannot exceed pre-development conditions of peak runoff, volume, or velocity. The ordinance also requires that drainage systems meet the requirements of Volumes 1, 2, and 3 of the Drainage Design Manual for Maricopa County. Maricopa County requires retention of the 100-year, 2-hr storm runoff. Therefore, in addition to retaining the 100-yr, 2-hour runoff volume, the resulting runoff must be checked to ensure that the “pre- vs. post” criteria described above are also met.

The Pinal County Drainage Ordinance also includes a “pre vs. post” retention requirement that peak discharge and velocity are not increased for the 2-, 10-, and 100-year storms. Volume 1 of the Pinal County Drainage Manual references the 100-year, 2-hour storm relating to detention/retention facilities without specifically requiring that the full 100-year, 2-hour volume be stored in the basin. It simply states that the basin “shall be designed to accommodate the peak flow and volume of runoff from the 100-year, 2-hour duration storm event from *NOAA-Atlas II* in order to meet the peak discharge requirement.” The peak discharge requirement is to prevent any increase in discharge above the pre-development condition. Similar to Queen Creek, this may be interpreted as dual criteria, requiring a check to ensure that the retention volume provided does not result in an increase in peak discharge and velocity. The County staff is interpreting and enforcing a minimum retention volume to be equal to the runoff volume from a

100-year 2-hour storm event using *NOAA Atlas II*, However, County staff is allow developers to use *NOAA Atlas 14* if they use the 90% confident limits.

The *Community Plan for Mesa Proving Grounds* was developed by DMB to establish the planning and development review process with the City of Mesa. The plan includes language that would allow the project to use alternatives to drainage standards in cases where it can be justified and substantiated subject to approval by the City of Mesa. The only alternative standard that is specifically identified in the Community Plan is a provision to allow decentralized retention that can be either privately or publicly owned. However, the Eastmark drainage plan was approved prior to the 2012 revisions of the *City of Mesa Engineering and Design Standards* and it used the 2007 version of the standards.

Both the City of Mesa and Town of Queen Creek have designated the District to manage their floodplains. As a result, all regulatory floodplains are governed by the floodplain regulations for Maricopa County. Although the City of Mesa and Town of Queen Creek have their own design procedures and standards manuals, the manuals contain mostly procedural requirements with minor differences in drainage design preferences. However, the manuals all reference one or more of the "base" documents noted above.

There are is not specific language in any of the jurisdictions that allows or gives guidance for preservation of agricultural lands. However, *The Town of Queen Creek General Plan* indicates as a goal to "Retain and reflect key elements of the Town's historic equestrian and agricultural heritage in the retention of open space and the development of the Town's recreational amenities." (Goal 4).

EAST MESA AREA DRAINAGE MASTER PLAN UPDATE
 TABLE 5.1 -REGULATORY ENVIRONMENT ANALYSIS SUMMARY

No.	Document	Source	Date	Summary/Notes	Hydrology	Detention/Retention	Landscape Design Themes and Considerations
1	Floodplain Regulations for Maricopa County	MC	Nov-11	Applies to all SFHAs within MC. Includes FEMA designated SFHAs (FIRMs); other areas designated as SFHAs, and areas with 100-yr Q greater than 50 cfs.			Preserve and enhance beneficial functions served by floodplains - All landscape design themes may be appropriate depending on setting. See LIA
2	Maricopa County Subdivision Regulations	MC	Mar-11	Ref. Floodplain and Drainage Regulations; Requires use of Drainage Design Manual for Maricopa County, Volumes 1, 2, and 3.			Comply with Floodplain regulations - see above
3	Drainage Regulations for Maricopa County	MC	Nov-10	Applies to all unincorporated areas including regulatory floodplains	Design for 100-yr frequency storm	Retain 100-yr, 2-hr runoff. Drain basins in 36-hrs	
4	Drainage Policies & Standards for Maricopa County, Arizona	MC	Apr-07	See Ch. 6 for Drainage Standards; this is a source document referenced in many other documents			
5	Clarification of Drainage Regulations	MC	Sep-01	Clarifies on lot retention requirement for lots less than 1-acre and retention requirement for lots greater than 1-acre		on-site retention is required for 100-yr, 2-hr rainfall regardless of lot size.	
6	Maricopa County Land Use Plan- Queen Creek Planning Area	MC	Apr-92	Encourages cooperation with FCDMC policies, ADMSSs and floodplain regs			See Queen Creek 2008 General Plan
7	Mesa Floodplain Regulations	Mesa	Mar-12	FCDMC as Floodplain Administrator Maricopa County regulations apply Ref. 2006 edition of County floodplain regs. Ref. Sept. 2005 Version of flood maps			
8	Mesa Storm Water Management Plan	Mesa	Sep-11	Includes Best Management Practices for storm water quality monitoring and enforcement			
9	Mesa Stormwater Annual Report to ADEQ 2010-2011	Mesa	Sep-11	Reports annual progress on Storm Water Management Plan initiatives			
10	City of Mesa Storm Drain Master Plan	Mesa	Jan-10	See Section 3 for Standards and Policies Review. Comparison with other cities & states.			
11	Engineering & Design Standards (Chapter 8)	Mesa	May-12	Adopt Drainage Policies & Stds. for MC Ref. City code Title 9; Ch. 6, 8, & 5, Title 11; ch. 15	Convey 100-yr, offsite flows, per FCDMC Hydrology Manual	100-yr, 2-hr storm (2.7-in rain depth)	All Landscape Design Themes Allowed to be determined by specific setting Side Slopes: Concrete 1:1 max Landscape 4:1 max Others 6:1 max
12	Mesa Subdivision Regulations	Mesa	Nov-06	No additional requirements			
13	Master Drainage Report for Mesa Proving Grounds Wood-Patel/ DMB Mesa Proving Grounds, LLC	Dev	Dec-11	Develop per City of Mesa and FCDMC drainage requirements (Section 1.1, p. 1) Ref. East Mesa ADMP, 1998	East Mesa ADMP model Updated 100-yr, 24-hr rainfall	100-yr, 2-hr retention Drain in 36-hrs NOAA 14 precip.	
14	Community Plan for Mesa Proving Grounds- Section 4- Regulatory Framework	Dev	Oct-08	Describes planning and approval process for all units. Identifies applicable standards and regulations that govern development. See Section 13 for Stormwater Drainage and Retention Standards.			

No.	Document	Source	Date	Summary/Notes	Hydrology	Detention/Retention	Landscape Design Themes and Considerations
15	Community Plan for Mesa Proving Grounds- Section 9- Applicability of Mesa Engineering & Design Standards	Dev	Oct-08	Ref. Mesa 2007 Engineering and Design Standards Manual, Ch. 8 (Note: latest version is 2009). Provides for alternatives to standards upon City approval		Provision for decentralized retention	
16	Community Plan for Mesa Proving Grounds- Section 12- Landscape Standards	Dev	Oct-08				Enhanced Desert Theme Desert Park Theme Desert Oasis Theme Design structures to be irregular in form, integral to theme Architectural forms allowed in appropriate urban plaza areas with Desert Plaza Theme
17	Community Plan for Mesa Proving Grounds- Section 13- Stormwater Drainage & Ret Stds	Dev	Oct-08	Ref. Mesa Drainage Design Standards and Uniform Drainage Policies and Standards for Maricopa County. minimize land area used for retention and drainage and maximize shared uses		change standards to allow Decentralized retention; allow publicly or privately owned	
18	Queen Creek Design Standards and Procedures Manual	QC	Aug-09	Drainage Report Checklist			
19	Queen Creek Subdivision Ordinance - Chapter 6 Subdivision Design Standards and Principles	QC	Oct-07	Sec 6.8- Drainage; Ref. Drainage Design Manual for Maricopa County, Vol 1, 2, & 3		Post devip Q cannot exceed Pre Devip Q (includes volume and velocity)	
20	Queen Creek Flood Control Ordinance - Chapter 13	QC	Aug-07	Designates FCDMC and Pinal County FCD as floodplain manager Ref. Drainage Design Manual for Maricopa County, Volumes 1, 2, and 3; and Pinal County Drainage Manual Volume 1 and 2			
21	Queen Creek General Plan - 2008 Amendment	QC	May-08	Describes community vision, planning goals, and broad design guidelines for the TOQC Outlines Goals and Underlying Policies that affect stormwater management and landscape design			"Rural, historic" themes preferred; Enhanced Desert Theme Open space at gateways Meridian Road Growth Area - high density future development Germann/ Queen Creek Road Corridor - Gateway, employment area. Develop themes related to equestrian-based, enhanced desert "water-wise" landscapes

No.	Document	Source	Date	Summary/Notes	Hydrology	Detention/Retention	Landscape Design Themes and Considerations
22	Development Services Code/ Pinal County Drainage Ordinance	PC	Jan-10	Applies to development of all land within the unincorporated area of Pinal County. "No increase in the peak discharge or velocity of runoff or change the point of entry of drainage onto other property during the two-, 10-, and 100-year runoff event." Ref. Floodplain Management Ordinance for development in a designated special flood hazard area.	Design for 100-yr frequency storm for offsite runoff contributing runoff to the development. -Finished floors 1-ft above high point of building site.	-Individual lot retention allowed for minimum lot size of one acre. -36-hour max drain time. -Pre- vs. Post- for 2-, 10-, and 100-year runoff	
23	Pinal County Floodplain Management Ordinance	PC	Aug-06	Applies to delineated floodplains and watercourses with 100-year discharge greater than 200 cfs.			
24	Pinal County Drainage Manual, Volumes 1 & 2	PC	Aug-04	Volume 1 contains minimum standards and criteria for drainage design; Volume 2 contains design methodology and procedures for drainage design <i>NOTE: Although the Drainage Manual has not been updated to reflect it, the current practice in Pinal County is to require on-site retention for the 100-year, 2-hr runoff using either the outdated NOAA II rainfall or the 90% confidence limit rainfall from the current NOAA 14 Rainfall Atlas.</i>		Requires retention "accommodate" 100-yr, 2-hr runoff, but further requires no increase in Q, V, etc.	
25	Amendment to Drainage Manual	PC	Feb-11	Establishes a minimum time of concentration of 5 minutes for use with the Rational Equation			
26	Development Services Code/ Pinal County Subdivision Regulations	PC	Jun-09	References existing county codes and ordinances must be in compliance for subdivision approval.			
27	Stormwater Management Program (SWMP)	PC	Dec-05				
28	Pinal County Open Space and Trails Master Plan	PC	Oct-07				
Source Codes:							
MC	Maricopa County						
Mesa	City of Mesa						
Dev	Major Developments						
QC	Queen Creek						
PC	Pinal County						

SECTION DC-6: LANDSCAPE INVENTORY AND ANALYSIS

A project-specific Landscape Inventory and Analysis (LIA) was prepared by the District for the study area. The 2011 *East Mesa Area Drainage Master Plan Update Project Landscape Inventory and Analysis Report* includes information related to the existing and planned landscape character, open space, and recreation resources and is included as Appendix G.

Each of the resources was assessed for its compatibility with the flood protection methods, flood protection structure types, and landscape design themes. The following general findings are offered as guidance for further stormwater mitigation planning. The compatibility mapping, however, should be referenced in order to verify the specific compatibility for each proposed structure will be evaluated during alternatives development.

- Moderate-sized basins and channels/levees at multiple scales are considered compatible with the majority of the study area.
- Semi-soft structures (i.e., earthen structures that generally emulate natural forms) are considered compatible with the entire study area where stormwater mitigation is likely to be proposed.
- Hard or enhanced hard structures (i.e., concrete or other hardened linings) may be considered compatible with the future setting in planned urban or industrial areas, provided appropriate screening and aesthetic considerations are included.
- Any of the Lower Sonoran Desert Landscape Design Themes are considered appropriate for proposed stormwater mitigation projects in the study area, including the more intense themes such as Desert Park or Desert Oasis. The Urban Park theme may be considered in areas where future urban cultural settings are identified in the LIA.

6.1 PHOTO DOCUMENTATION AND NARRATIVE

Field reconnaissance of the scenery and recreation resources was conducted and documented in the *East Mesa Area Drainage Master Plan Update Photo Inventory*, prepared as a separate document (Appendix G). It includes the following items:

- A photo log of images depicting the landscape character units found in the project area as described in the LIA
- Photos and brief descriptions of the visual character of the major existing flood control structures within and adjacent to the study area

The full spectrum of flood protection structure types are represented within the study area, ranging from the PVR Structures to the many channels and basins, to small segments of preserved washes within developed residential areas. The existing structures also represent the full spectrum of flood protection methods, including the hard structural Powerline Floodway, the semi-hard structural Rittenhouse Channel and PVR Structures, the semi-soft structural Ellsworth Channel, and the soft-structural wash-like conveyances found in residential developments.

6.2 OPEN SPACES AND RECREATION RESOURCES

In arid environments, flood control facilities can be dry for most of the year. Incorporating multi-use functions into stormwater conveyance or storage facilities can provide the community with year-round value to this otherwise unused land. The Open Spaces and Recreation Resources assessment identifies the significant existing and planned future parks and recreation and open space resources that are found within and adjacent to the study area (Figure 6.2 – Open Spaces and Recreation Resources).

6.2.1 Open Space Resources

Significant existing open space resources within the study area and depicted on the exhibit are limited to the floodplains previously identified in the *East Mesa ADMP-Update LIA*. These areas are derived from the *MAG Desert Spaces Plan* and are generally associated with the EMF and adjacent floodplains.

According to the *MAG Desert Spaces Plan*, open space retention areas should only allow development that retains the integrity of, and public access to, regionally and locally significant natural features, wildlife habitats, scenic resources, and cultural sites.

6.2.2 Recreation Resources

Existing significant recreation resources within the study area include the following:

- Toka Sticks Public Golf Course at 9610 East Williams Field Road (Near Williams Gateway Airport and ASU West Campus)
- The Barney Family Sports Complex at 22050 East Queen Creek Road

Existing recreation resources in the vicinity of the study area include:

- Founder's Park, an 11.5-acre neighborhood park located south of the study area in the center of Queen Creek
- Elliot Detention Basin, a multi-use facility maintained by City of Mesa Parks, located adjacent to the study area north of Eastmark

Planned future recreation resources depicted in the exhibit include two of the five planned parks identified in the *2007 Town of Queen Creek Five Parks Master Plan*.

- East Park, a planned 102-acre active-use sports complex, located between Signal Butte Road and Meridian Road on the north side of Queen Creek Road. The Town of Queen Creek is in discussions with a local developer that may result in a change in the park location. At the time of writing, this new location is expected to be the parcel immediately north and east of the Barney Farms Sports Complex. If this occurs, the current planned park site would change ownership and land use.
- West Park, a planned active community park comprising three parcels totaling approximately 78 acres, located outside the project site area

Additional planned future parks within or adjacent to the project site area include:

- The Great Park and proposed golf-course at Eastmark, located between Ellsworth and Signal Butte Roads south of Elliot Road; it is a planned collection of open space, recreational, educational, civic, and social spaces that will connect various planned neighborhoods and urban cores
- The City of Mesa has identified additional planned parks adjacent to the Elliot Detention Basin parks.

Significant trails identified in the exhibit include:

- Segments of the Maricopa County Regional Trail, located along the Powerline Floodway, the East Maricopa Floodway, Queen Creek Wash, and the CAP Canal
- Segments of Pinal County trails that serve as connections to Maricopa County trails identified in the *Pinal County Open Space and Trails Master Plan*
- City of Mesa planned trails along the power line corridor north of Elliot Road
- A series of trail nodes, paved multi-use paths, and unpaved multi-use trails identified in the *2005 Town of Queen Creek Parks, Trails and Open Space Master Plan (PTOS)*

Queen Creek's planned trails within the study area connect to a more extensive network of trails, trailheads, and neighborhood equestrian park/trailheads south of the study area. The Town has indicated that its PTOS is used to guide development; it does not generally build trails using CIP funds. Co-locating the trails with flood control facilities is permissible.

The Rittenhouse Basin, located at the northwest corner of Power Road and Rittenhouse Road, and the proposed channel and basin for the proposed segment of SR 24, are also depicted in the exhibit. As noted previously, the Town of Gilbert has identified the Rittenhouse Basin as a potential site for a future active-use park.

SECTION DC-7: FLOODING AND DRAINAGE ISSUES FOR ANALYSIS

Data collection and analysis revealed several drainage issues that have been grouped into four somewhat independent zones to facilitate discussion and evaluation. These are depicted in Figure 7.2a – Drainage Issue Zones, and described below.

7.1.1 Zone 1: Powerline Floodway

The area east of the Meridian Road alignment (Pinal County) is mostly undeveloped open desert; Ironwood Road is the only major constructed feature. This portion of the watershed is State Trust land. The floodway analysis indicates that the culvert under Ironwood Road does not have sufficient capacity to pass the estimated discharges (100-year plus 600 cfs from the PVR Structures); runoff is expected to spill out of the channel and flow south along Ironwood Road.

Master-planned communities between Meridian and Signal Butte Roads are substantially complete with drainage systems that appear to be in place and functioning properly.

Eastmark's drainage master plan addresses how onsite and offsite runoff will be handled. As previously noted, the Powerline Floodway culverts through Eastmark and the culvert at Ellsworth Road appear to have insufficient capacity to convey the *Hydrology Update* flows and are likely to overtop.

The portion of Zone 1 between Ellsworth Road and the EMF is undeveloped desert with the exception of Ray Road, Hawes Road, and the airport's overnight parking lot. This area is zoned for industrial development and the floodway provides an adequate outfall.

7.1.2 Zone 2: Ellsworth Channel

East of Meridian Road (Pinal County) the watershed is mostly undeveloped open desert; man-made features include Ironwood Road, a motocross track, a model airplane field, a power substation, a power corridor, and a ranching operation.

As described previously, significant drainage issues were identified between Meridian and Signal Butte Roads. This area contains large-lot residential development with little or no drainage infrastructure. Flows from the east tend to concentrate along the roads, and frequent flooding is reported by residents. After storm events, runoff ponds in several locations and must be pumped into tanker trucks by MCDOT for removal.

The second cluster of drainage issues was identified near Pecos Road. Again, uncontrolled runoff flowing from the east floods Pecos Road and adjacent industrial facilities on the north side.

Between Signal Butte and Ellsworth Roads, runoff is conveyed in a channel along the southern perimeter of the old GM Desert Proving Grounds and into a small collection basin on the northeast corner of Pecos and Ellsworth Roads. From there, runoff enters a

culvert across Ellsworth Road and drains into the Ellsworth Channel. The capacity and performance of the culvert needs to be verified to ensure that it can convey the flows to the Ellsworth Channel.

The recently-constructed Ellsworth Channel has capacity issues; some sections may overtop during a 100-year event, while other segments may not have sufficient freeboard to meet District safety factor goals. The *final Drainage Report - Ellsworth Road - Phase I - Germann Road to Ray Road (Reference 36)* indicates that the channel was designed for future conditions as recommended in the *1998 ADMP*. Under those conditions, the entire upstream area is assumed to be fully developed and retains the runoff from the NOAA Atlas II 100-year 2-hour event. Additionally, it assumes the two basins near the intersection of Pecos and Meridian Roads are constructed. Since the two basins have not been constructed, and the area is not fully developed with retention in place, the existing conditions flows are much higher than the design flows.

7.1.3 Zone 3: Phoenix Mesa Gateway Airport

A master drainage plan has been developed for Williams Gateway Airport by Dibble & Associates Consulting Engineers, Inc.; therefore, no additional analysis or planning will be conducted for this area in the current study.

7.1.4 Zone 4: Rittenhouse Channel

Land use in Zone 4 is predominantly agricultural. Drainage issues have been reported along Germann and Queen Creek Roads and are likely to worsen as farmlands are converted to urban developments.

A combination channel/levee facility located along Meridian Road is intended to intercept runoff from just south of Germann Road and convey it to Pecos Road. This channel is not engineered and has been breached in the past. Additional analysis will be completed to determine how improving or removing this feature would impact the Ellsworth and Rittenhouse Channels.

This is an area where additional retention requirements or regulations may be beneficial to control flows reaching the Rittenhouse Channel.

The Rittenhouse Channel has some capacity issues, in particular for future conditions. Potential improvements could be made to the channel to increase its capacity. However, improvements or regulations in the upstream watershed may be a more effective and efficient solution and will also be considered.

SECTION DC-8: PUBLIC AND STAKEHOLDER INPUT

The project team met with the public and local stakeholders during the data collection and analysis phase of the study. The first of three planned public meetings was held on May 8, 2012, at the Queen Creek Library, to introduce the project and solicit information on existing drainage problems within the study planning area.

The first of four planned group stakeholder meetings was held on April 23, 2012, at the District offices. The meeting was held to introduce the project to agencies that manage infrastructure and/or have regulatory responsibility in the study area and to large landholders who may develop their properties in the future.

8.1.1 Initial Public Input

A questionnaire was distributed at the public meeting to collect specific information on drainage problems and define a sense of the character of the study area. A copy of the questionnaire is included in Appendix F. Residents also had the opportunity to discuss drainage issues one-on-one with project team members. Existing drainage concerns are summarized below based on questionnaire responses and discussions at the meeting:

Locations of flooding problems

- Mountain Road north of Williams Road
- Ellsworth Road south of Germann Road
- Meridian Road
- Signal Butte north of Pecos Road
- Wash near Ray Road east of Mountain Road
- Mountain Road
- Mountain Road from Ray to Pecos roads
- Erie Street
- Ivanhoe Road west of Meridian Road

Locations of access problems

- Mountain Road
- Driveways along Erie Street and Galveston Street

Current or desired recreational activities

- Aquaculture
- Ball fields
- Bicycling
- Equestrian
- Fishing
- Frisbee
- Gardening
- Hiking trails
- Jogging trails

- Off-road vehicles
- Soccer
- Walking trails

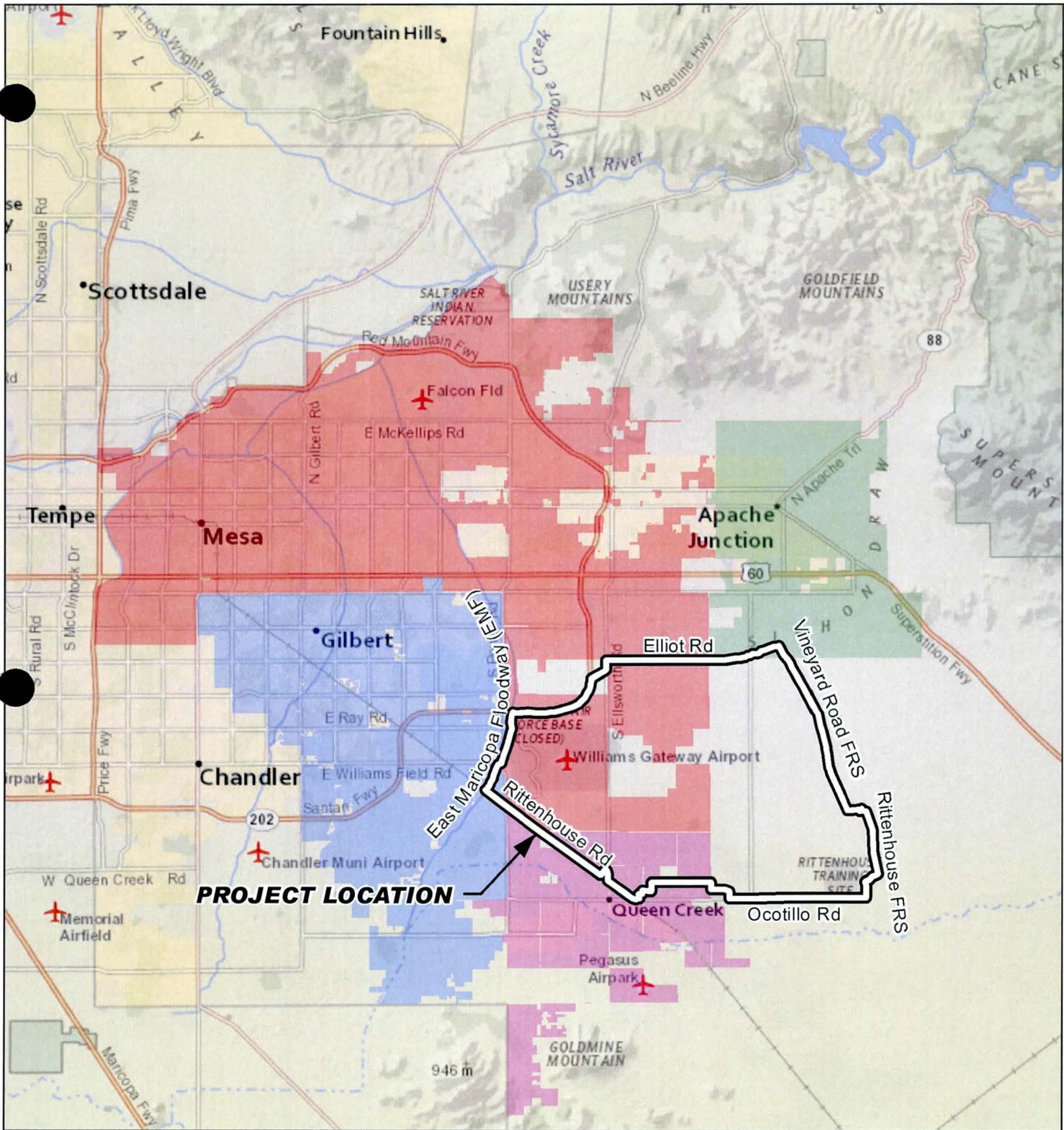
Locations of current or desired recreational activities

- Ray Road east of Mountain Road
- Detention basin at the northeast corner of Mountain and Ray Roads
- East of Signal Butte Road north of Pecos Road
- Ride horseback on state land east of Meridian Road

8.1.2 Initial Stakeholder Input

Two stakeholder meetings were held to reflect the significant differences in focus of the public and private sector attendees and maximize efficient data collection in the time allowed. One meeting was held with public agencies, i.e., those with regulatory or infrastructure management responsibility. The other meeting included private sector interests for future residential, commercial, and industrial development. Summaries of these meetings are included in Appendix F.





LEGEND

-  Project Boundary
-  City of Mesa
-  Town of Queen Creek
-  Town of Gilbert
-  City of Apache Junction



**EAST MESA
AREA DRAINAGE
MASTER PLAN UPDATE
FCD 2011C017**



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**FIGURE 1.1
PROJECT LOCATION**

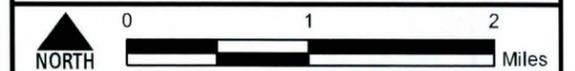
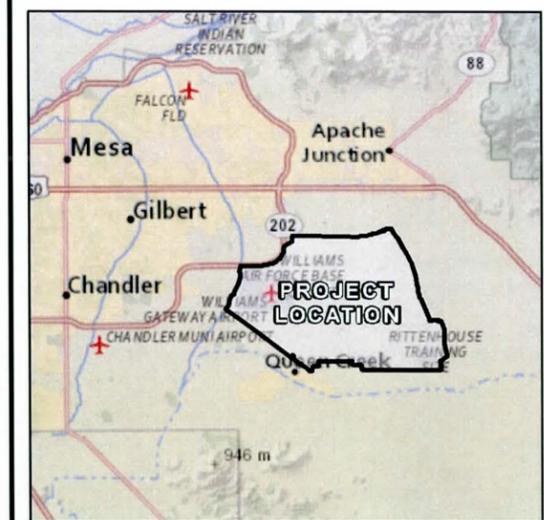


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LEGEND

-  Project Boundary
-  County Boundary
-  Mesa
-  Queen Creek
-  Gilbert
-  Apache Junction

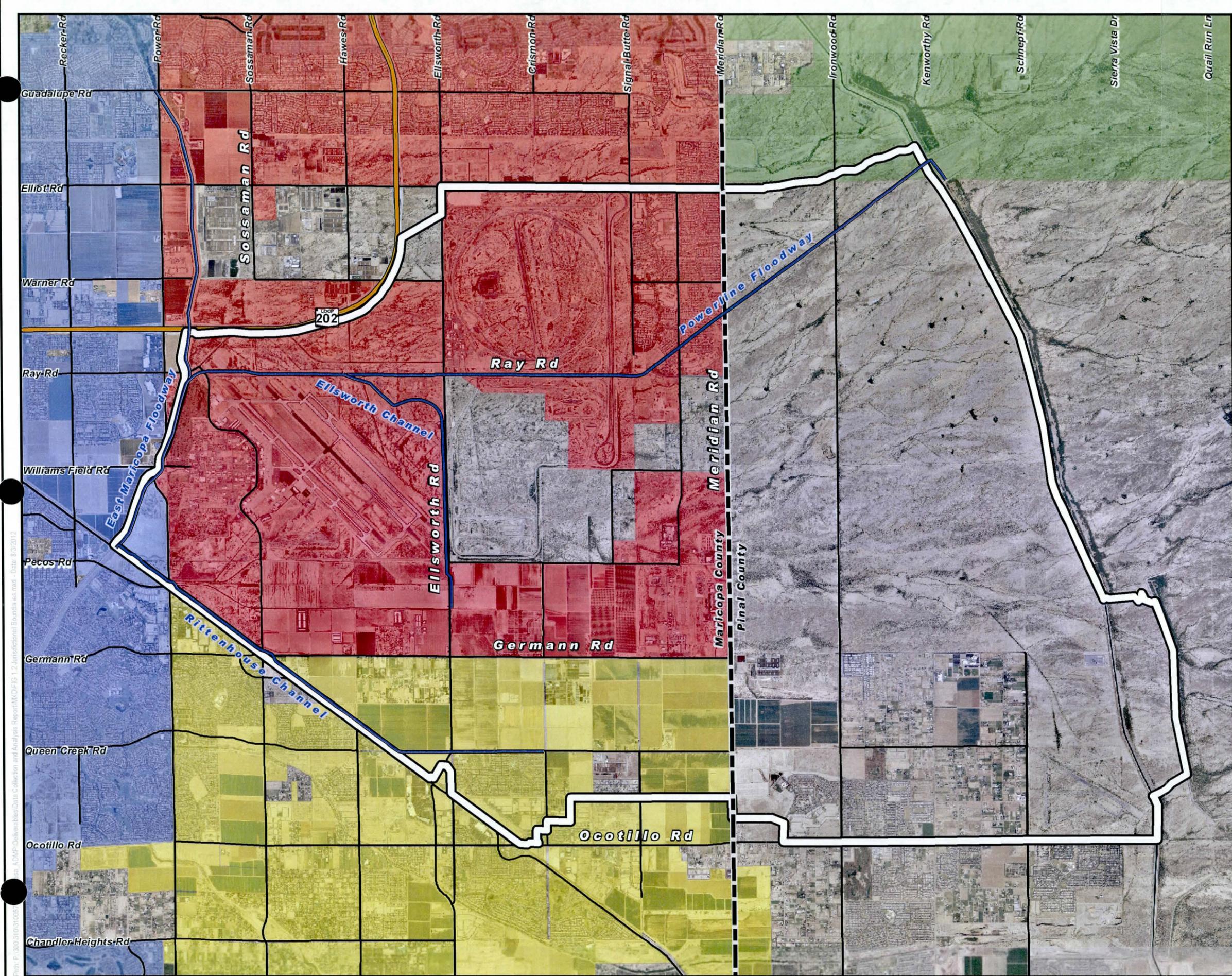
LOCATION MAP



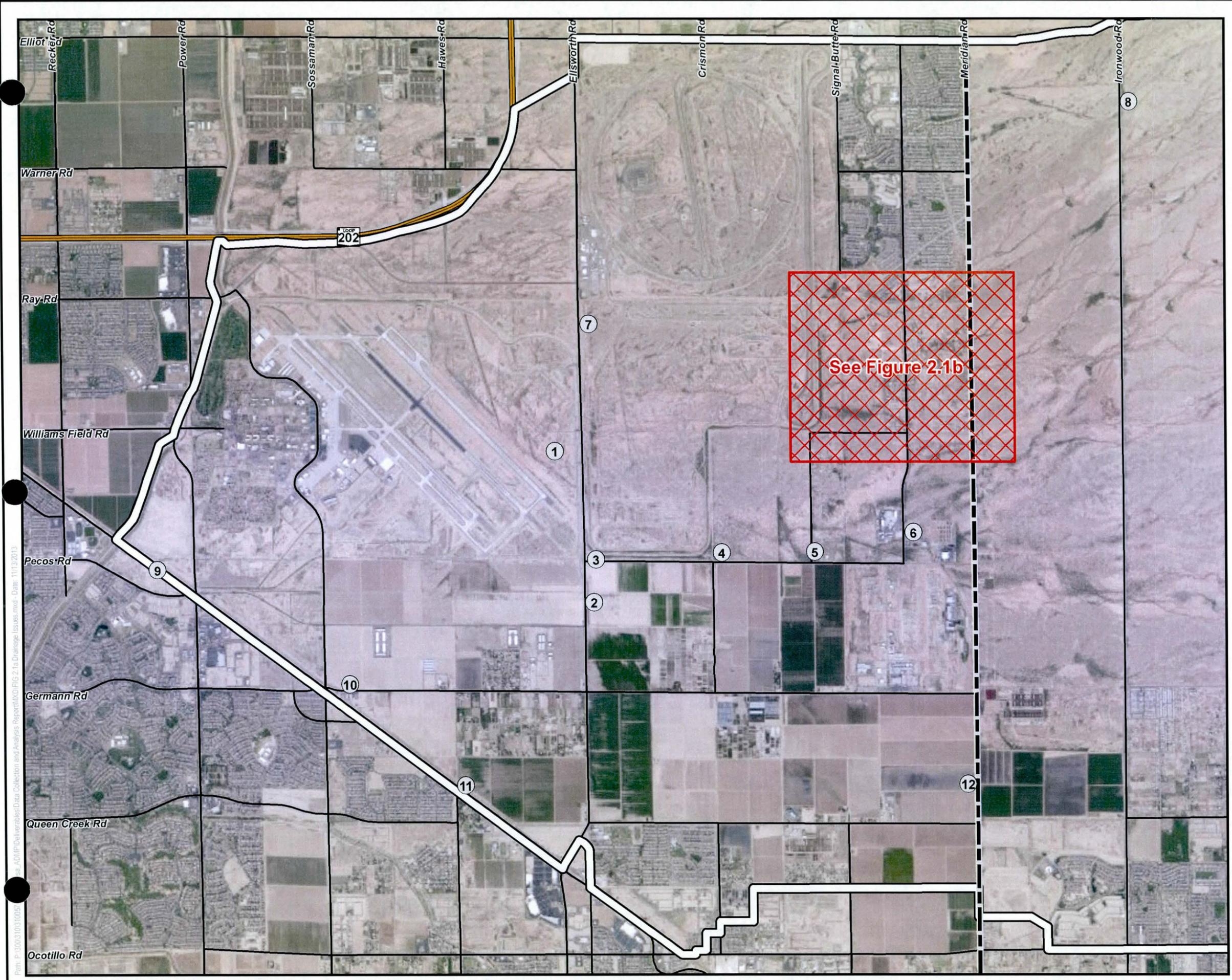
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FIGURE 1.2
JURISDICTIONAL BOUNDARIES



File: P:\3000\310\31005...ADMP\Drawables\Data Collection and Analysis\Report\MCD\FEB 12 Jurisdictional Boundaries.mxd - Date: 8/2/2012



Path: P:\3000310310202..._AD\IP\Drawables\Data Collection and Analysis\Report\MXD\FIG 2.1a Drainage Issues.mxd - Date: 11/13/2013

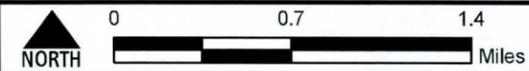
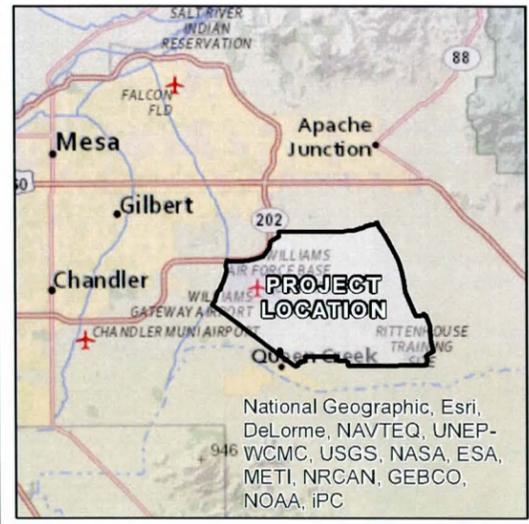


**EAST MESA
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LEGEND

-  Project Boundary
-  County Boundary
-  Drainage Issue ID (See Table 2.1)

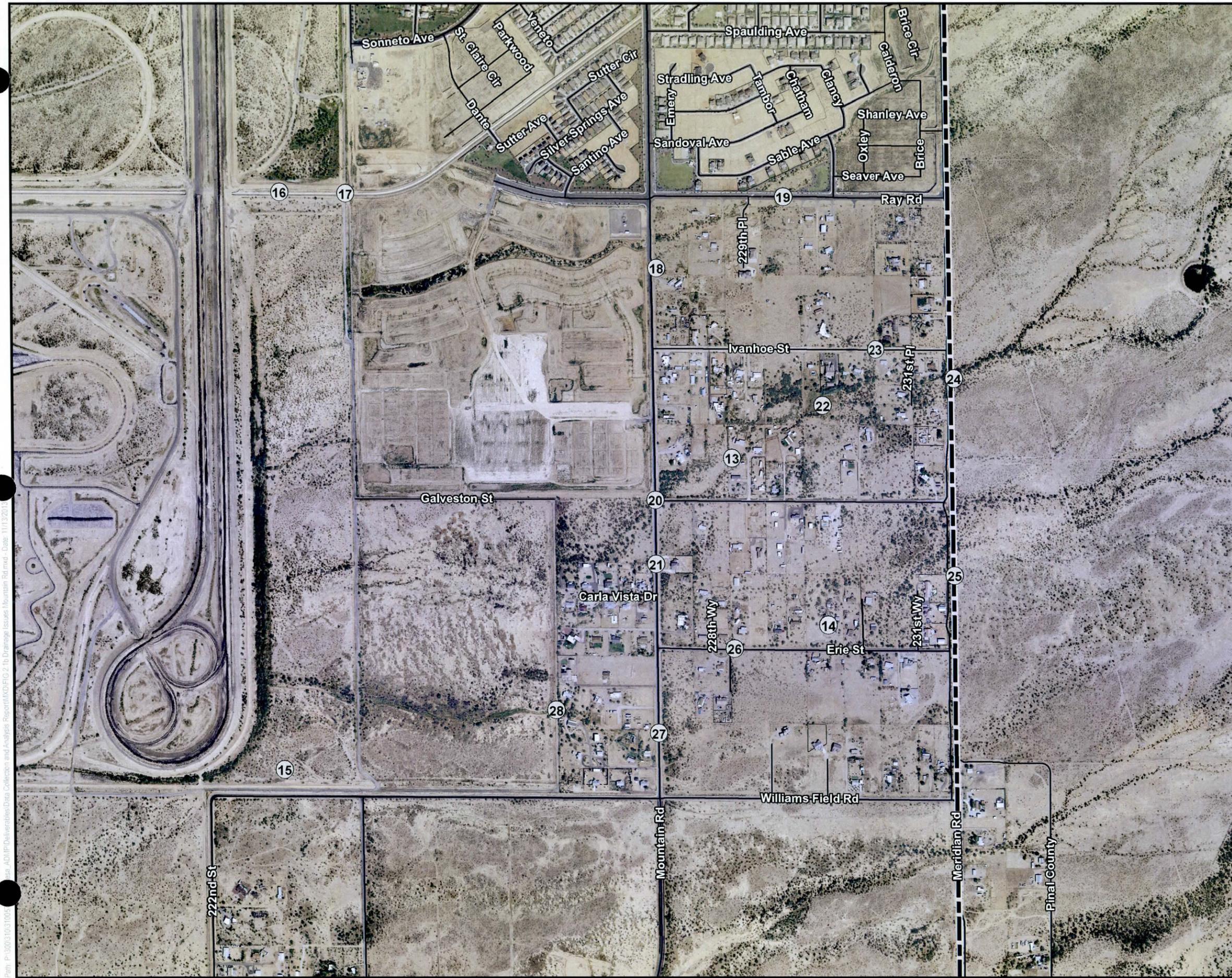
LOCATION MAP




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**FIGURE 2.1a
DRAINAGE ISSUES**

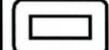


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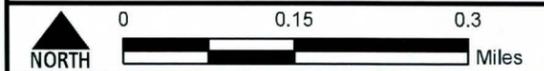
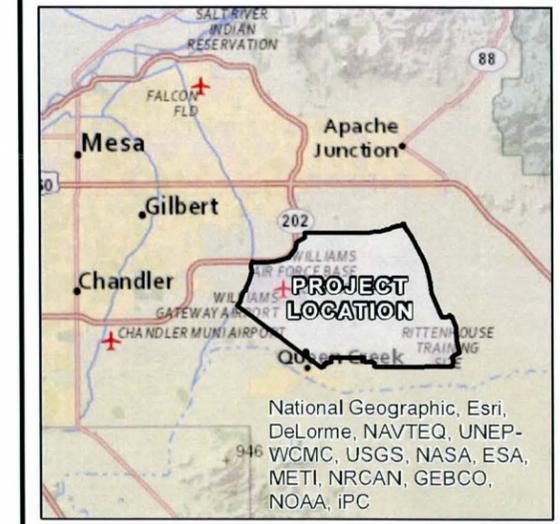


EAST MESA
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LEGEND

-  Project Boundary
-  County Boundary
-  Drainage Issue ID (See Table 2.1)

LOCATION MAP



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FIGURE 2.1b
MOUNTAIN/ERIE AREA
DRAINAGE ISSUES

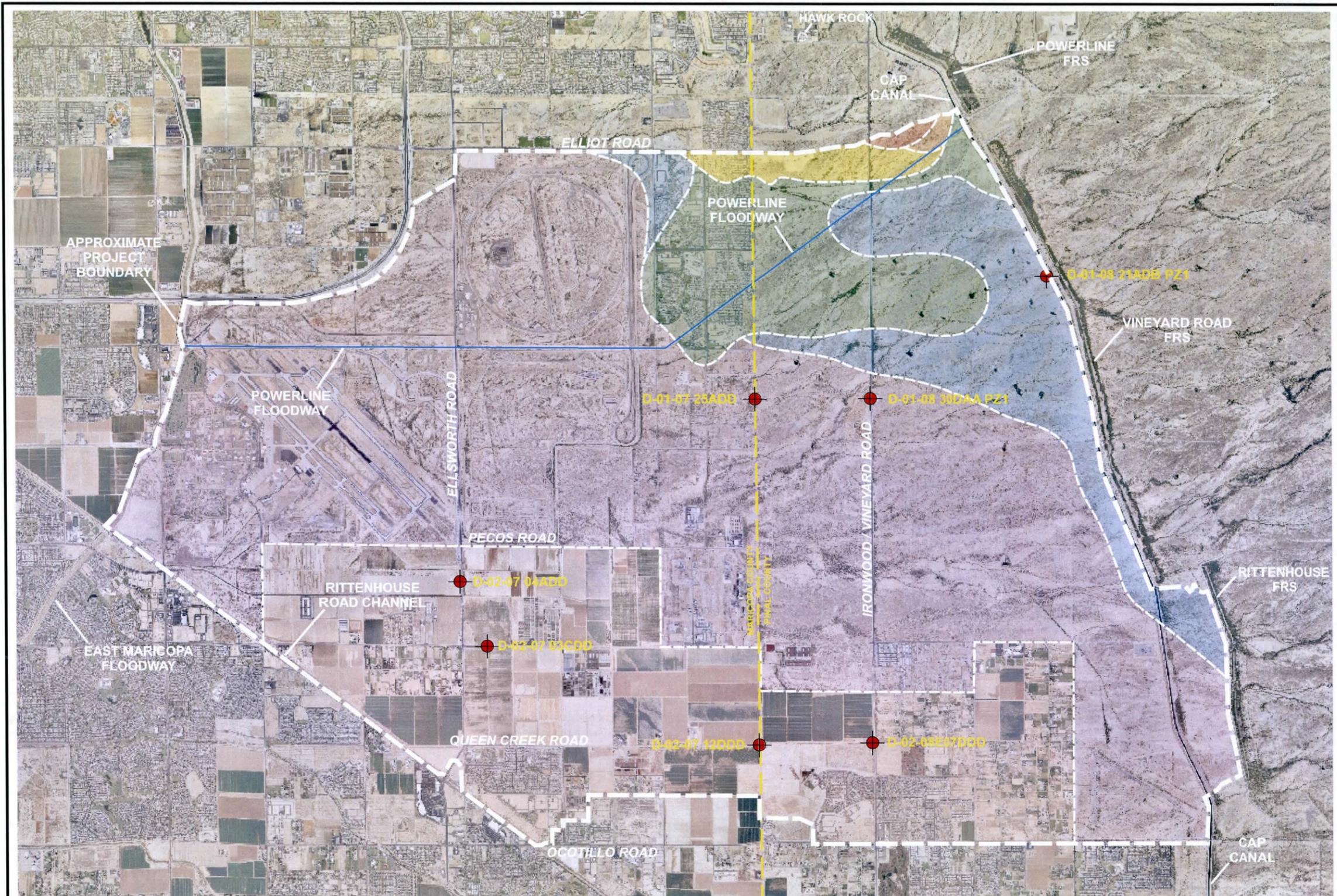


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LEGEND

Cumulative subsidence measurements from the following time periods:
May 1992 to April 2000, October 2004 to September 2010, and May 2010 to May 2011.

- Up to 22 cm Subsidence
- Up to 19 cm Subsidence
- Up to 15 cm Subsidence
- Up to 12.5 cm Subsidence
- Up to 7.5 cm Subsidence
- Up to 5.5 cm Subsidence
- Approximate Limits of Decorrelated Data
- ADWR Well Location and ID



Aerial Photograph Source: FCDMC, 2012.
Note: Dimensions directions and locations are approximate.

SOURCE - Arizona Department of Water Resources: Land Subsidence in the Hawk Rock Area of East Mesa and Apache Junction Based on ADWR Radarsat-2 Time-Series InSAR Data for time periods 05/17/1992 to 04/19/2000, 10/20/2004 to 09/29/2010, and 05/15/2010 to 05/10/2011 (No data available between 2000 and 2004).



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RECENT LAND SUBSIDENCE
BASED ON ADWR INSAR DATA
FIGURE 2.2a

file no. 3640sub0512c



EAST MESA
AREA DRAINAGE
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LEGEND

- Documented Continuous Earth Fissure location
- Documented Discontinuous Earth Fissure location
- Unconfirmed Earth Fissure location

Sources:

- 1) AMEC, 2009, Powerline and Vineyard Road FRS, 2008-2009 Instrumentation Monitoring Report: dated May 5.
- 2) Arizona Geological Survey (AZGS), 2008, Earth Fissure Map of the Apache Junction Study Area, Pinal and Maricopa Counties, Arizona, Digital Map Series – Earth Fissure Map 2 (DM-EF-2): dated April.
- 3) Arizona Geological Survey (AZGS), 2008, Earth Fissure Map of the Chandler Heights Study Area, Pinal and Maricopa Counties, Arizona, Digital Map Series – Earth Fissure Map 1 (DM-EF-1): dated August.

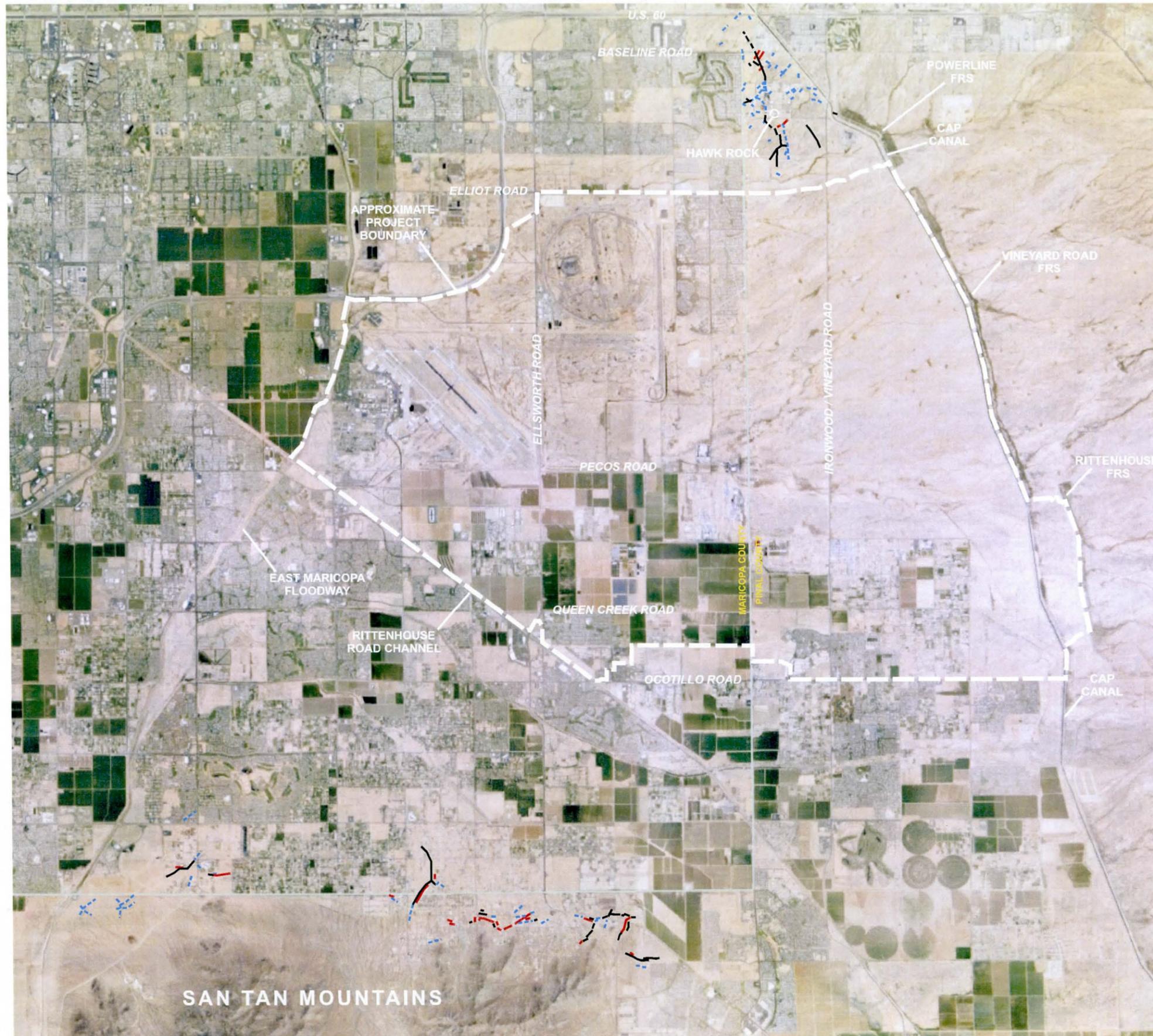


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DOCUMENTED EARTH FISSURES

FIGURE 2.2b



file no. 364010s0812b

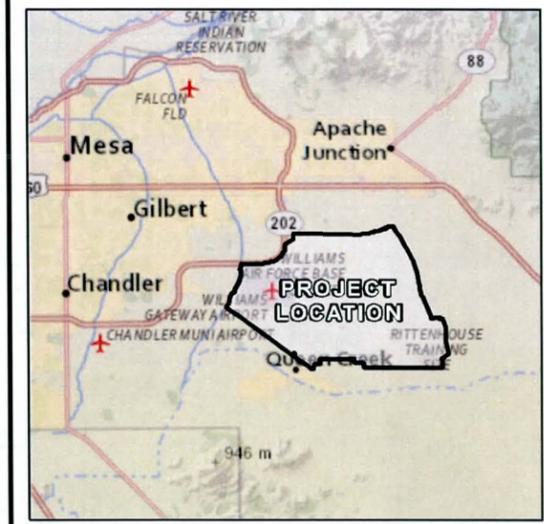


EAST MESA
AREA DRAINAGE
MASTER PLAN UPDATE
FCD 2011C017

LEGEND

- Stock Pond
 - Culvert
 - Channel - Maintained
 - Channel - Unknown Condition
 - Embankment - Maintained
 - Embankment - Unknown Condition
 - Project Boundary
 - Corporate Boundary
 - County Boundary
- Existing Land Use**
- Industrial
 - Commercial
 - Residential
 - Low Density Residential
 - Agriculture
 - Open Space
 - Natural Desert

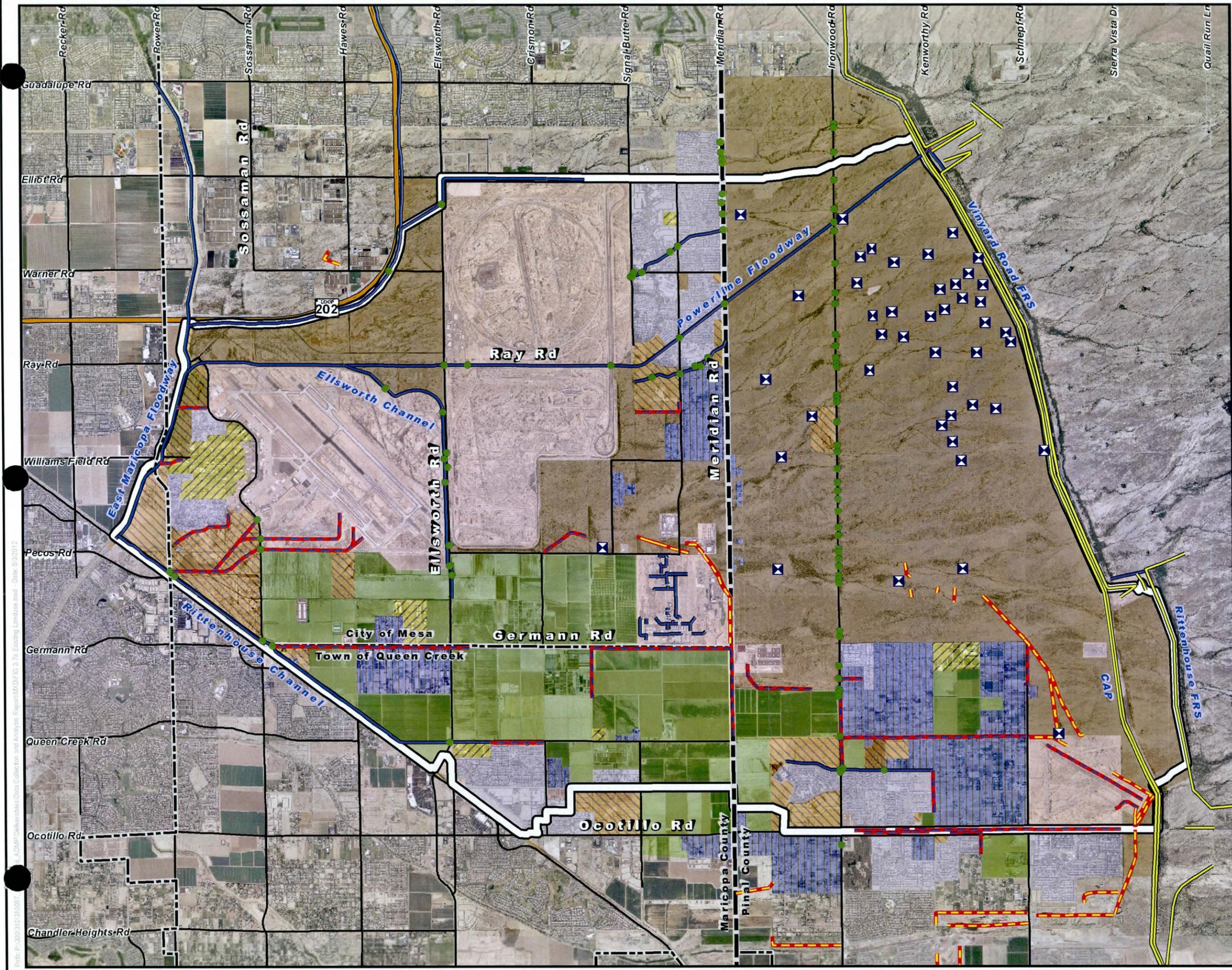
LOCATION MAP



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FIGURE 3.7a
EXISTING LAND USE & FACILITIES



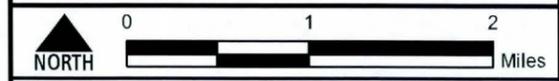
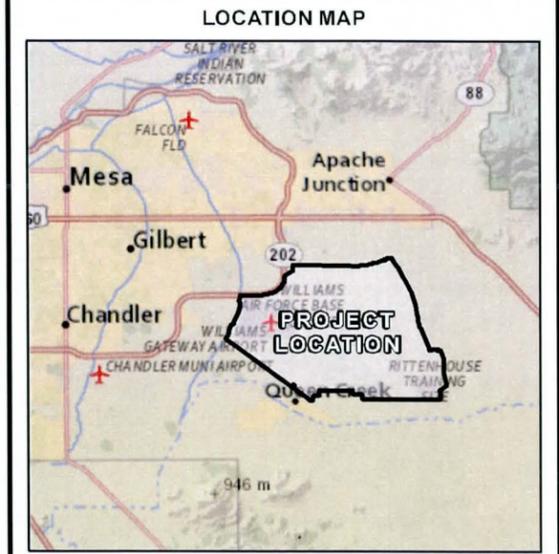
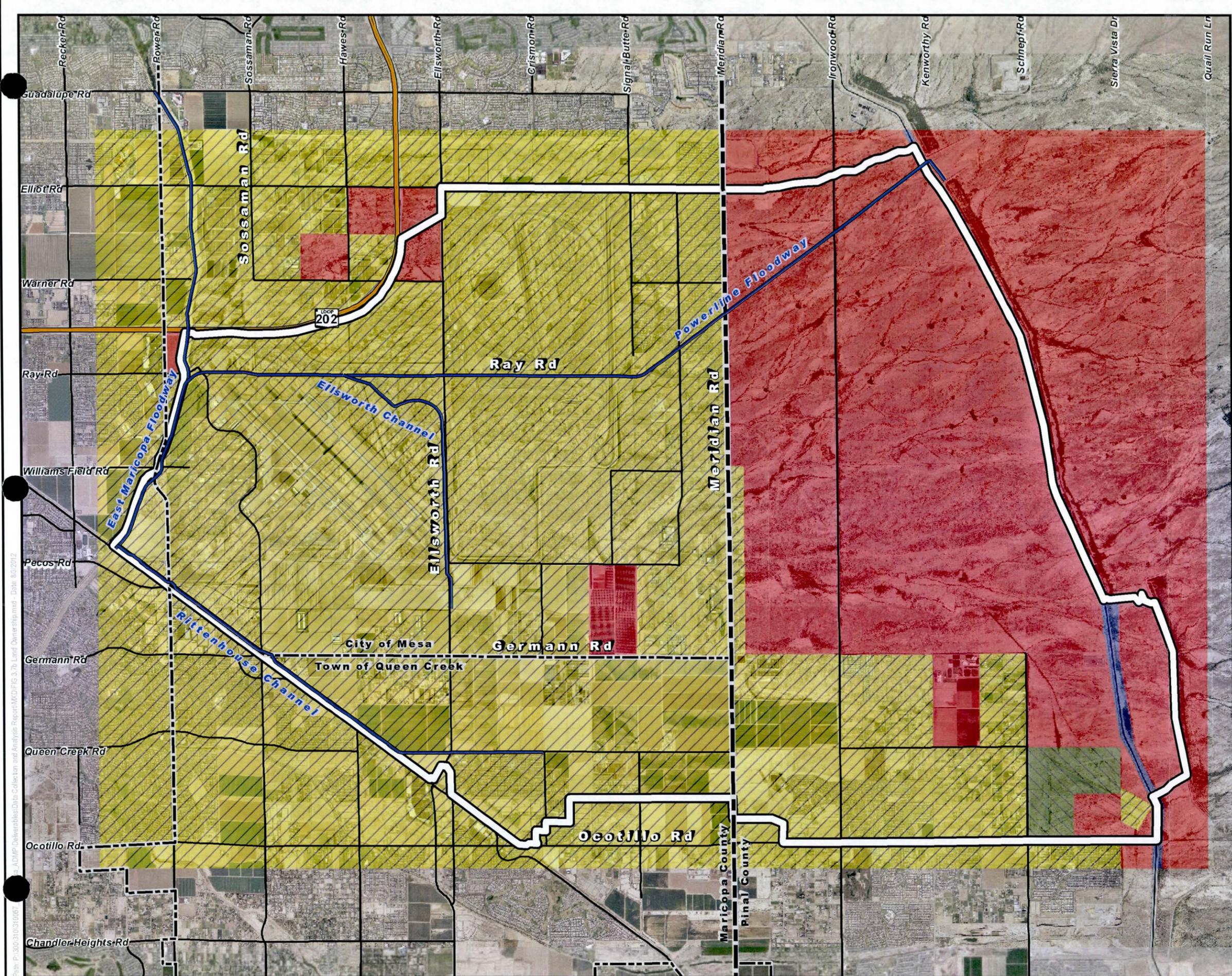
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 ADMP\Deliverables\Data Collection and Analysis\Report\MXD\Fig 3.7a Existing Landuse.mxd Date: 8/3/2012



EAST MESA
AREA DRAINAGE
MASTER PLAN UPDATE
FCD 2011C017

LEGEND

- Project Boundary
- Corporate Boundary
- County Boundary
- Existing Land Owner**
 - Bureau of Land Mgmt.
 - Bureau of Reclamation
 - Private Land
 - State Trust Land



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FIGURE 3.7b
LAND OWNERSHIP

Date: 8/8/2012
 File: P:\300\310\310057
 ADMP Deliverables Data Collection and Analysis Report\MXD\Fig 3.7b Land Ownership.mxd

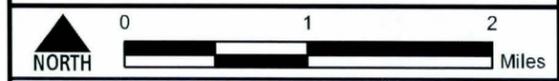
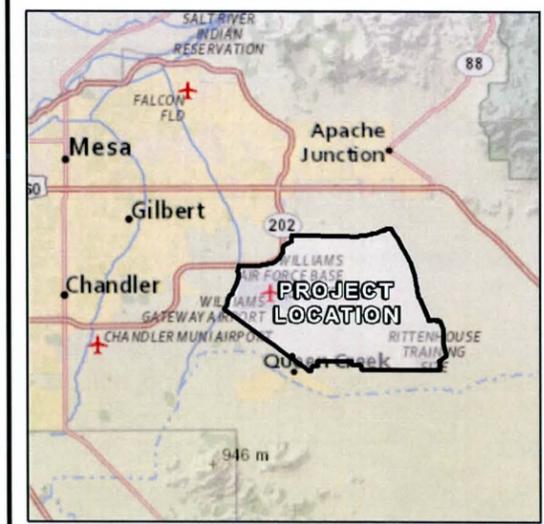


EAST MESA
AREA DRAINAGE
MASTER PLAN UPDATE
FCD 2011C017

LEGEND

- Existing Stock Pond
 - Existing Culvert
 - Existing Channel
 - Existing Embankment
 - Future SR 24 Alignment
 - Future SR 24 Channel
 - Future SR 24 Basins
 - Project Boundary
 - County Boundary
 - Corporate Boundary
- Future Land Use**
- Industrial
 - Commercial
 - Residential
 - Low Density Residential
 - Open Space

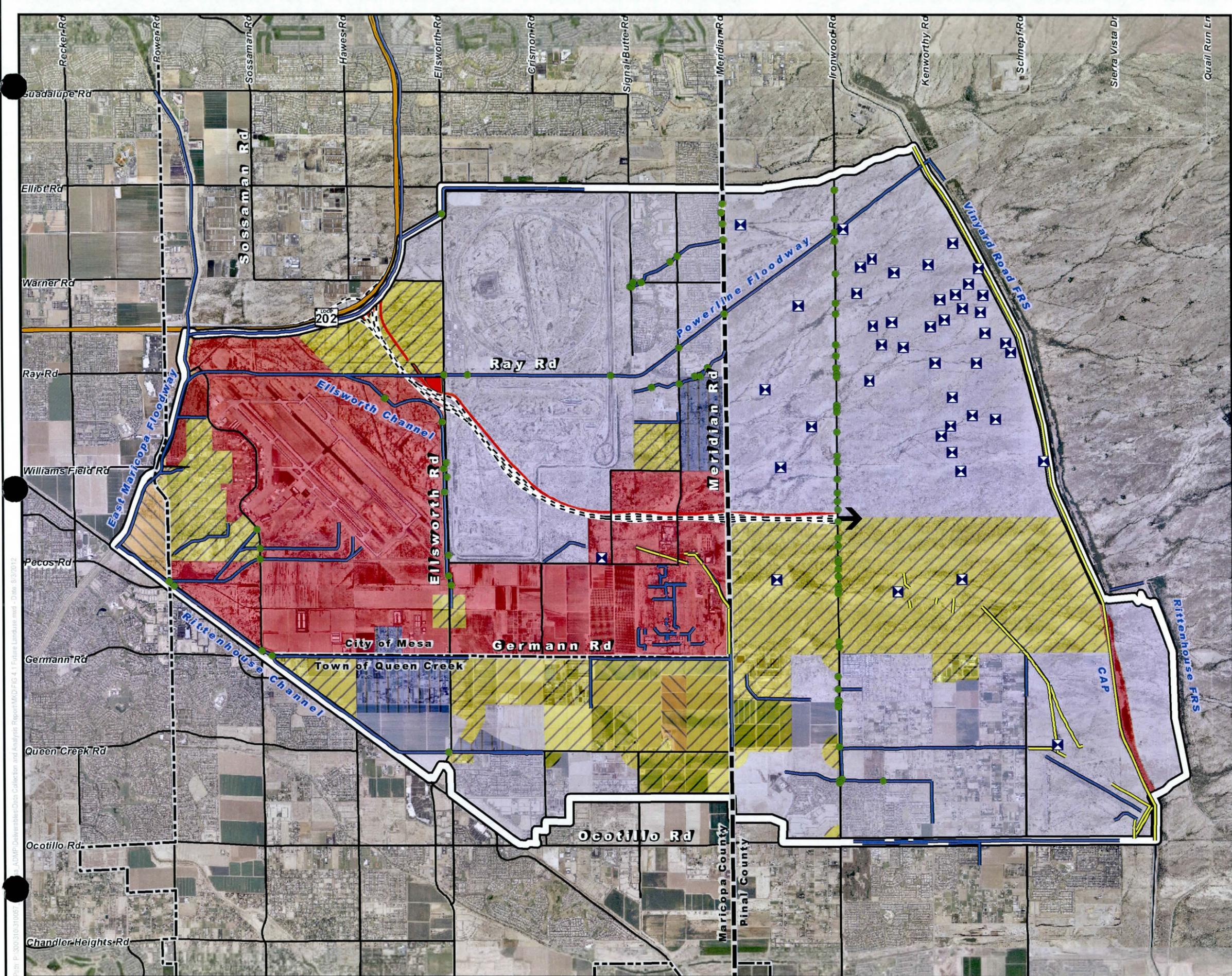
LOCATION MAP



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FIGURE 4.1
FUTURE LAND USE &
PLANNED FACILITIES



Date: P:\2003\310\310057
 ADMP\Deliverables\Data Collection and Analysis\Report\MAP\Fig 4.1 Future Landuse.mxd - Date: 8/3/2012



**EAST MESA
AREA DRAINAGE
MASTER PLAN UPDATE
FCD 2011C017**

LEGEND

- Open Space Resources**
 - Open Space with the Potential for Environmentally Sensitive Development
- Recreation Resources**
 - Local Golf Course
 - Local Golf Course (Planned)
 - Local Community Park
 - Local Community Park (Planned)
 - Barney Family Sports Complex
 - Planned Maricopa County Regional Trail System
 - Planned Pinal County Trails
- Town of Queen Creek**
 - Planned Trailhead
 - Planned Neighborhood Equestrian Park/Trailhead
 - Planned Trail Node
 - Planned Paved Path: multi-use, 10'-12' width
 - Planned Town Unpaved Trail: multi-use, 12' width
 - Planned Neighborhood Unpaved Trail: multi-use, 8' width
 - Planned Wide Unpaved Shoulder: shared-use, 4' width
 - Planned Wash Equestrian Trail: equestrian only, wash bottom
 - Planned Downtown Trail/Sidewalk Corridor: 4' wide trail & 5'-6' wide sidewalk
- City of Mesa**
 - Planned Trail
- Reference Features**
 - Study Area
 - County Boundary
 - SR 24 Alignment
 - SR 24 Channel
 - SR 24 Basin
 - Highway
 - Arterial
 - Canal
 - Washes/Channels
 - Flood Control District Structure
 - Flood Control District Basin

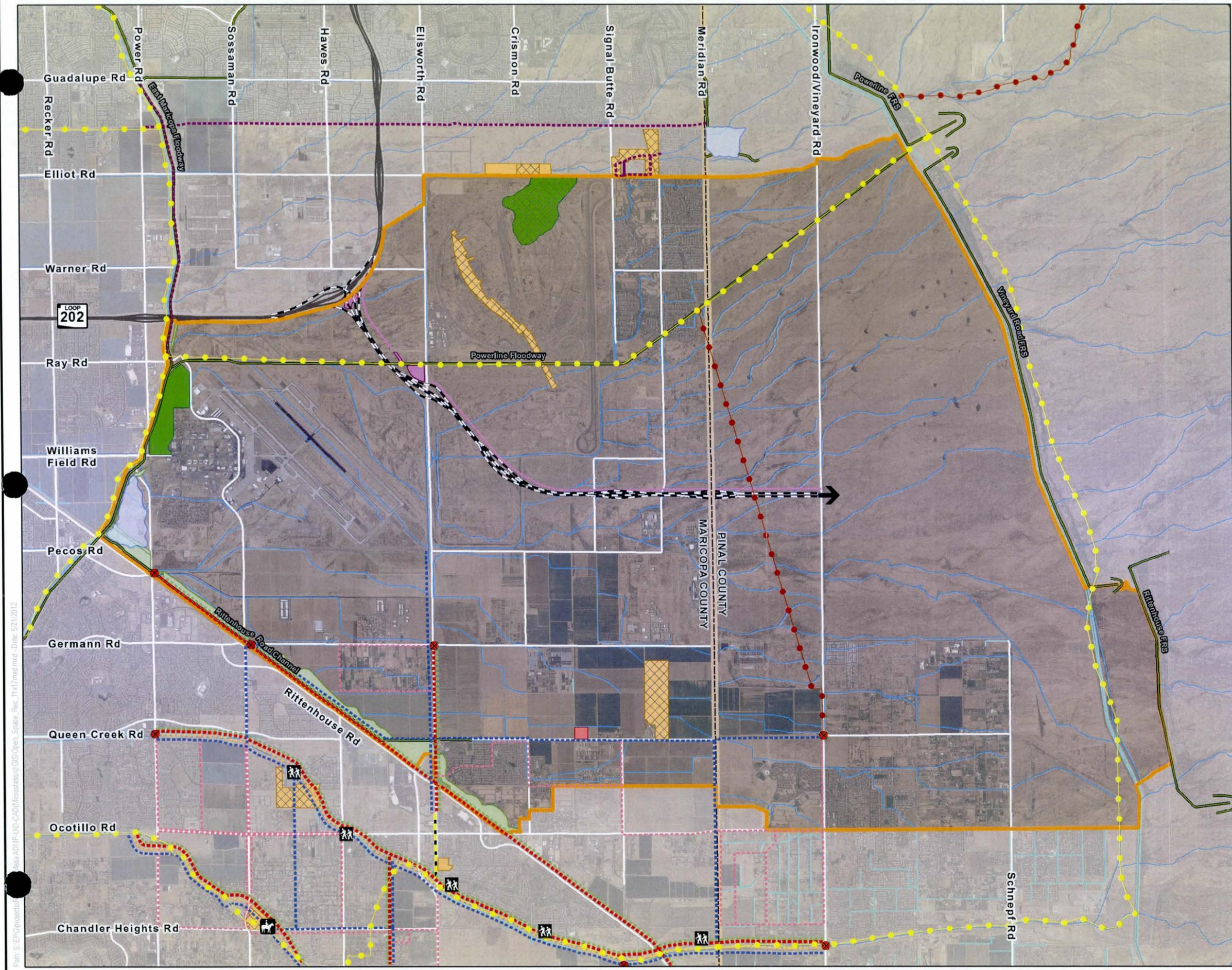
Data Sources
 Maricopa County Department of Transportation
 USDI Bureau of Land Management (BLM)
 Town of Queen Creek
 City of Mesa
 DMB Mesa Proving Grounds, LLC
 Pinal County Open Space and Trails Master Plan



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**FIGURE 6.2
OPEN SPACES & RECREATION
RESOURCES**



Path: S:\EP\Projects\F...
 Date: 5/21/2012



APPENDIX A. EAST MESA ADMP HYDROLOGY UPDATE

Provided in electronic format on enclosed CD.

APPENDIX B. DATA COLLECTION LOG

Project: East Mesa ADMP Update
 FCD Contract FCD2011C017

Data Collection Tracking Sheet

Item Number	Type	Number of Copies	Title	Description	Prepared			Received From		Date Received	Stored/Location	Entered by
					By	Agency	Date	Contact	Agency			
Flood Control Distric of Maricopa County												
5	PDF	1	East Mesa ADMP Project Phasing Map	ADMP Map	Dibble & Associates Consulting Engineers	FCDMC	7/23/1998	-	FCDMC		Entellus	MAN
80	JPG	1	East Mesa ADMP Field Photos	Field Photos	Unkown	FCDMC	8/17/2009	-	FCDMC	3/8/2012	Entellus	RLJ
81	PDF	1	East Mesa ADMP Hydrology	Field Photos	Unkown	FCDMC	9/9/2006	-	FCDMC	3/8/2012	Entellus	RLJ
82	JPG	1	Stock tank West of BMX	Field Photos	Unkown	FCDMC	4/22/2009	-	FCDMC	3/8/2012	Entellus	RLJ
91	DAT	1	EMF HEC-1 Models	Modified Hydrology Models	FCDMC	FCDMC	5/9/2002	-	FCDMC	3/8/2012	Entellus	RLJ
92	PDF	1	EMF HEC-1 Schematics	Modified Hydrology Schematics	J2 Engineering and Environmental Design	FCDMC	6/8/2009	-	FCDMC	3/8/2012	Entellus	RLJ
93	XLS	1	Williams Gateway Freeway HEC-1 Results Summary	Hydrology Flows	J2 Engineering and Environmental Design	FCDMC	10/20/2009	-	FCDMC	3/8/2012	Entellus	RLJ
94	PDF	1	Southeast Mesa Area Drainage Master Plan	Hydrology Schematic	FCDMC	FCDMC	6/8/2008	-	FCDMC	3/8/2012	Entellus	RLJ
96	PRJ	1	Ellsworth Channel HEC-RAS Model	HEC-RAS Model	Unkown	FCDMC	8/3/2006	-	FCDMC	3/8/2012	Entellus	RLJ
99	PDF	1	East Mesa Area Drainage Master Plan Update	ADMPU	FCDMC	FCDMC	8/11/2011	-	Unkown	2/16/2012	Entellus	RLJ
100	PDF	1	East Mesa ADMPU Project Landscape Inventory & Analysis (LIA)	Landscape Report	FCDMC	FCDMC	2/12/2012	-	Unkown	2/16/2012	Entellus	RLJ
101	PDF	1	MCDOT Corridor Studies Book of Summaries 1997-2010	Corridor Study	Maricopa County	MCDOT	10/1/2012	-	Unkown	2/16/2012	Entellus	RLJ
102	PDF	1	Powerline Floodway Final Survey Report	Survey Report	FCDMC	FCDMC	1/19/2012	-	Unkown	2/16/2012	Entellus	RLJ
103	PDF	1	Powerline and Vineyard Road FRS 2010-2011 Instrumentation Monitoring Report	Subsidence Report	AMEC Infrastructure, Inc	FCDMC	4/29/2011	-	Unkown	2/16/2012	Entellus	RLJ
107	PDF	1	East Mesa ADMP Recommended Design Report	Master Drainage Plan	Dibble & Associates Consulting Engineers	FCDMC	7/23/1998	-	Unkown	2/16/2012	Entellus	RLJ
108	PDF	1	A class I Cultural Resources Literature Review for the East Mesa ADMP, Maricopa and Pinal Counties, Arizona	Literature Review	Archaeological Consulting Services	FCDMC	6/10/2011	-	Unkown	2/16/2012	Entellus	RLJ
109	PDF	1	East Mesa Area Drainage Master Plan Preliminary Biological Survey	Biological Survey	EcoPlan Associates, Inc.	FCDMC	6/24/2011	-	Unkown	2/16/2012	Entellus	RLJ
111	PDF	1	Annual Monitoring Inspection Report Earth Fissure Site Investigation Siphon Draw Wash Drainage Improvements Project	Earth Fissure Report	AMEC Earth & Environmental, Inc.	FCDMC	8/23/2011	-	FCDMC	3/22/2012	Ninyo & Moore	HAH
112	PDF	1	Initial Subsidence and Earth Fissure Report Powerline Vineyard Road and Rittenhouse Flood Retarding Structures Rehabilitation or Replacement Project	Subsidence and Earth Fissure Report	AMEC Earth & Environmental, Inc.	FCDMC	8/10/2010	-	FCDMC	3/22/2012	Ninyo & Moore	HAH
113	PDF	1	Preliminary Design Report Site Evaluation of Interim Dam Safety Measure Powerline Flood Retarding Structure	Preliminary Dam Design Report	AMEC Earth & Environmental, Inc.	FCDMC	7/15/2009	-	FCDMC	3/22/2012	Ninyo & Moore	HAH
114	PDF	1	Geologic/Geotechnical Investigation Report Site Evaluation of Interim Dam Safety Measure Powerline Flood Retarding Structure	Geotechnical Report	AMEC Earth & Environmental, Inc.	FCDMC	7/15/2009	-	FCDMC	3/22/2012	Ninyo & Moore	HAH
115	PDF	1	Powerline and Vineyard Road FRS 2008-2009 Instrumentation Monitoring Report	Subsidence Report	AMEC Earth & Environmental, Inc.	FCDMC	5/5/2009	-	FCDMC	3/22/2012	Ninyo & Moore	HAH
116	PDF	1	Siphon Draw Drainage Improvement Project Geologic Hazard Assessment and Geotechnical Characterization Report	Geotechnical Report	AMEC Earth & Environmental, Inc.	FCDMC	9/3/2008	-	FCDMC	3/22/2012	Ninyo & Moore	HAH
117	PDF	1	Powerline Flood Retarding Structure Earth Fissure Failure Modes and Effects Analysis - Planning Phase	Earth Fissure Report	AMEC Earth & Environmental, Inc.	FCDMC	6/5/2008	-	FCDMC	3/22/2012	Ninyo & Moore	HAH
118	PDF	1	Supplemental Earth Fissure/Ground Subsidence Investigation Report Powerline Flood Retarding Structure	Subsidence and Earth Fissure Report	AMEC Earth & Environmental, Inc.	FCDMC	6/4/2008	-	FCDMC	3/22/2012	Ninyo & Moore	HAH
119	PDF	1	Earth Fissure/Ground Subsidence Instrumentation Installation Report and Monitoring Plan Powerline & Vineyard Road Flood Retarding Structures	Subsidence and Earth Fissure Report	AMEC Earth & Environmental, Inc.	FCDMC	6/29/2007	-	FCDMC	3/22/2012	Ninyo & Moore	HAH
120	PDF	1	Preliminary Earth Fissure Risk Zone Investigation Report Hawk Rock Study Area	Earth Fissure Report	AMEC Earth & Environmental, Inc.	FCDMC	9/25/2006	-	FCDMC	3/22/2012	Ninyo & Moore	HAH
121	PDF	1	Earth Fissure Risk Zone Investigation Report Powerline and Vineyard Flood Retarding Structures	Earth Fissure Report	AMEC Earth & Environmental, Inc.	FCDMC	5/25/2006	-	FCDMC	3/22/2012	Ninyo & Moore	HAH
198	PDF	1	Floodplain Regulations for Maricopa County	Regulations		FCDMC	11/1/2011	-	MC		JE Fuller	
224	PDF	1	Supplemental Earth Fissure Risk Report, Powerline FRS Interim Dam Safety Design Measure Project	Earth Fissure Report	AMEC Earth & Environmental, Inc.	FCDMC	12/6/2010	-	FCDMC	3/28/2012	Ninyo & Moore	HAH
225	PDF	1	Powerline and Vineyard Road FRS, 2009-2010 Instrumentation Monitoring Report	Subsidence Report	AMEC Earth & Environmental, Inc.	FCDMC	6/25/2010	-	FCDMC	3/28/2012	Ninyo & Moore	HAH
226	PDF	1	Survey Report Manual for Powerline and Vineyard FRS Subsidence Surveys 2008	Survey Report	A Team Professional Associates, Inc.	FCDMC	10/1/2008	-	FCDMC	3/22/2012	Ninyo & Moore	HAH
227	PDF	1	Structures Assessment Phase II Investigation of Ground Subsidence and Earth Fissures Assignment 2 - Vineyard FRS (Volumes I, II, and III)	Subsidence and Earth Fissure Report	AMEC Earth & Environmental, Inc.	FCDMC	4/29/2002	-	FCDMC	3/22/2012	Ninyo & Moore	HAH
228	PDF	1	Procedural Documents for Land Subsidence and Earth Fissure Appraisals	Subsidence and Earth Fissure Report	AMEC Earth & Environmental, Inc.	FCDMC	5/27/2011	-	FCDMC	3/22/2012	Ninyo & Moore	HAH
231	PDF	1	East Mesa Area Drainage Master Plan Hydrologic Analysis Vol 1 of 2	Hydrology Report	FCDMC	FCDMC	10/1/1998	-	FCDMC	4/6/2012	Entellus	RLJ
232	PDF	1	East Mesa Area Drainage Master Plan Hydrologic Analysis Vol 2 of 2	Hydrology Report	FCDMC	FCDMC	10/1/1998	-	FCDMC	4/6/2012	Entellus	RLJ
233	PDF	1	Southeast Mesa Area Drainage Master Plan Data Collection Report	Data Collection Report	Dibble & Associates Consulting Engineers	FCDMC	5/3/1997	-	FCDMC	4/6/2012	Entellus	RLJ
234	PDF	1	East Mesa Area Drainage Master Plan Recommended Design Report	Drainage Report	Dibble & Associates Consulting Engineers	FCDMC	6/23/1998	-	FCDMC	4/6/2012	Entellus	RLJ
235	PDF	1	Geotechnical Engineering Report Southeast Mesa Area Drainage Master Plan	Geotechnical Report	Ricker, Atkinson, McBee & Associates, Inc.	FCDMC	5/7/1998	-	FCDMC	4/6/2012	Entellus	RLJ
236	PDF	1	DRAFT Phase 1 Environmental Site Assessment Southeast Mesa Area Drainage Master Plan	Environmental Assessment	Western Technologies Inc.	FCDMC	4/15/1998	-	FCDMC	4/6/2012	Entellus	RLJ
237	PDF	1	East Mesa Area Drainage Master Plan - Preliminary Plan	Preliminary Drainage Plan Map	Dibble & Associates Consulting Engineers	FCDMC		-	FCDMC	4/6/2012	Entellus	RLJ
247	PDF	1	Rittenhouse Channel LOMR	LOMR	FCDMC	FCDMC	10/28/1999	Jennifer Pokorski	FCDMC	5/2/2012	Entellus	RAS
248	PDF	1	Letter of Map revision for Rittenhouse Road Channel - Technical Data Notebook	Technical Data Notebook	FCDMC	FCDMC	1/1/1999	Jennifer Pokorski	FCDMC	5/2/2012	Entellus	RAS
249	PDF	1	Final Conceptual Design Report For Rittenhouse Channel From Signal Butte Road to the East Maricopa Floodway	Design Concept report	Gannett Fleming, Inc.	FCDMC	8/19/1993	Jennifer Pokorski	FCDMC	5/2/2012	Entellus	RAS
258		1	Appendix HEC - 1 Schematic - North and South of the Superstition Freeway	FCDMC East Mesa Area Drainage Master Plan	Dibble & Associates Consulting Engineering	FCDMC			FCDMC	6/16/12	Entellus	ATC
259	PDF	1	Siphon Draw Drainage Improvements Phase 1	Plans for the Siphon Draw Drainage Improvements	Stanley Consultants, Inc.	FCDMC	1/19/2009		FCDMC	6/18/12	Entellus	ATC
261	PDF	1	East Mesa Area Drainage Master Plan	Preliminary Design Plans	Dibble & Associates Consulting Engineering	FCDMC	6/18/1998		FCDMC	6/18/12	Entellus	ATC
Development												
1	PDF	1	Master Drainage Report for Mesa Proving Grounds (Redline Version)	Redline Version	Wood-Patel		9/30/2008	Shahir Safi	City of Mesa	12/15/2008	Entellus	MAN
2	PDF	1	Final Drainage Report for Ironwood Crossing	Drainage Report	CMX		1/16/2006	Elise Moore	Pinal County	12/13/2009	Entellus	MAN
3	PDF	1	Preliminary Drainage Report for Ironwood/Pima Subdivision	Drainage Report	CAN-AM		10/27/2004	Elise Moore	Pinal County	12/13/2009	Entellus	MAN
12	PDF	1	Final Drainage Report for Gila River Ranches Sub Division	Final Drainage Report	CMX		1/25/2005	Shahir Safi	City of Mesa	3/2/2009	Entellus	MAN

Project: East Mesa ADMP Update
 FCD Contract FCD2011C017

Data Collection Tracking Sheet

Item Number	Type	Number of Copies	Title	Description	Prepared			Received From		Date Received	Stored/Location	Entered by
					By	Agency	Date	Contact	Agency			
13	PDF	1	Final Drainage Report for Mountain Heights Sub division	Final Drainage Report	Infinity Engineering Services		9/12/2001	Shahir Safi	City of Mesa	3/2/2009	Entellus	MAN
14	PDF	1	Final Drainage Report for Mountain Horizons Sub Division 1 of 2	Final Drainage Report - 1 st Submittal	CMX		9/20/2005	Shahir Safi	City of Mesa	3/2/2009	Entellus	MAN
15	PDF	1	Final Drainage Report for Mountain Horizons Sub Division 2 of 2	Final Drainage Report - 2 nd Submittal	CMX		1/18/2006	Shahir Safi	City of Mesa	3/2/2009	Entellus	MAN
18	PDF	1	Master Drainage Plan for Mountain Ranch Sub Division	Drainage Report	DEI Professional Services		12/8/1999	Shahir Safi	City of Mesa	3/2/2009	Entellus	MAN
21	PDF	1	Offsite Flow Management for Gila River Ranches Sub Division 1 of 2	Offsite Drainage Report - 2 nd Submittal	CMX		6/15/2005	Shahir Safi	City of Mesa	3/2/2009	Entellus	MAN
22	PDF	1	Offsite Flow Management for Gila River Ranches Sub Division 2 of 2	Offsite Drainage Report - 1 st Submittal	CMX		12/2/2004	Shahir Safi	City of Mesa	3/2/2009	Entellus	MAN
25	PDF	1	Drainage Master Plan for Leslie Estates	Master Drainage Report	Community Science Corporation		6/29/2000	-	Town of Queen Creek	3/16/2009	Entellus	MAN
26	PDF	1	Final Drainage Report for Charleston Estates	Final Drainage Report	Sunrise Engineering		6/5/2007	-	Town of Queen Creek	3/16/2009	Entellus	MAN
27	PDF	1	Final Drainage Report for ALC Builders	Final Drainage Report	D & M Engineering		5/10/2005	-	Town of Queen Creek	3/16/2009	Entellus	MAN
28	PDF	1	Final Drainage Report for Langley Gateway Estates	Final Drainage Report	AMEC Infrastructure, Inc		1/18/2005	-	Town of Queen Creek	3/16/2009	Entellus	MAN
29	PDF	1	Final Drainage Report for Nauvoo Station	Final Drainage Report	Fleet-Fisher Engineering, Inc		6/7/2006	-	Town of Queen Creek	3/16/2009	Entellus	MAN
30	PDF	1	Final Drainage Report for Grison Heights	Final Drainage Report	Fleet-Fisher Engineering, Inc		9/24/2004	-	Town of Queen Creek	3/16/2009	Entellus	MAN
54	PDF	1	Gila River Ranches - Offsite Improvement Plans for South Meridian Drive	As-Built	CMX		10/30/2006	-	FCDMC	3/9/2012	Entellus	RLJ
55	PDF	1	Gila River Ranches Unit 2 - Grading Plans	As-Built	CMX		6/30/2005	-	FCDMC	3/8/2012	Entellus	RLJ
56	PDF	1	Gila River Ranches Unit 3 - Final Plat	As-Built	CMX		1/21/2005	-	FCDMC	3/8/2012	Entellus	RLJ
57	PDF	1	Gila River Ranches: Offsite Water Plans - S. Mountain Road	As-Built	CMX		7/9/2004	-	FCDMC	3/8/2012	Entellus	RLJ
60	PDF	1	Mountain Horizons Improvement Plans - Unit 5	Plans	CMX		1/26/2006	-	FCDMC	3/8/2012	Entellus	RLJ
61	PDF	1	Mountain Horizons Improvement Plans - Unit 6	Plans	CMX		1/25/2006	-	FCDMC	3/8/2012	Entellus	RLJ
62	PDF	1	Mountain Horizons Improvement Plans - Unit 8	As-Built	CMX		1/25/2006	-	FCDMC	3/8/2012	Entellus	RLJ
63	PDF	1	Final Plat of Mountain Horizons Unit 5	Plat	CMX		2/15/2006	-	FCDMC	3/8/2012	Entellus	RLJ
64	PDF	1	Final Plat of Mountain Horizons Unit 2	Plat	CMX		2/15/2006	-	FCDMC	3/8/2012	Entellus	RLJ
65	PDF	1	Mountain Horizons Offsite Improvement Plans - Phase 2	Plans	CMX		3/3/2008	-	FCDMC	3/8/2012	Entellus	RLJ
66	PDF	1	Mountain Horizons Improvement Plans - Unit 1	Plans	CMX		9/14/2006	-	FCDMC	3/8/2012	Entellus	RLJ
67	PDF	1	Mountain Horizons Improvement Plans - Unit 9	Plans	CMX		3/28/2007	-	FCDMC	3/8/2012	Entellus	RLJ
68	PDF	1	Mountain Horizons Improvement Plans - Unit 4	Plans	CMX		9/7/2007	-	FCDMC	3/8/2012	Entellus	RLJ
69	PDF	1	Mountain Horizons Water Meter Plans - Unit 7	Plans	CMX		8/23/2007	-	FCDMC	3/8/2012	Entellus	RLJ
70	PDF	1	Mountain Horizons Improvement Plans - Unit 10	Plans	CMX		2/7/2008	-	FCDMC	3/8/2012	Entellus	RLJ
71	PDF	1	Mountain Horizons South Offsite Water & Sewer Plans - Phase 2	Plans	CMX		11/19/2007	-	FCDMC	3/8/2012	Entellus	RLJ
72	PDF	1	Mountain Ranch Unit 2 Improvement Plans	As-Built	DEI Professional Services		12/30/1999	-	FCDMC	3/8/2012	Entellus	RLJ
73	PDF	1	Nova Vista Arterial Improvement Plans	As-Built	CMX		6/30/2006	-	FCDMC	3/8/2012	Entellus	RLJ
74	PDF	1	Nova Vista Collector Improvement Plans	As-Built	CMX		8/25/2006	-	FCDMC	3/8/2012	Entellus	RLJ
75	PDF	1	Nova Vista Improvement Plans - Unit C	As-Built	CMX		7/12/2006	-	FCDMC	3/8/2012	Entellus	RLJ
76	PDF	1	Nova Vista Improvement Plans - Unit A	As-Built	CMX		8/25/2006	-	FCDMC	3/8/2012	Entellus	RLJ
77	PDF	1	Nova Vista Improvement Plans - Unit B	As-Built	CMX		8/26/2006	-	FCDMC	3/8/2012	Entellus	RLJ
78	PDF	1	Nova Vista Improvement Plans - Unit D	Plans	CMX		5/25/2007	-	FCDMC	3/8/2012	Entellus	RLJ
79	PDF	1	Offsite Improvements for Stratford Estates	As-Built	Infinity Engineering Services		9/29/2000	-	FCDMC	3/8/2012	Entellus	RLJ
106	PDF	1	Master Drainage Report for Development Unit 7 at Mesa Proving Grounds	Drainage Report	Wood-Patel		9/29/2011	-	Unkown	2/16/2012	Entellus	RLJ
205	PDF	1	Community Plan for Mesa Proving Grounds-Section 4- Regulatory Framework	Guide			10/1/2008	-	Mesa		JE Fuller	
206	PDF	1	Community Plan for Mesa Proving Grounds-Section 9- Applicability of Mesa Engineering & Design Standards	Guide			10/1/2008	-	Mesa		JE Fuller	
207	PDF	1	Community Plan for Mesa Proving Grounds-Section 12- Landscape Standards	Guide			10/1/2008	-	Mesa		JE Fuller	
208	PDF	1	Community Plan for Mesa Proving Grounds-Section 13- Stormwater Drainage & Ret Stds	Guide			10/1/2008	-	Mesa		JE Fuller	
213	Hard Copy	1	Eastmark Thematic Design Guidelines	Eastmark Thematic Design Guidelines	DMB		10/1/2011	Trevor Barger	DMB	3/22/2012	EPG	JJG
229	PDF	1	Pacific Proving Grounds Master Drainage Report	Drainage Report	EPS Group, Inc.		1/1/2012	-	FCDMC	4/6/2012	Entellus	RLJ
241	PDF	1	Master Drainage Report for Mesa Proving Grounds	Drainage Report	Wood-Patel		9/15/2011	-			Entellus	RLJ
262	PDF	1	MGC Pure Chemicals America Warehouse & Isotainer Parking Additions	Plans	Wood-Patel	MGC Pure Chemicals	01/11/12	Ashok Patel	Wood-Patel	41088	Entellus	RLJ
Williams Gateway Airport												
11	PDF	1	Drainage Master Plan for Phoenix Mesa Gateway Airport	Drainage Master Plan	Dibble Engineering		2/11/2008	Shahir Safi	City of Mesa	3/2/2009	Entellus	MAN
16	PDF	1	Hydrology & Drainage Plan for Williams Gateway Airport Apr 1999	Supplement to Master Drainage Report	Gilbertson Associates, Inc		4/30/1999	Shahir Safi	City of Mesa	3/2/2009	Entellus	MAN
17	PDF	1	Hydrology Study-Drainage Master Plan for Williams Gateway Airport Oct 2001	Hydrology Study	Gilbertson Associates, Inc		10/10/2001	Shahir Safi	City of Mesa	3/2/2009	Entellus	MAN
19	PDF	1	North Area Drainage Evaluation for Williams Gateway Airport	Drainage Report	Dibble & Associates Consulting Engineers		10/31/2006	Shahir Safi	City of Mesa	3/2/2009	Entellus	MAN
20	PDF	1	North General Aviation Area Drainage Improvements & Cul-de-sac Design for Williams Gateway Airport	Final Drainage Report	Dibble & Associates Consulting Engineers		6/14/2007	Shahir Safi	City of Mesa	3/2/2009	Entellus	MAN
85	PDF	1	Drainage Report for Gateway Airport Commerce Center	Drainage Report	Allen Consulting Engineers, Inc.		4/26/2007	-	FCDMC	3/8/2012	Entellus	RLJ
87	PDF	1	Master Drainage Plan for Williams Gateway Airport	Master Drainage Report	Dibble & Associates Consulting Engineers		4/19/1996	-	FCDMC	3/8/2012	Entellus	RLJ
88	PDF	1	Supplement to Williams Gateway Airport Hydrology Study and Master Drainage Plan	Master Drainage Report Supplement	Gilbertson Associates, Inc		6/12/2002	-	FCDMC	3/8/2012	Entellus	RLJ
Arizona State Land Department												
4	PDF	1	Desert Drive Study	Hydrology & Sediment Yield Study	JE Fuller	ASLD	12/10/2007	-	ASLD		Entellus	MAN
33	PDF	1	Desert Drive Area Study Volume I - Existing Conditions Hydrology	Area Study	JE Fuller	ASLD	12/10/2007	-	ASLD	3/8/2012	Entellus	RLJ
34	PDF	1	Desert Drive Area Study Volume II - Book 1	Area Study	JE Fuller	ASLD	4/28/2008	-	ASLD	3/8/2012	Entellus	RLJ
35	PDF	1	Desert Drive Area Study Volume II - Book 2	Area Study	JE Fuller	ASLD	4/29/2008	-	ASLD	3/8/2012	Entellus	RLJ
City of Mesa												
32	PDF	1	City of Mesa Storm Drain Master Plan	Storm Drain Master Plan	Entellus, Inc	City of Mesa	1/14/2010	-	FCDMC	3/8/2012	Entellus	RLJ
58	PDF	1	City of Mesa Improvement Plans for Keighley Place	As-Built	Landaide, Inc.	City of Mesa	3/19/2007	-	FCDMC	3/8/2012	Entellus	RLJ

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Item Number	Type	Number of Copies	Title	Description	Prepared			Received From		Date Received	Stored/Location	Entered by
					By	Agency	Date	Contact	Agency			
59	PDF	1	City of Mesa Improvement Plans for Mountain Heights	As-Built	Infinity Engineering Services	City of Mesa	3/5/2001	-	FCDMC	3/8/2012	Entellus	RLJ
110	PDF	1	City of Mesa Engineering and Design Standards 2009	Design Standards	City of Mesa	City of Mesa	2/1/2009	-	Unkown	3/8/2012	Entellus	RLJ
203	PDF	1	Mesa Storm Water Management Plan	Guide	City of Mesa	City of Mesa	9/1/2011	-	Mesa		JE Fuller	
204	PDF	1	Mesa Stormwater Annual Report to ADEQ 2010-2011	Guide	City of Mesa	City of Mesa	9/1/2011	-	Mesa		JE Fuller	
209	PDF	1	Mesa Subdivision Regulations	Reg	City of Mesa	City of Mesa	11/1/2006	-	Mesa		JE Fuller	
215	GIS	1	City of Mesa Utilities	GIS utility files	City of Mesa	City of Mesa	3/24/2012	-	City of Mesa	3/24/2012	Entellus	HAA
Town of Queen Creek												
7	PDF	1	Town of Queen Creek General Plan	General Plan Update 2008	Town of Queen Creek	Town of Queen Creek	5/21/2008	Chris Dovel	Town of Queen Creek	1/14/2009	Entellus	MAN
8	PDF	1	Town of Queen Creek Landuse Plan	Landuse Plan Amendment	Town of Queen Creek	Town of Queen Creek	5/21/2008	Chris Dovel	Town of Queen Creek	1/14/2009	Entellus	MAN
9	PDF	1	Town of Queen Creek Parks, Trails & Open Space Master Plan	Parks, Trails & Open Space Master Plan	Town of Queen Creek	Town of Queen Creek	11/30/2005	Chris Dovel	Town of Queen Creek	1/14/2009	Entellus	MAN
10	PDF	1	Town of Queen Creek Five Parks Master Plan	Five Parks Master Plan	Town of Queen Creek	Town of Queen Creek	9/30/2007	Chris Dovel	Town of Queen Creek	1/14/2009	Entellus	MAN
210	PDF	1	Queen Creek Subdivision Ordinance - Chapter 6 Subdivision Design Standards and Principles	Ord		Town of Queen Creek	10/1/2007	-	Town of Queen Creek		JE Fuller	
211	PDF	1	Queen Creek Design Standards and Procedures Manual Final Drainage Report Review Checklist	Guide		Town of Queen Creek	10/1/2007	-	Town of Queen Creek		JE Fuller	
212	PDF	1	Queen Creek Flood Control Ordinance	Ord		Town of Queen Creek	8/1/2007	-	Town of Queen Creek		JE Fuller	
214	GIS	1	Queen Creek Utilities	GIS utility files	Town of Queen Creek	Town of Queen Creek	4/23/2012	-	Town of Queen Creek	4/23/2012	Entellus	HAA
257	PDF	1	Germann Road Corridor Improvement Study	Slideshow Slides from Technical Advisory Group Meeting #3	Town of Queen Creek	Town of Queen Creek	3/28/2012	-	Town of Queen Creek	3/28/12	Entellus	ATC
Pinal County												
6	PDF	1	Draft Pinal County ADMP - Phase C - Queen Creek Watershed	Draft ADMP	Entellus, Inc	Pinal County	10/31/2008	Elise Moore	Pinal County	Unkown	Entellus	MAN
23	PDF	1	Final Drainage Report for Germann Road Between Ironwood Drive and Kenworthy Road	Improvement Drainage Report	Jacobs	Pinal County	3/10/2009	Elise Moore	Pinal County	3/12/2009	Entellus	MAN
24	PDF	1	Final Pavement Drainage Memorandum East West Arterial Widening Between Ironwood and Meridian, Combs Rd, Ocotillo Rd, Pecos Rd (Phase I) Pima Rd, Germann Rd (Phase II)	Drainage Report	Carter Burgess	Pinal County	6/7/2007	Elise Moore	Pinal County	3/12/2009	Entellus	MAN
31	PDF	1	Apache Junction Watershed (Pinal County)	Final Drainage Report	Entellus, Inc	Pinal County	10/25/2006	Andrea Betts	Pinal County	4/1/2009	Entellus	MAN
43	PDF	1	Ironwood Drive Paving Plans Phase B1	Paving Plans	Kimley-Horn and Associates, Inc.	Pinal County	12/7/2006	-	FCDMC	3/8/2012	Entellus	RLJ
44	PDF	1	Ironwood Drive Paving Plans Phase B2	Paving Plans	Kimley-Horn and Associates, Inc.	Pinal County	12/2/2006	-	FCDMC	3/8/2012	Entellus	RLJ
45	PDF	1	Ironwood Drive Paving Plans Phase B3 and B4	Paving Plans	Kimley-Horn and Associates, Inc.	Pinal County	1/22/2007	-	FCDMC	3/8/2012	Entellus	RLJ
83	PDF	1	Pinal County Comprehensive Plan	Comprehensive Plan	Pinal County	Pinal County	11/18/2009	-	FCDMC	3/8/2012	Entellus	RLJ
97	TIF	1	Ironwood Drive - Ocotillo Road	Plans/As-Built	Kimley-Horn and Associates, Inc.	Pinal County	1/29/2007	-	FCDMC	3/8/2012	Entellus	RLJ
255	Hard Copy	1	Pinal County Area Drainage Master Plan Phase A - Apache Junction (Final)	Area Drainage Master Plan	Entellus, Inc	Pinal County	10/25/2006	-	Entellus Library		Entellus	RLJ
256	Hard Copy	1	Pinal County Area Drainage Master Plan Phase C - Queen Creek (Final)	Area Drainage Master Plan	Entellus, Inc	Pinal County	5/15/2009	-	Entellus Library		Entellus	RLJ
MCDOT												
36	PDF	1	Final Drainage Report for Ellsworth Road - Phase I - Germann Road to Ray Road	Final Drainage Report	AMEC Infrastructure, Inc	MCDOT	5/23/2005	-	FCDMC	3/8/2012	Entellus	RLJ
37	PDF	1	Plans for the Construction of Ellsworth Road - Phase I - Germann Road to Ray Road	As-Built	AMEC Infrastructure, Inc	MCDOT	4/19/2005	-	FCDMC	3/8/2012	Entellus	RLJ
46	PDF	1	Signal Butte Corridor Improvement Study: US 60 to Rittenhouse Road	Draft Roadway Improvements Study	EPS Group, Inc.	MCDOT	12/1/2009	-	FCDMC	3/8/2012	Entellus	RLJ
47	PDF	1	Signal Butte Corridor Improvement Study: US 60 to Rittenhouse Road - Technical Memorandum No. 1: Purpose and Need	Draft Roadway Improvements Study	EPS Group, Inc.	MCDOT	1/2/2009	-	FCDMC	3/8/2012	Entellus	RLJ
48	PDF	1	Signal Butte Corridor Improvement Study: US 60 to Rittenhouse Road - Technical Memorandum No. 5: Conceptual Drainage report	Draft Roadway Improvements Study	JE Fuller	MCDOT	4/6/2009	-	FCDMC	3/8/2012	Entellus	RLJ
49	PDF	1	Signal Butte Corridor Improvement Study: US 60 to Rittenhouse Road - Technical Memorandum No. 8: Design Features & Access Management Guidelines	Draft Roadway Improvements Study	EPS Group, Inc.	MCDOT	11/1/2009	-	FCDMC	3/8/2012	Entellus	RLJ
50	PDF	1	MCDOT RightTods Program Summary of Public Involvement - Signal Butte Corridor Improvement Study: US 60 to Rittenhouse Road	Final Roadway Improvements Study	MCDOT	MCDOT	12/1/2009	-	FCDMC	3/8/2012	Entellus	RLJ
51	PDF	1	Signal Butte Corridor Improvement Study: US 60 to Rittenhouse Road - Draft Technical Memorandum No. 2: Corridor Characteristics	Draft Roadway Improvements Study	EPS Group, Inc.	MCDOT	2/1/2009	-	FCDMC	3/8/2012	Entellus	RLJ
52	PDF	1	Signal Butte Corridor Improvement Study: US 60 to Rittenhouse Road - Draft Technical Memorandum No. 5: Conceptual Drainage report	Draft Roadway Improvements Study	JE Fuller	MCDOT	2/1/2009	-	FCDMC	3/8/2012	Entellus	RLJ
53	PDF	1	Signal Butte Corridor Improvement Study: US 60 to Rittenhouse Road - Draft Technical Memorandum No.4: Environmental Overview	Draft Roadway Improvements Study	Logan Simpson Design Inc.	MCDOT	1/1/2009	-	FCDMC	3/8/2012	Entellus	RLJ
98	DAT	1	Signal Butte Corridor HEC-1	Hydrology Models	Unkown	MCDOT	1/14/2009	-	FCDMC	3/8/2012	Entellus	RLJ
191	PDF	1	Pavement Design Summary, Ironwood-Gantzel, Roadway Improvement Project, Pinal County, Arizona N&M Project No. 600948002	Pavement Design Report	Ninyo & Moore	Pinal County	9/13/2005	-	Ninyo & Moore		Ninyo & Moore	HAH
192	PDF	1	Geotechnical Evaluation, Ironwood Drive Improvements, Ocotillo Road to US 60, Pinal County, Arizona N&M Project No. 600948001	Geotechnical Evaluation Report	Ninyo & Moore	Pinal County	3/11/2005	-	Ninyo & Moore		Ninyo & Moore	HAH
238	PDF	1	Ellsworth Rd Phase I - Germann Rd to Ray Road	As-Built	MCDOT	MCDOT	6/6/2007	-	FCDMC	4/6/2012	Entellus	RLJ
239	PDF	1	Erie Street Drainage Improvements	Drainage Report	Prestige Engineering Consultants	MCDOT	6/1/2008	-	FCDMC	4/6/2012	Entellus	RLJ
250	PDF	1	Meridian Road Access Control and Corridor Improvement Study - Final Report	Corridor Study	URS	MCDOT	1/1/2006	-	Baker	5/17/2012	Entellus	RLJ
251	PDF	1	Meridian Road Access Control and Corridor Improvement Study - Appendices 1 - 7	Corridor Study	URS	MCDOT	1/1/2006	-	Baker	5/17/2012	Entellus	RLJ
252	PDF	1	Meridian Road Access Control and Corridor Improvement Study - Appendices 8 - 9	Corridor Study	URS	MCDOT	1/1/2006	-	Baker	5/17/2012	Entellus	RLJ
253	PDF	1	Meridian Road Access Control and Corridor Improvement Study - Technical Memo No. 9	Corridor Study	URS	MCDOT	1/1/2006	-	Baker	5/17/2012	Entellus	RLJ
254	PDF	1	Meridian Road Access Control and Corridor Improvement Study - Appendix 10	Corridor Study	URS	MCDOT	1/1/2006	-	Baker	5/17/2012	Entellus	RLJ

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FEMA												
38	JPG	1	FIRM Maricopa County, Arizona - Panel 2685 of 4350	Flood Insurance Rate Map	FEMA	FEMA	9/30/2005	-	FCDMC	3/8/2012	Entellus	RLJ
39	JPG	1	FIRM Maricopa County, Arizona - Panel 2690 of 4350	Flood Insurance Rate Map	FEMA	FEMA	9/30/2005	-	FCDMC	3/8/2012	Entellus	RLJ
40	JPG	1	FIRM Maricopa County, Arizona - Panel 2695 of 4350	Flood Insurance Rate Map	FEMA	FEMA	9/30/2005	-	FCDMC	3/8/2012	Entellus	RLJ
41	PDF	1	FIRM Pinal County, Arizona - Panel 200 of 2575 (Rittenhouse Air Force Auxiliary Field)	Flood Insurance Rate Map	FEMA	FEMA	10/4/2007	-	FCDMC	3/8/2012	Entellus	RLJ
42	PDF	1	FIRM Pinal County, Arizona - Panel 200 of 2575	Flood Insurance Rate Map	FEMA	FEMA	10/4/2007	-	FCDMC	3/8/2012	Entellus	RLJ
ADOT												
89	PDF	1	SR 802 Williams Gateway Freeway - Powerline Floodway Overpass	Preliminary Plans	AECOM	ADOT	10/9/2012	-	FCDMC	3/8/2012	Entellus	RLJ
90	PDF	1	SR 802 Williams Gateway Freeway - Ironwood Drive	Draft Roll Plot	Unkown	ADOT	9/29/2009	-	FCDMC	3/8/2012	Entellus	RLJ
95	PDF	1	SR 802 Williams Gateway Freeway Corridor Study: SR 202L to Florence Junction Location/Design Concept Study & Environmental Assessment	Draft SR802 Alignments	ADOT	ADOT	5/9/2012	-	FCDMC	3/8/2012	Entellus	RLJ
230	PDF	1	Germann Road Corridor Improvement Study Technical Advisory Group Meeting #3	Roadway Study	ADOT/Town of Queen Creek	ADOT	11/3/2011	-	FCDMC	4/6/2012	Entellus	RLJ
240	PDF	1	Germann Road Corridor Improvement Study Power Road to Ironwood Road	Drainage Report	Wilson & Company	ADOT	3/1/2012	Jennifer Pokorski	FCDMC	4/11/2012	Entellus	RLJ
242	Hard copy	1	Project Plans State Highway Getaway Freeway (SR -24)	Construction Plans	Stantec Consultants Inc.	ADOT	11/3/2011	Jennifer Pokorski	FCDMC	3/24/2012	Entellus	HAA
242	PDF	1	Final Materials Design Memorandum - State Route 24 - Gateway Freeway - State Route 202L to Ellsworth Road	Final Materials Design Memorandum	AMEC Earth & Environmental, Inc.	ADOT	10/7/2011	-	ADOT	4/13/2012	Ninyo & Moore	HAH
243	PDF	1	Final Foundation Investigation Report - State Route 24 - Gateway Freeway - State Route 202L to Ellsworth Road	Final Foundation Investigation Report	AMEC Earth & Environmental, Inc.	ADOT	8/12/2011	-	ADOT	4/13/2012	Ninyo & Moore	HAH
244	PDF	1	Final Design Concept Report (Volume 1 of 2) SR 24, Gateway Freeway (SR 202L - Ironwood Road)	Final Design Concept Report	AECOM	ADOT	4/1/2011	-	ADOT	4/13/2012	Ninyo & Moore	HAH
245	PDF	1	Final Geotechnical Investigation Report - State Route 24 - Gateway Freeway - State Route 202L to Ellsworth Road	Final Geotechnical Investigation Report	AMEC Earth & Environmental, Inc.	ADOT	8/12/2011	-	ADOT	4/13/2012	Ninyo & Moore	HAH
260	PDF	1	State Highway Gateway Freeway (SR 24)	SR 24: SR 202L to Ellsworth Road	Stanley Consultants, Inc.	ADOT	11/1/2011	-	ADOT	6/18/12	Entellus	ATC
ADWR												
105	PDF	1	Land Subsidence Maps	Subsidence Maps	ADWR	ADWR	Varies	-	Unkown	2/16/2012	Entellus	RLJ
167	PDF	1	Land Subsidence in the Hawk Rock Area of East Mesa and Apache Junction 2/22/2006 to 4/2/2008	Land Subsidence Map	Arizona Dept of Water Resources	ADWR	6/30/1905	-	ADWR		Ninyo & Moore	HAH
168	PDF	1	Land Subsidence in the Hawk Rock Area of East Mesa and Apache Junction 2/7/2007 to 4/2/2008	Land Subsidence Map	Arizona Dept of Water Resources	ADWR	7/1/1905	-	ADWR		Ninyo & Moore	HAH
169	PDF	1	Land Subsidence in the Hawk Rock Area of East Mesa and Apache Junction 2/7/2007 to 3/18/2009	Land Subsidence Map	Arizona Dept of Water Resources	ADWR	7/2/1905	-	ADWR		Ninyo & Moore	HAH
170	PDF	1	Land Subsidence in the Hawk Rock Area of East Mesa and Apache Junction 2/11/2009 to 3/3/2010	Land Subsidence Map	Arizona Dept of Water Resources	ADWR	7/1/1905	-	ADWR		Ninyo & Moore	HAH
171	PDF	1	Land Subsidence in the Hawk Rock Area of East Mesa and Apache Junction 1/23/2008 to 2/11/2009	Land Subsidence Map	Arizona Dept of Water Resources	ADWR	7/2/1905	-	ADWR		Ninyo & Moore	HAH
172	PDF	1	Land Subsidence in the Hawk Rock Area of East Mesa and Apache Junction 1/23/2008 to 3/3/2010	Land Subsidence Map	Arizona Dept of Water Resources	ADWR	7/2/1905	-	ADWR		Ninyo & Moore	HAH
173	PDF	1	Land Subsidence in the Hawk Rock Area of East Mesa and Apache Junction 5/15/2010 to 5/10/2011	Land Subsidence Map	Arizona Dept of Water Resources	ADWR	7/3/1905	-	ADWR		Ninyo & Moore	HAH
174	PDF	1	Land Subsidence in the Hawk Rock Area of East Mesa and Apache Junction 10/20/2004 to 9/29/2010	Land Subsidence Map	Arizona Dept of Water Resources	ADWR	7/2/1905	-	ADWR		Ninyo & Moore	HAH
175	PDF	1	Land Subsidence in the Hawk Rock Area of East Mesa and Apache Junction 5/17/1992 to 4/19/2000	Land Subsidence Map	Arizona Dept of Water Resources	ADWR	6/22/1905	-	ADWR		Ninyo & Moore	HAH
176	PDF	1	East Mesa Change in Water Level from 1900 to 2002	Water Level Map	Arizona Dept of Water Resources	ADWR	6/24/1905	-	ADWR		Ninyo & Moore	HAH
177	PDF	1	ADWR Hydrologic Map Series Report No. 35 Depth to Water and Water-Level Altitude	Water Level Map	Arizona Dept of Water Resources	ADWR	2/1/2003	-	ADWR		Ninyo & Moore	HAH
AZGS												
104	PDF	1	Suggested Guidelines for Investigating Land-Subsidence and Earth Fissure Hazards in Arizona	Subsidence Report	Arizona Geological Survey	AZGS	8/1/2011	-	Unkown	2/16/2012	Entellus	RLJ
155	PDF	1	AZGS DGM-52 Estimated Depth to Bedrock in Arizona	Geologic Map	rd, S.M., Shipman, T.C., Greene, L., & Harris	AZGS	4/1/2007	-	AZGS		Ninyo & Moore	HAH
156	PDF	1	AZGS DM-EF-17 Earth Fissure Map of Maricopa County, Arizona	Earth Fissure Map	Arizona Geological Survey	AZGS	12/1/2009	-	AZGS		Ninyo & Moore	HAH
157	PDF	1	AZGS DM-EF-21 Earth Fissure Map of Pinal County, Arizona	Earth Fissure Map	Arizona Geological Survey	AZGS	3/1/2011	-	AZGS		Ninyo & Moore	HAH
158	PDF	1	AZGS DM-EF-2 Earth Fissure Map of the Apache Junction Study Area: Pinal and Maricopa Counties, Arizona	Earth Fissure Map	Arizona Geological Survey	AZGS	4/1/2008	-	AZGS		Ninyo & Moore	HAH
159	PDF	1	AZGS DM-EF-1 Earth Fissure Map of the Chandler Heights Study Area: Pinal and Maricopa Counties, Arizona	Earth Fissure Map	Arizona Geological Survey	AZGS	8/1/2008	-	AZGS		Ninyo & Moore	HAH
160	PDF	1	AZGS OFR 96-23 Geologic Map of the Mesa 30' x 60' Quadrangle, East-Central Arizona	Geologic Map	Spencer, J.E., Richard, S.M., & Pearthree, P.A	AZGS	9/1/1996	-	AZGS		Ninyo & Moore	HAH
161	PDF	1	AZGS OFR 94-24 Surficial Geologic Map of the Mesa 30' x 60' Quadrangle, Arizona	Geologic Map	Pearthree, P.A. and Huckleberry, G.	AZGS	11/1/1994	-	AZGS		Ninyo & Moore	HAH
162	PDF	1	AZGS OFR 94-10 Surficial Geology of the Apache Junction Area, Northern Pinal and Eastern Maricopa Counties, Arizona	Geologic Map and Report	Huckleberry, Gary	AZGS	6/1/1994	-	AZGS		Ninyo & Moore	HAH
163	PDF	1	AZGS OFR 07-01 Earth Fissure Mapping Program 2006 Progress Report	Earth Fissure Report	Allison, M.L., and Shipman, T.C.	AZGS	6/1/2007	-	AZGS		Ninyo & Moore	HAH
164	PDF	1	AZGS OFR 08-02 Earth Fissure Mapping Program 2007 Progress Report	Earth Fissure Report	Allison, M.L., and Shipman, T.C.	AZGS	3/20/2008	-	AZGS		Ninyo & Moore	HAH

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165	PDF	1	AZGS OFR 08-03 Arizona's Earth Fissure Mapping Program: Protocols, Procedures and Products	Earth Fissure Report	Shipman, T.C., and Diaz, M.	AZGS	5/1/2008	-	AZGS		Ninyo & Moore	HAH
166	PDF	1	AZGS OFR 94-11 A Reconnaissance of Earth Fissures Near Apache Junction, Chandler Heights, and Southwestern Picacho Basin	Earth Fissure Report	Harris, R.C.	AZGS	6/1/1994	-	AZGS		Ninyo & Moore	HAH
CAP												
122	PDF & TIF	1	Salt-Gila Aqueduct - Various Plan Sheets	Plans/As-Built	Central Arizona Project	CAP	Varies	-	CAP	3/21/2012	Ninyo & Moore	HAH
123	PDF	1	Earth Fissure Investigations for Reaches 2A Salt-Gila Aqueduct	Earth Fissure Report	Central Arizona Project	CAP	1/1/1985	-	CAP	3/21/2012	Ninyo & Moore	HAH
124	PDF	1	Execution of Earth Fissure Repair Contract, Reach 2, Salt-Gila Aqueduct	Earth Fissure Report	Central Arizona Project	CAP	8/16/1985	-	CAP	3/21/2012	Ninyo & Moore	HAH
126	PDF	1	Salt-Gila Aqueduct Reaches 1, 2 and 3 Subsidence Study	Subsidence Report	Geodetic Surveying Services, LLC	CAP	1/4/2002	-	CAP	3/21/2012	Ninyo & Moore	HAH
127	PDF	1	PXAO Library Database Keyword "Subsidence"	Library List	Central Arizona Project	CAP	11/8/2007	-	CAP	3/21/2012	Ninyo & Moore	HAH
128	PDF	1	PXAO Library Database Keyword "Earth Fissure"	Library List	Central Arizona Project	CAP	11/8/2007	-	CAP	3/21/2012	Ninyo & Moore	HAH
129	PDF	1	PXAO Library Database Keyword "Compaction"	Library List	Central Arizona Project	CAP	11/8/2007	-	CAP	3/21/2012	Ninyo & Moore	HAH
130	PDF	1	PXAO Library Database Keyword "Tension"	Library List	Central Arizona Project	CAP	11/8/2007	-	CAP	3/21/2012	Ninyo & Moore	HAH
135	PDF	1	Superstition Mountains Recharge Project	Article	Central Arizona Project	CAP	Unknown	-	CAP Website	3/21/2012	Ninyo & Moore	HAH
USBR												
125	PDF	1	Final Environmental Statement Salt-Gila Aqueduct Central Arizona Project	Environmental Statement	U.S. Bureau of Reclamation	USBR	11/13/1979	-	CAP	3/21/2012	Ninyo & Moore	HAH
131	PDF	1	Subsidence Test Well No. 1 Joint USGS-USBR Earth Fissure and Subsidence Study Bid Documents	Specifications/Bid Docs	U.S. Bureau of Reclamation	USBR	5/19/1978	-	CAP	3/21/2012	Ninyo & Moore	HAH
132	PDF	1	Geohydrologic Data Along the Salt-Gila Aqueduct of the Central Arizona Project in Maricopa and Pinal Counties, Arizona, USGS OFR 86-236	Technical Paper	U.S. Geological Survey	USGS	5/1/1986	-	CAP	3/21/2012	Ninyo & Moore	HAH
133	PDF	1	Ground-Water Depletion and Land Subsidence in Western Pinal County, Arizona	Technical Paper	U.S. Geological Survey	USGS	10/1/1986	-	CAP	3/21/2012	Ninyo & Moore	HAH
134	PDF	1	Salt-Gila Aqueduct Earth Fissure Repair Modifications-Reach 2	Specifications/Bid Docs	U.S. Bureau of Reclamation	USBR	6/7/1905	-	CAP	3/21/2012	Ninyo & Moore	HAH
USGS												
178	PDF	1	Desert Well, AZ USGS Topographic Quadrangle 7.5-Minute Series 2011	Topographic Map	United States Geological Survey	USGS	7/3/1905	-	USGS		Ninyo & Moore	HAH
179	PDF	1	Desert Well, AZ USGS Topographic Quadrangle 7.5-Minute Series 2009	Topographic Map	United States Geological Survey	USGS	7/1/1905	-	USGS		Ninyo & Moore	HAH
180	PDF	1	Desert Well, AZ USGS Topographic Quadrangle 7.5-Minute Series 1971	Topographic Map	United States Geological Survey	USGS	5/24/1905	-	USGS		Ninyo & Moore	HAH
181	PDF	1	Desert Well, AZ USGS Topographic Quadrangle 7.5-Minute Series 1956	Topographic Map	United States Geological Survey	USGS	5/9/1905	-	USGS		Ninyo & Moore	HAH
182	PDF	1	Desert Well, AZ USGS Topographic Quadrangle 7.5-Minute Series 1906 (Reprinted 1946)	Topographic Map	United States Geological Survey	USGS	3/20/1905	-	USGS		Ninyo & Moore	HAH
183	PDF	1	Higley, AZ USGS Topographic Quadrangle 7.5-Minute Series 2011	Topographic Map	United States Geological Survey	USGS	7/3/1905	-	USGS		Ninyo & Moore	HAH
184	PDF	1	Higley, AZ USGS Topographic Quadrangle 7.5-Minute Series 2009	Topographic Map	United States Geological Survey	USGS	7/1/1905	-	USGS		Ninyo & Moore	HAH
185	PDF	1	Higley, AZ USGS Topographic Quadrangle 7.5-Minute Series 1971	Topographic Map	United States Geological Survey	USGS	5/24/1905	-	USGS		Ninyo & Moore	HAH
186	PDF	1	Higley, AZ USGS Topographic Quadrangle 7.5-Minute Series 1956	Topographic Map	United States Geological Survey	USGS	5/9/1905	-	USGS		Ninyo & Moore	HAH
187	PDF	1	Mesa, AZ USGS Topographic Map 30 x 60 Minute Series	Topographic Map	United States Geological Survey	USGS	6/16/1905	-	USGS		Ninyo & Moore	HAH
Others												
84	PDF	1	Town of Gilbert General Plan Land Use Map	Land Use Map	Town of Gilbert	Town of Gilbert	2/10/2010	-	FCDMC	3/8/2012	Entellus	RLJ
86	PRJ	1	Ocotillo Channel HEC-RAS Model	HEC-RAS Model	Unknown		4/17/2006	-	FCDMC	3/8/2012	Entellus	RLJ
136	PDF	1	Land Subsidence, Earth Fissures, and Water-Level Change in Southern Arizona, AZGS OFR 86-14	Technical Paper/Map	Schumann, H.H. and Genualdi, R.B.		6/8/1905	-	N&M Library		Ninyo & Moore	HAH
137	PDF	1	Land Subsidence and Earth Fissures in Arizona	Technical Paper	Slaff, Steven		6/15/1905	-	AZGS	3/19/2012	Ninyo & Moore	HAH
138	PDF	1	Ground-Water Pumping Causes Arizona to Sink, Arizona Geology, Vol. 29, No. 3	Technical Paper	Fellows, Larry		6/21/1905	-	N&M Library		Ninyo & Moore	HAH
139	PDF	1	Use of Low-Sun Angle Photography for Identification of Subsidence-Induced Earth Fissures, IAHS Publication No. 200	Technical Paper	Leckwith, G.H., Slemmons, D.B., & Weeks, R. E.		6/13/1905	-	N&M Library		Ninyo & Moore	HAH
140	PDF	1	South Central Arizona, Earth Fissures and Subsidence Complicate Development of Desert Water Resources, USGS	Technical Paper	Carpenter, M.C.		Unknown	-	N&M Library		Ninyo & Moore	HAH
141	PDF	1	Land Subsidence, Earth Fissures Change Arizona's Landscape, Arroyo, Summer 1992, Vol. 6, No. 2	Technical Paper	Gelt, Joe		6/14/1905	-	N&M Library		Ninyo & Moore	HAH
142	PDF	1	Impacts of Land Subsidence Caused by Withdrawal of Underground Fluids in the United States, GSA, Reviews in Engineering Geology, Volume XVI	Technical Paper	Holzer, T.L. and Galloway, D.L.		6/27/1905	-	N&M Library		Ninyo & Moore	HAH
143	PDF	1	Methods for Prediction of Earth Fissures and Surface Faults Caused by Groundwater Withdrawal, International Conference	Technical Paper	Holzer, T.L.		6/22/1905	-	N&M Library		Ninyo & Moore	HAH
144	PDF	1	Earth Fissures and Localized Differential Subsidence, Water Resources Research, Vol. 17, No. 1, Pgs. 223-227	Technical Paper	Holzer, T.L. and Pampeyan, E.H.		2/1/1981	-	N&M Library		Ninyo & Moore	HAH
145	PDF	1	Faulting Caused by Groundwater Extraction in South-central Arizona, Journal of Geophysical Research, Vol. 84, No. 82	Technical Paper	Holzer, T.L., Davis, S.N., and Lofgren, B.E.		2/10/1979	-	N&M Library		Ninyo & Moore	HAH
146	PDF	1	Geophysical Investigations of Ground Failure Related to Ground-Water Withdrawal - Picacho Basin, Arizona, Ground Water, Vol. 17, No. 6	Technical Paper	Jachens, R.C. and Holzer, T.L.		12/1/1979	-	N&M Library		Ninyo & Moore	HAH
147	PDF	1	Land Subsidence and Earth Fissuring on the Central Arizona Project, Arizona, IAHS Publication No. 200	Technical Paper	Sandoval, J.P. and Bartlett, S.R.		6/13/1905	-	N&M Library		Ninyo & Moore	HAH
148	PDF	1	Notes on Earth Fissures in Southern Arizona, Geological Survey Circular 466	Technical Paper	Robinson, G.M. and Peterson, D.E.		5/15/1905	-	N&M Library		Ninyo & Moore	HAH
149	PDF	1	Land Subsidence, Earth Fissures and Groundwater Withdrawal in South-Central Arizona, U.S.A.	Technical Paper	Schumann, H.H. and Poland, J.F.		5/22/1905	-	N&M Library		Ninyo & Moore	HAH

Project: East Mesa ADMP Update
 FCD Contract FCD2011C017

Data Collection Tracking Sheet

Item Number	Type	Number of Copies	Title	Description	Prepared			Received From		Date Received	Stored/Location	Entered by
					By	Agency	Date	Contact	Agency			
150	PDF	1	Land Subsidence in Central Arizona, Second International Symposium on Land Subsidence	Technical Paper	Winikka, C.C. and Wold, P.D.		12/1/1976	-	FCDMC	3/22/2012	Ninyo & Moore	HAH
151	PDF	1	Field Trip Guidebook for the 2011 AEG Shlemon Specialty Conference, Opportunities for Alternative Energy Development in Arizona and the Southwest	Technical Paper	AEG and ALSG		10/1/2011	-	N&M Library		Ninyo & Moore	HAH
152	PDF	1	Ground Subsidence and Earth Fissuring: Investigations, Solutions and Monitoring, 2011 AEG Shlemon Specialty Conference Presentation	Technical Presentation	Rucker, M.R.		10/1/2011	-	N&M Library		Ninyo & Moore	HAH
153	PDF	1	Land Subsidence and Cracking Due to Ground-Water Depletion, Ground Water, Vol. 15, No. 5	Technical Paper	Bouwer, Herman		10/1/1977	-	N&M Library		Ninyo & Moore	HAH
154	PDF	1	Subsidence Areas and Earth-Fissure Zones, Field notes Publication	Technical Paper	Unknown		6/9/1905	-	N&M Library		Ninyo & Moore	HAH
188	PDF	1	Investigation of Earth Fissure Across San Tan Boulevard, Queen Creek, Arizona	Earth Fissure Report	Shi, John and Perera, Yugantha		7/26/2007	-	MCDOT		Ninyo & Moore	HAH
189	PDF	1	Arizona State Hazard Mitigation Plan 2010, Chapter 5, Section 5.4.5 Fissures	Hazard Mitigation Planning Report	AZ Division of Emergency Management	AZDEM	7/2/1905	-	AZDEM		Ninyo & Moore	HAH
190	PDF	1	Arizona State Hazard Mitigation Plan 2010, Chapter 5, Section 5.4.10 Subsidence	Hazard Mitigation Planning Report	AZ Division of Emergency Management	AZDEM	7/2/1905	-	AZDEM		Ninyo & Moore	HAH
193	PDF	1	Limited Fissure Evaluation, Lost Dutchman Heights UPP, Pinal County, Arizona N&M Project No. 601700001	Earth Fissure Report	Ninyo & Moore		1/14/2009	-	Ninyo & Moore		Ninyo & Moore	HAH
194	PDF	1	Limited Subsidence Evaluation, Lost Dutchman Heights UPP, Pinal County, Arizona N&M Project No. 601700001	Subsidence Report	Ninyo & Moore		1/14/2009	-	Ninyo & Moore		Ninyo & Moore	HAH
195	PDF	1	Initial Geotechnical Evaluation, Desert Drive Planning Area, Pinal County, Arizona N&M Project No. 601702001	Geotechnical Evaluation Report	Ninyo & Moore		6/19/2007	-	Ninyo & Moore		Ninyo & Moore	HAH
196	PDF	1	Earth Fissure Mitigation Plan, Affordable Storage, Apache Junction, Arizona	Earth Fissure Report	Ray Harris Consulting, LLC		3/22/2010	-	Pinal County		Ninyo & Moore	HAH
197	PDF	1	Draft Memorandum Geotechnical Assessment North-South Corridor Study US 60 to I-10, Pinal County, Arizona	Geotechnical Evaluation Report	NCS Consultants, LLC		6/1/2011	-	Pinal County		Ninyo & Moore	HAH
199	PDF	1	Maricopa County Subdivision Regulations	Regulations			3/1/2011	-	MC		JE Fuller	
200	PDF	1	Drainage Regulations for Maricopa County	Regulations		FCDMC	11/1/2010	-	MC		JE Fuller	
201	PDF	1	Clarification of Drainage Regulations	Regulations		FCDMC	9/1/2001	-	MC		JE Fuller	
202	PDF	1	Maricopa County Land Use Plan - Queen Creek Planning Area	Study		MAG	4/1/1992	-	MC		JE Fuller	
218	PDF	1	2nd Gateway-are home plan - 3,500 dwellings would occupy part of former GM test site	Article	Arizona Republic		3/9/2012	Jennifer Pokorski	FCDMC	3/13/2012	Entellus	RLJ
219	PDF	1	On the Ground-Arizona is Cracking Up, Southwest Hydrology, pp. 8 and 9	Technical Paper	Harris, Ray		2/1/2006	-	N&M Library		Ninyo & Moore	HAH
220	PDF	1	Water-Level Declines, Land Subsidence, and Specific Compaction Near Apache Junction, South-Central Arizona	Technical Paper	Carpenter, M.C.		1/1/1987	-	N&M Library		Ninyo & Moore	HAH
221	PDF	1	Geotechnical Evaluation, East Maricopa Floodway, Rittenhouse Detention Basin, Maricopa County, Arizona N&M Project No. 600198002	Geotechnical Evaluation Report	Ninyo & Moore		10/10/2002	-	Ninyo & Moore		Ninyo & Moore	HAH
222	Hard Copy	1	Land Subsidence and Earth Fissures in Alluvial Deposits in the Phoenix Area, Arizona USGS Map I-845-H	Land Subsidence Map	Schumann, H.H.		5/27/1905	-	N&M Library		Ninyo & Moore	HAH
223	PDF	1	Mechanisms of Earth Fissuring Caused by Groundwater Withdrawal, Environmental & Engineering Geoscience, Vol. IX, No. 4, pp. 351-362	Technical Paper	Sheng, Z., Helm, D.C., & Li, J.		11/1/2003	-	N&M Library		Ninyo & Moore	HAH

APPENDIX C. LAND SUBSIDENCE AND EARTH FISSURES MEMO

Provided in electronic format on enclosed CD.

APPENDIX D. POWERLINE FLOODWAY HYDRAULIC ANALYSIS



**EAST MESA AREA DRAINAGE MASTER
PLAN UPDATE**

**POWERLINE FLOODWAY
HYDRAULIC ANALYSIS
TECHNICAL MEMORANDUM**

Contract FCD 2011C017

November 2013

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**EAST MESA AREA DRAINAGE MASTER PLAN UPDATE
 FCD 2011C017
 POWERLINE FLOODWAY HYDRAULIC ANALYSIS
 TECHNICAL MEMORANDUM**

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**EAST MESA AREA DRAINAGE MASTER PLAN UPDATE
POWERLINE FLOODWAY HYDRAULIC ANALYSIS
TECHNICAL MEMORANDUM**

SECTION 1: INTRODUCTION

The *East Mesa Area Drainage Master Plan (ADMP) Update* was initiated to develop and recommend context-sensitive and cost-effective strategies to reduce flood hazards and protect public safety in a 58-square-mile portion of southeastern Maricopa County. The study area includes portions of Mesa, Queen Creek, Gilbert, and unincorporated Maricopa and Pinal counties. The Flood Control District of Maricopa County (District) retained Entellus, Inc., under Contract FCD 2011C017 to prepare an update to the previous ADMP prepared by others in 1998 (1998 ADMP) (Reference 234).

One element of the 1998 ADMP had been to make use of the existing Powerline Floodway, constructed in 1967 as the outlet conveyance for the Powerline, Vineyard Road, and Rittenhouse Flood Retarding Structures (PVR Structures). However, the District recognizes the need to reserve a conveyance capacity of 600 cubic feet per second (cfs) to meet the functional requirements of the PVR Structures. Therefore, it was necessary to evaluate the floodway's performance under the changed condition of reserved conveyance. The purpose of this technical memorandum is to present the results of the hydraulic analysis and document the methodology, assumptions, problems encountered, and solutions for the Powerline Floodway hydraulic analysis. The results are presented in the Technical Data Notebook (TDN) format as defined in the Arizona Department of Water Resources (ADWR) *State Standards for Floodplain Management SS1-97, Requirements for Flood Study Technical Documentation*.

1.1 Project Location

The Powerline Floodway is located in southeast Maricopa County and northwest Pinal County (**Figure 1.1**). It conveys impounded water from the PVR Structures west to the East Maricopa Floodway (EMF) just north of the Phoenix-Mesa Gateway Airport.

Figure 1.1 Location Map



SECTION 2: MAPPING AND SURVEY INFORMATION

Geometric and survey information was provided by the District from two different sources. The first was the *Powerline Floodway Final Survey Report* prepared by the District in advance of this project. The second is the survey and as-built information included in the *East Mesa Area Drainage Master Plan Hydrologic Update (East Mesa ADMPHU)* prepared previously by the District (Reference 231-232). Survey reports can be found in **Attachment 1**.

SECTION 3: HYDROLOGY

Peak discharges for the Powerline Floodway were provided by the District and include the 100-year, 24-hour and 100-year, 6-hour discharges for both existing and future conditions. These models were essentially the same models developed during the *East Mesa ADMPHU*. The only modification by the District was the inclusion of the 600-cfs outflow from the PVR Structures. Typically, controlling flows between the upstream and downstream concentration points within a particular hydrologic subbasin are used to determine flow in a specific section of the channel. This methodology was not used for the Powerline Floodway because berms are located along both banks of the channel. Therefore, inflow to the channel is, in general, limited to specific locations where spillways allow flow to enter the channel. Due to these physical conditions, inflows were only applied downstream of the spillway locations. The only exception is just upstream of the Ironwood Road crossing, where ponding depths are higher than the berm along the north bank, and flow overtops the berm and spills into the channel. **Tables 3.1a and 3.1b** present the peak discharges from the District's hydrologic analysis and the flows used in the hydraulic modeling of the Powerline Floodway for the existing and future conditions, respectively. In both cases (existing and future conditions) the controlling storm was use in the modeling of the floodway.

Table 3.1a Existing Conditions Flows

ID	Location	Controlling Storm	HEC-1 Flow [cfs]	Contributing Area [sq mi]	HEC-RAS Flow [cfs]
FRS	CAP Overchute	NA	600	0.01	600
PWIRON	@ Ironwood Rd	100 Year - 6 Hour	786	0.39	790
CPP3	@ Meridian Rd	100 Year - 24 Hour	962	0.91	960
CPP5	@ Mountian Rd	100 Year - 24 Hour	1085	1.16	1090
CPP7	@ Signal Butte Rd	100 Year - 24 Hour	1160	3.19	1160
CPP8	@ Ellsworth Rd	100 Year - 24 Hour	1267	7.18	1270
CPE33	@ Confluence w/Ellsworth Channel	100 Year - 24 Hour	3096	33.27	3100
CPP9	~3/4 Mile East of Roosevelt Canal	100 Year - 24 Hour	3206	34.39	3210

Table 3.1b Future Conditions Flows

ID	Location	Controlling Storm	HEC-1 Flow [cfs]	Contributing Area [sq mi]	HEC-RAS Flow [cfs]
FRS	CAP Overchute	NA	600	0.01	600
PWIRON	@ Ironwood Rd	100 Year - 24 Hour	681	0.39	680
CPP3	@ Meridian Rd	100 Year - 24 Hour	791	0.91	790
CPP5	@ Mountian Rd	100 Year - 24 Hour	803	1.16	800
CPP7	@ Signal Butte Rd	100 Year - 24 Hour	889	3.17	890
CPG14C	@ Ellsworth Rd	100 Year - 24 Hour	1461	7.01	1460
CPE26A	~1/4 Mile West of Ellsworth Rd	100 Year - 24 Hour	2249	21.3	2250
CPE33B	@ Confluence w/Ellsworth Channel	100 Year - 24 Hour	2334	33.05	2330
CPP9	~3/4 Mile East of Roosevelt Canal	100 Year - 24 Hour	2318	34.17	2320

SECTION 4: HYDRAULICS

4.1 Method Description

Hydraulic analysis of the Powerline Floodway was performed using the River Analysis Extension for AutoCAD Civil 3D 2012 and U.S. Army Corps of Engineers HEC-RAS 4.1.0. Modeling parameters were estimated per the guidelines of the *Drainage Design Manual for Maricopa County - Hydraulics*.

4.2 Work Study Maps

Work study maps were not developed for this study since floodplain delineation is not a part of this study.

4.3 Parameter Estimation

4.3.1 Roughness Coefficient

The roughness coefficients used in the previous analysis of the floodway during the *East Mesa ADMPHU* were reviewed and appear reasonable, so they were also used for this analysis. The n-value used for the concrete lined portion of the channel was 0.016, which is higher than normal for smooth concrete, but is more appropriate based on the conditions of the liner observed during field visits. An n-value of 0.025 was used for the dirt overbanks and maintenance road. Again, this value was consistent with the conditions observed in the field. For the unlined reach downstream from the confluence of the Ellsworth Channel, a value of 0.030 was used for the channel, which is considered an appropriate reflection of the riprap slopes and degree of vegetation and debris observed in the channel bottom.

4.3.2 Contraction and Expansion Coefficients

Different values for contraction and expansion coefficients were used for the supercritical (lined) portion of the channel than for the subcritical (unlined) portion of the channel. For the lined portion, contraction and expansion coefficients of 0.01 and 0.03, respectively, were used. For abrupt transitions, values of 0.05 and 0.2 were used. Culverts were considered to be abrupt transitions, while bridges were not.

For the unlined portion of the channel, expansion and contraction coefficients were set to 0.1 and 0.3, respectively. For significant transitions such as drop structures, coefficients

of 0.3 and 0.5 were assumed. Values of 0.6 and 0.8 were used at the structure just upstream of the confluence with the Ellsworth Channel. Contraction and expansion coefficients of 0.2 and 0.4, respectively, were used for curved sections of the channel such as the confluence with the EMF.

4.4 Cross-Section Description

Cross sections were cut from left to right looking downstream, and the cross-section identifier reflects the distance from the confluence with the EMF. The cross sections were cut from a Triangulated Irregular Network (TIN) provide by the District.

Bank stations were located at the edge of the liner, which allows the use of the concrete n-value for the channel and the dirt n-value for the overbanks.

4.5 Modeling Considerations

4.5.1 Hydraulic Jumps and Drop Analysis

Hydraulic jumps and drop structures were analyzed within HEC-RAS. Because of the potential for both subcritical and supercritical flow in the channel, the mixed flow regime option of HEC-RAS was used. More closely spaced cross sections were placed in the vicinity of drop structures and potential hydraulic jumps to minimize any computational issues resulting from the violation of the gradually-varied flow assumption of the HEC-RAS methodology.

4.5.2 Bridges and Culverts

Fourteen structures cross the floodway. Information on the crossings was taken either from the *East Mesa ADMPHU* or from survey data provided by the District for this project. These structures were included in the hydraulic model of the floodway. The following list summarizes the crossings in order from upstream to downstream and the source of the information obtained.

Ironwood Road Culvert: This structure was originally designed for supercritical flow with smooth transitions and drop inlet intended to maintain supercritical flow conditions through the structure. When Ironwood Road was later widened, the culvert was extended and the inlet and outlet transitions were replicated. Data Source: *Powerline Floodway Final Survey Report* as well as the TIN provided by the District.

Maintenance Crossing Bridge 1: Located approximately 50 feet downstream from the outlet of the Ironwood Road culvert. Data Source: *Powerline Floodway Final Survey Report* prepared by the District.

Maintenance Crossing Bridge 2: Located approximately 4,100 feet downstream from Ironwood Road. Data Source: *Powerline Floodway Final Survey Report* prepared by the District.

Meridian Road Bridge: Data Source: *Powerline Floodway Final Survey Report*.

Pedestrian Bridge 1: Located approximately 640 feet downstream from Meridian Road. Data Source: *Powerline Floodway Final Survey Report*.

Pedestrian Bridge 2: This bridge is located approximately 2,000 feet downstream from the Meridian Road and approximately 1,200 feet upstream from Mountain Road. Data Source: *Powerline Floodway Final Survey Report*.

Mountain Road Bridge: Data Source: *Powerline Floodway Final Survey Report* as well as the TIN provided by the District.

Dante Street Bridge: Data Source: *Powerline Floodway Final Survey Report*.

Signal Butte Culvert: Located at the approximate alignment of Signal Butte Road just inside of the former General Motors (GM) Desert Proving Grounds property boundary. Data Source: *East Mesa ADMPHU* and the TIN provided by the District.

Proving Grounds East Road Culvert: Data Source: B3 GM Proving Ground Culverts 3-4-10 Survey Report in the *East Mesa ADMPHU*.

Proving Grounds West Road Culvert: Data Source: B3 GM Proving Ground Culverts 3-4-10 Survey Report in the *East Mesa ADMPHU*.

Ellsworth Road Culvert: Data Source: survey data found in the hydraulics appendix of the *East Mesa ADMPHU*.

Maintenance Crossing Bridge 3: Located approximately 2,600 feet west of Ellsworth Road. Data Source: *Powerline Floodway Final Survey Report*.

Sossaman Road Bridge: This is a new bridge; based on the *Powerline Floodway Final Survey Report* and field observations, it is a single-span bridge and the bottom of the deck is higher than the banks of the channel. The bridge does not encroach on the Powerline Floodway and therefore was not modeled.

4.5.3 Berms and Dikes

The Powerline Floodway is flanked by earthen berms along most of its reaches. The berms are one to two feet high and are topped by a maintenance road. The lined portion of the channel is typically below natural grade.

4.5.4 Islands and Flow Splits

Flow splits were not considered as part of this analysis. Even though the analysis shows overtopping of the banks at several locations, it was assumed that the flow would stay in the channel and continue downstream. This is not the case in most instances where flow would be lost and may not return to the floodway. However, the purpose of this analysis is to identify deficiencies and investigate solutions to convey the full flow.

4.5.5 Ineffective Flow Areas

The ineffective flow area option of HEC-RAS was used when appropriate to reflect wetted areas that do not actually contribute to the conveyance of flow. This condition is most common upstream and downstream from transitions.

4.5.6 Supercritical Flow

Most of the flow in the Powerline Floodway upstream of its confluence with the Ellsworth Channel is supercritical. The only exceptions are upstream of constrictions where hydraulic jumps form for a short distance before returning to supercritical flow downstream of the constriction.

4.5.7 Blocked Obstructions

The blocked obstructions option of HEC-RAS was not used for this model.

4.5.8 Special Modeling Considerations

Flow Regime

The model was first run using the subcritical flow regime only, but for the majority of the cross sections, it defaulted to critical depth, indicating that flow may be supercritical. Next the model was run in supercritical mode and several cross sections defaulted to critical depth, indicating potential for subcritical depth. Therefore, a mixed flow regime was selected as the appropriate option for this model.

Friction Slope Methodology

HEC-RAS has several options to calculate the friction slope in the channel. The default method is the average conveyance method. The model was run using average conveyance as well as the other three methods: average friction slope, geometric mean friction slope, and harmonic mean friction slope. Differences in the computed water surface elevations among methodologies were inconsequential; therefore, the default average conveyance method appears to be adequate for this model.

4.6 Problems Encountered During Modeling

4.6.1 Special Problems and Solutions

Structures Modeling

At most of the culvert crossings, the results show hydraulic jumps occurring in the vicinity of the structure. For culverts, the transition and configuration of the culverts caused a hydraulic jump and corresponding large increase in the water surface elevation at the inlet. It is possible that this could be caused by a numerical instability issue within HEC-RAS for the culvert calculation. To test this theory, the culverts were removed and replaced with open culverts (without the top wall). To better model the longer culverts (Ironwood Road Culvert and Proving Grounds East Culvert), interpolated cross section were used. Interpolated cross section were also used upstream of the culvert crossings to better represent the transitional areas. The results show that, even without the culvert, the changes in channel geometry were sufficient to cause a hydraulic jump and the hydraulics through the culvert had little to do with the formation of the jump. Therefore, it is appropriate to model the culverts using the HEC-RAS culvert routine.

All of the bridges are single-span with minor geometric changes to the channel configuration. The Sossaman Channel was constructed with the bottom of the bridge deck above the channel bank and the 100-year water surface elevation is significantly below the bottom of the deck. Because the bridge does not affect the flow conditions in the channel, this structure was only modeled as a regular channel section and no bridge information was entered into the model. However, for all the other bridges, the bottom of

the deck does encroach on the 100-year water surface elevation. Therefore, the bridge information was incorporated into the model.

4.6.2 Modeling Warning and Errors

There are no errors reported by the HEC-RAS models. Warnings were reviewed and do not appear to be problematic based on the physical conditions of the Powerline Floodway.

4.7 Calibration

There are no apparent high water marks or other means to determine actual flow stages along the length of the floodway. The only flow gage in this floodway is located at the crossing of Ellsworth Road. This gage was installed in 2008 and has only recorded four storm events. Additionally, a pool gage was installed at the Powerline FRS in 1992 and the District has developed a discharge rating curve for the outlet. Similarly, the Vineyard Road FRS has a gage, and by combining these flows, it is possible to determine the discharge entering the floodway at its upstream end from the structures. However, in addition to the flows from the PVR Structures, the floodway accepts flows from the watershed downstream of the PVR Structures.

4.8 Final Results

4.8.1 Hydraulic Analysis Results

Two main profiles were generated for this project, one each for existing and future conditions. Both of the profiles show slight overtopping of the concrete lining near structures with inadequate capacity. In some reaches, the overtopping is only a few inches; however, it is likely that significant damage to the banks and to the liner could occur if the overtopping is sustained for an extended period of time. The profile plots, along with HEC-RAS summary tables, are provided in **Attachment 2**. Representative cross sections showing the water surface elevation for the 100-year peak discharges are also included in **Attachment 2**, along with an overview map showing the representative cross sections locations.

The downstream reach between the confluence with the Ellsworth Channel and the EMF shows no overtopping of the channel, except near drop structures. In general, there is approximately 1.5 feet of freeboard under existing conditions and approximately three feet of freeboard under future conditions.

Even though the liner is overtopped upstream from the confluence with the Ellsworth Channel, the flows are contained within the channel banks except at immediately upstream from the bridge/culvert crossings. Some of the culverts show water surface elevations several feet above the banks. This condition would in reality be less severe within the channel because the flow would leave the channel and reduce the actual flow continuing downstream. However, the purpose of this study is not to determine the inundation limits resulting from overtopping, but to determine the adequacy of the channel and potential modifications required to mitigate any deficiencies. Therefore, the ineffective flow option of HEC-RAS was used to artificially contain the flow within the width of the channel banks.

In addition to the 100-year flow profiles, additional scenarios were modeled to determine the maximum flow that would be contained within the existing lined portion of the channel as well as at the structures. To determine the capacity of the lined channel, a new profile was defined in the EXISTING GEOMETRY plan called CONATAINED LINER. Different flows were tested at the flow change locations to determine the maximum flow allowed before the water surface elevation rose above the channel banks (liner). Two cross sections were selected (6.931 and 4.090) as representative of the typical characteristics of the lined portion of the channel. The results of the lined channel capacity analysis are provided for these typical cross sections in **Table 4.8**, as well as in **Attachment 2**. To determine the capacity of the structures, a new plan, EXIST. GEOM. FLOW CONT. AT STRUCTURES, was defined and flows were tested to determine max flow allowed without a hydraulic jump. **Table 4.8** shows the capacity of the structures compared to the 100-year peak discharges.

Table 4.8 Structure & Channel Capacities

Name	Q [CFS]		
	100-Year Existing Peak Flow (cfs)	100-Year Future Peak Flow (cfs)	Capacity (cfs)
Ironwood Road Culvert	790	680	380
Maintenance Crossing Bridge 1	790	680	800
Maintenance Crossing Bridge 2	790	680	800
Meridian Road Bridge	790	680	800
Pedestrian Bridge 1	960	790	1300
Pedestrian Bridge 2	960	790	1300
Mountain Road Bridge	1090	800	1300
Dante Street Bridge	1090	800	1300
Signal Butte Culvert	1090	800	1100
Proving Grounds East Road Culvert	1160	890	600
Proving Grounds West Road Culvert	1160	890	600
Ellsworth Road Culvert	1270	1460	600
Maintenance Crossing Bridge 3	1270	2250	1200
Sossaman Road Bridge	3100	2300	4500
Cross Section 6.931	960	790	700
Cross Section 4.090	1160	890	1100

4.8.2 Other Considerations - Subsidence along the Floodway

Data developed by ADWR indicates that the area east of Meridian Road has experienced some differential subsidence. The Powerline Floodway traverses this area and may have been affected by this subsidence. The effects of differential settlement would be an increase or decrease in channel slope. However, this condition was not indicated by the modeling results.

SECTION 5: CONCLUSIONS

In general, the Powerline Floodway capacity is exceeded under existing conditions, and it is at capacity under future conditions. However, inadequate freeboard is indicated in the concrete-lined portion of the floodway. Since the floodway flows supercritical through the entire concrete-lined section, the lack of freeboard is of concern. Any obstruction or debris in the channel could cause a hydraulic jump in the channel, and because of freeboard deficiencies in the liner, the flow could erode the protective berm along the canal and potentially allow flows to break away from the floodway. As stated in **Section 4.8**, overtopping of the liner occurs near the crossings. Of the fourteen crossings, five are significantly under capacity for both the existing and future conditions. Because of the supercritical flow conditions in the floodway, it is recommended that crossings be configured to expand over the channel and that all existing culverts be removed and replaced with bridges that do not create any obstruction to the flow.

ATTACHMENT 1: SURVEY REPORTS

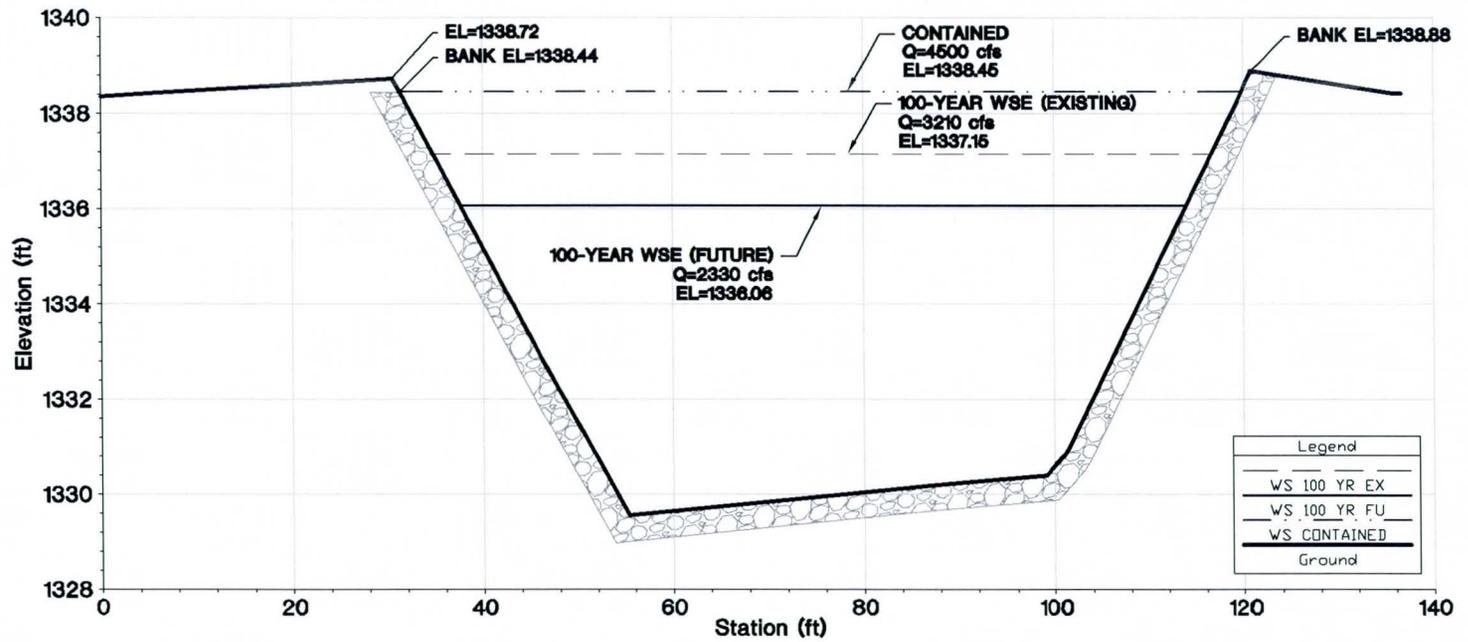
Survey Reports used for this analysis are provided in electronic format only and can be found on the CD in **Attachment 3**.

ATTACHMENT 2: HEC-RAS OUTPUT

**EAST MESA AREA DRAINAGE MASTER PLAN UPDATE
 FCD 2011C017**

X-SEC 0.568

Powerline Floodway Plan: Ex/Fu/Contained Flows 5/17/2012



EAST MESA AREA DRAINAGE MASTER PLAN UPDATE
FCD 2011C017

SHEET: 2 OF 3

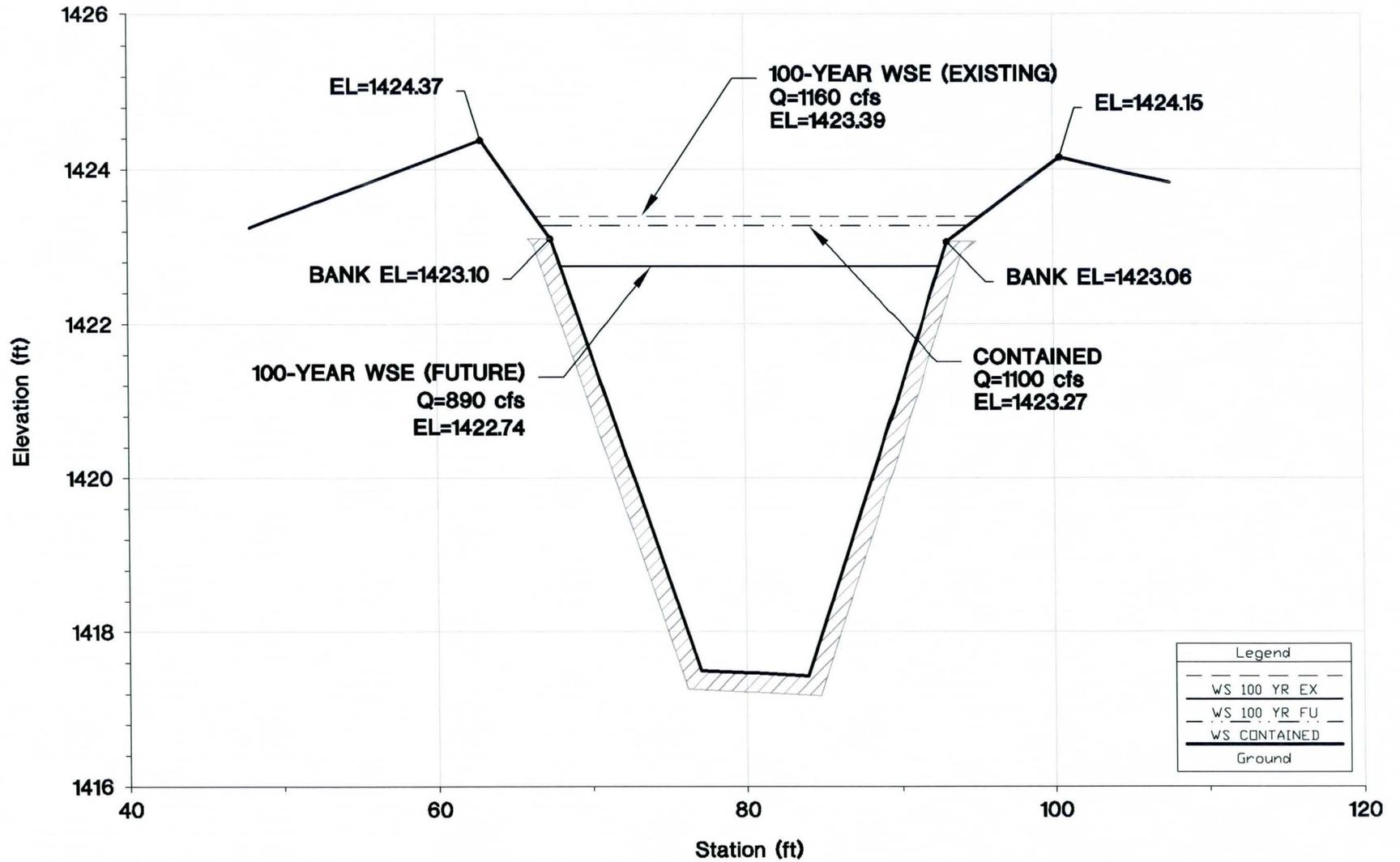
SECTIONS

X-SEC 4.090

Powerline Floodway

Plan: Base Geometry - Ex/Fu/Contained Flows

5/17/2012



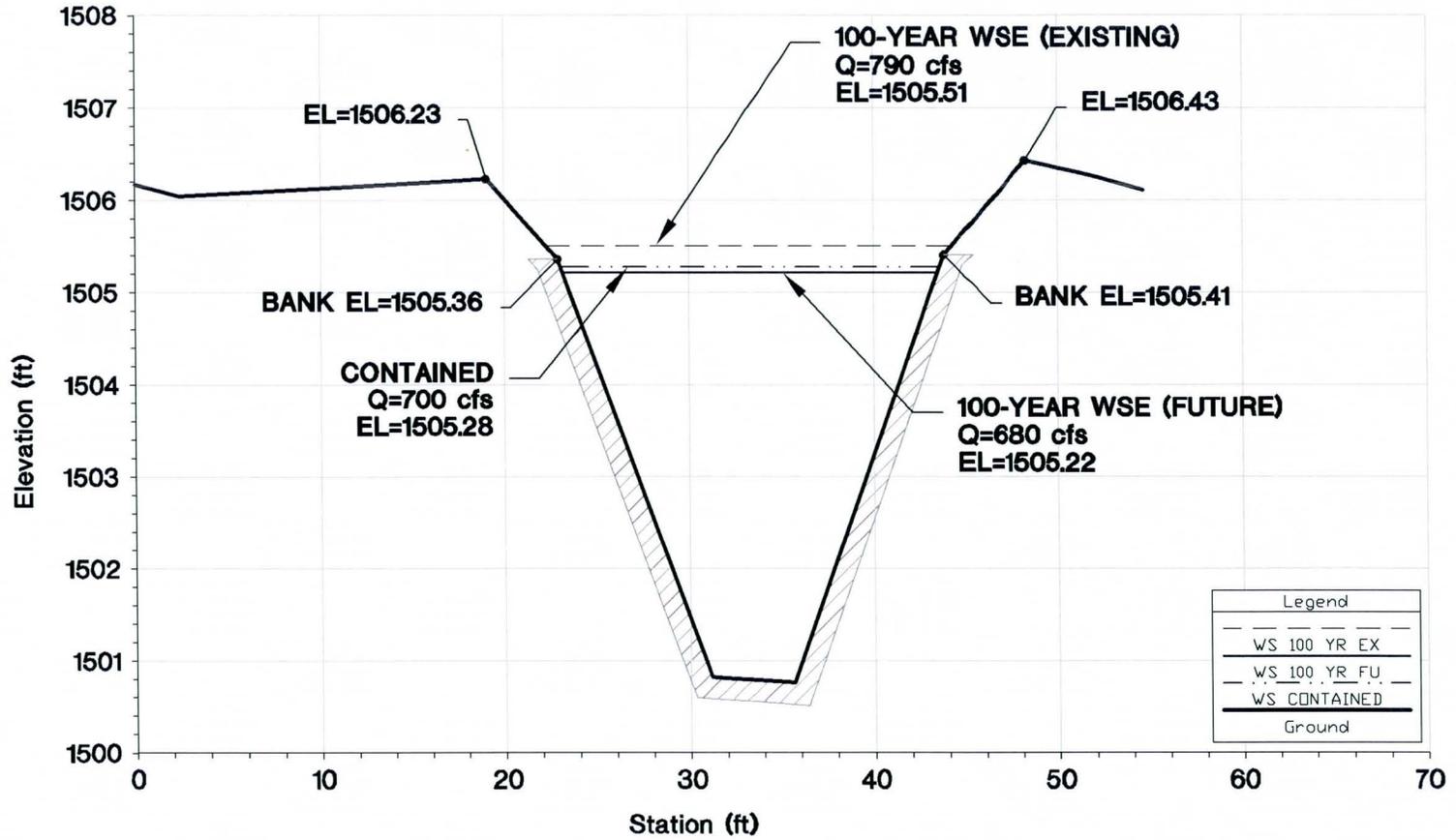
EAST MESA AREA DRAINAGE MASTER PLAN UPDATE
FCD 2011C017

X-SEC 6.931

Powerline Floodway

Plan: Ex/Fu/Contained Flows

5/17/2012



Legend	
---	WS 100 YR EX
---	WS 100 YR FU
---	WS CONTAINED
---	Ground

HEC-RAS Plan: EXISTING River: Powerline Reach: Powerline

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	LOB Elev (ft)	ROB Elev (ft)
Powerline	8.687	100 YR EX	600.00	1560.18	1564.79	1564.79	1566.48	0.003213	10.44	57.49	16.84	1.00	1566.74	1567.17
Powerline	8.687	100 YR FU	600.00	1560.18	1564.79	1564.79	1566.48	0.003213	10.44	57.49	16.84	1.00	1566.74	1567.17
Powerline	8.635	100 YR EX	600.00	1557.67	1561.27	1562.47	1564.99	0.010686	15.49	38.74	16.97	1.81	1562.43	1561.93
Powerline	8.635	100 YR FU	600.00	1557.67	1561.27	1562.47	1564.99	0.010686	15.49	38.74	16.97	1.81	1562.43	1561.93
Powerline	8.579	100 YR EX	600.00	1555.89	1559.95	1560.69	1562.51	0.006445	12.84	46.71	38.00	1.42	1560.55	1560.30
Powerline	8.579	100 YR FU	600.00	1555.89	1559.95	1560.69	1562.51	0.006445	12.84	46.71	38.00	1.42	1560.55	1560.30
Powerline	8.522	100 YR EX	600.00	1554.06	1558.20	1558.89	1560.63	0.006080	12.52	47.92	53.46	1.39	1558.66	1558.42
Powerline	8.522	100 YR FU	600.00	1554.06	1558.20	1558.89	1560.63	0.006080	12.52	47.92	53.46	1.39	1558.66	1558.42
Powerline	8.465	100 YR EX	600.00	1552.20	1556.34	1557.06	1558.81	0.006090	12.62	47.54	40.02	1.38	1556.99	1556.73
Powerline	8.465	100 YR FU	600.00	1552.20	1556.34	1557.06	1558.81	0.006090	12.62	47.54	40.02	1.38	1556.99	1556.73
Powerline	8.408	100 YR EX	600.00	1550.44	1554.53	1555.23	1556.99	0.006074	12.59	47.66	49.83	1.38	1555.14	1554.84
Powerline	8.408	100 YR FU	600.00	1550.44	1554.53	1555.23	1556.99	0.006074	12.59	47.66	49.83	1.38	1555.14	1554.84
Powerline	8.351	100 YR EX	600.00	1548.64	1552.77	1553.43	1555.19	0.005957	12.50	48.02	41.64	1.37	1553.39	1553.01
Powerline	8.351	100 YR FU	600.00	1548.64	1552.77	1553.43	1555.19	0.005957	12.50	48.02	41.64	1.37	1553.39	1553.01
Powerline	8.295	100 YR EX	600.00	1546.87	1551.05	1551.72	1553.43	0.005821	12.39	48.41	57.19	1.36	1551.65	1551.41
Powerline	8.295	100 YR FU	600.00	1546.87	1551.05	1551.72	1553.43	0.005821	12.39	48.41	57.19	1.36	1551.65	1551.41
Powerline	8.238	100 YR EX	600.00	1545.26	1549.47	1550.05	1551.74	0.005496	12.08	49.66	48.49	1.32	1549.90	1549.60
Powerline	8.238	100 YR FU	600.00	1545.26	1549.47	1550.05	1551.74	0.005496	12.08	49.66	48.49	1.32	1549.90	1549.60
Powerline	8.181	100 YR EX	600.00	1543.56	1547.73	1548.35	1550.07	0.005686	12.28	48.87	66.72	1.34	1548.23	1548.02
Powerline	8.181	100 YR FU	600.00	1543.56	1547.73	1548.35	1550.07	0.005686	12.28	48.87	66.72	1.34	1548.23	1548.02
Powerline	8.124	100 YR EX	600.00	1541.94	1546.14	1546.73	1548.39	0.005468	12.06	49.76	89.95	1.32	1546.48	1546.34
Powerline	8.124	100 YR FU	600.00	1541.94	1546.14	1546.73	1548.39	0.005468	12.06	49.76	89.95	1.32	1546.48	1546.34
Powerline	8.067	100 YR EX	600.00	1540.18	1544.47	1545.07	1546.75	0.005494	12.11	49.54	71.31	1.32	1544.92	1544.78
Powerline	8.067	100 YR FU	600.00	1540.18	1544.47	1545.07	1546.75	0.005494	12.11	49.54	71.31	1.32	1544.92	1544.78
Powerline	8.010	100 YR EX	600.00	1538.56	1542.75	1543.37	1545.07	0.005650	12.22	49.10	38.64	1.34	1543.32	1542.96
Powerline	8.010	100 YR FU	600.00	1538.56	1542.75	1543.37	1545.07	0.005650	12.22	49.10	38.64	1.34	1543.32	1542.96
Powerline	7.954	100 YR EX	600.00	1536.63	1540.66	1541.43	1543.25	0.006526	12.92	46.44	33.00	1.43	1541.38	1541.10
Powerline	7.954	100 YR FU	600.00	1536.63	1540.66	1541.43	1543.25	0.006526	12.92	46.44	33.00	1.43	1541.38	1541.10
Powerline	7.897	100 YR EX	600.00	1534.48	1538.52	1539.31	1541.23	0.006988	13.22	45.38	26.10	1.48	1539.11	1539.01
Powerline	7.897	100 YR FU	600.00	1534.48	1538.52	1539.31	1541.23	0.006988	13.22	45.38	26.10	1.48	1539.11	1539.01
Powerline	7.840	100 YR EX	600.00	1532.26	1536.20	1537.08	1539.06	0.007492	13.58	44.18	19.15	1.53	1537.00	1536.67
Powerline	7.840	100 YR FU	600.00	1532.26	1536.20	1537.08	1539.06	0.007492	13.58	44.18	19.15	1.53	1537.00	1536.67
Powerline	7.783	100 YR EX	600.00	1530.01	1534.03	1534.89	1536.83	0.007332	13.43	44.66	21.22	1.51	1534.81	1534.38
Powerline	7.783	100 YR FU	600.00	1530.01	1534.03	1534.89	1536.83	0.007332	13.43	44.66	21.22	1.51	1534.81	1534.38
Powerline	7.726	100 YR EX	600.00	1527.90	1531.83	1532.69	1534.63	0.007288	13.44	44.65	22.99	1.51	1532.61	1532.25
Powerline	7.726	100 YR FU	600.00	1527.90	1531.83	1532.69	1534.63	0.007288	13.44	44.65	22.99	1.51	1532.61	1532.25
Powerline	7.670	100 YR EX	600.00	1525.66	1529.73	1530.56	1532.48	0.007099	13.31	45.07	18.16	1.49	1530.34	1530.25
Powerline	7.670	100 YR FU	600.00	1525.66	1529.73	1530.56	1532.48	0.007099	13.31	45.07	18.16	1.49	1530.34	1530.25
Powerline	7.613	100 YR EX	600.00	1523.50	1531.15	1528.34	1531.49	0.000288	4.76	139.49	103.64	0.35	1528.26	1527.77
Powerline	7.613	100 YR FU	600.00	1523.50	1529.92	1528.34	1530.50	0.000677	6.23	104.56	103.64	0.51	1528.26	1527.77
Powerline	7.556	100 YR EX	600.00	1521.44	1531.28	1526.24	1531.44	0.000091	3.29	206.20	82.67	0.20	1526.19	1525.84
Powerline	7.556	100 YR FU	600.00	1521.44	1530.18	1526.24	1530.40	0.000154	3.90	173.40	82.67	0.26	1526.19	1525.84
Powerline	7.529	100 YR EX	790.00	1520.56	1531.21	1525.93	1531.42	0.000112	3.90	233.08	74.79	0.23	1525.05	1525.24
Powerline	7.529	100 YR FU	680.00	1520.56	1530.17	1525.53	1530.38	0.000129	3.87	201.81	74.79	0.24	1525.05	1525.24
Powerline	7.524	100 YR EX	790.00	1520.15	1530.56	1525.95	1531.38	0.000806	7.30	108.32	135.82	0.41	1526.39	1526.61
Powerline	7.524	100 YR FU	680.00	1520.15	1529.59	1525.37	1530.35	0.000842	6.96	97.71	135.82	0.41	1526.39	1526.61
Powerline	7.502		Culvert											
Powerline	7.482	100 YR EX	790.00	1518.38	1524.18	1524.18	1527.06	0.005756	13.61	58.03	49.92	1.00	1524.36	1524.40
Powerline	7.482	100 YR FU	680.00	1518.38	1523.62	1523.62	1526.24	0.005591	12.99	52.36	10.00	1.00	1524.36	1524.40
Powerline	7.479	100 YR EX	790.00	1518.20	1522.70	1524.11	1526.89	0.008869	16.43	48.09	14.19	1.57	1523.53	1523.45
Powerline	7.479	100 YR FU	680.00	1518.20	1522.43	1523.59	1526.08	0.008188	15.34	44.33	13.73	1.50	1523.53	1523.45
Powerline	7.476	100 YR EX	790.00	1518.06	1521.79	1523.32	1526.69	0.012595	17.76	44.47	17.80	1.98	1522.78	1522.63
Powerline	7.476	100 YR FU	680.00	1518.06	1521.58	1522.96	1525.90	0.011822	16.68	40.76	17.14	1.91	1522.78	1522.63
Powerline	7.472	100 YR EX	790.00	1517.99	1521.77	1523.25	1526.44	0.011838	17.35	45.55	18.06	1.92	1522.65	1522.52
Powerline	7.472	100 YR FU	680.00	1517.99	1521.56	1522.86	1525.67	0.011059	16.26	41.82	17.39	1.85	1522.65	1522.52
Powerline	7.471	100 YR EX	790.00	1517.97	1524.97	1523.20	1525.67	0.000669	6.80	124.79	62.62	0.52	1522.60	1522.48
Powerline	7.471	100 YR FU	680.00	1517.97	1524.40	1522.83	1525.07	0.000743	6.64	108.86	62.62	0.54	1522.60	1522.48
Powerline	7.470		Bridge											

HEC-RAS Plan: EXISTING River: Powerline Reach: Powerline (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	LOB Elev (ft)	ROB Elev (ft)
Powerline	7.469	100 YR EX	790.00	1517.91	1523.18	1523.18	1524.88	0.002693	10.48	76.80	55.28	0.97	1522.53	1522.42
Powerline	7.469	100 YR FU	680.00	1517.91	1522.80	1522.80	1524.38	0.002900	10.10	67.62	23.01	0.99	1522.53	1522.42
Powerline	7.465	100 YR EX	790.00	1517.80	1522.99	1523.11	1524.82	0.003018	10.86	73.91	52.40	1.02	1522.42	1522.33
Powerline	7.465	100 YR FU	680.00	1517.80	1522.69	1522.75	1524.32	0.003028	10.25	66.68	25.80	1.01	1522.42	1522.33
Powerline	7.443	100 YR EX	790.00	1517.03	1522.01	1522.63	1524.38	0.004456	12.35	64.43	30.63	1.23	1521.74	1521.55
Powerline	7.443	100 YR FU	680.00	1517.03	1521.69	1522.19	1523.87	0.004692	11.84	57.43	20.40	1.24	1521.74	1521.55
Powerline	7.386	100 YR EX	790.00	1515.22	1519.94	1520.81	1522.81	0.006157	13.61	58.09	21.45	1.42	1519.80	1519.82
Powerline	7.386	100 YR FU	680.00	1515.22	1519.67	1520.41	1522.26	0.006114	12.93	52.60	19.86	1.40	1519.80	1519.82
Powerline	7.329	100 YR EX	790.00	1513.64	1518.32	1519.15	1521.05	0.005630	13.27	59.74	22.87	1.37	1518.09	1518.15
Powerline	7.329	100 YR FU	680.00	1513.64	1518.06	1518.72	1520.50	0.005618	12.55	54.20	20.09	1.35	1518.09	1518.15
Powerline	7.272	100 YR EX	790.00	1511.80	1516.35	1517.59	1519.30	0.006024	13.80	57.87	21.97	1.42	1515.66	1516.25
Powerline	7.272	100 YR FU	680.00	1511.80	1516.07	1516.86	1518.74	0.006071	13.13	52.03	20.36	1.40	1515.66	1516.25
Powerline	7.215	100 YR EX	790.00	1509.54	1513.98	1515.27	1517.28	0.007538	14.59	54.16	19.88	1.56	1514.29	1514.31
Powerline	7.215	100 YR FU	680.00	1509.54	1513.69	1514.63	1516.73	0.007451	13.98	48.64	18.90	1.54	1514.29	1514.31
Powerline	7.158	100 YR EX	790.00	1507.78	1512.42	1513.24	1515.23	0.006119	13.45	58.73	20.87	1.41	1512.44	1512.47
Powerline	7.158	100 YR FU	680.00	1507.78	1512.13	1512.86	1514.71	0.006029	12.88	52.80	19.85	1.39	1512.44	1512.47
Powerline	7.102	100 YR EX	790.00	1506.05	1510.75	1511.46	1513.45	0.005783	13.17	59.97	21.13	1.38	1510.75	1510.74
Powerline	7.102	100 YR FU	680.00	1506.05	1510.44	1511.11	1512.94	0.005792	12.68	53.62	20.01	1.37	1510.75	1510.74
Powerline	7.045	100 YR EX	790.00	1504.23	1508.88	1509.82	1511.68	0.006053	13.42	58.86	20.78	1.41	1508.92	1508.97
Powerline	7.045	100 YR FU	680.00	1504.23	1508.58	1509.30	1511.16	0.006025	12.90	52.72	19.72	1.39	1508.92	1508.97
Powerline	6.988	100 YR EX	790.00	1502.39	1507.02	1507.85	1509.85	0.006167	13.51	58.48	20.74	1.42	1507.10	1507.16
Powerline	6.988	100 YR FU	680.00	1502.39	1506.72	1507.44	1509.34	0.006134	12.98	52.39	19.68	1.40	1507.10	1507.16
Powerline	6.931	100 YR EX	790.00	1500.76	1505.51	1506.57	1508.12	0.005415	12.96	61.00	22.02	1.34	1505.36	1505.41
Powerline	6.931	100 YR FU	680.00	1500.76	1505.22	1505.84	1507.60	0.005461	12.39	54.90	20.34	1.33	1505.36	1505.41
Powerline	6.874	100 YR EX	790.00	1498.91	1503.43	1504.72	1506.35	0.006455	13.70	57.66	20.81	1.45	1503.53	1503.50
Powerline	6.874	100 YR FU	680.00	1498.91	1503.14	1503.93	1505.83	0.006419	13.16	51.67	19.76	1.43	1503.53	1503.50
Powerline	6.818	100 YR EX	790.00	1497.08	1501.77	1502.55	1504.50	0.005861	13.26	59.60	25.28	1.39	1501.81	1501.68
Powerline	6.818	100 YR FU	680.00	1497.08	1501.47	1502.17	1503.99	0.005867	12.72	53.45	20.08	1.37	1501.81	1501.68
Powerline	6.761	100 YR EX	790.00	1495.27	1499.91	1500.74	1502.71	0.006037	13.45	58.76	23.46	1.40	1500.09	1499.86
Powerline	6.761	100 YR FU	680.00	1495.27	1499.60	1500.34	1502.20	0.006050	12.93	52.60	19.65	1.39	1500.09	1499.86
Powerline	6.726	100 YR EX	790.00	1494.14	1500.99	1499.59	1501.78	0.000832	7.27	116.58	45.51	0.57	1498.89	1498.79
Powerline	6.726	100 YR FU	680.00	1494.14	1500.41	1499.21	1501.19	0.000955	7.18	100.56	45.51	0.60	1498.89	1498.79
Powerline	6.724	100 YR EX	790.00	1494.10	1501.01	1499.57	1501.78	0.000792	7.16	118.47	46.17	0.56	1498.83	1498.73
Powerline	6.724	100 YR FU	680.00	1494.10	1500.43	1499.17	1501.18	0.000901	7.05	102.56	46.17	0.58	1498.83	1498.73
Powerline	6.723		Bridge											
Powerline	6.721	100 YR EX	790.00	1493.96	1499.42	1499.42	1501.09	0.002617	10.40	78.28	59.07	0.96	1498.70	1498.62
Powerline	6.721	100 YR FU	680.00	1493.96	1499.04	1499.04	1500.61	0.002830	10.04	68.33	41.80	0.98	1498.70	1498.62
Powerline	6.716	100 YR EX	790.00	1493.78	1498.86	1499.29	1501.00	0.003909	11.75	67.80	67.41	1.15	1498.53	1498.48
Powerline	6.716	100 YR FU	680.00	1493.78	1498.49	1498.87	1500.52	0.004317	11.42	59.53	44.78	1.19	1498.53	1498.48
Powerline	6.704	100 YR EX	790.00	1493.34	1498.22	1498.89	1500.71	0.005035	12.66	62.44	25.03	1.29	1498.16	1498.12
Powerline	6.704	100 YR FU	680.00	1493.34	1497.90	1498.46	1500.21	0.005145	12.20	55.74	20.02	1.29	1498.16	1498.12
Powerline	6.647	100 YR EX	790.00	1491.56	1496.38	1497.13	1499.10	0.005770	13.23	59.71	20.67	1.37	1496.50	1496.47
Powerline	6.647	100 YR FU	680.00	1491.56	1496.07	1496.76	1498.58	0.005736	12.71	53.51	19.63	1.36	1496.50	1496.47
Powerline	6.590	100 YR EX	790.00	1490.02	1494.73	1495.86	1497.38	0.005630	13.07	60.43	21.10	1.36	1494.72	1494.72
Powerline	6.590	100 YR FU	680.00	1490.02	1494.42	1495.09	1496.87	0.005610	12.56	54.15	19.98	1.34	1494.72	1494.72
Powerline	6.533	100 YR EX	790.00	1488.22	1492.84	1493.89	1495.64	0.005992	13.43	58.83	21.00	1.40	1492.96	1492.72
Powerline	6.533	100 YR FU	680.00	1488.22	1492.53	1493.27	1495.12	0.006053	12.91	52.66	19.76	1.39	1492.96	1492.72
Powerline	6.477	100 YR EX	790.00	1486.45	1491.13	1492.02	1493.87	0.005806	13.28	59.49	20.93	1.38	1491.33	1491.07
Powerline	6.477	100 YR FU	680.00	1486.45	1490.83	1491.51	1493.35	0.005797	12.74	53.37	19.69	1.36	1491.33	1491.07
Powerline	6.420	100 YR EX	790.00	1484.63	1489.26	1490.19	1492.09	0.006064	13.50	58.57	21.11	1.41	1489.40	1489.14
Powerline	6.420	100 YR FU	680.00	1484.63	1488.96	1489.70	1491.56	0.006094	12.95	52.51	19.70	1.40	1489.40	1489.14
Powerline	6.363	100 YR EX	790.00	1482.31	1486.76	1488.06	1490.06	0.007534	14.58	54.20	24.33	1.56	1487.14	1486.94
Powerline	6.363	100 YR FU	680.00	1482.31	1486.47	1487.41	1489.53	0.007543	14.04	48.45	18.90	1.54	1487.14	1486.94
Powerline	6.306	100 YR EX	790.00	1479.88	1484.25	1485.35	1487.72	0.008069	14.96	52.81	19.66	1.61	1484.62	1484.60
Powerline	6.306	100 YR FU	680.00	1479.88	1483.95	1484.97	1487.18	0.008099	14.42	47.16	18.64	1.60	1484.62	1484.60
Powerline	6.249	100 YR EX	790.00	1477.47	1481.85	1483.13	1485.31	0.008018	14.92	52.96	19.71	1.60	1482.28	1482.16
Powerline	6.249	100 YR FU	680.00	1477.47	1481.56	1482.56	1484.76	0.008017	14.36	47.37	18.70	1.59	1482.28	1482.16

HEC-RAS Plan: EXISTING River: Powerline Reach: Powerline (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	LOB Elev (ft)	ROB Elev (ft)
Powerline	6.193	100 YR EX	790.00	1475.09	1479.46	1480.86	1482.90	0.008001	14.89	53.05	21.94	1.60	1479.84	1479.75
Powerline	6.193	100 YR FU	680.00	1475.09	1479.17	1480.16	1482.36	0.007996	14.33	47.46	18.79	1.59	1479.84	1479.75
Powerline	6.136	100 YR EX	790.00	1472.81	1477.23	1478.38	1480.56	0.007615	14.64	53.96	37.69	1.57	1477.54	1477.52
Powerline	6.136	100 YR FU	680.00	1472.81	1476.94	1477.89	1480.02	0.007601	14.08	48.30	30.96	1.55	1477.54	1477.52
Powerline	6.079	100 YR EX	790.00	1470.84	1475.36	1476.26	1478.41	0.006743	14.01	56.39	21.99	1.48	1475.57	1475.55
Powerline	6.079	100 YR FU	680.00	1470.84	1475.07	1475.90	1477.88	0.006703	13.45	50.55	19.22	1.46	1475.57	1475.55
Powerline	6.058	100 YR EX	790.00	1470.23	1474.97	1475.68	1477.71	0.005752	13.27	59.55	20.40	1.37	1475.11	1475.18
Powerline	6.058	100 YR FU	680.00	1470.23	1474.67	1475.34	1477.18	0.005690	12.71	53.48	19.41	1.35	1475.11	1475.18
Powerline	6.054	100 YR EX	790.00	1470.12	1474.91	1475.68	1477.59	0.005502	13.12	60.29	22.20	1.34	1475.03	1475.15
Powerline	6.054	100 YR FU	680.00	1470.12	1474.60	1475.33	1477.06	0.005457	12.59	53.99	19.11	1.32	1475.03	1475.15
Powerline	6.047		Bridge											
Powerline	6.041	100 YR EX	790.00	1469.72	1474.24	1475.13	1477.20	0.006592	13.80	57.24	20.76	1.46	1474.54	1474.62
Powerline	6.041	100 YR FU	680.00	1469.72	1473.96	1474.84	1476.67	0.006509	13.22	51.43	19.74	1.44	1474.54	1474.62
Powerline	6.037	100 YR EX	790.00	1469.54	1473.93	1474.90	1477.03	0.007122	14.12	55.93	20.96	1.52	1475.85	1475.49
Powerline	6.037	100 YR FU	680.00	1469.54	1473.65	1474.53	1476.50	0.007065	13.55	50.20	19.94	1.50	1475.85	1475.49
Powerline	6.022	100 YR EX	790.00	1469.07	1473.66	1474.52	1476.52	0.006260	13.56	58.25	20.84	1.43	1475.35	1475.24
Powerline	6.022	100 YR FU	680.00	1469.07	1473.37	1474.15	1475.99	0.006197	13.00	52.29	19.81	1.41	1475.35	1475.24
Powerline	5.965	100 YR EX	960.00	1467.27	1472.75	1473.19	1475.04	0.004026	12.16	78.98	23.65	1.17	1473.43	1473.47
Powerline	5.965	100 YR FU	790.00	1467.27	1472.14	1472.66	1474.42	0.004553	12.11	65.23	21.60	1.23	1473.43	1473.47
Powerline	5.930	100 YR EX	960.00	1466.17	1471.38	1472.15	1474.18	0.005326	13.43	71.50	22.89	1.34	1472.21	1472.24
Powerline	5.930	100 YR FU	790.00	1466.17	1470.92	1471.63	1473.49	0.005401	12.85	61.49	21.30	1.33	1472.21	1472.24
Powerline	5.928	100 YR EX	960.00	1466.10	1471.28	1472.08	1474.13	0.005461	13.56	70.82	22.78	1.35	1472.15	1472.19
Powerline	5.928	100 YR FU	790.00	1466.10	1470.82	1471.56	1473.44	0.005548	12.98	60.87	21.20	1.35	1472.15	1472.19
Powerline	5.927		Bridge											
Powerline	5.926	100 YR EX	960.00	1466.01	1471.18	1472.00	1474.06	0.005530	13.63	70.45	22.68	1.36	1472.08	1472.11
Powerline	5.926	100 YR FU	790.00	1466.01	1470.73	1471.48	1473.37	0.005623	13.05	60.53	21.10	1.36	1472.08	1472.11
Powerline	5.921	100 YR EX	960.00	1465.81	1470.96	1471.82	1473.91	0.005691	13.78	69.64	22.50	1.38	1471.92	1471.94
Powerline	5.921	100 YR FU	790.00	1465.81	1470.51	1471.29	1473.22	0.005796	13.21	59.81	20.92	1.38	1471.92	1471.94
Powerline	5.909	100 YR EX	960.00	1465.36	1470.51	1471.39	1473.53	0.005870	13.96	68.78	22.29	1.40	1471.53	1471.54
Powerline	5.909	100 YR FU	790.00	1465.36	1470.06	1470.88	1472.83	0.005969	13.37	59.10	20.74	1.40	1471.53	1471.54
Powerline	5.852	100 YR EX	960.00	1463.33	1468.36	1469.39	1471.67	0.006572	14.61	65.72	21.57	1.47	1469.64	1469.59
Powerline	5.852	100 YR FU	790.00	1463.33	1467.92	1468.84	1470.95	0.006637	13.96	56.61	20.09	1.47	1469.64	1469.59
Powerline	5.795	100 YR EX	960.00	1461.64	1466.69	1468.01	1469.78	0.006019	14.11	68.03	22.08	1.42	1467.86	1467.70
Powerline	5.795	100 YR FU	790.00	1461.64	1466.26	1467.09	1469.05	0.005984	13.40	58.95	20.63	1.40	1467.86	1467.70
Powerline	5.738	100 YR EX	960.00	1459.68	1464.69	1465.69	1467.92	0.006364	14.41	66.63	21.87	1.45	1465.98	1465.87
Powerline	5.738	100 YR FU	790.00	1459.68	1464.26	1465.16	1467.19	0.006383	13.73	57.56	20.41	1.44	1465.98	1465.87
Powerline	5.681	100 YR EX	960.00	1457.91	1462.95	1463.88	1466.05	0.006052	14.15	67.87	22.03	1.42	1464.10	1464.12
Powerline	5.681	100 YR FU	790.00	1457.91	1462.52	1463.34	1465.33	0.006035	13.45	58.75	20.58	1.40	1464.10	1464.12
Powerline	5.674	100 YR EX	960.00	1457.63	1462.70	1463.61	1465.80	0.006047	14.15	67.86	21.99	1.42	1463.85	1463.87
Powerline	5.674	100 YR FU	790.00	1457.63	1462.27	1463.10	1465.08	0.006023	13.44	58.77	20.54	1.40	1463.85	1463.87
Powerline	5.672	100 YR EX	960.00	1457.57	1462.64	1463.57	1465.74	0.006022	14.13	67.95	21.99	1.42	1463.80	1463.82
Powerline	5.672	100 YR FU	790.00	1457.57	1462.22	1463.04	1465.01	0.005994	13.42	58.86	20.54	1.40	1463.80	1463.82
Powerline	5.671		Bridge											
Powerline	5.670	100 YR EX	960.00	1457.51	1462.59	1463.51	1465.70	0.006037	14.15	67.87	21.95	1.42	1463.75	1463.77
Powerline	5.670	100 YR FU	790.00	1457.51	1462.16	1462.97	1464.96	0.005996	13.43	58.83	20.51	1.40	1463.75	1463.77
Powerline	5.667	100 YR EX	960.00	1457.37	1462.45	1463.37	1465.57	0.006064	14.17	67.74	21.92	1.42	1463.62	1463.64
Powerline	5.667	100 YR FU	790.00	1457.37	1462.02	1462.86	1464.84	0.006037	13.46	58.67	20.47	1.40	1463.62	1463.64
Powerline	5.625	100 YR EX	960.00	1455.96	1460.98	1461.95	1464.20	0.006347	14.39	66.70	21.87	1.45	1462.16	1462.18
Powerline	5.625	100 YR FU	790.00	1455.96	1460.55	1461.43	1463.47	0.006355	13.70	57.65	20.41	1.44	1462.16	1462.18
Powerline	5.568	100 YR EX	960.00	1454.14	1459.24	1460.52	1462.33	0.006072	14.12	67.99	22.24	1.42	1460.34	1460.21
Powerline	5.568	100 YR FU	790.00	1454.14	1458.81	1459.65	1461.61	0.006042	13.41	58.90	20.78	1.40	1460.34	1460.21
Powerline	5.511	100 YR EX	960.00	1452.17	1457.09	1458.48	1460.42	0.006673	14.63	65.60	21.84	1.49	1458.31	1458.20
Powerline	5.511	100 YR FU	790.00	1452.17	1456.66	1457.60	1459.69	0.006728	13.97	56.55	20.36	1.48	1458.31	1458.20
Powerline	5.469	100 YR EX	960.00	1450.86	1455.97	1456.85	1459.01	0.005898	13.98	68.65	22.28	1.40	1456.96	1457.00
Powerline	5.469	100 YR FU	790.00	1450.86	1455.55	1456.34	1458.28	0.005856	13.27	59.52	20.82	1.38	1456.96	1457.00
Powerline	5.455	100 YR EX	1090.00	1450.42	1455.92	1456.60	1458.63	0.004693	13.21	82.53	24.68	1.27	1456.64	1456.76
Powerline	5.455	100 YR FU	800.00	1450.42	1454.82	1455.75	1457.83	0.006701	13.94	57.40	20.79	1.48	1456.64	1456.76

HEC-RAS Plan: EXISTING River: Powerline Reach: Powerline (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	LOB Elev (ft)	ROB Elev (ft)
Powerline	5.452	100 YR EX	1090.00	1450.31	1455.85	1456.51	1458.56	0.004634	13.21	82.49	24.29	1.26	1456.51	1456.72
Powerline	5.452	100 YR FU	800.00	1450.31	1454.72	1455.64	1457.74	0.006614	13.94	57.40	20.50	1.47	1456.51	1456.72
Powerline	5.441													
		Bridge												
Powerline	5.429	100 YR EX	1090.00	1449.69	1454.60	1455.56	1457.86	0.006286	14.49	75.21	24.83	1.47	1455.71	1455.81
Powerline	5.429	100 YR FU	800.00	1449.69	1453.86	1454.78	1456.86	0.007259	13.91	57.50	22.77	1.54	1455.71	1455.81
Powerline	5.424	100 YR EX	1090.00	1449.34	1455.11	1455.68	1457.71	0.004397	12.93	84.30	33.18	1.23	1455.48	1455.61
Powerline	5.424	100 YR FU	800.00	1449.34	1454.19	1454.81	1456.69	0.005157	12.69	63.05	21.46	1.30	1455.48	1455.61
Powerline	5.413	100 YR EX	1090.00	1448.87	1454.53	1455.45	1457.44	0.005074	13.69	79.65	23.72	1.32	1455.17	1455.23
Powerline	5.413	100 YR FU	800.00	1448.87	1453.68	1454.45	1456.38	0.005678	13.20	60.62	20.83	1.36	1455.17	1455.23
Powerline	5.398	100 YR EX	1090.00	1448.34	1453.91	1455.08	1457.00	0.005479	14.12	77.20	23.90	1.36	1454.71	1454.69
Powerline	5.398	100 YR FU	800.00	1448.34	1453.10	1453.92	1455.90	0.005928	13.44	59.51	20.47	1.39	1454.71	1454.69
Powerline	5.341	100 YR EX	1090.00	1446.48	1451.95	1453.22	1455.28	0.006034	14.63	74.52	22.81	1.43	1452.96	1452.82
Powerline	5.341	100 YR FU	800.00	1446.48	1451.23	1452.08	1454.09	0.006084	13.57	58.97	20.41	1.41	1452.96	1452.82
Powerline	5.284	100 YR EX	1090.00	1444.68	1450.20	1451.27	1453.48	0.005939	14.54	74.97	22.89	1.42	1451.08	1451.10
Powerline	5.284	100 YR FU	800.00	1444.68	1449.49	1450.31	1452.29	0.005915	13.42	59.60	20.52	1.39	1451.08	1451.10
Powerline	5.227	100 YR EX	1090.00	1443.10	1448.54	1449.82	1451.73	0.005728	14.34	75.99	23.06	1.39	1449.40	1449.42
Powerline	5.227	100 YR FU	800.00	1443.10	1447.82	1448.60	1450.55	0.005700	13.24	60.44	20.69	1.36	1449.40	1449.42
Powerline	5.170	100 YR EX	1090.00	1441.45	1446.93	1448.17	1450.05	0.005536	14.16	76.99	23.23	1.37	1447.68	1447.77
Powerline	5.170	100 YR FU	800.00	1441.45	1446.22	1446.96	1448.87	0.005507	13.06	61.23	20.84	1.34	1447.68	1447.77
Powerline	5.124	100 YR EX	1090.00	1440.07	1445.80	1446.53	1448.76	0.004898	13.79	79.02	21.96	1.28	1446.38	1446.47
Powerline	5.124	100 YR FU	800.00	1440.07	1444.98	1445.62	1447.57	0.005058	12.91	61.97	19.61	1.28	1446.38	1446.47
Powerline	5.121	100 YR EX	1090.00	1439.93	1445.30	1446.32	1448.68	0.006083	14.76	73.87	22.34	1.43	1446.33	1446.40
Powerline	5.121	100 YR FU	800.00	1439.93	1444.56	1445.44	1447.50	0.006218	13.75	58.19	19.98	1.42	1446.33	1446.40
Powerline	5.115													
		Bridge												
Powerline	5.108	100 YR EX	1090.00	1439.61	1444.92	1445.95	1448.28	0.006094	14.71	74.08	22.65	1.43	1445.92	1445.94
Powerline	5.108	100 YR FU	800.00	1439.61	1444.20	1445.06	1447.09	0.006144	13.64	58.66	20.31	1.41	1445.92	1445.94
Powerline	5.102	100 YR EX	1090.00	1439.37	1444.89	1445.78	1448.06	0.005663	14.29	76.30	23.08	1.38	1445.73	1445.73
Powerline	5.102	100 YR FU	800.00	1439.37	1444.18	1444.93	1446.87	0.005588	13.14	60.86	20.73	1.35	1445.73	1445.73
Powerline	5.056	100 YR EX	1090.00	1438.07	1443.63	1444.90	1446.71	0.005499	14.09	77.37	23.77	1.37	1444.41	1444.47
Powerline	5.056	100 YR FU	800.00	1438.07	1442.92	1443.63	1445.54	0.005441	12.98	61.65	21.04	1.34	1444.41	1444.47
Powerline	4.997	100 YR EX	1090.00	1436.43	1441.54	1442.57	1444.92	0.006156	14.75	73.89	22.79	1.44	1443.50	1442.77
Powerline	4.997	100 YR FU	800.00	1436.43	1440.83	1441.70	1443.74	0.006245	13.69	58.45	20.49	1.43	1443.50	1442.77
Powerline	4.942	100 YR EX	1090.00	1434.83	1440.09	1440.98	1443.22	0.005578	14.18	76.88	24.55	1.38	1442.16	1441.10
Powerline	4.942	100 YR FU	800.00	1434.83	1439.40	1440.14	1442.03	0.005464	13.00	61.55	19.09	1.34	1442.16	1441.10
Powerline	4.885	100 YR EX	1090.00	1433.16	1438.93	1439.59	1441.68	0.004649	13.30	81.98	26.11	1.26	1439.65	1439.18
Powerline	4.885	100 YR FU	800.00	1433.16	1438.20	1438.74	1440.52	0.004576	12.22	65.47	19.69	1.23	1439.65	1439.18
Powerline	4.849	100 YR EX	1160.00	1431.47	1440.39	1437.62	1441.10	0.000481	6.75	171.91	107.81	0.46	1437.29	1437.19
Powerline	4.849	100 YR FU	890.00	1431.47	1438.91	1436.91	1439.59	0.000639	6.61	134.65	107.81	0.50	1437.29	1437.19
Powerline	4.844	100 YR EX	1160.00	1431.27	1439.65	1437.24	1441.07	0.001507	9.65	127.13	131.31	0.59	1437.67	1437.67
Powerline	4.844	100 YR FU	890.00	1431.27	1438.29	1436.27	1439.56	0.001680	9.05	99.23	105.83	0.60	1437.67	1437.67
Powerline	4.842													
		Culvert												
Powerline	4.840	100 YR EX	1160.00	1431.19	1437.18	1437.18	1440.15	0.004662	13.85	83.78	35.53	1.00	1437.59	1437.59
Powerline	4.840	100 YR FU	890.00	1431.19	1436.21	1436.21	1438.70	0.004456	12.67	70.24	14.00	1.00	1437.59	1437.59
Powerline	4.833	100 YR EX	1160.00	1431.21	1436.18	1437.34	1439.93	0.006859	15.54	74.63	36.50	1.53	1436.89	1436.84
Powerline	4.833	100 YR FU	890.00	1431.21	1435.93	1436.61	1438.53	0.005040	12.95	68.75	28.78	1.30	1436.89	1436.84
Powerline	4.829	100 YR EX	1160.00	1431.13	1436.17	1437.26	1439.78	0.006542	15.26	76.01	43.00	1.49	1436.77	1436.75
Powerline	4.829	100 YR FU	890.00	1431.13	1435.89	1436.53	1438.42	0.004850	12.75	69.78	32.68	1.28	1436.77	1436.75
Powerline	4.772	100 YR EX	1160.00	1429.97	1437.26	1436.16	1438.42	0.001152	8.68	139.16	140.85	0.68	1435.68	1435.67
Powerline	4.772	100 YR FU	890.00	1429.97	1436.55	1435.44	1437.49	0.001139	7.81	115.97	121.26	0.66	1435.68	1435.67
Powerline	4.715	100 YR EX	1160.00	1429.08	1437.48	1435.06	1438.18	0.000517	6.79	183.56	150.16	0.47	1434.52	1434.65
Powerline	4.715	100 YR FU	890.00	1429.08	1436.72	1434.34	1437.27	0.000477	5.99	157.22	141.41	0.44	1434.52	1434.65
Powerline	4.658	100 YR EX	1160.00	1427.93	1437.53	1433.93	1438.05	0.000309	5.84	206.84	153.83	0.37	1433.49	1433.68
Powerline	4.658	100 YR FU	890.00	1427.93	1436.78	1433.22	1437.16	0.000261	5.00	184.36	144.22	0.34	1433.49	1433.68
Powerline	4.652	100 YR EX	1160.00	1427.89	1436.63	1434.05	1437.99	0.001482	9.41	126.09	133.21	0.59	1434.55	1434.59
Powerline	4.652	100 YR FU	890.00	1427.89	1436.21	1433.05	1437.12	0.001056	7.66	118.37	133.21	0.50	1434.55	1434.59
Powerline	4.614													
		Culvert												
Powerline	4.575	100 YR EX	1160.00	1426.21	1433.53	1430.74	1434.39	0.000896	7.48	155.47	24.42	0.49	1433.26	1433.10

HEC-RAS Plan: EXISTING River: Powerline Reach: Powerline (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	LOB Elev (ft)	ROB Elev (ft)
Powerline	4.575	100 YR FU	890.00	1426.21	1432.72	1430.01	1433.37	0.000753	6.45	137.92	21.23	0.45	1433.26	1433.10
Powerline	4.570	100 YR EX	1160.00	1426.20	1432.31	1432.15	1434.30	0.002655	11.30	102.64	23.55	0.95	1432.25	1433.12
Powerline	4.570	100 YR FU	890.00	1426.20	1431.80	1431.35	1433.29	0.002187	9.79	90.89	22.46	0.86	1432.25	1433.12
Powerline	4.564	100 YR EX	1160.00	1426.08	1432.49	1432.17	1434.16	0.002240	10.35	112.11	131.65	0.90	1432.90	1433.15
Powerline	4.564	100 YR FU	890.00	1426.08	1431.82	1431.41	1433.20	0.002106	9.42	94.48	90.11	0.86	1432.90	1433.15
Powerline	4.544	100 YR EX	1160.00	1425.84	1431.99	1431.99	1433.90	0.002763	11.09	104.73	132.90	1.00	1431.88	1431.83
Powerline	4.544	100 YR FU	890.00	1425.84	1431.25	1431.25	1432.94	0.002845	10.44	85.26	100.01	0.99	1431.88	1431.83
Powerline	4.488	100 YR EX	1160.00	1424.68	1430.33	1430.84	1432.89	0.004112	12.84	90.34	141.51	1.20	1430.38	1430.40
Powerline	4.488	100 YR FU	890.00	1424.68	1429.65	1430.11	1431.91	0.004189	12.08	73.70	120.78	1.19	1430.38	1430.40
Powerline	4.431	100 YR EX	1160.00	1423.65	1429.58	1429.84	1431.79	0.003268	11.95	97.34	132.15	1.08	1429.32	1429.33
Powerline	4.431	100 YR FU	890.00	1423.65	1428.98	1429.10	1430.81	0.003173	10.87	81.91	98.28	1.05	1429.32	1429.33
Powerline	4.374	100 YR EX	1160.00	1422.50	1428.29	1428.72	1430.73	0.003827	12.53	92.57	131.11	1.16	1428.29	1428.24
Powerline	4.374	100 YR FU	890.00	1422.50	1427.61	1427.99	1429.75	0.003888	11.76	75.71	102.39	1.15	1428.29	1428.24
Powerline	4.317	100 YR EX	1160.00	1421.48	1427.20	1427.60	1429.60	0.003736	12.43	93.33	123.61	1.15	1427.15	1427.10
Powerline	4.317	100 YR FU	890.00	1421.48	1426.56	1426.88	1428.61	0.003685	11.50	77.42	97.77	1.12	1427.15	1427.10
Powerline	4.260	100 YR EX	1160.00	1420.34	1426.17	1426.51	1428.51	0.003569	12.27	94.60	107.70	1.13	1426.04	1426.05
Powerline	4.260	100 YR FU	890.00	1420.34	1425.51	1425.80	1427.53	0.003593	11.40	78.10	75.97	1.11	1426.04	1426.05
Powerline	4.204	100 YR EX	1160.00	1419.33	1425.21	1425.52	1427.47	0.003389	12.06	96.36	70.11	1.10	1424.94	1425.03
Powerline	4.204	100 YR FU	890.00	1419.33	1424.59	1424.78	1426.49	0.003368	11.08	80.32	62.40	1.08	1424.94	1425.03
Powerline	4.147	100 YR EX	1160.00	1418.40	1424.18	1424.51	1426.45	0.003404	12.10	96.85	80.38	1.11	1423.98	1423.49
Powerline	4.147	100 YR FU	890.00	1418.40	1423.60	1423.79	1425.48	0.003393	10.99	80.99	69.43	1.08	1423.98	1423.49
Powerline	4.090	100 YR EX	1160.00	1417.42	1423.39	1423.55	1425.49	0.002997	11.63	100.18	113.14	1.04	1423.10	1423.06
Powerline	4.090	100 YR FU	890.00	1417.42	1422.74	1422.81	1424.52	0.003026	10.69	83.22	81.87	1.02	1423.10	1423.06
Powerline	4.033	100 YR EX	1160.00	1416.44	1422.11	1422.51	1424.49	0.003709	12.36	93.88	130.95	1.15	1422.05	1422.02
Powerline	4.033	100 YR FU	890.00	1416.44	1421.45	1421.79	1423.52	0.003746	11.53	77.20	100.96	1.13	1422.05	1422.02
Powerline	3.976	100 YR EX	1160.00	1414.21	1419.21	1420.39	1422.98	0.006960	15.59	74.42	65.96	1.54	1420.37	1420.32
Powerline	3.976	100 YR FU	890.00	1414.21	1418.57	1419.64	1421.97	0.007293	14.81	60.10	55.60	1.55	1420.37	1420.32
Powerline	3.919	100 YR EX	1160.00	1413.25	1418.86	1419.38	1421.38	0.004073	12.73	91.10	84.08	1.20	1419.21	1419.27
Powerline	3.919	100 YR FU	890.00	1413.25	1418.26	1418.62	1420.38	0.003880	11.68	76.17	60.92	1.15	1419.21	1419.27
Powerline	3.863	100 YR EX	1160.00	1412.02	1417.92	1418.27	1420.23	0.003588	12.18	95.22	86.77	1.13	1418.16	1418.25
Powerline	3.863	100 YR FU	890.00	1412.02	1417.22	1417.52	1419.26	0.003643	11.45	77.73	63.88	1.12	1418.16	1418.25
Powerline	3.806	100 YR EX	1160.00	1410.92	1416.68	1417.12	1419.11	0.003833	12.51	92.72	86.95	1.16	1417.07	1417.09
Powerline	3.806	100 YR FU	890.00	1410.92	1415.99	1416.36	1418.13	0.003863	11.72	75.93	56.31	1.15	1417.07	1417.09
Powerline	3.749	100 YR EX	1160.00	1409.83	1415.62	1416.01	1417.98	0.003664	12.33	94.12	112.29	1.14	1415.98	1415.97
Powerline	3.749	100 YR FU	890.00	1409.83	1414.94	1415.24	1417.00	0.003660	11.51	77.34	87.39	1.12	1415.98	1415.97
Powerline	3.692	100 YR EX	1160.00	1408.56	1414.11	1414.72	1416.78	0.004365	13.12	88.41	104.83	1.23	1414.68	1414.71
Powerline	3.692	100 YR FU	890.00	1408.56	1413.44	1413.97	1415.79	0.004413	12.30	72.34	61.35	1.22	1414.68	1414.71
Powerline	3.635	100 YR EX	1160.00	1406.82	1412.09	1413.01	1415.30	0.005583	14.39	80.62	79.09	1.39	1413.02	1413.01
Powerline	3.635	100 YR FU	890.00	1406.82	1411.44	1412.24	1414.29	0.005698	13.54	65.74	47.61	1.38	1413.02	1413.01
Powerline	3.579	100 YR EX	1160.00	1405.07	1410.21	1411.21	1413.58	0.005938	14.72	78.79	75.26	1.43	1411.21	1411.19
Powerline	3.579	100 YR FU	890.00	1405.07	1409.59	1410.46	1412.54	0.005980	13.78	64.59	23.87	1.41	1411.21	1411.19
Powerline	3.522	100 YR EX	1160.00	1403.19	1408.38	1409.39	1411.78	0.006023	14.79	78.41	86.32	1.44	1409.40	1409.31
Powerline	3.522	100 YR FU	890.00	1403.19	1407.76	1408.64	1410.73	0.006040	13.83	64.36	29.57	1.42	1409.40	1409.31
Powerline	3.465	100 YR EX	1160.00	1401.38	1406.55	1407.59	1409.97	0.006064	14.83	78.24	90.10	1.44	1407.60	1407.47
Powerline	3.465	100 YR FU	890.00	1401.38	1405.94	1406.83	1408.92	0.006063	13.85	64.27	73.01	1.42	1407.60	1407.47
Powerline	3.408	100 YR EX	1160.00	1399.61	1404.81	1405.82	1408.17	0.005914	14.71	78.86	101.97	1.42	1405.88	1405.79
Powerline	3.408	100 YR FU	890.00	1399.61	1404.20	1405.05	1407.12	0.005909	13.73	64.80	80.01	1.40	1405.88	1405.79
Powerline	3.351	100 YR EX	1160.00	1397.86	1402.99	1404.01	1406.38	0.006026	14.78	78.48	90.70	1.44	1404.00	1404.04
Powerline	3.351	100 YR FU	890.00	1397.86	1402.38	1403.21	1405.33	0.006023	13.79	64.52	74.95	1.42	1404.00	1404.04
Powerline	3.294	100 YR EX	1160.00	1395.88	1400.93	1402.04	1404.50	0.006447	15.18	76.42	82.12	1.48	1402.00	1402.08
Powerline	3.294	100 YR FU	890.00	1395.88	1400.31	1401.28	1403.45	0.006491	14.21	62.85	70.93	1.47	1402.00	1402.08
Powerline	3.238	100 YR EX	1160.00	1394.17	1399.45	1400.38	1402.69	0.005621	14.44	80.31	95.72	1.39	1400.37	1400.42
Powerline	3.238	100 YR FU	890.00	1394.17	1398.84	1399.64	1401.64	0.005557	13.43	66.27	68.22	1.36	1400.37	1400.42
Powerline	3.181	100 YR EX	1160.00	1392.45	1400.83	1398.64	1401.56	0.000597	6.94	175.73	164.73	0.50	1398.63	1398.72
Powerline	3.181	100 YR FU	890.00	1392.45	1397.03	1397.87	1399.93	0.005836	13.66	65.16	72.28	1.39	1398.63	1398.72
Powerline	3.102	100 YR EX	1160.00	1389.91	1401.11	1396.21	1401.43	0.000166	4.67	265.60	118.59	0.28	1396.28	1396.29
Powerline	3.102	100 YR FU	890.00	1389.91	1399.05	1395.43	1399.40	0.000250	4.80	195.70	118.48	0.33	1396.28	1396.29
Powerline	3.096	100 YR EX	1160.00	1390.15	1400.69	1396.57	1401.40	0.000593	6.97	179.53	116.26	0.40	1396.57	1396.67

HEC-RAS Plan: EXISTING River: Powerline Reach: Powerline (Continued)

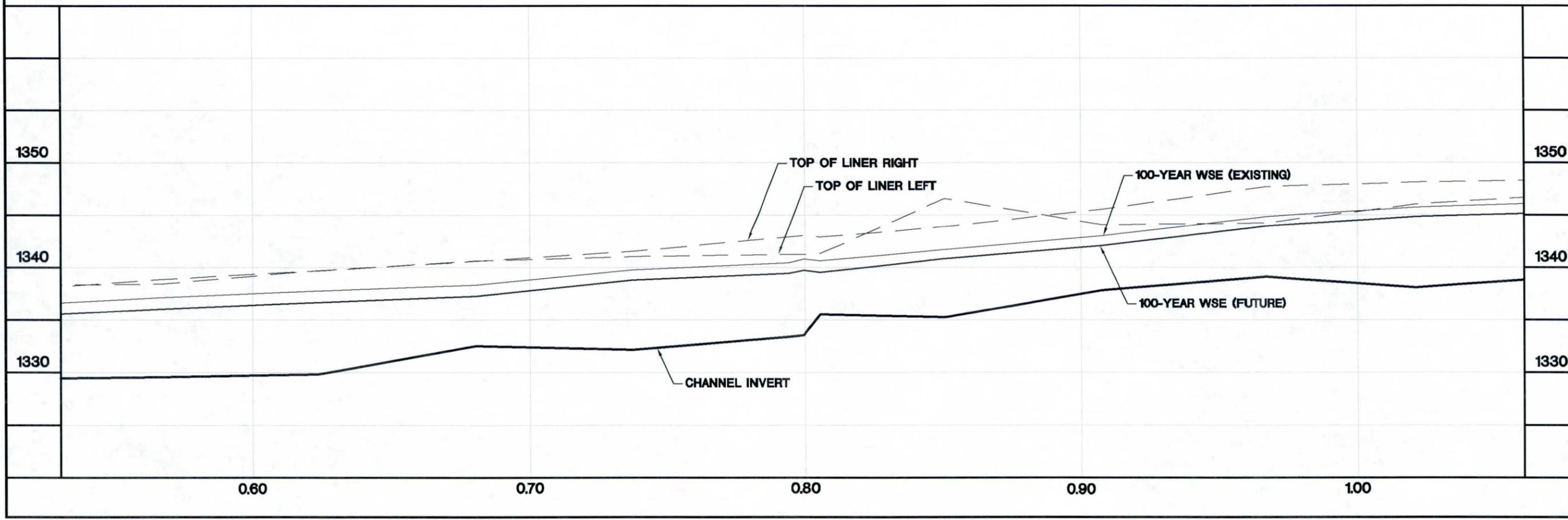
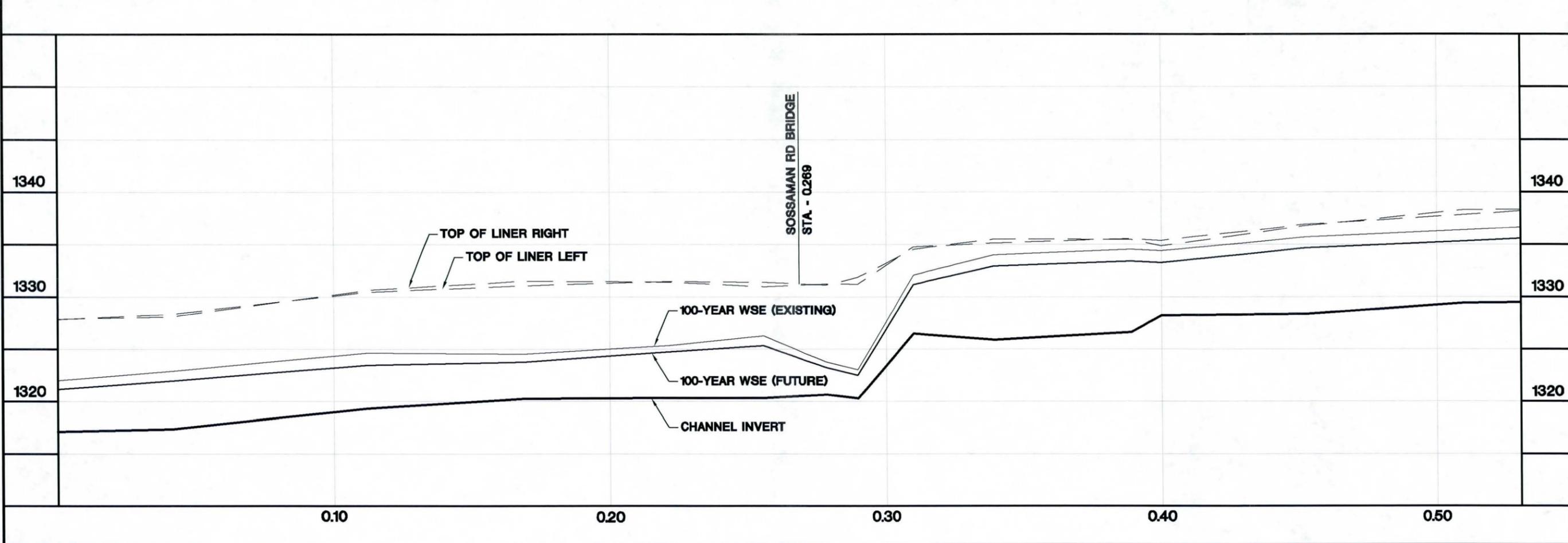
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	LOB Elev (ft)	ROB Elev (ft)
Powerline	3.096	100 YR FU	890.00	1390.15	1398.57	1395.26	1399.36	0.000892	7.21	129.99	116.26	0.47	1396.57	1396.67
Powerline	3.087													
Powerline	3.077	100 YR EX	1160.00	1389.37	1395.47	1395.47	1398.51	0.004783	13.99	82.92	40.79	1.00	1396.06	1396.23
Powerline	3.077	100 YR FU	890.00	1389.37	1393.15	1394.48	1397.81	0.010646	17.32	51.40	13.60	1.57	1396.06	1396.23
Powerline	3.071	100 YR EX	1160.00	1389.22	1393.84	1395.27	1398.26	0.008627	16.86	68.79	22.58	1.70	1395.41	1395.47
Powerline	3.071	100 YR FU	890.00	1389.22	1393.12	1394.51	1397.44	0.010121	16.68	53.34	20.16	1.81	1395.41	1395.47
Powerline	3.067	100 YR EX	1160.00	1389.16	1393.92	1395.25	1398.02	0.007819	16.24	71.41	34.27	1.63	1395.29	1395.36
Powerline	3.067	100 YR FU	890.00	1389.16	1393.20	1394.49	1397.17	0.009026	15.98	55.70	20.65	1.71	1395.29	1395.36
Powerline	3.011	100 YR EX	1160.00	1387.39	1392.67	1393.58	1395.88	0.005556	14.37	80.70	28.09	1.38	1393.57	1393.55
Powerline	3.011	100 YR FU	890.00	1387.39	1394.50	1392.84	1395.23	0.000805	6.90	131.46	96.16	0.56	1393.57	1393.55
Powerline	2.954	100 YR EX	1160.00	1385.77	1392.99	1391.96	1394.17	0.001257	8.75	135.51	136.59	0.70	1391.90	1391.92
Powerline	2.954	100 YR FU	890.00	1385.77	1394.67	1391.22	1395.03	0.000262	4.87	193.61	141.10	0.34	1391.90	1391.92
Powerline	2.897	100 YR EX	1160.00	1384.14	1393.26	1390.42	1393.85	0.000417	6.22	196.60	138.68	0.42	1390.36	1390.41
Powerline	2.897	100 YR FU	890.00	1384.14	1394.73	1389.66	1394.95	0.000122	3.84	246.60	138.68	0.24	1390.36	1390.41
Powerline	2.856	100 YR EX	1270.00	1383.01	1393.26	1389.58	1393.75	0.000290	5.73	240.52	133.49	0.36	1389.32	1389.34
Powerline	2.856	100 YR FU	1460.00	1383.01	1394.45	1390.03	1394.91	0.000232	5.63	283.07	133.49	0.33	1389.32	1389.34
Powerline	2.851	100 YR EX	1270.00	1382.57	1392.45	1388.93	1393.70	0.001022	9.04	146.36	141.46	0.51	1388.57	1388.57
Powerline	2.851	100 YR FU	1460.00	1382.57	1393.54	1389.59	1394.86	0.000936	9.29	165.06	141.46	0.49	1388.57	1388.57
Powerline	2.837													
Powerline	2.824	100 YR EX	1270.00	1382.09	1388.45	1388.45	1391.61	0.004578	14.27	89.06	58.68	1.00	1388.09	1388.09
Powerline	2.824	100 YR FU	1460.00	1382.09	1389.10	1389.10	1392.53	0.004353	14.86	98.74	105.63	0.99	1388.09	1388.09
Powerline	2.814	100 YR EX	1270.00	1381.61	1386.62	1388.11	1391.22	0.008626	17.20	73.84	23.58	1.71	1388.07	1387.81
Powerline	2.814	100 YR FU	1460.00	1381.61	1386.85	1388.48	1392.12	0.009430	18.43	79.24	24.37	1.80	1388.07	1387.81
Powerline	2.784	100 YR EX	1270.00	1380.57	1385.85	1387.10	1389.83	0.007048	16.02	79.28	24.09	1.56	1386.88	1386.93
Powerline	2.784	100 YR FU	1460.00	1380.57	1386.12	1387.53	1390.61	0.007517	17.00	85.88	25.02	1.62	1386.88	1386.93
Powerline	2.727	100 YR EX	1270.00	1378.89	1384.67	1385.55	1387.99	0.005316	14.62	86.87	23.98	1.35	1385.17	1385.33
Powerline	2.727	100 YR FU	1460.00	1378.89	1385.01	1386.01	1388.67	0.005504	15.35	95.12	25.03	1.39	1385.17	1385.33
Powerline	2.670	100 YR EX	1270.00	1377.34	1382.80	1383.77	1386.30	0.005863	15.03	84.52	24.48	1.43	1383.48	1383.61
Powerline	2.670	100 YR FU	1460.00	1377.34	1383.15	1384.26	1386.95	0.005925	15.63	93.38	25.64	1.44	1383.48	1383.61
Powerline	2.613	100 YR EX	1270.00	1375.80	1381.30	1382.23	1384.61	0.005439	14.59	87.04	24.93	1.38	1382.19	1382.04
Powerline	2.613	100 YR FU	1460.00	1375.80	1384.98	1382.66	1385.84	0.000602	7.54	207.69	70.04	0.51	1382.19	1382.04
Powerline	2.556	100 YR EX	1270.00	1374.30	1379.94	1380.76	1383.05	0.004972	14.16	89.70	25.01	1.32	1380.68	1380.82
Powerline	2.556	100 YR FU	2250.00	1374.30	1382.83	1382.83	1385.47	0.002123	13.14	180.23	127.26	0.94	1380.68	1380.82
Powerline	2.499	100 YR EX	1270.00	1372.96	1378.71	1379.43	1381.62	0.004545	13.68	92.84	25.51	1.26	1379.33	1379.47
Powerline	2.499	100 YR FU	2250.00	1372.96	1380.26	1381.49	1384.55	0.004580	16.63	137.19	35.55	1.33	1379.33	1379.47
Powerline	2.443	100 YR EX	1270.00	1371.68	1377.53	1378.15	1380.30	0.004272	13.34	95.23	26.00	1.23	1378.09	1378.08
Powerline	2.443	100 YR FU	2250.00	1371.68	1379.05	1380.21	1383.20	0.004351	16.37	139.97	85.62	1.30	1378.09	1378.08
Powerline	2.386	100 YR EX	1270.00	1370.38	1377.78	1376.84	1379.09	0.001351	9.18	141.20	61.49	0.73	1376.72	1376.81
Powerline	2.386	100 YR FU	2250.00	1370.38	1377.75	1378.89	1381.90	0.004328	16.36	140.20	60.51	1.30	1376.72	1376.81
Powerline	2.346	100 YR EX	1270.00	1369.39	1378.16	1375.74	1378.89	0.000548	6.94	194.48	74.97	0.48	1375.70	1375.85
Powerline	2.346	100 YR FU	2250.00	1369.39	1379.93	1377.79	1381.24	0.000724	9.37	260.04	74.97	0.58	1375.70	1375.85
Powerline	2.343	100 YR EX	1270.00	1369.33	1378.17	1375.72	1378.89	0.000537	6.89	196.20	93.06	0.48	1375.65	1375.79
Powerline	2.343	100 YR FU	2250.00	1369.33	1379.94	1377.77	1381.23	0.000711	9.31	261.95	93.06	0.57	1375.65	1375.79
Powerline	2.341													
Powerline	2.340	100 YR EX	1270.00	1369.24	1374.31	1375.71	1378.70	0.007995	16.81	75.57	23.49	1.65	1375.54	1375.70
Powerline	2.340	100 YR FU	2250.00	1369.24	1376.24	1377.75	1381.15	0.005708	17.80	127.73	83.49	1.47	1375.54	1375.70
Powerline	2.335	100 YR EX	1270.00	1369.13	1374.28	1375.62	1378.49	0.007567	16.48	77.08	23.64	1.61	1375.42	1375.58
Powerline	2.335	100 YR FU	2250.00	1369.13	1376.17	1377.65	1381.01	0.005569	17.67	129.00	99.23	1.45	1375.42	1375.58
Powerline	2.329	100 YR EX	1270.00	1369.02	1374.19	1375.47	1378.27	0.007255	16.21	78.33	23.86	1.58	1375.28	1375.45
Powerline	2.329	100 YR FU	2250.00	1369.02	1376.04	1377.50	1380.84	0.005509	17.60	129.50	102.01	1.45	1375.28	1375.45
Powerline	2.272	100 YR EX	1270.00	1367.72	1373.36	1374.18	1376.45	0.005006	14.10	90.05	43.05	1.32	1374.01	1374.09
Powerline	2.272	100 YR FU	2250.00	1367.72	1374.96	1376.20	1379.31	0.004708	16.76	136.65	92.28	1.35	1374.01	1374.09
Powerline	2.215	100 YR EX	1270.00	1366.26	1372.09	1372.82	1375.01	0.004597	13.73	92.52	59.00	1.27	1372.76	1372.82
Powerline	2.215	100 YR FU	2250.00	1366.26	1373.65	1374.84	1377.92	0.004564	16.59	137.93	100.53	1.33	1372.76	1372.82
Powerline	2.159	100 YR EX	1270.00	1364.81	1370.66	1371.40	1373.62	0.004678	13.81	91.95	39.79	1.28	1371.35	1371.36
Powerline	2.159	100 YR FU	2250.00	1364.81	1372.22	1373.45	1376.54	0.004647	16.71	136.93	80.55	1.34	1371.35	1371.36
Powerline	2.102	100 YR EX	1270.00	1363.32	1369.19	1369.97	1372.21	0.004759	13.94	91.11	25.10	1.29	1369.97	1370.03

HEC-RAS Plan: EXISTING River: Powerline Reach: Powerline (Continued)

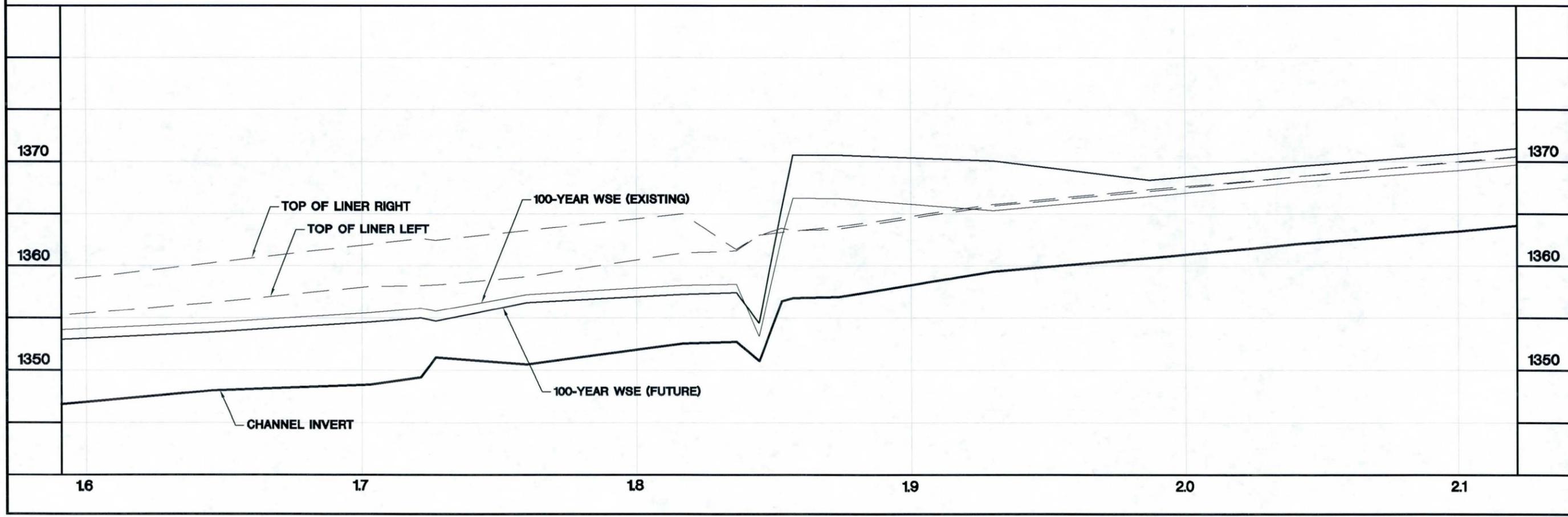
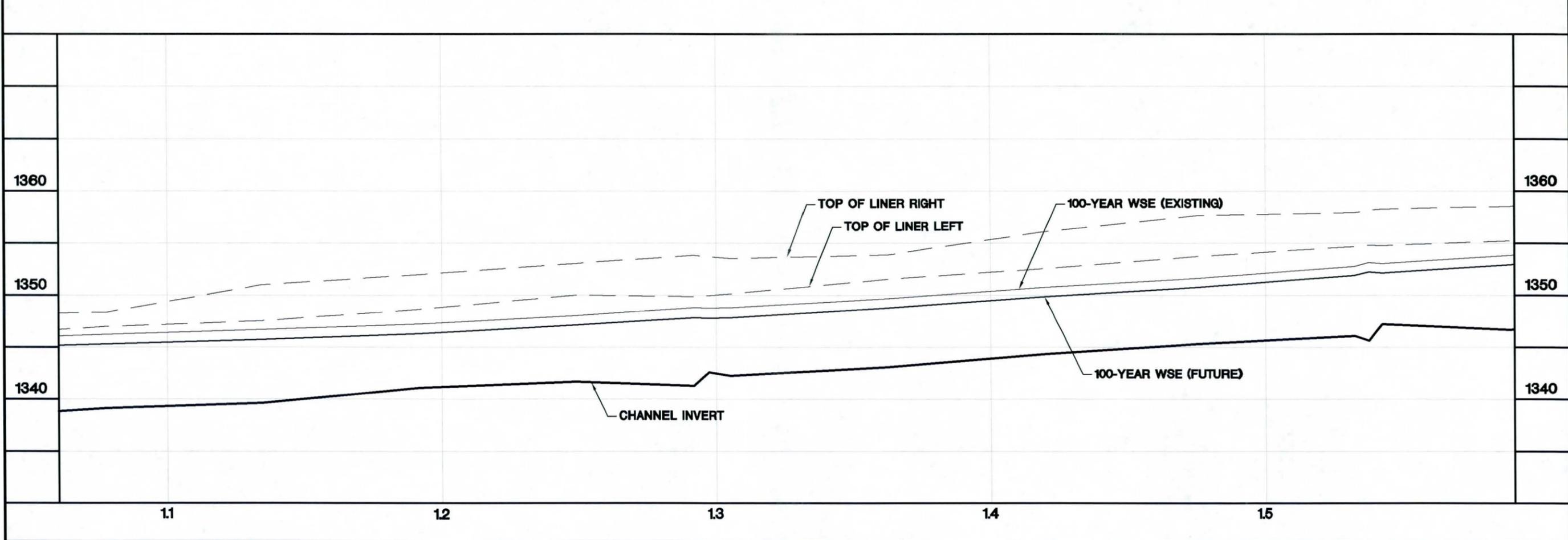
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	LOB Elev (ft)	ROB Elev (ft)
Powerline	2.102	100 YR FU	2250.00	1363.32	1370.76	1372.00	1375.14	0.004759	16.80	135.75	95.28	1.35	1369.97	1370.03
Powerline	2.045	100 YR EX	1270.00	1362.16	1368.11	1368.71	1370.86	0.004241	13.30	95.47	37.69	1.22	1368.66	1368.63
Powerline	2.045	100 YR FU	2250.00	1362.16	1369.63	1370.72	1373.77	0.004338	16.36	140.31	100.52	1.30	1368.66	1368.63
Powerline	1.988	100 YR EX	1270.00	1360.76	1366.69	1367.37	1369.56	0.004494	13.59	93.46	25.77	1.26	1367.16	1367.35
Powerline	1.988	100 YR FU	2250.00	1360.76	1368.25	1369.38	1372.45	0.004414	16.48	139.16	83.93	1.31	1367.16	1367.35
Powerline	1.931	100 YR EX	1270.00	1359.45	1365.31	1366.02	1368.20	0.004581	13.64	93.08	25.97	1.27	1365.76	1365.91
Powerline	1.931	100 YR FU	2250.00	1359.45	1370.07	1368.02	1371.42	0.000757	9.53	254.42	115.97	0.59	1365.76	1365.91
Powerline	1.875	100 YR EX	1270.00	1357.00	1366.47	1363.58	1367.09	0.000429	6.40	212.23	137.72	0.43	1363.53	1363.77
Powerline	1.875	100 YR FU	2250.00	1357.00	1370.63	1365.65	1371.28	0.000250	6.70	367.89	137.72	0.36	1363.53	1363.77
Powerline	1.858	100 YR EX	1270.00	1356.91	1366.50	1363.29	1367.05	0.000364	6.09	225.02	163.33	0.40	1363.37	1363.33
Powerline	1.858	100 YR FU	2250.00	1356.91	1370.65	1365.37	1371.26	0.000225	6.48	381.51	163.33	0.34	1363.37	1363.33
Powerline	1.854	100 YR EX	1270.00	1356.60	1362.73	1362.73	1365.63	0.004124	13.66	92.99	15.93	1.00	1363.60	1363.20
Powerline	1.854	100 YR FU	2250.00	1356.60	1365.55	1365.55	1369.34	0.003448	15.66	145.42	119.55	0.98	1363.60	1363.20
Powerline	1.846	100 YR EX	1270.00	1350.88	1353.24	1355.40	1361.83	0.027944	23.52	53.99	25.51	2.85	1362.93	1362.93
Powerline	1.846	100 YR FU	2250.00	1350.88	1354.51	1357.38	1365.00	0.020366	26.00	86.55	25.90	2.51	1362.93	1362.93
Powerline	1.838	100 YR EX	1270.00	1352.73	1358.26	1356.30	1358.58	0.001440	4.57	277.62	71.38	0.41	1361.43	1361.57
Powerline	1.838	100 YR FU	2250.00	1352.73	1357.44	1357.44	1359.05	0.009021	10.20	220.66	67.78	1.00	1361.43	1361.57
Powerline	1.818	100 YR EX	3100.00	1352.54	1358.16		1358.42	0.000977	4.08	759.96	175.90	0.35	1361.23	1365.01
Powerline	1.818	100 YR FU	2330.00	1352.54	1357.27	1355.45	1357.50	0.001133	3.84	606.00	171.62	0.36	1361.23	1365.01
Powerline	1.761	100 YR EX	3100.00	1350.54	1357.26	1355.34	1357.95	0.002207	6.65	466.12	94.54	0.53	1358.97	1363.37
Powerline	1.761	100 YR FU	2330.00	1350.54	1356.47	1354.68	1357.02	0.002063	5.93	393.22	90.38	0.50	1358.97	1363.37
Powerline	1.728	100 YR EX	3100.00	1351.22	1355.66	1355.39	1357.23	0.007126	10.04	308.91	81.35	0.91	1358.17	1362.46
Powerline	1.728	100 YR FU	2330.00	1351.22	1354.72	1354.72	1356.26	0.009328	9.95	234.23	76.76	1.00	1358.17	1362.46
Powerline	1.723	100 YR EX	3100.00	1349.33	1355.95		1356.73	0.002261	7.10	436.42	80.42	0.54	1358.11	1362.60
Powerline	1.723	100 YR FU	2330.00	1349.33	1355.01	1353.10	1355.65	0.002198	6.42	362.75	76.38	0.52	1358.11	1362.60
Powerline	1.704	100 YR EX	3100.00	1348.63	1355.51	1353.84	1356.44	0.002867	7.74	400.49	77.97	0.60	1358.03	1362.06
Powerline	1.704	100 YR FU	2330.00	1348.63	1354.60	1353.11	1355.37	0.002822	7.03	331.54	74.01	0.59	1358.03	1362.06
Powerline	1.647	100 YR EX	3100.00	1348.06	1354.55		1355.53	0.003157	7.95	389.79	78.45	0.63	1356.48	1360.29
Powerline	1.647	100 YR FU	2330.00	1348.06	1353.64		1354.46	0.003182	7.27	320.53	74.54	0.62	1356.48	1360.29
Powerline	1.590	100 YR EX	3100.00	1346.68	1353.85	1351.92	1354.65	0.002414	7.21	429.67	81.91	0.56	1355.24	1358.56
Powerline	1.590	100 YR FU	2330.00	1346.68	1352.94	1351.19	1353.60	0.002344	6.52	357.40	77.83	0.54	1355.24	1358.56
Powerline	1.544	100 YR EX	3100.00	1347.22	1353.05		1353.97	0.002976	7.67	404.33	81.97	0.61	1354.78	1358.29
Powerline	1.544	100 YR FU	2330.00	1347.22	1352.15		1352.92	0.003031	7.01	332.27	78.37	0.60	1354.78	1358.29
Powerline	1.539	100 YR EX	3100.00	1345.60	1353.14		1353.77	0.001621	6.34	488.86	82.89	0.46	1354.82	1358.17
Powerline	1.539	100 YR FU	2330.00	1345.60	1352.24		1352.73	0.001471	5.60	415.75	79.14	0.43	1354.82	1358.17
Powerline	1.534	100 YR EX	3100.00	1346.07	1352.78	1351.19	1353.68	0.002893	7.62	406.86	81.64	0.60	1354.69	1357.93
Powerline	1.534	100 YR FU	2330.00	1346.07	1351.90	1350.46	1352.65	0.002858	6.91	337.22	77.91	0.59	1354.69	1357.93
Powerline	1.477	100 YR EX	3100.00	1345.30	1351.65	1350.43	1352.70	0.003616	8.21	377.55	80.40	0.67	1353.73	1357.68
Powerline	1.477	100 YR FU	2330.00	1345.30	1350.78	1349.70	1351.66	0.003690	7.53	309.40	76.41	0.66	1353.73	1357.68
Powerline	1.420	100 YR EX	3100.00	1344.30	1350.73	1349.21	1351.67	0.003071	7.77	399.23	81.67	0.62	1352.55	1356.08
Powerline	1.420	100 YR FU	2330.00	1344.30	1349.84	1348.47	1350.62	0.003076	7.09	328.68	77.41	0.61	1352.55	1356.08
Powerline	1.363	100 YR EX	3100.00	1343.09	1349.67	1348.35	1350.68	0.003446	8.08	383.56	80.67	0.65	1351.54	1353.88
Powerline	1.363	100 YR FU	2330.00	1343.09	1348.76	1347.60	1349.63	0.003537	7.45	312.75	76.01	0.65	1351.54	1353.88
Powerline	1.306	100 YR EX	3100.00	1342.26	1348.79	1347.20	1349.69	0.002953	7.62	406.60	83.07	0.61	1350.13	1353.54
Powerline	1.306	100 YR FU	2330.00	1342.26	1347.83	1346.51	1348.61	0.003109	7.08	328.96	78.26	0.61	1350.13	1353.54
Powerline	1.298	100 YR EX	3100.00	1342.56	1348.77		1349.54	0.002345	7.04	440.44	85.05	0.55	1349.97	1353.72
Powerline	1.298	100 YR FU	2330.00	1342.56	1347.80		1348.45	0.002416	6.47	359.90	80.88	0.54	1349.97	1353.72
Powerline	1.293	100 YR EX	3100.00	1341.29	1348.82		1349.39	0.001456	6.07	510.95	85.61	0.44	1349.87	1353.83
Powerline	1.293	100 YR FU	2330.00	1341.29	1347.85		1348.30	0.001356	5.42	430.01	81.17	0.41	1349.87	1353.83
Powerline	1.250	100 YR EX	3100.00	1341.68	1348.05	1346.24	1348.88	0.002561	7.31	424.06	82.86	0.57	1350.01	1353.06
Powerline	1.250	100 YR FU	2330.00	1341.68	1347.13	1345.53	1347.82	0.002550	6.66	349.79	78.60	0.56	1350.01	1353.06
Powerline	1.193	100 YR EX	3100.00	1341.08	1347.24	1345.55	1348.09	0.002722	7.42	417.96	83.81	0.59	1348.65	1351.99
Powerline	1.193	100 YR FU	2330.00	1341.08	1346.29	1344.85	1347.02	0.002808	6.83	340.95	79.39	0.58	1348.65	1351.99
Powerline	1.136	100 YR EX	3100.00	1339.60	1346.70	1344.34	1347.36	0.001867	6.52	475.17	86.79	0.49	1347.54	1351.00
Powerline	1.136	100 YR FU	2330.00	1339.60	1345.75	1343.63	1346.29	0.001817	5.90	394.83	82.42	0.48	1347.54	1351.00
Powerline	1.079	100 YR EX	3100.00	1339.12	1346.24	1343.63	1346.82	0.001596	6.13	505.57	90.30	0.46	1346.99	1348.39
Powerline	1.079	100 YR FU	2330.00	1339.12	1345.30	1342.94	1345.77	0.001518	5.50	423.26	85.86	0.44	1346.99	1348.39
Powerline	1.022	100 YR EX	3100.00	1338.08	1345.75	1343.12	1346.34	0.001623	6.16	503.15	90.44	0.46	1346.03	1348.15

HEC-RAS Plan: EXISTING River: Powerline Reach: Powerline (Continued)

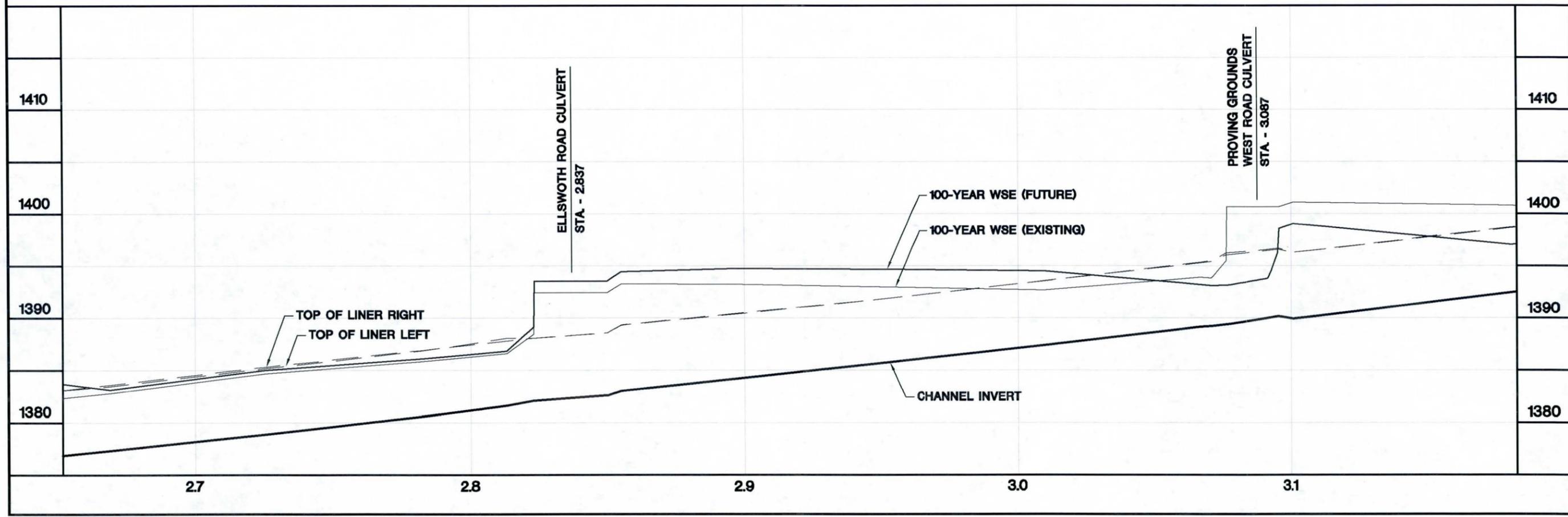
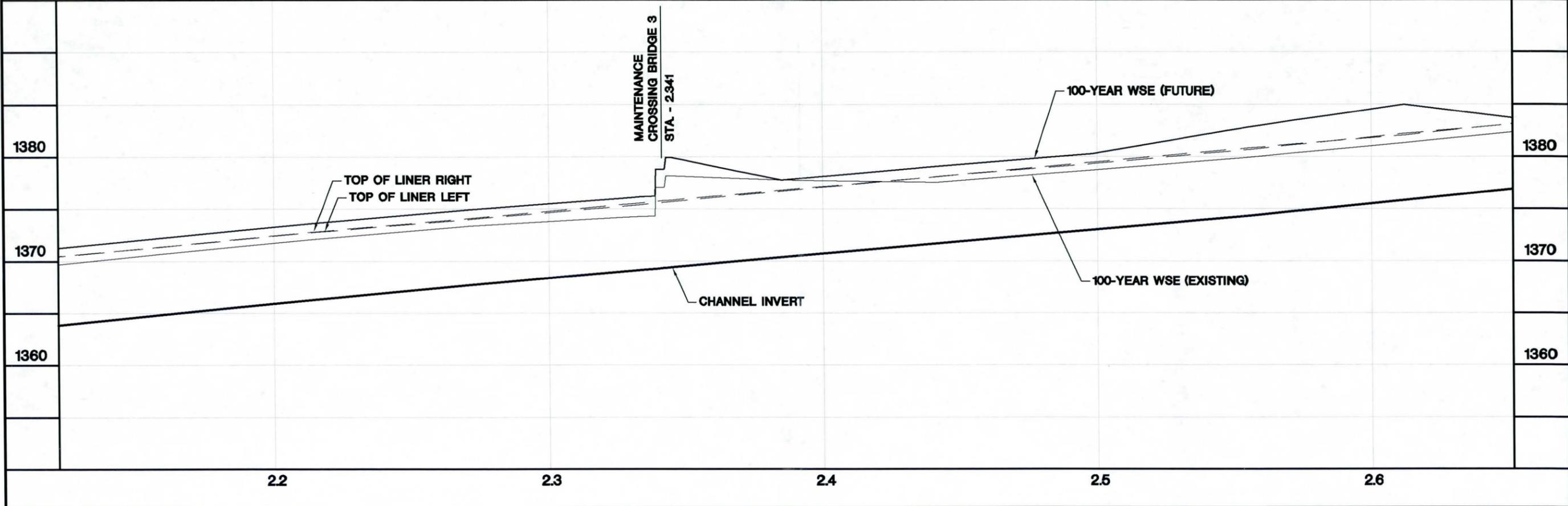
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl (ft/ft)	LOB Elev (ft)	ROB Elev (ft)
Powerline	1.022	100 YR FU	2330.00	1338.08	1344.85	1342.42	1345.32	0.001505	5.49	424.09	85.74	0.44	1346.03	1348.15
Powerline	0.968	100 YR EX	3100.00	1339.10	1344.85	1343.42	1345.70	0.002929	7.37	420.82	92.17	0.60	1344.23	1347.71
Powerline	0.968	100 YR FU	2330.00	1339.10	1343.96	1342.76	1344.68	0.003185	6.84	340.79	87.28	0.61	1344.23	1347.71
Powerline	0.909	100 YR EX	3210.00	1337.80	1343.00	1342.46	1344.39	0.005734	9.47	339.01	82.64	0.82	1344.08	1345.54
Powerline	0.909	100 YR FU	2330.00	1337.80	1342.09	1341.68	1343.28	0.006262	8.76	266.04	78.13	0.84	1344.08	1345.54
Powerline	0.852	100 YR EX	3210.00	1335.24	1341.72		1342.90	0.004002	8.71	368.57	77.33	0.70	1346.58	1343.90
Powerline	0.852	100 YR FU	2330.00	1335.24	1340.86		1341.77	0.003712	7.67	303.91	73.18	0.66	1346.58	1343.90
Powerline	0.806	100 YR EX	3210.00	1335.50	1340.64	1339.80	1341.86	0.004627	8.88	361.34	82.32	0.75	1341.34	1342.90
Powerline	0.806	100 YR FU	2330.00	1335.50	1339.55	1339.02	1340.67	0.005608	8.49	274.46	77.67	0.80	1341.34	1342.90
Powerline	0.801	100 YR EX	3210.00	1333.55	1340.82	1338.25	1341.52	0.001809	6.68	480.57	81.86	0.49	1341.23	1343.05
Powerline	0.801	100 YR FU	2330.00	1333.55	1339.76	1337.42	1340.30	0.001682	5.89	395.81	77.44	0.46	1341.23	1343.05
Powerline	0.795	100 YR EX	3210.00	1333.39	1340.46	1338.71	1341.38	0.002783	7.71	416.51	79.43	0.59	1341.25	1342.92
Powerline	0.795	100 YR FU	2330.00	1333.39	1339.43	1337.88	1340.17	0.002725	6.91	337.35	74.91	0.57	1341.25	1342.92
Powerline	0.738	100 YR EX	3210.00	1332.16	1339.79	1337.68	1340.59	0.002279	7.20	445.92	81.17	0.54	1341.05	1341.55
Powerline	0.738	100 YR FU	2330.00	1332.16	1338.80	1336.84	1339.42	0.002107	6.33	367.90	76.77	0.51	1341.05	1341.55
Powerline	0.681	100 YR EX	3210.00	1332.51	1338.35	1337.51	1339.60	0.004885	8.96	358.25	81.18	0.75	1340.63	1340.60
Powerline	0.681	100 YR FU	2330.00	1332.51	1337.26	1336.73	1338.40	0.005622	8.55	272.52	76.29	0.80	1340.63	1340.60
Powerline	0.625	100 YR EX	3210.00	1329.80	1337.79	1335.48	1338.56	0.002081	7.01	457.76	81.21	0.52	1339.72	1339.69
Powerline	0.625	100 YR FU	2330.00	1329.80	1336.68	1334.63	1337.30	0.002024	6.29	370.31	76.00	0.50	1339.72	1339.69
Powerline	0.568	100 YR EX	3210.00	1329.54	1337.15	1334.89	1337.92	0.002151	7.06	454.85	81.83	0.53	1338.44	1338.88
Powerline	0.568	100 YR FU	2330.00	1329.54	1336.06	1334.00	1336.68	0.002062	6.31	369.14	76.28	0.51	1338.44	1338.88
Powerline	0.511	100 YR EX	3210.00	1329.42	1336.36	1334.46	1337.21	0.002531	7.41	433.18	83.31	0.57	1338.30	1337.82
Powerline	0.511	100 YR FU	2330.00	1329.42	1335.30	1333.61	1336.00	0.002498	6.68	349.05	76.91	0.55	1338.30	1337.82
Powerline	0.454	100 YR EX	3210.00	1328.34	1335.71	1333.53	1336.48	0.002206	7.08	453.48	90.35	0.53	1336.79	1336.92
Powerline	0.454	100 YR FU	2330.00	1328.34	1334.68	1332.68	1335.29	0.002079	6.29	370.66	78.96	0.51	1336.79	1336.92
Powerline	0.401	100 YR EX	3210.00	1328.22	1334.40	1333.45	1335.59	0.004385	8.77	366.11	82.01	0.73	1334.86	1335.38
Powerline	0.401	100 YR FU	2330.00	1328.22	1333.27	1332.63	1334.37	0.005188	8.41	277.10	75.20	0.77	1334.86	1335.38
Powerline	0.390	100 YR EX	3210.00	1326.59	1334.52	1331.80	1335.18	0.001700	6.48	495.21	137.02	0.47	1335.48	1335.55
Powerline	0.390	100 YR FU	2330.00	1326.59	1333.41	1330.92	1333.92	0.001608	5.77	403.53	79.17	0.45	1335.48	1335.55
Powerline	0.340	100 YR EX	3210.00	1325.89	1334.01	1331.36	1334.70	0.001809	6.68	480.58	117.07	0.49	1335.50	1335.14
Powerline	0.340	100 YR FU	2330.00	1325.89	1332.95	1330.50	1333.49	0.001652	5.88	396.24	77.10	0.46	1335.50	1335.14
Powerline	0.311	100 YR EX	3210.00	1326.49	1332.07	1332.07	1334.05	0.008543	11.29	284.39	72.00	1.00	1334.54	1334.77
Powerline	0.311	100 YR FU	2330.00	1326.49	1331.17	1331.17	1332.87	0.008953	10.47	222.45	65.35	1.00	1334.54	1334.77
Powerline	0.291	100 YR EX	3210.00	1320.28	1323.03	1325.08	1330.91	0.021311	22.53	142.50	64.86	2.68	1331.86	1331.20
Powerline	0.291	100 YR FU	2330.00	1320.28	1322.50	1324.27	1329.68	0.027085	21.51	108.34	63.64	2.90	1331.86	1331.20
Powerline	0.280	100 YR EX	3210.00	1320.63	1323.78	1325.19	1328.52	0.009689	17.49	183.57	67.08	1.86	1331.15	1331.26
Powerline	0.280	100 YR FU	2330.00	1320.63	1323.24	1324.39	1327.09	0.010173	15.74	148.00	66.09	1.85	1331.15	1331.26
Powerline	0.257	100 YR EX	3210.00	1320.30	1326.26	1324.95	1327.34	0.001016	8.37	383.62	76.46	0.66	1331.40	1330.99
Powerline	0.257	100 YR FU	2330.00	1320.30	1325.35	1324.18	1326.20	0.000989	7.40	314.80	74.46	0.63	1331.40	1330.99
Powerline	0.222	100 YR EX	3210.00	1320.30	1325.34	1324.96	1326.99	0.001855	10.29	311.84	71.87	0.87	1331.48	1331.42
Powerline	0.222	100 YR FU	2330.00	1320.30	1324.74	1324.15	1325.91	0.001545	8.65	269.22	70.57	0.78	1331.48	1331.42
Powerline	0.170	100 YR EX	3210.00	1320.26	1324.52	1324.52	1326.36	0.002496	10.87	295.26	80.38	1.00	1331.07	1331.52
Powerline	0.170	100 YR FU	2330.00	1320.26	1323.76	1323.76	1325.29	0.002662	9.91	235.05	77.44	1.00	1331.07	1331.52
Powerline	0.113	100 YR EX	3210.00	1319.33	1324.64	1321.94	1324.83	0.000661	3.45	931.75	207.57	0.29	1330.46	1330.65
Powerline	0.113	100 YR FU	2330.00	1319.33	1323.48	1321.52	1323.65	0.000882	3.36	694.25	200.03	0.32	1330.46	1330.65
Powerline	0.042	100 YR EX	3210.00	1317.34	1322.90	1322.04	1324.25	0.001355	9.34	343.60	73.52	0.76	1328.36	1328.10
Powerline	0.042	100 YR FU	2330.00	1317.34	1321.97	1321.18	1323.07	0.001351	8.41	277.21	69.65	0.74	1328.36	1328.10
Powerline	0.001	100 YR EX	3210.00	1317.10	1321.99	1321.78	1323.84	0.002135	10.90	294.50	70.56	0.94	1327.85	1327.88
Powerline	0.001	100 YR FU	2330.00	1317.10	1321.17	1320.96	1322.66	0.002134	9.80	237.81	67.07	0.92	1327.85	1327.88



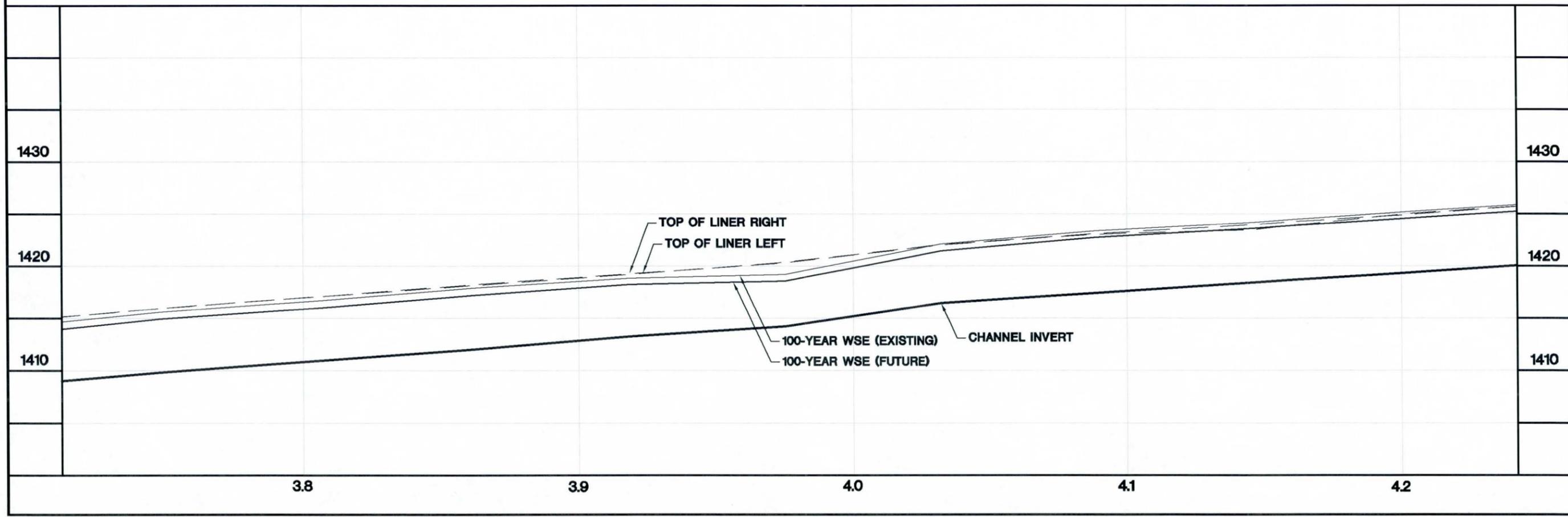
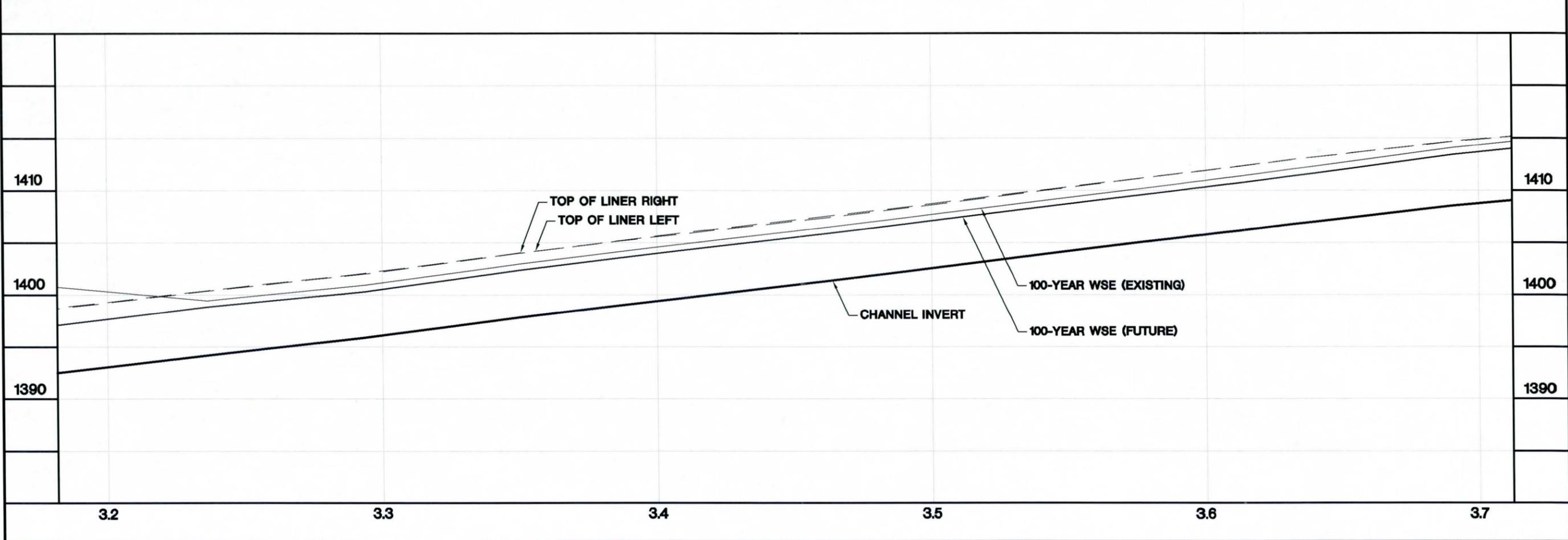
EAST MESA AREA DRAINAGE MASTER PLAN UPDATE
FCD 2011C017



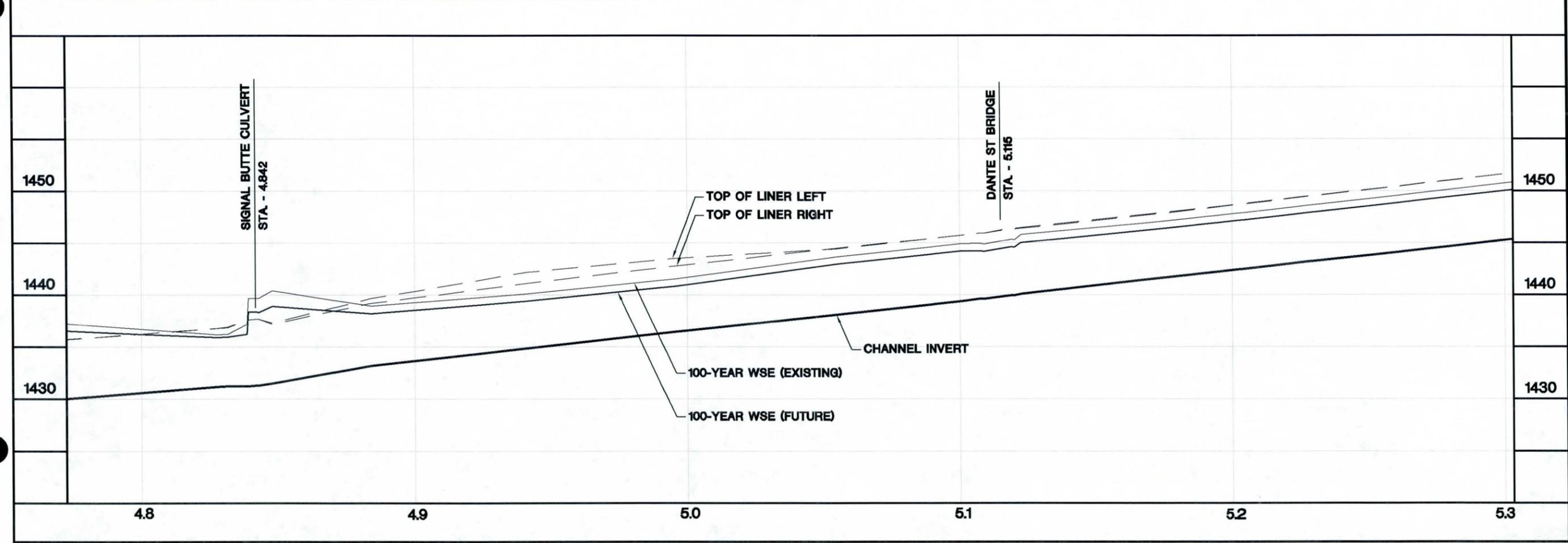
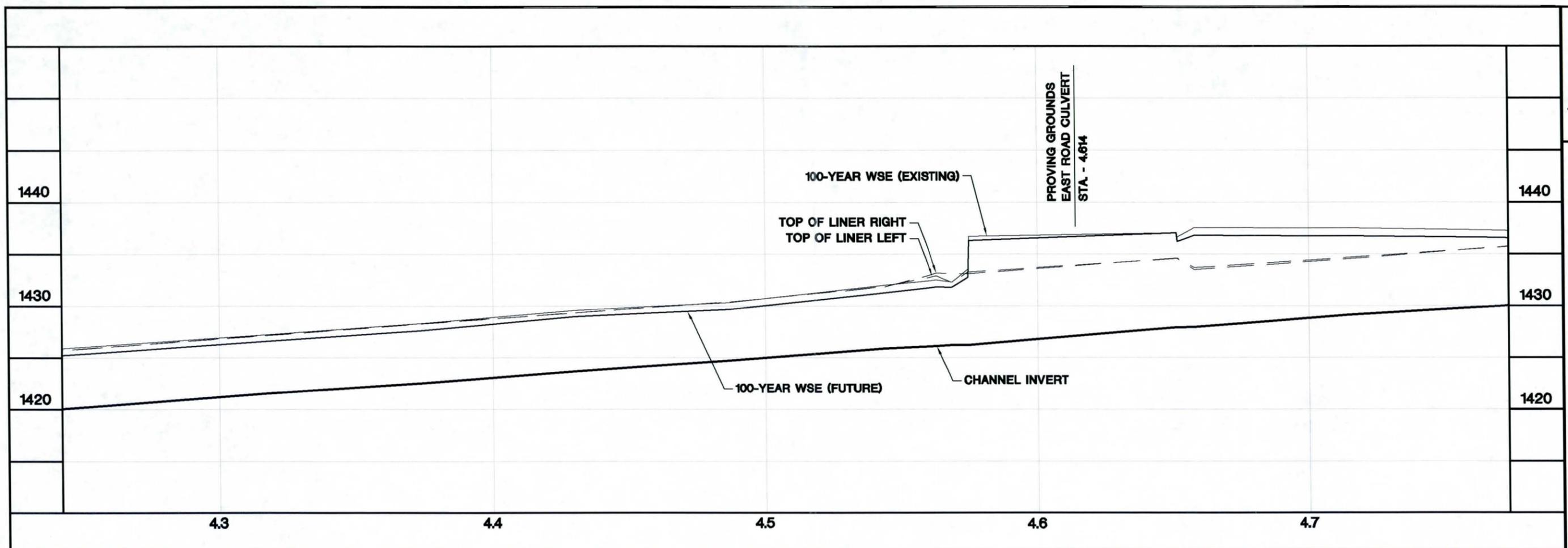
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FCD 2011C017



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FCD 2011C017

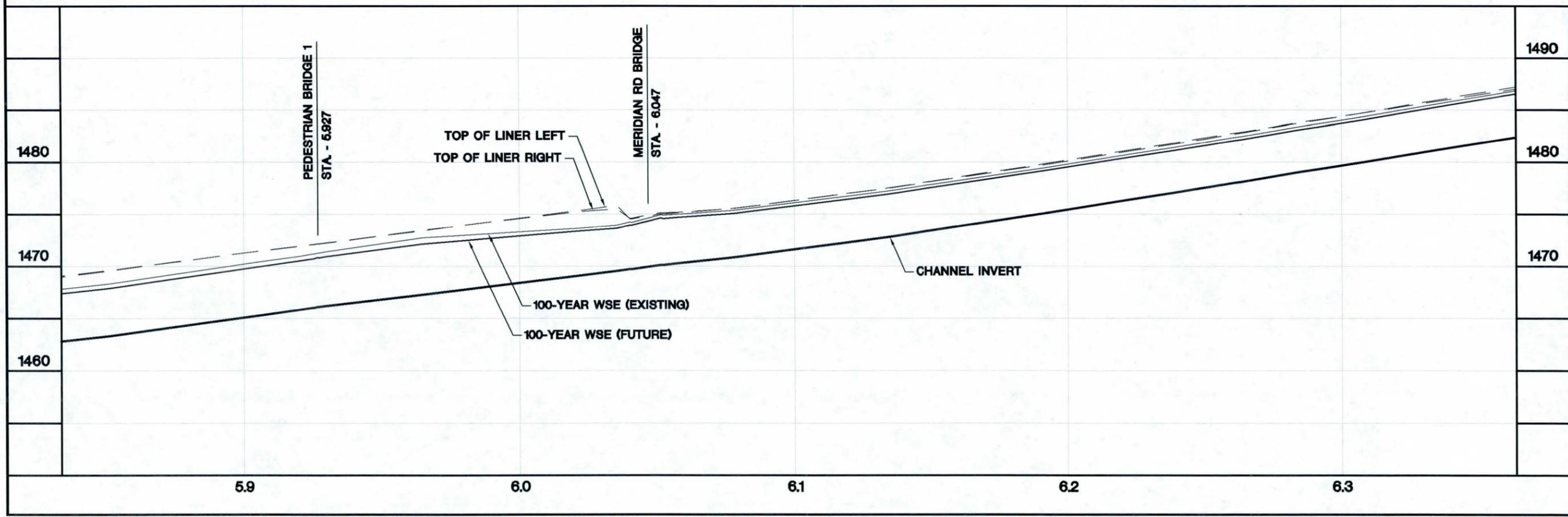
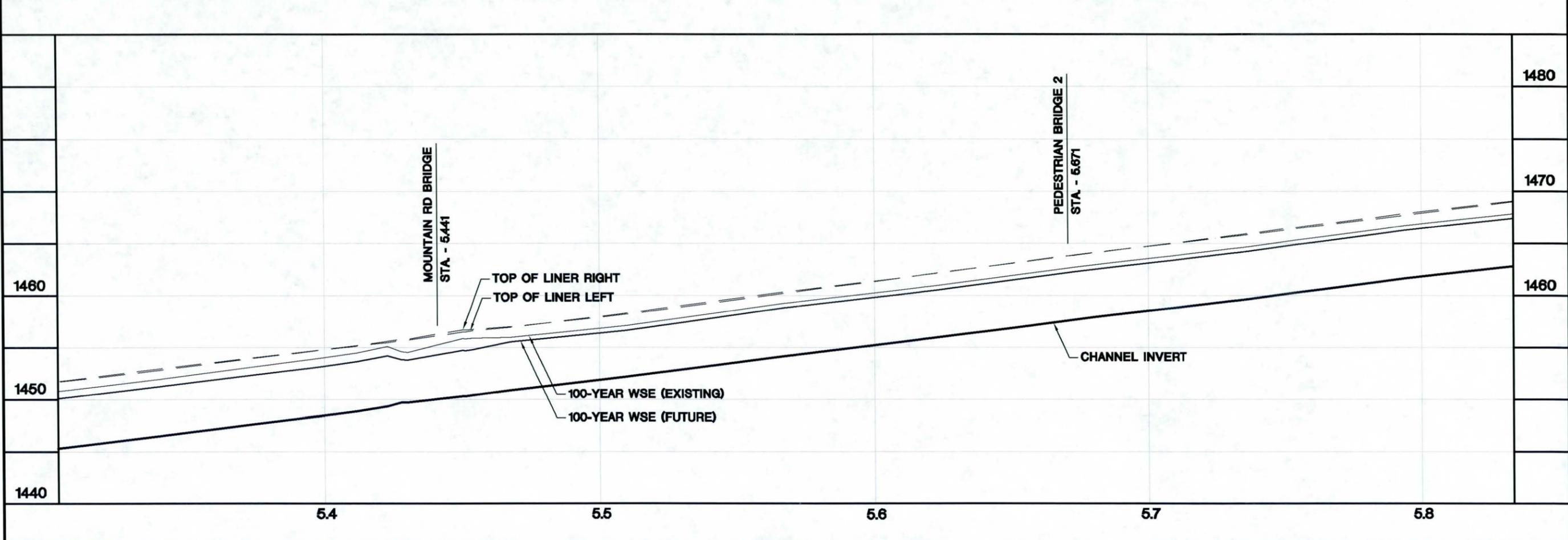


EAST MESA AREA DRAINAGE MASTER PLAN UPDATE
FCD 2011C017

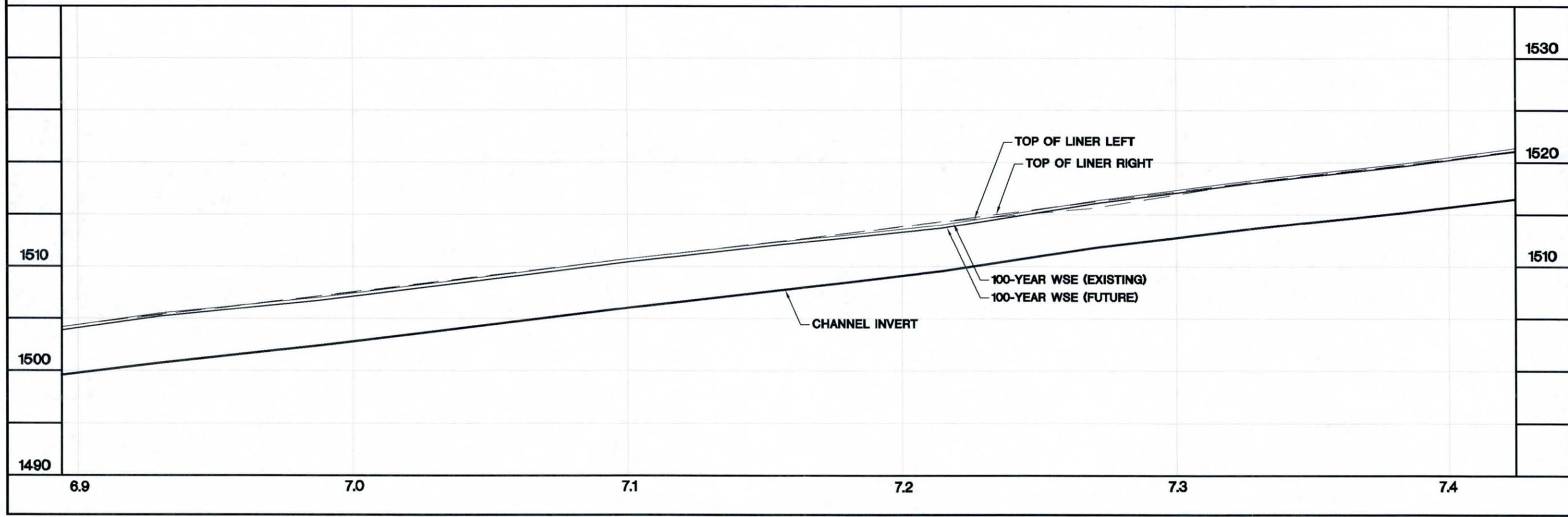
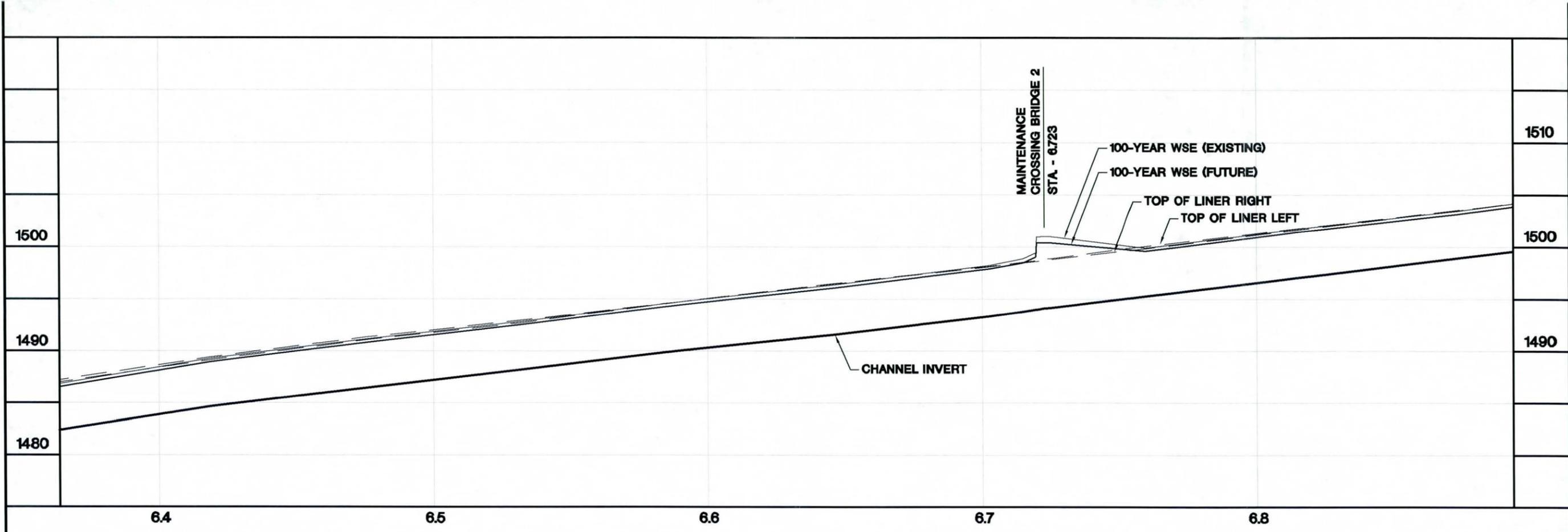


EAST MESA AREA DRAINAGE MASTER PLAN UPDATE
FCD 2011C017

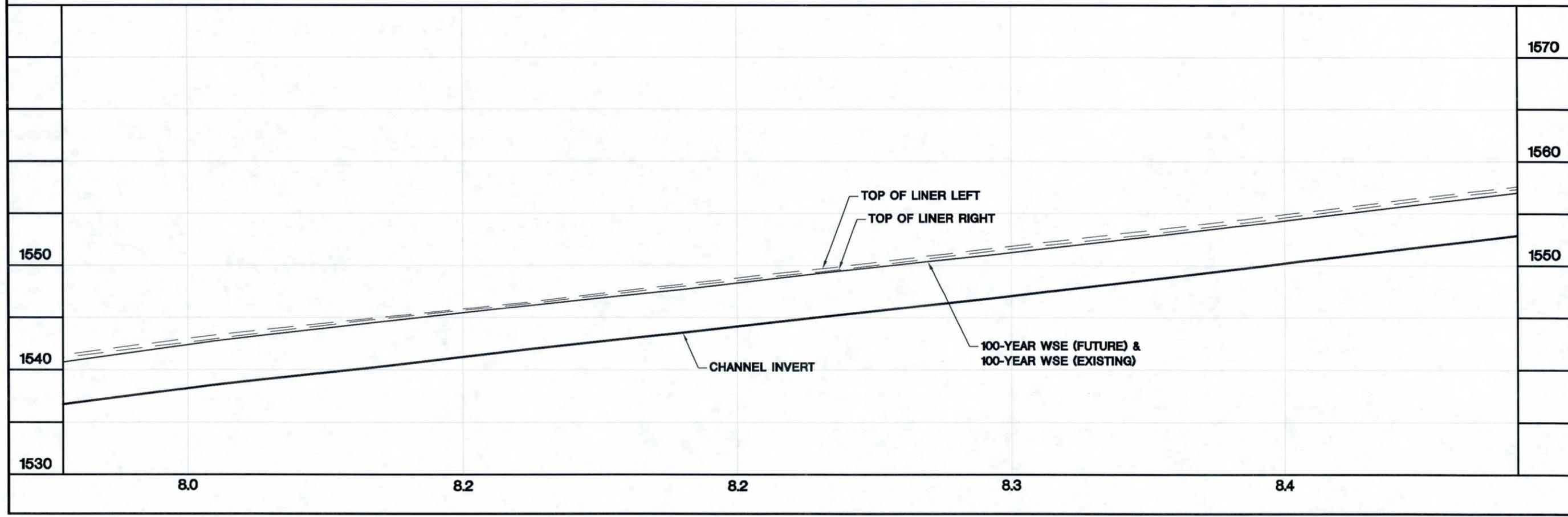
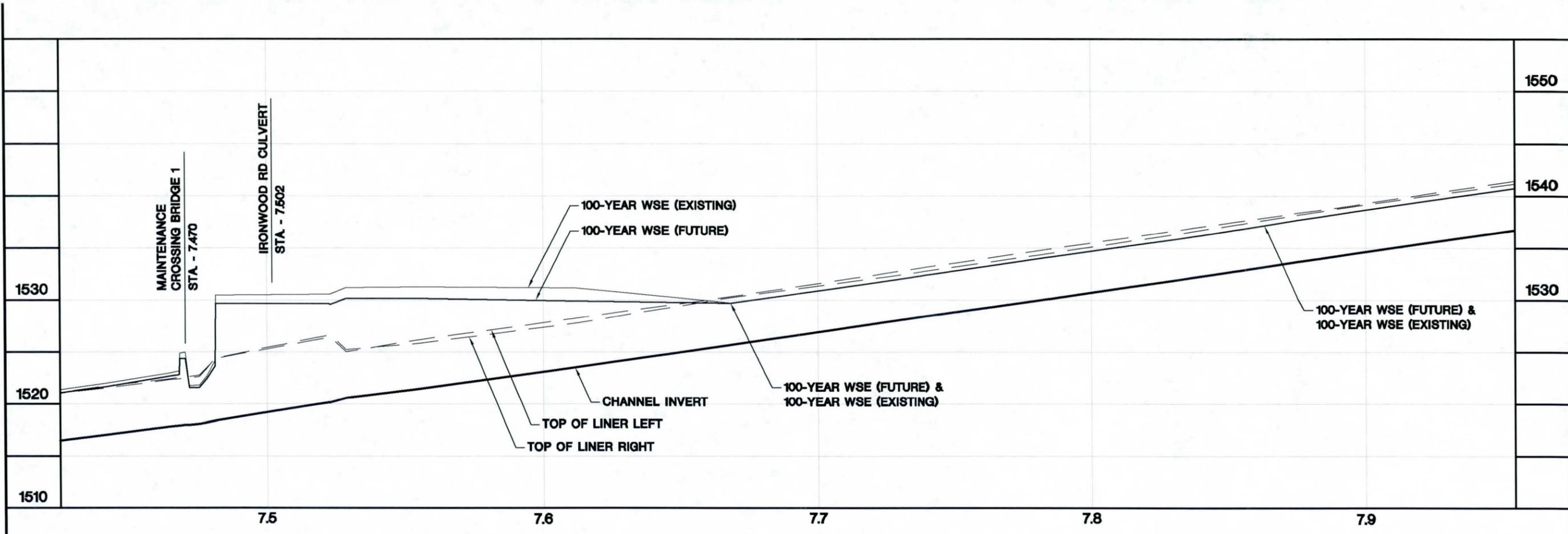
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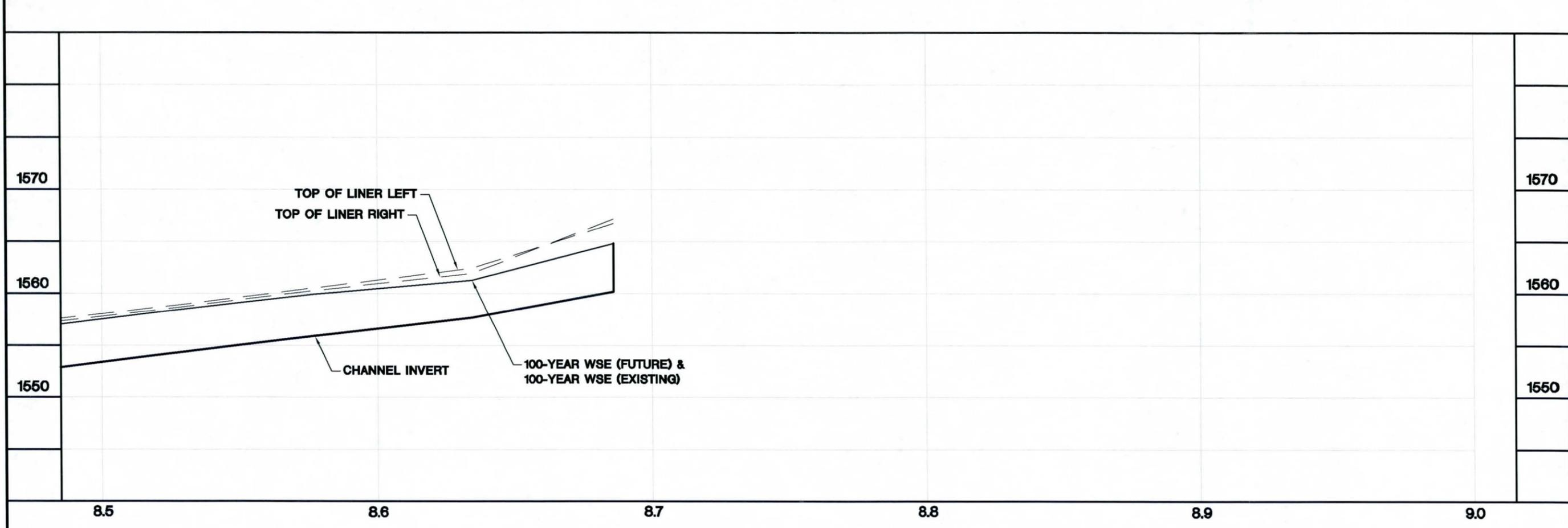
EAST MESA AREA DRAINAGE MASTER PLAN UPDATE
FCD 2011C017



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FCD 2011C017



EAST MESA AREA DRAINAGE MASTER PLAN UPDATE
FCD 2011C017



EAST MESA AREA DRAINAGE MASTER PLAN UPDATE
FCD 2011C017

ATTACHMENT 3: CD

APPENDIX E. PRELIMINARY BIOLOGY SURVEY

Provided in electronic format on enclosed CD.

APPENDIX F. PUBLIC AND STAKEHOLDERS MEETING INPUT



EAST MESA AREA DRAINAGE MASTER PLAN UPDATE
Public Meeting Questionnaire

May 8, 2012

Name: _____ Phone: _____

Address: _____ E-mail: _____

1. Please describe past flooding problems in your neighborhood and the location(s) of the flooding:

Three horizontal lines for describing flooding problems.

2. How often is your neighborhood flooded?

- Four checkbox options: Frequently (once or more per year), Rarely, Occasionally (every few years), Not aware of any past flooding problems.

3. Have you had problems accessing your property during storms? If yes, which streets were flooded? [Yes/No checkboxes]

Two horizontal lines for listing flooded streets.

4. Has your home or other building(s) on your property been flooded? If yes, how many times and how severe was the damage? [Yes/No checkboxes]

Two horizontal lines for describing damage.

5. What types of outdoor activities do you enjoy in your neighborhood or the surrounding area? (Flood control solutions can possibly accommodate or incorporate recreational features.) Where do you think facilities to practice these outdoor activities could be located?

Two horizontal lines for describing activities and locations.

6. Flood control solutions include open channels, washes, and detention basins. Do you use any existing channels, washes, or basins in the study area for recreation? If yes, please name and/or describe the locations of the basins/channels/ washes: [Yes/No checkboxes]

Two horizontal lines for naming and describing locations.

7. Please name any local organizations or groups that may be interested in recreation, wildlife, or other outdoor activities within the study area. (Examples: equestrian, bicycling, or hiking clubs.)

Three horizontal lines for naming organizations or groups.



MEETING SUMMARY



Project: East Mesa ADMP Update	Date: April 23, 2012
Job No.: FCD 2011C017	Time: 9:00 a.m.
Subject: Public Sector Stakeholder Involvement Kick-Off Meeting	Place: FCDMC

The following is a summary of discussion at the public sector stakeholder involvement kick-off meeting for the East Mesa Area Drainage Master Plan (ADMP) Update. The purpose of the meeting was to introduce the project to representatives of agencies that have activities in or regulatory responsibility for the study area and solicit input on storm drainage management solutions. The meeting agenda and list of attendees are attached.

INTRODUCTIONS & PROJECT BACKGROUND

After attendee introductions, Jen Pokorski, project manager for the Flood Control District of Maricopa County (District) presented an overview of the project background, history, and goals. The original East Mesa ADMP was completed in 1998, and a significant portion of the recommended facilities have since been implemented. An update was initiated due to subsequent extensive development, the obligation to reserve capacity in the Powerline Floodway for upstream dam functions, and District jurisdictional decisions to locate all facilities within Maricopa County. Additionally, changes in watershed drainage patterns have exacerbated flooding in some areas.

PROJECT SCHEDULE & MILESTONES

The District recently prepared an update to the hydrologic modeling to account for changes to the watershed. Major milestones for the project include development and evaluation of alternatives (spring and summer 2012, respectively), selection of a recommended alternative (August 2012), and project completion in February 2013.

CURRENT/FUTURE REGIONAL ACTIVITIES, OPPORTUNITIES, & CONSTRAINTS

The study area is divided into four regions. Approximate boundaries are as follows:

- Zone 1: Northern boundary to the Powerline Floodway
- Zone 2: Powerline Floodway to Germann Road
- Zone 3: Phoenix-Mesa Gateway Airport
- Zone 4: Germann Road to southern boundary

Activities, opportunities, and constraints were discussed as follows by region.

Zone 1 Activities

SR 24. ADOT reported that the first mile of the SR 24 (Gateway Freeway) is now under construction. The first segment extends southeast from SR 202 to Ellsworth Road. The freeway drainage system includes an interceptor/conveyance channel on the north side of the freeway with detention basins at Ellsworth and SR 202. The outfall is to the existing Loop 202 drainage system. This phase of the new freeway will be constructed within 18 months.

MCDOT Bridges. MCDOT has a combination of a bridge and a box culvert at Meridian Road at the Powerline Floodway. The bridge spans the floodway, while the culvert passes surface drainage north of the floodway under the road.

ASLD. Arizona State Land Department (ASLD) does not have a specific land development plan for the Pinal County portion of the upstream watershed. However, the area has high potential for future development. *An email request for ASLD's most recent planning information should be sent to Manny Patel.*

Zone 2 Activities

SR 24. Pre-design (15%) of the next phase, from Ellsworth Road to Ironwood Road) is complete. Construction is expected to begin after 2020; the timeline will be updated in July 2012. The design phase typically begins one to two years prior to construction.

Three alternative alignments of the Pinal County portion of the freeway have been identified, but a recommended alignment has not been selected yet. ADOT noted that it is important to avoid showing an alignment east of Ironwood on any exhibits since the final alignment has not been selected. Javier Gurrola, ADOT, may be contacted for additional information on that segment. Additionally, he may have information on the North/South Corridor Study from Coolidge/Eloy to Apache Junction.

Generally, ADOT freeways are designed to allow the 50-year storm to pass. However, if the freeway intercepts offsite drainage from a large area, the 100-year storm may be used in the design criteria. J2 Design is a drainage subconsultant on the freeway design team and will *provide the drainage design criteria.*

ADOT may be amenable to a future Intergovernmental Agreement (IGA) to coordinate drainage needs along the Gateway Freeway. If the East Mesa ADMP Update identifies a mutual benefit to combining drainage solutions along the freeway corridor, the effort should be coordinated with Ron McCulley (ADOT), AECOM (ADOT managing consultant), and Arizona State Land Department (ASLD). ASLD is also interested in the potential for drainage partnerships in developing regional solutions.

Meridian Road Corridor. ADOT has recently initiated a Planning Assistance for Rural Areas (PARA) study for Meridian Road with Pinal County and Apache Junction. Charla Glendening is the ADOT contact and Mike Sabatini, Michael Baker, Jr., is the consultant project manager. The extents of the study were not identified.

MCDOT has also initiated a study for Meridian Road. TY Lin is the consultant project manager. *The limits of the study were not identified.*

Pinal County noted the lack of development activity within its portion of the watershed and lack of transportation planning funds. The absence of development and shortage of funds dictate that transportation or drainage partnering opportunities along Meridian Road is a low priority for Pinal County.

Central Arizona Project. The CAP has recently constructed a 60-inch diameter turnout south of the Powerline Floodway. No drainage issues were identified along the CAP Canal within the project study area. Recharge basins are planned adjacent to the canal; however, they will be located south of the study area.

Mountain Road Corridor. MCDOT recently initiated roadway and drainage improvements along Mountain, Erie, and Galveston roads. The area was previously evaluated for improvements in response to neighborhood flooding complaints after Earie Street was paved. However, the improvements recommended in the evaluation had not been constructed. Leon Adair is the MCDOT project manager, and Raj Shah, Ritoch-Powell & Associates, is the consultant project manager. The current project design includes elevating Mountain Road and installing a culvert north of Williams Field Road. In addition, the existing channel along Erie Street from Meridian Road alignment to Mountain Road will be improved along with driveway crossings. The design is expected to be complete by the end of June 2012. Construction will begin in late July 2012.

Signal Butte Road Corridor Improvements Study. MCDOT conducted this study recently; EPS was the prime consultant and JE Fuller was a subconsultant. The MCDOT project manager was Denise Lacey was MCDOT. The limits of the corridor study were not identified.

Ironwood Road. It was noted that past improvements to Ironwood Road within the study area raised the road elevations. ASLD indicated that a hydrologic study was conducted and accounted for the corresponding impedance to natural drainage patterns.

Levees and Diversions. Several levees and diversions were noted on ASLD land in the southeastern portion of Zone 2, as well as the eastern portion of Zone 4. The structures may not have been engineered and may not be legal. The structures have a significant impact on drainage patterns. The lack of design and maintenance raise the probability of failure, so it is important to understand the impact on downstream drainage behavior for in-place conditions as well as if the berms were to fail. ASLD suggested that the project team *send an email request for more information on the history and status of the structures.* The District had determined that the levees and diversions in the eastern portion of the study area within Pinal County do not have a significant impact on the regional drainage analysis performed in advance of this project.

Zone 3 Activities

Zone 3 is the Phoenix-Mesa Gateway Airport, and since the airport has its own drainage plan, no additional regional facilities are needed. Therefore, Zone 3 activities and drainage issues are excluded from the project planning area and were not discussed.

Zone 4 Activities

Germann Road Corridor Study. Wilson & Company is currently conducting a study along Germann Road from Powerline Road to Meridian Road under ADOT's PARA program. A roadway centerline has been identified for a six-lane arterial roadway, and alternatives will be developed by the end of May 2012. The project will be completed in August 2012.

Flooding issues were identified in the vicinity of Ellsworth and Germann Roads.

Pinal County. The portion of Zone 4 within Pinal County has experienced some large-lot development. A channel was constructed as part of a subdivision that empties onto vacant land.

Queen Creek. The Town of Queen Creek was asked about opportunities to co-locate detention basins with future parks. Chris Dovel said that a municipal park is planned on town-owned land along Queen Creek Road east of Signal Butte Road, designated as East Park in the Town's Five Parks Master Plan. The Town has been approached to shift the park site to a parcel north and east of the Barney Family Sports Complex at Queen Creek and Merrill Roads. If this occurs, the town parcel would change ownership and land use as part of a land trade. The Town might be willing to discuss potential partnerships for co-locating retention with the park; other Town staff would provide additional input on this possibility.

Depending on the locations, trails may also be possible along drainage channels. Queen Creek has a trails master plan showing trails along arterial roads, washes, and other locations. However, funding for trail construction within the study area is not currently identified in the Five-Year Capital Improvement Projects budget. The trails master plan is intended as a guide for development.

FUTURE MEETINGS

Additional stakeholder meetings will be held to present and discuss proposed alternatives in early June 2012 and to present a draft recommended alternative in August 2012.

OTHER

Because of land value, ASLD prefers to avoid locating detention basins on arterial corners where commercial interest would be high.

ACTION ITEMS

The following action items were assigned:

Action Item	Responsible Party
Send an email request to Manny Patel for ASLD's most recent planning information.	Entellus
Send an email request to Manny Patel for information on the history and status of existing levee/diversion structures in the southeast portion of the study area, primarily along Meridian Road (Zone 4).	Entellus
Collect information from TY Lin/MCDOT on the corridor study for Meridian Road.	Entellus
Provide drainage design criteria for SR24 between Loop 202 and Ironwood Road.	J2

The preceding summary was prepared by Laurie Miller. Attendees were asked to report any discrepancies and/or omissions within one week of the May 4th distribution date.

c: Attendees

MEETING AGENDA
East Mesa ADMP Update
Stakeholder Kick-Off Meeting
April 23, 2012

- 1. Introductions & Project Background**
 - Project Summary
 - Project Goals
 - Purpose of Meeting
 - Identify stakeholder goals, concerns, opportunities/constraints

- 2. Project Schedule & Milestones**

- 3. Current/Future Regional Activities**
 - Transportation
 - Residential Development
 - Commercial/Industrial Development
 - Utilities
 - Recreation
 - Other

- 4. Stakeholder Interest & Concerns**
 - Current/Future Drainage Issues
 - Timing Constraints
 - Potential Alternatives Evaluation Criteria

- 5. Stakeholder Involvement**
 - Continued Interest in Project
 - Partnering Opportunities
 - Potential Cost-Share Partners

- 6. Future Meetings**

- 7. Other**

Flood Control District of Maricopa County
East Mesa Area Drainage Master Plan Update
Public Sector Stakeholder Coordination Meeting Attendees

April 23, 2012

Name		Representing	Phone	Email
Adair	Leon	MCDOT	602-723-5813	leonadair@mail.maricopa.gov
Ahouraiyan	Afshin	FCDMC	602-506-4519	afa@mail.maricopa.gov
Aristizabal	Hernan	Entellus	602-244-2566	ahernan@entellus.com
Dovel	Chris	Town of Queen Creek	480-358-3067	chris.dovel@queencreek.org
Fry	Brian	JE Fuller	623-889-0166x307	brian.fry@jefuller.com
Griffin	John	EPG	602-956-4370	jgriffin@epgaz.com
Hatab	Samir	MCDOT	602-506-2867	samirhatab@mail.maricopa.gov
Kernan	Patrick	Central Ariz. Project	623-869-2494	pkernan@cap-az.com
Marum	Dan	Wilson & Company	602-283-2702	dan.marum@wilsonco.com
McCally	Ron	ADOT	602-712-7646	rmccally@azdot.gov
Miller	Laurie	LTM Engineering	602-485-5880	miller@LTMengineering.com
Montgomery	Charlene	MCDOT	602-506-8673	charlenemontgomery@mail.maricopa.gov
Moore	Elise	Pinal County FCD	520-866-6638	elisemoore@pinalcountyyaz.gov
Patel	Manny	ASLD	602-364-1596	mpatel@land.az.gov
Philbin	James	J2 Design	602-438-2221	jphilbin@j2design.us
Pokorski	Jen	FCDMC	602-506-4695	jmp@mail.maricopa.gov
Sonnemann	Thomas	MCDOT	602-506-4880	TomSonnemann@mail.maricopa.gov

Note: Shaded rows denote District and consultant team members



MEETING SUMMARY



Project: East Mesa ADMP Update	Date: April 23, 2012
Job No.: FCD 2011C017	Time: 1:30 p.m.
Private Sector Stakeholder Involvement	
Subject: Kick-Off Meeting	Place: FCDMC

The following is a summary of discussion at the public sector stakeholder involvement kick-off meeting for the East Mesa Area Drainage Master Plan (ADMP) Update. The purpose of the meeting was to introduce the project to those with active and/or future development within the study area and solicit input on storm drainage management solutions. The meeting agenda and list of attendees are attached.

INTRODUCTIONS & PROJECT BACKGROUND

After attendee introductions, Jen Pokorski, project manager for the Flood Control District of Maricopa County (District) presented an overview of the project background, history, and goals. The original East Mesa ADMP was completed in 1998, and a significant portion of the recommended facilities have since been implemented. An update was initiated due to subsequent extensive development, the obligation to reserve capacity in the Powerline Floodway for upstream dam functions, and District jurisdictional decisions to locate all facilities within Maricopa County. Additionally, changes in watershed drainage patterns have exacerbated flooding in some areas.

PROJECT SCHEDULE & MILESTONES

The District recently prepared an update to the hydrologic modeling to account for changes to the watershed. Major milestones for the project include development and evaluation of alternatives (spring and summer 2012, respectively), selection of a recommended alternative (August 2012), and project completion in February 2013.

CURRENT/FUTURE REGIONAL ACTIVITIES, OPPORTUNITIES, & CONSTRAINTS

The study area is divided into four regions. Approximate boundaries are as follows:

- Zone 1: Northern boundary to the Powerline Floodway
- Zone 2: Powerline Floodway to Germann Road
- Zone 3: Phoenix-Mesa Gateway Airport
- Zone 4: Germann Road to southern boundary

Activities, opportunities, and constraints were discussed as follows by region.

Zone 1 Activities

Hawes & Ray Roads. Morgan Neville noted that the land on the northwest and southwest corners have commercial entitlements. There are no immediate plans for development. He mentioned a study that may be relevant to the project: the Northeast Development Plan prepared by Jacobs Consultancy for the Phoenix-Mesa Gateway Airport. It is available through the link titled "Draft NAPD" under the Current Planning Studies" section at: <http://www.phxmesagateway.org/DocumentsAndFormsLibrary.aspx>

Hawes & SR 202. Land at this location is zoned for dense mixed-use development, although there are no immediate plans for development.

Eastmark Development. Eastmark Development, located on the GM Proving Grounds site, covers a large portion of Zone 1 and extends into Zone 2. DMB is currently working through the District's permitting process on Development Unit 7, which impacts the Powerline Floodway. The project team will contact Hoskin/Ryan, the DU-7 consultant, for the latest development plan.

Zone 2 Activities

Pecos Road. Chronic flooding was noted along Pecos Road in the vicinity of Mountain Road. In general, drainage conveyance between Meridian and Signal Buttes roads is disjointed and subject to sheet flooding.

Germann & Meridian Roads. CMC Steel operates on the northwest corner of Germann and Meridian roads. Improvements are underway to address drainage problems within the property.

TRW has an industrial site on Germann Road adjacent to CMC Steel. A large onsite detention basin was constructed to handle onsite runoff. In the future, TRW may sell its land and lease back a portion of the site for its operations.

It was noted that a recent industrial development along Germann Road has improved drainage conditions at Germann and Meridian roads.

Zone 3 Activities

Zone 3 is the Phoenix-Mesa Gateway Airport, and since the airport has its own drainage plan, no additional regional facilities are needed. Therefore, Zone 3 activities and drainage issues are excluded from the project planning area and were not discussed.

Zone 4 Activities

Germann & Meridian Roads. Barney Farms owns 350 acres at the southwest corner of Germann and Meridian roads, across from the TRW facilities. Future development may

include residential and light industrial; however, such a development would require a major land use plan amendment. It was noted that the Signal Butte Road alignment would shift eastward between Germann Road and ½ mile south of Germann Road to the Meridian Road alignment and then continue south.

Barney Farms. Barney Farms has existing recreational facilities within Zone 4 and is discussing a potential land trade with the Town of Queen Creek to relocate a planned community park adjacent to the Barney Family Sports Complex. Barney Farms would be willing to co-locate future detention facilities if there are mutual benefits to do so. The park would be owned and operated by the Town; incorporating flood mitigation would be coordinated with the Town.

Queen Creek Station. A residential development is planned for a parcel north of the Rittenhouse Channel along Ellsworth Road. The project team will verify that the development was considered when updating the hydrologic analysis for the East Mesa ADMP Update.

A question arose as to whether crossing of the Rittenhouse Channel is allowed. Jen Pokorski responded that it can be crossed, but a permit is required to do so.

FUTURE MEETINGS

Additional stakeholder meetings will be held to present and discuss proposed alternatives in early June 2012 and to present a draft recommended alternative in August 2012.

OTHER

Questions arose regarding how non-engineered berms will be treated in the East Mesa ADMP Update. The berms have a significant effect on drainage patterns. However, lack of design and maintenance raise the probability of failure, so it is important to understand the impact on downstream drainage behavior for in-place conditions as well as if the berms were to fail. From a regulatory standpoint, they may not be counted on to function in the future. However, this situation poses difficulties for developers because of the uncertainty of what will be required of them to handle offsite drainage. Given Mesa's offsite/onsite retention and conveyance policies, developers need direction on how to proceed because the amount and location of offsite flow could change significantly.

Questions arose on the status of the Powerline, Vineyard Road, and Rittenhouse (PVR) Flood Retarding Structure rehabilitation project. The District will provide a status update to the stakeholders.

ACTION ITEMS

The following action items were assigned:

Action Item	Responsible Party
Collect and review the Northeast Development Plan prepared by Dibble & Associates for the Phoenix-Mesa Gateway Airport	Entellus
Collect and review the latest Eastmark Development plan from Hoskin/Ryan	Entellus
Verify that Queen Creek Station was considered when updating the hydrologic analysis for the East Mesa ADMP Update	FCDMC/Entellus
Provide a status update of the PVR Rehabilitation Project. to the stakeholders	FCDMC

The preceding summary was prepared by Laurie Miller. Attendees were asked to report any discrepancies and/or omissions within one week of the May 4th distribution date.

c: Attendees
Andy Sarat, CMC Americas
Nicholaus Fischer, Merit Partners, Inc.

MEETING AGENDA
East Mesa ADMP Update
Stakeholder Kick-Off Meeting
April 23, 2012

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 - Continued Interest in Project
 - Partnering Opportunities
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- 6. Future Meetings**

- 7. Other**

Flood Control District of Maricopa County
East Mesa Area Drainage Master Plan Update
Private Sector Stakeholder Coordination Meeting Attendees

April 23, 2012

Name		Representing	Phone	Email
Ahouraiyan	Afshin	FCDMC	602-506-4519	afa@mail.maricopa.gov
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Aristizabal	Hernan	Entellus	602-244-2566	ahernan@entellus.com
Bertram	Ron		602-821-4677	Ron.bertram@soitec.com
Feiter	Tony	Levine Investments	602-248-8181	tony@levineinvestments.com
Fry	Brian	JE Fuller	623-889-0166x307	brian.fry@jefuller.com
Griffin	John	EPG	602-956-4370	jgriffin@epgaz.com
Hartman	John	Landmark Companies	480-305-7000	john@landmark.net
Hatch	Steve		480-225-5918	hatchadamj@gmail.com
Holston	Ricky	Sunrise Engineering	480-768-8600	rholston@sunrise-eng.com
Magruder	Mike	TRW Vehicle Safety Systems, Inc.	480-722-4174	Michael.magruder@trw.com
Miller	Laurie	LTM Engineering	602-485-5880	miller@LTMEngineering.com
Moser	Brent	Marwest Intl. and Kitchell Development	602-224-4486	bmoser@brephoenix.com
Neville	Morgan	Mesa Airport Growth Properties	480-586-4300	hutchjhawk@cox.net
Patel	Ash	Wood-Patel (Eastmark and Multi Pure Chemical)	602-335-8544	apatel@woodpatel.com
Pokorski	Jen	FCDMC	602-506-4695	jmp@mail.maricopa.gov
Reeb	Mark	PM Industrial Holdings	480-898-9090	danreeb@reebgroup.com
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Note: Shaded rows denote District and consultant team members

APPENDIX G. LANDSCAPE INVENTORY AND ANALYSIS AND PHOTO LOG

Landscape Inventory Analysis is provided in electronic format on enclosed CD.