Picture Rocks Technical Data Notebook

Prepared for:

Pima County Regional Flood Control District
97 East Congress, Tucson, AZ 85701

Prepared by:

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Approved by

S Shields

Registered Professional Engineer (Civil)
CERTIFICATE No.
15610
SUZANNE J.
SHIELDS
DATE SIGNED
11/4/2011

Suzanne Shields, PE
Director

Pima County Regional Flood Control District
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Jun 2013

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Exhibit 2 Picture Rocks Flood Hazard Areas

Attached CD Picture Rocks TDN with supporting models and GIS data.

Section 1 Introduction

1.1 Purpose

This Technical Data notebook (TDN) has been prepared for the Picture Rocks (PCR) area located in Pima County, Arizona. The objective of the TDN is to provide regulatory discharge rates and identify floodplain hazard area along in the Picture Rocks study area using better topographic, hydrologic, and hydraulic data.

The precision of the floodplain data resulting from this study is limited to 50 feet based on the grid resolution used in the FLO-2D models. Therefore, the results are appropriate for planning but may not be appropriate for detailed studies at the parcel or sub-division level. It is recommended that the results from this study are used as the inflow for performing more detailed studies at smaller scales. Floodplain cross sections from this study are intended to provide discharge values for future detailed studies.

The purpose of the FLO-2D modeling was to delineate flood hazard areas for floodplain management. Larger flow depths and velocities were used to delineate the main flow corridors, and the shallow flow depths were identified as sheet flooding areas. Wash lines were created and are intended for use with erosion hazard setbacks.

This TDN was prepared in accordance with the "Instructions for Organizing and Submitting Technical Documentation for Flood Studies" prepared by the Arizona Department of Water Resources, Flood Mitigation Section (Arizona State Standard, SSA 1-97) and FEMA Guidelines.

1.2 Project Authority

The State of Arizona has delegated the responsibility to each county flood control district to adopt floodplain regulations designed to promote the public health, safety and general welfare of its citizenry as provided under the Arizona Revised Statutes, Title 48, Chapter 21, Article 1, Sections 48-3601 through 3627. More specifically, A.R.S. 3609 directs county flood control districts to adopt floodplain regulations that:

> A. Regulate all development of land, construction of residential, commercial or industrial structures or uses of any kind which may divert, retard or obstruct flood water and threaten public health or safety or the general welfare; and
> B. Establish minimum flood protection elevations and flood damage prevention requirements for uses, structures and facilities which are vulnerable to flood damage; and
> C. Comply with state and local land use plans and ordinances, if any.

In conformance with A.R.S. 3609, this ordinance provides for protection of the public health safety and welfare by regulation of flood and erosion hazard areas to control flood hazards and prevent repetitive loss from flood damage.
D. The flood hazard areas of Pima County are subject to periodic inundation which may result in loss of life and property, create health and safety hazards, disrupt commerce and governmental services, require extraordinary public expenditures for flood protection and relief, and impair the tax base, all of which adversely affect the public health, safety, and general welfare.
E. These flood losses are caused by the cumulative effect of obstructions in areas of special flood hazards which increase flood heights, flow velocities, and cause flood and erosion damage. Uses that are inadequately flood-proofed, elevated, or otherwise protected from flood damage, also contribute to the flood loss. (Ord. 2005 FC-2 § 2 (part), 2005).

Section 16 of the Pima County Ordinance describes the provisions for floodplain regulation in Pima County.

This study has been prepared by the Pima County Regional Flood Control District (RFCD):

Pima County Regional Flood Control District
97 East Congress, Tucson, AZ 85701

The project was prepared by:

Dave Stewart, EIT, Civil Engineering Assistant.
Pima County Regional Flood Control District
97 East Congress, Tucson, AZ 85701

1.3 Project Location

The Picture Rocks study area currently has a Federal Emergency Management Agency (FEMA) undetermined flood hazard risk or “Zone D”, as depicted on FIRM Map Panel Numbers 04019C1600K (February 8, 1999).

The study area is the region primarily East of the Central Arizona Project (CAP) canal, West of Golden Gate Rd., South of Magee Rd., and North of Sweetwater Dr. The region is located in the following Sections:

E121132	E131101	E131108	E131113	E131120	E131218
E121133	E131102	E131109	E131114	E131121	
E121134	E131103	E131110	E131115	E131122	
E121135	E131104	E131111	E131116	E131206	
E121136	E131105	E131112	E131117	E131207	

1.4 Hydrologic and Hydraulic Methods

A hydrologic analysis was performed to determine proposed regulatory discharge rates at concentration points along the CAP canal using the U.S. Army Corps of Engineers Hydrologic Modeling System (HEC-HMS). The proposed regulatory discharges are flow rates that have a 1-percent chance of being equaled or exceeded each year (“100-year” discharge rates). The discharge values from the HEC-HMS were used in the hydraulic analysis using FLO-2D to determine the main flow corridor floodplains.

A second hydrologic analysis was performed by using the 100-yr rainfall depth with a 3-hr SCS Type II distribution and SCS Curve Number infiltration in FLO-2D to determine the local flow or tributary floodplains.

The hydraulic analysis was performed to delineate floodplain limits within the study area using FLO-2D.

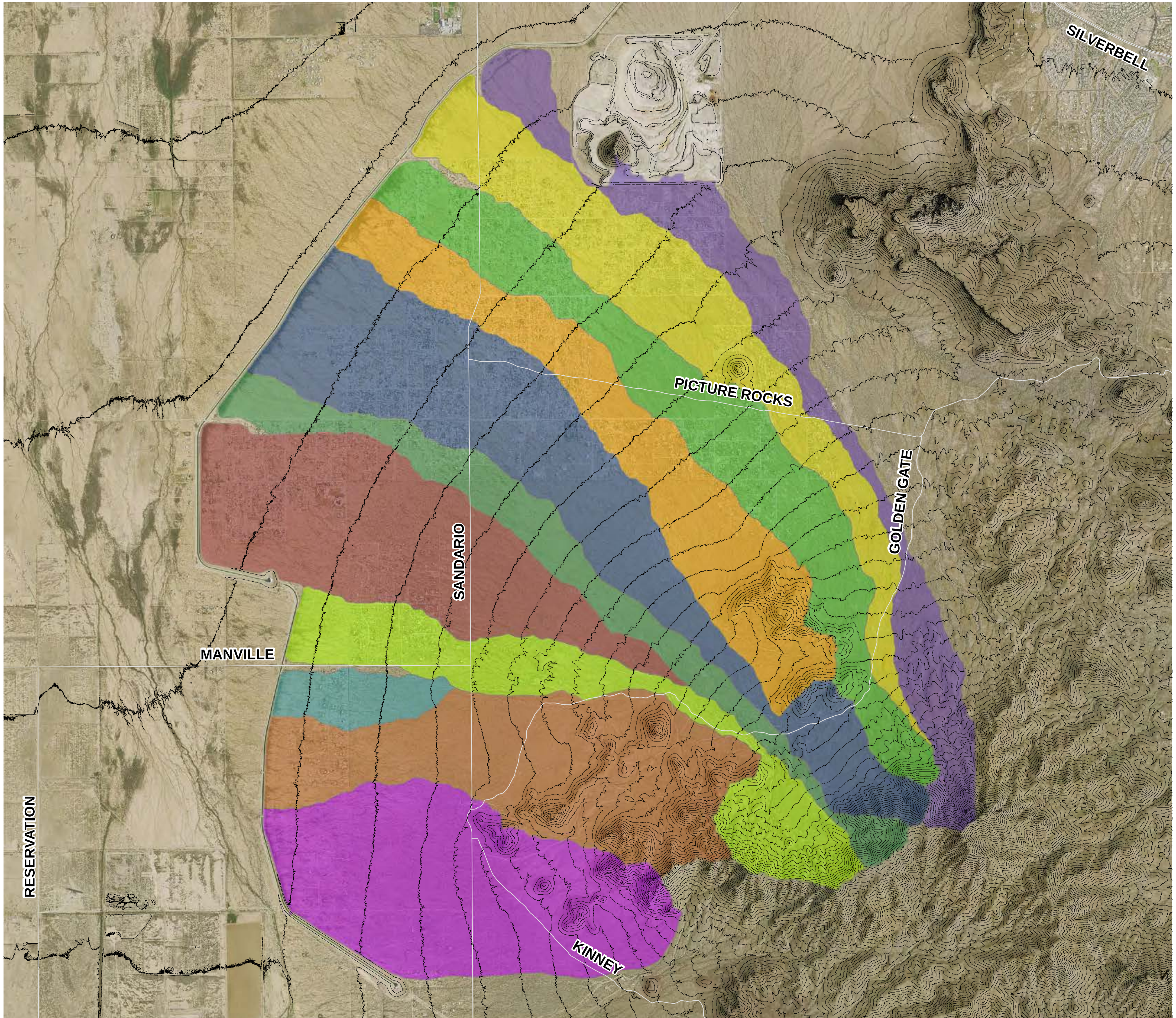
1.5 Acknowledgments

This study relied on assistance of RFCD staff, who were integral to the development of the models and maps.

1.6 Study Results

The regulatory discharges for floodplain mapping were calculated along the CAP in HEC-HMS (Appendix D) and the flow depths within the study area were modeled using FLO-2D (Appendix E). Floodplain cross sections were used in FLO-2D to provide 100-yr discharge values on the floodplain map (Exhibit 1). Flood hazard areas were mapped as a flow corridor, shallow sheet flooding, or as a tributary wash line for erosion hazard setbacks (Exhibit 2).

Figure 1.1
Watershed Map
Picture Rocks Wash



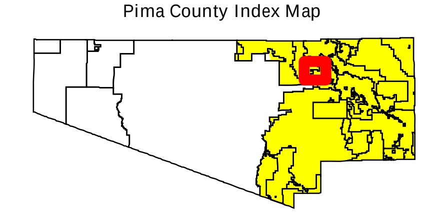
Countour 50 ft

Subbasins

- PCR1
- PCR2
- PCR3
- PCR4
- PCR5
- PCR6
- PCR7
- PCR8
- PCR9
- PCR10
- PCR11

Aerial : 2009 Landiscor Aerial Imagery
Topo: 2008 Pima Association of Governments
Datum: NAVD 1988

Pima County Index Map



Index Map Scale 1:5,250,000

The information depicted on this display is the result of digital analyses performed on a variety of databases provided and maintained by several governmental agencies. The accuracy of the information presented is limited to the collective accuracy of these databases on the date of the analysis. The Pima County Regional Flood Control Department makes no claims regarding the accuracy of the information depicted herein.

This product is subject to the Department of Transportation Technical Services Division's Use Restriction Agreement.

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Pima County Regional Flood Control District

Pima County Regional FLOOD CONTROL DISTRICT

THE SEAL OF PIMA COUNTY ARIZONA

12/2010

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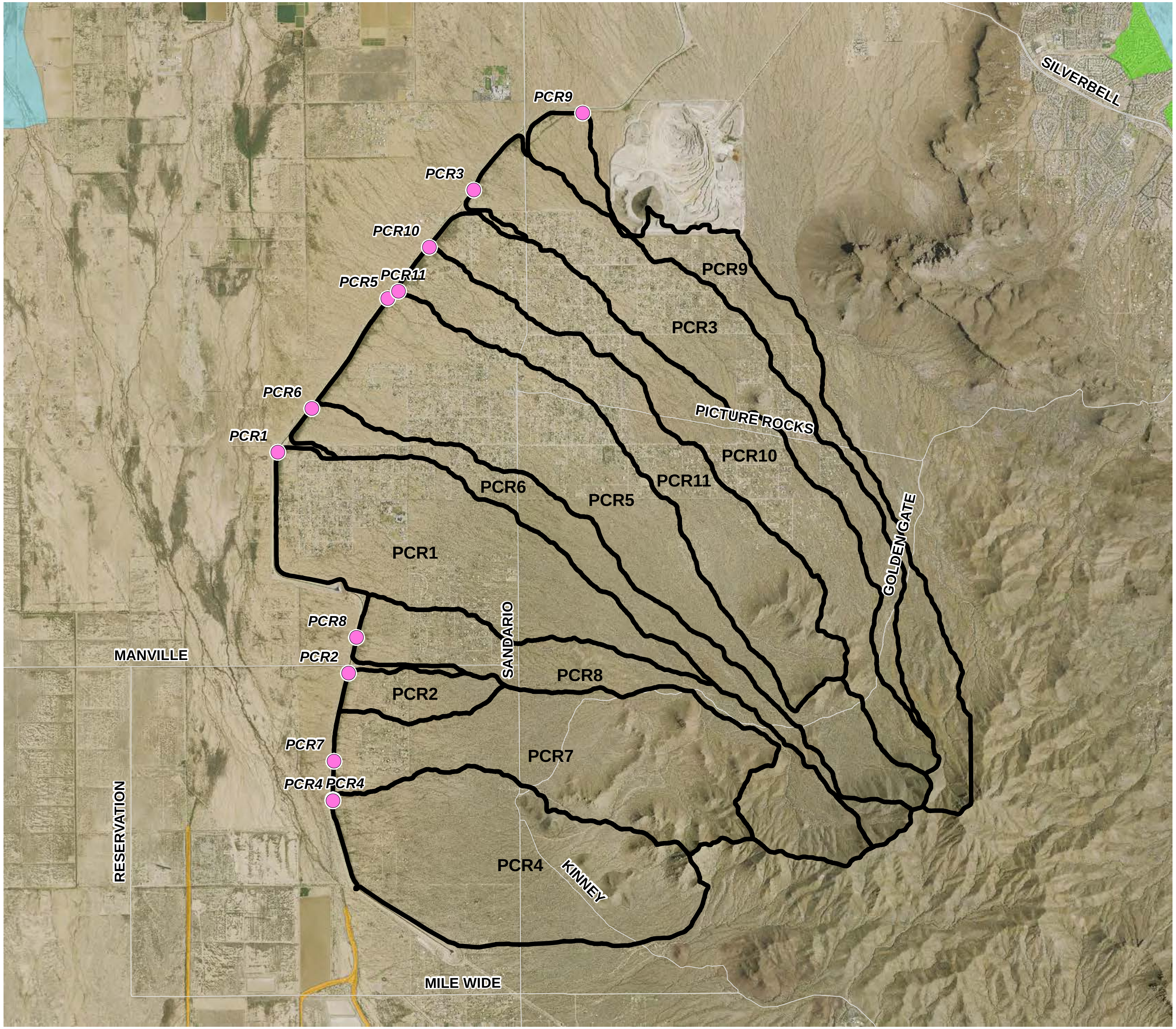
Figure 1.2
Study Limit Map
Picture Rocks Wash



Discharge Point

Subbasin

Existing FEMA Floodplain

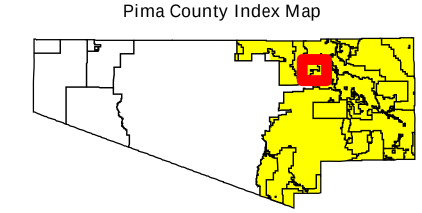
ZONE A

ZONE AE

ZONE X - SHADED

Aerial : 2009 Landiscor Aerial Imagery

Pima County Index Map



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Pima County Regional Flood Control District

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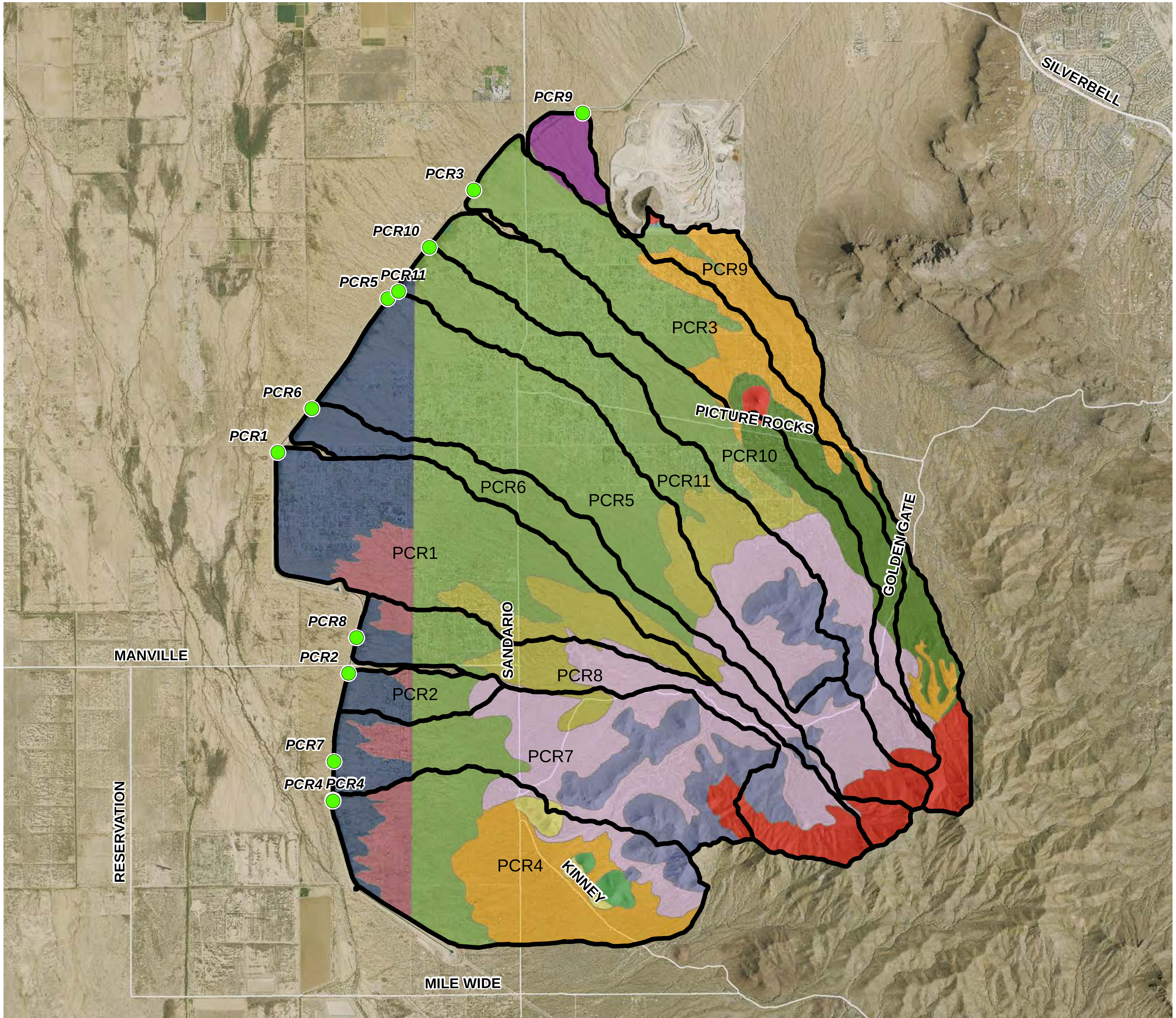
Figure 1.3
Soil Classification
Picture Rocks Wash



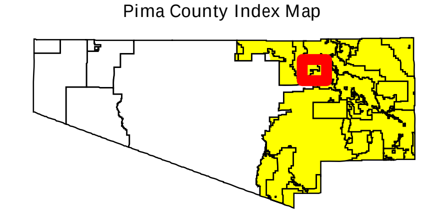
Discharge Point
Subbasin

Soil Classification

- Soil Group: B (100%), HAYHOOK SANDY LOAM, 1 TO 5 PERCENT SLOPES
- Soil Group: B (100%), MOHAVE SOILS AND URBAN LAND, 1 TO 8 PERCENT SLOPES
- Soil Group: B (100%), PINALENO VERY COBBLY SANDY LOAM, 1 TO 8 PERCENT SLOPES
- Soil Group: B (100%), PINALENO-STAGECOACH COMPLEX, 5 TO 16 PERCENT SLOPES
- Soil Group: B (100%), SONOITA SANDY LOAM, 0 TO 1 PERCENT SLOPES
- Soil Group: B (100%), VALENCIA-ANTHONY SANDY LOAMS, 1 TO 5 PERCENT SLOPES
- Soil Group: B (100%), VALENCIA-SONOITA SANDY LOAMS, 1 TO 5 PERCENT SLOPES
- Soil Group: B (43%) C (57%), NAHDA-PINALENO COMPLEX, 2 TO 8 PERCENT SLOPES
- Soil Group: C (100%), TUBAC SANDY LOAM, 0 TO 1 PERCENT SLOPES
- Soil Group: C (47%) D (53%), PANTANO-GRANOLITE COMPLEX, 5 TO 25 PERCENT SLOPES
- Soil Group: C (53%) D (47%), PALOS VERDES-JAYNES COMPLEX, 2 TO 8 PERCENT SLOPES
- Soil Group: D (100%), ANKLAM-CELLAR-ROCK OUTCROP COMPLEX, 15 TO 55 PERCENT SLOPES
- Soil Group: D (100%), CHIMENEA VERY GRAVELLY FINE SANDY LOAM, 5 TO 15 PERCENT SLOPES
- Soil Group: D (100%), CHIMENEA-CELLAR-ROCK OUTCROP COMPLEX, 15 TO 50 PERCENT SLOPE
- Soil Group: D (100%), PANTANO-ROCK OUTCROP COMPLEX, 25 TO 60 PERCENT SLOPES
- Soil Group: D (100%), SAGUARO-ROCK OUTCROP COMPLEX, 15 TO 45 PERCENT SLOPES

Aerial : 2009 Landiscor Aerial Imagery

Pima County Index Map



Index Map Scale 1:5,250,000

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Pima County Regional Flood Control District

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Section 2 FEMA Forms

2.1 Study Documentation Abstract for FEMA submittals

2.1.1 Date Study Accepted: _________________

2.1.2 Study Contractor:

Planning and Development Division,
Pima County Regional Flood Control District
97 East Congress, Tucson, AZ 85701
(520) 243-1800

Prepared by Dave Stewart, Civil Engineering Assistant.

2.1.3 Local Technical Reviewer:

Planning and Development Division,
Pima County Regional Flood Control District
97 East Congress, Tucson, AZ 85701
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2.1.4 Reach Description

The washes of the PCR study area are braided channels that have residential development in some of the flow paths. The obstructions in the flow paths appear to increase the distributary flow conditions and sheet flooding hazard of the study area.

The channels of the PCR study area contain coarse sand and cobble beds. Small shrubs and trees grow in some areas of the channel bed, and desert brush covers the overbanks.

2.1.5 USGS Quad Sheets

The study area is better described by the FEMA maps, which are referenced in Section 2.1.7.

2.1.6 Unique Conditions and Problems

There were no unique conditions or problems with the study.

2.1.7 Coordination of Peak Discharges

The 100-year regulatory discharge rates at the concentration points were calculated using HEC-HMS, assuming no base flow in the watersheds and no transmission loss within the reaches. The discharge rates were acceptable per Suzanne Shields, Director of the Pima County Regional Flood Control District.

2.2 FEMA Forms

No FEMA MT-2 forms are included in this TDN.

Section 3 Survey and Mapping Information

3.1 Field Survey Information

No field survey was performed for this study.

3.2 Mapping

The topographic data for the hydrology was obtained using 2005 Pima Associations of Governments (PAG) Light Detection and Ranging (LiDAR). A raster was created from the 2005 LiDAR data with 5' cells and used with ArcGIS and Geo-RAS.

The following data was used in this TDN;

The aerial photo: 2010 PAG aerial photo
Projection: NAD 1983 HARN State Plane Arizona Central
Units: International feet
The contour interval of the topographic map is 2 feet.
Vertical Datum: NAVD 1988

Section 4 Hydrology

4.1 Method Description

The 100-year peak discharges for the Picture Rocks study area were modeled at the CAP using the U.S. Army Corps of Engineers Computer Hydrologic Modeling System, (HEC-HMS) version 3.2.

The HEC-HMS model requires parameters for rainfall, topography, soil, vegetation, and channel characteristics to determine runoff volume and peak discharge. Those parameters were determined according to the Pima County Regional Flood Control District Technical Policy 018 (Tech-018). Tech-018 is included in Appendix A. The HEC-HMS model is included in Appendix D.

The second hydrologic analysis used the 100-yr rainfall depth with a 3-hr SCS Type II distribution and the SCS Curve Number infiltration method in FLO-2D to model the floodplains for the tributaries to the main flow corridors.

4.2 Parameter Estimation

4.2.1 Drainage Area

The topographic data was obtained from a 5' cell raster created from 2005 PAG LiDAR data. ArcGIS was used to delineate watersheds from the raster and determine the drainage area of each sub-basin. The composite watershed map is included in Figure 1.1.

4.2.2 Watershed Work Map

Eleven sub-basins were delineated in ArcGIS for the Picture Rocks study area with the concentration points located at the Central Arizona Project canal. The locations of the sub-basins were chosen based on the major flow paths found using the flow accumulation ArcGIS hydrology functions with a 5-ft cell raster. Sub-basins were placed at the culverts leading over the CAP, and additional sub-basin points were placed where major flow paths reached the CAP to break up larger sub-basins

4.2.3 Gage Data

No gage data were used in this TDN.

4.2.4 Statistical Parameters

No recorded data was available for the washes in the Picture Rocks study area and therefore no Bulletin 17B analysis was used for this TDN.

4.2.5 Precipitation

According to Tech-018, the design storm should be used that produces the higher discharge between the 100-yr 3-hour SCS Type II distribution and the 100-yr 24-hr SCS Type I distribution. The 100-yr 3-hour SCS Type II distribution was found to produce the higher discharges for the Picture Rocks study area. The PCR 2 sub-basin has a drainage area of less than 1 mi^2 and therefore a PC-Hydro run was performed that uses a 1-hr rainfall depth.

NOAA Atlas 14, upper 90% confidence interval precipitation frequency estimate values (NOAA 14 rainfall) were used to determine 3-hour and 24-hour point rainfall depths for the watershed. The point rainfall depth for the 3-hour storm was obtained for the coordinates of the watershed centroid. An areal reduction factor was applied to watersheds larger than 1 square mile as noted in Tech-018.

4.2.6 Physical Parameters

The physical parameters for the sub-basins and reaches of the HEC-HMS model are summarized in Tables 4.1 and 4.2. As mentioned in Section 4.1, all the methods and parameters were determined based on Tech-018. Table 4.1 summarizes the method used for the HEC-HMS analysis.

Table 4. 1. Methods used for the HEC-HMS analysis

	Selected Method
Rainfall Depth	NOAA 14, upper 90% Confidence Interval
Rainfall Distribution	3-hr SCS Type II Storm
Rainfall Loss	SCS Curve number
Time of Concentration	SCS Segmental Method
Transform	SCS Unit Hydrograph
Routing	Modified-Puls

The SCS Curve Number (CN) method was utilized as a rainfall loss method in the HEC-HMS model. The CN was determined using the Curve Number tables and Hydrologic Soils Group maps associated with the PC Hydro User Guide (Arroyo Engineering, 2007). The CN was not adjusted for rainfall intensity or antecedent moisture conditions.

The SCS Unit Hydrograph method was used as a transform method. Impervious cover was determined using 2010 PAG aerial photographs. The combination of the kinematic wave time of concentration method and the U.S. Natural Resources Conservation Service (NRCS) segmented Time of Concentration (Tc) calculation (USDA-NRCS, 1986) was used to determine Tc, based on the recommendation on Tech-018. The Tc was calculated by summing the travel time for sheet flow, shallow concentrated flow and channel flow. The Tc for sheet flow was estimated using the kinematic wave equation. The Manning’s roughness coefficient for sheet flow was obtained using Table 3-1 in Technical Release 55, Urban Hydrology for Small Watersheds (USDA-NRCS, 1986). The channel velocity of each sub-basin was calculated as the harmonic mean velocity from a HEC-RAS model of the longest flowpath. The Tc calculations are included in Appendix D.

Table 4. 2. Physical Parameters for the Sub-Basins.

Sub-basin	Area (sq mi)	CN	Impervious Area (%)	Vegetation Cover (%)	Lag Time (min)
PCR1	3.55	87.31	20	20	62.8
PCR2	0.53	85.37	10	20	30.9
PCR3	3.00	87.81	20	20	100.2
PCR4	3.91	85.49	5	20	43.1
PCR5	4.45	86.44	10	20	75.0
PCR6	1.77	86.91	10	20	84.7
PCR7	3.59	89.38	5	20	40.9
PCR8	2.26	89.53	10	20	56.1
PCR9	2.57	87.13	10	20	89.9
PCR10	3.18	87.79	10	20	76.9
PCR11	2.99	87.94	10	20	76.7

The sub-basins were not subdivided above the concentration points at the CAP canal, and therefore no hydrologic routing was performed to determine the 100-yr peak discharge rates.

4.3 Problems Encountered During the Study

4.3.1 Special Problems and Solutions

There were no problems with the hydrologic modeling.

4.3.2 Modeling Warning and Error Messages

The time interval of the rainfall data used in this study is 5 minutes, while the simulation time interval is 1 minute. The HEC-HMS model interpolated the 5-minute time interval of the rainfall data to 1-minute time interval.

The following warnings were produced in HEC-HMS;

- The “3-hr SCS Type II” gage with data interval of 5 minutes was interpolated to a simulation time interval of 1 minute.

4.4 Calibration

No calibration was conducted in this study.

4.5 Final Results

4.5.1 Hydrologic Analysis Results

The 100-yr peak discharges at the CAP canal are summarized in Tables 4.3.

Table 4.3. Summary of the Hydrologic Analysis Results for Sub-Basins.

Sub-basin	Area (sq mi)	Rainfall Depth (in)	Runoff Volume (in)	Peak Discharge (cfs)
PCR1	3.55	2.70	1.50	1966.4
PCR2*	0.53			972.0
PCR3	3.00	2.76	1.59	1216.1
PCR4	3.91	2.68	1.36	2596.4
PCR5	4.45	2.64	1.39	1975.4
PCR6	1.77	2.85	1.60	824.8
PCR7	3.59	2.71	1.67	3091.9
PCR8	2.26	2.81	1.77	1623.7
PCR9	2.57	2.79	1.57	1122.5
PCR10	3.18	2.74	1.57	1575.6
PCR11	2.99	2.76	1.60	1510.5

*PC-Hydro run. No rainfall or runoff volume is directly calculated.

4.5.2 Verification of Results

The modeled 100-yr peak discharges are compared with the USGS Regional Regression Equation 13 (Thomas et al., 1997) peak discharges in Table 4.4.

The Picture Rocks sub-basins have long flow paths due to their shape which causes a lower modeled peak discharge. However, the long flow paths do not change the hydrograph volume in the HEC-HMS modeling because no transmission losses are used and the hydrograph volume is the basis of the FLO-2D modeling. The modeled hydrographs at the sub-basin outlets at the CAP were entered at the top of the hydraulic modeling study area in FLO-2D and therefore the modeling produced a conservative floodplain.

Table 4.4. Comparison of the modeled peak discharges to the USGS Regional Regression Equation 13 peak discharges.

Sub-basin	Area (sq mi)	Modeled Peak Discharge (cfs)	USGS RRE 13 Peak Discharge (cfs)
PCR1	3.55	1966.4	2761.8
PCR2*	0.53	972.0	812.4
PCR3	3.00	1216.1	2505.3
PCR4	3.91	2596.4	2918.6
PCR5	4.45	1975.4	3139.5
PCR6	1.77	824.8	1819.5
PCR7	3.59	3091.9	2778.6
PCR8	2.26	1623.7	2116.0
PCR9	2.57	1122.5	2288.6
PCR10	3.18	1575.6	2594.4
PCR11	2.99	1510.5	2500.1

Section 5 Hydraulics

5.1 Method Description

The hydraulic modeling for the PCR was performed using FLO-2D Version 2009, and ArcGIS Version 9.3.

The topographic data was obtained using a 5-ft cell raster developed in ArcGIS from the PAG 2005 LiDAR data and exporting it into FLO-2D. An initial "overview" model was created in FLO-2D that used 100-ft cells to identify areas for additional detail would be needed. The developed regions within the Picture Rocks study area were split into three areas and a detailed FLO-2D model with 50-ft cells was created for each area.

A sample area in the Picture Rocks study area was used to measure the density of obstructions by development. A sample area of 17.3 ac was used, and approximately 1.3 acres was measured as obstructed by houses or other development. The blocked density was calculated as 7%, and a general value of 10% obstruction was assumed for all areas of development in the Picture Rocks study area. Therefore, the areas with development in the FLO-2D models were assumed to have a reduction in flow area of 10%.

The HEC-HMS peak discharges at the CAP were entered into the FLO-2D model at the upstream boundaries of the major flow paths and routed through the study areas to obtain the main flow corridors.

In addition, separate FLO-2D models were created for each area that used the rainfall distribution as an input and modeled the runoff using the weighted SCS Curve Numbers of each watershed to determine the tributary floodplains.

The hydraulic data obtained from FLO-2D were exported to ArcGIS to delineate the floodplains in the study area. The tributary floodplains were then added to the main flow corridor floodplains.

The FLO-2D data and shape files (maximum flow depths, flood hazard polygons, contour lines, flow paths, sub-basins, concentration points, hydrologic soil groups) used in the analysis are included in Appendix D.

5.2 Work Study Maps

The work study map for the Picture Rocks study area is included as Exhibits 1 and 2. Exhibit 1 is the maximum flow depth data with the cross section discharges, and Exhibit 2 displays the flood hazard areas designated from the floodplain data.

5.3 Parameter Estimation

5.3.1 Roughness Coefficients

Manning's n values were determined based on documentation in the FLO-2D User Manual, USGS publications for Manning's n values in southern Arizona (Phillips and Tadayon, 2006), and field visits to the study area. The FLO-2D workshops and documentation recommend higher Manning's n values for the floodplain grid in FLO-2D than is generally used for uniform flow in natural channels.

A consistent Manning's n value of 0.045 was assigned for the floodplain of the Picture Rocks study area based on the vegetation in the coarse sand channels (Figures 5.1). The models were calibrated by replacing the initial roughness values with any increased roughness values during the FLO-2D simulation.

Grid elements that caused large numbers of time step reductions were assigned a Manning's n value of 0.085.

Figure 5. 1. Picture Rocks Flow Path Photo 1.

Figure 5.2. Picture Rocks Flow Path Photo 2.

5.3.2 Expansion and Contraction Coefficients

The expansion and contraction coefficients were not adjusted in the FLO-2D program.

5.4 Cross-Section Description

The floodplain grid was used in FLO-2D and cross sections were not utilized in the hydraulic routing.

5.5 Modeling Consideration

5.5.1 Hydraulic Jump and Drop Analysis

No hydraulic jumps or hydraulic drops were modeled in this study.

5.5.2. Bridges and Culverts

No bridges or culverts were modeled in the Picture Rocks study.

5.5.3 Levees and Dikes

There are no levees or dikes located within the study limit.

5.5.4 Island and Flow Splits

There is distributary flow in much of the Picture Rocks study area, and the FLO-2D model was utilized to determine the two dimensional direction of the discharge.

5.5.5 Ineffective Flow Areas

The developed areas were assumed to have a consistent blocked cell area of 10% based on the sample measurement. The major roads were digitized in FLO-2D and assumed to be 20 ft wide and have the minimum curb height of 0.1 ft.

5.6 Floodway Modeling

No floodway modeling was performed in this study.

5.7 Problems Encountered

5.7.1 Special Problems and Solutions

The floodplain limiting Froude number in the FLO-2D model was set to 1.0 to force subcritical or critical flow. The dynamic wave stability coefficient was set to 1.0 for initial runs, and lowered to 0.25 for the final results of each FLO-2D model.

There were no other special problems encountered in this study.

5.7.2 Model Warnings and Errors

There were no warnings or errors on the final runs of the FLO-2D models. Volume conservation in all FLO-2D models remained negligible.

5.8 Calibration

The roughness coefficients were calibrated when applicable by replacing the initial roughness values with the values adjusted by the FLO-2D program for each model. Additionally, grid elements that caused significant reduction in the time step were assigned a roughness value of 0.085.

5.9 Final Results

5.9.1 Hydraulic Analysis Results

The FLO-2D modeling results are summarized in Appendix E.

5.9.2 Verification of Results

The resulting floodplains fit the topographic data and the observed geologic floodplain from aerial photographs. Other verification of the floodplain results was not possible.

Section 6 Erosion and Sediment Transport

No erosion or sediment transport analysis was conducted in this study.

Section 7 Draft FIS Report Data

7.1 Summary of Discharges

The discharge results are summarized in Table 4.3.

7.2 Floodway Data

Not applicable.

7.3 Annotated Flood Insurance Rate Map

No annotated Flood Insurance Rate Map is included.

7.4 Flood Profiles

Flood profiles are included in Appendix E.

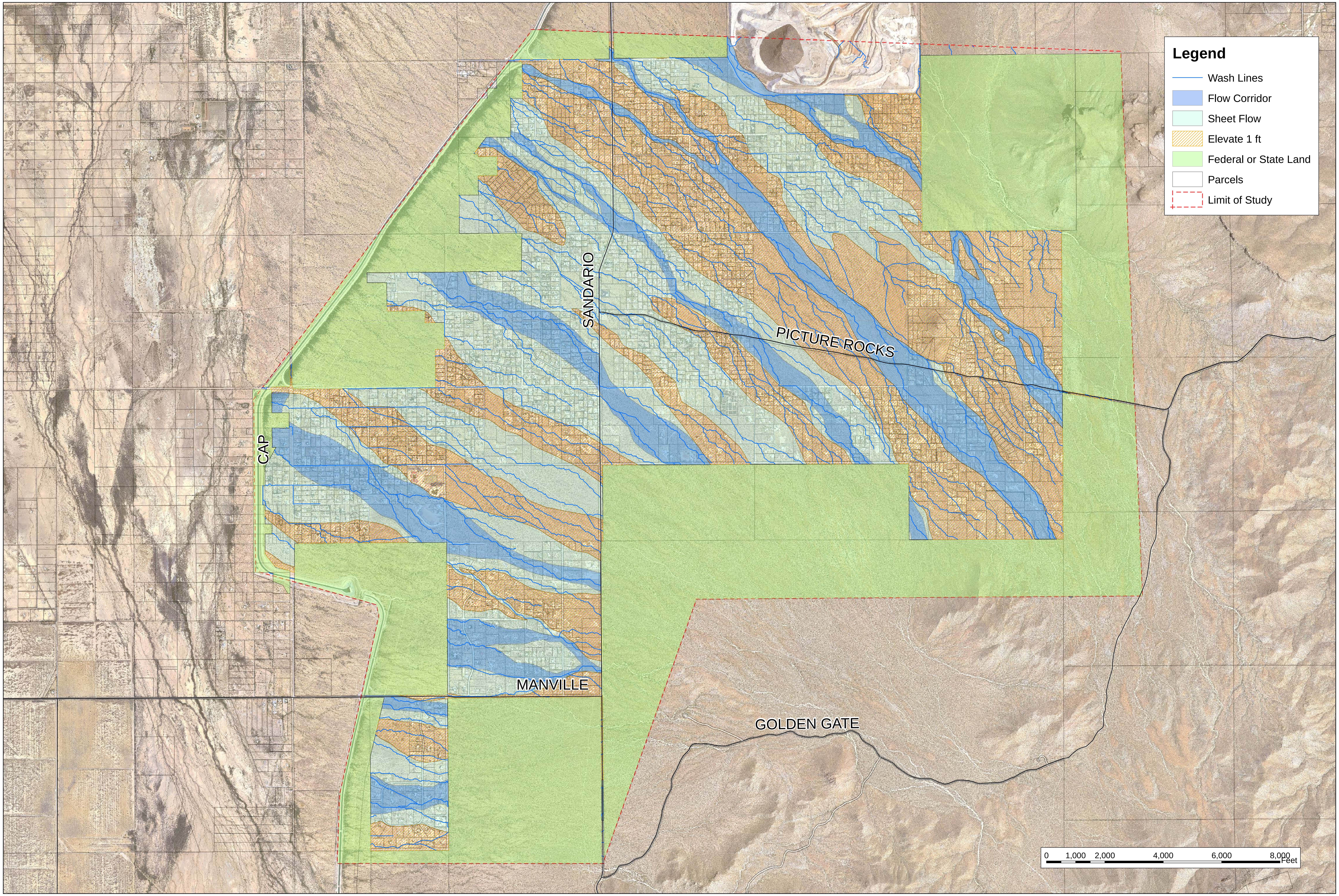

Exhibit 2
Picture Rocks
Flood Hazard Areas

Scale: 1 inch = 1,000 feet

Date: December 13, 2010

Pima County Regional Flood Control District
97 E Congress - 3rd Floor
Tucson, Arizona 85701-1207
(520) 243-1800, FAX: (520)243-1821
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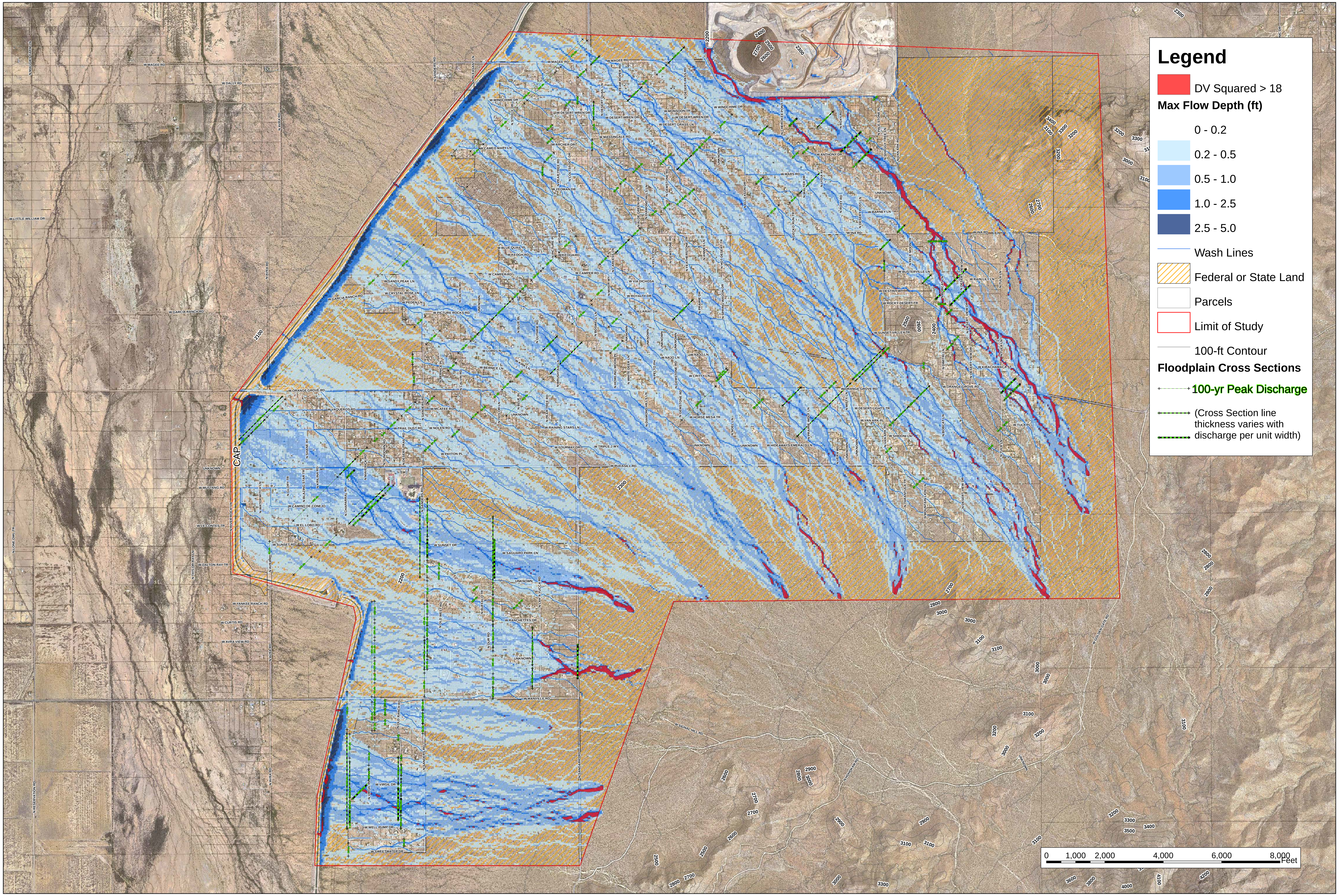

Pima County Regional
FLOOD CONTROL
DISTRICT

Pima County Regional Flood Control District
97 E Congress - 3rd Floor
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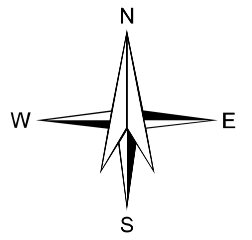
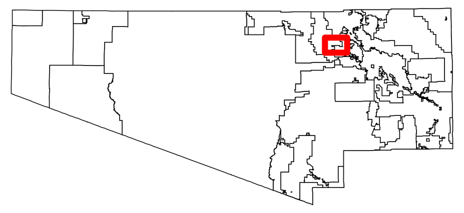
Picture Rocks Draft
Max Flow Depth





Scale: 1 inch = 1,000 feet

R:\templates\48x36_portrait_template_rfcd_exhibit.mxd

Date: August 27, 2009