

**Floodplain Analysis
for
Tanuri Wash**

Sections 24 and 25 of Township 13 South, Range 14 East, Section 19 and 30 of
Township 13, Range 15, Pima County, Arizona

By:

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Prepared by

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Introduction

This study was prepared by Pima County Regional Flood Control District to provide a drainage condition for Tanuri Wash. The site includes Sections 24 and 25 of Township 13 South, Range 14 East, Section 19 and 30 of Township 13, Range 15, Pima County, Arizona. The study site is currently mapped as FEMA Zone A by approximate methodology using USGS Quadrangle maps with 20 foot contours and no aerial photography. The enclosed information would modify the floodplain limits for the Tanure Wash as shown on Flood Insurance Rate Map (FIRM) number 04019C-1663K.

Site description

The study area is the downstream area of Tanuri Wash which is currently mapped as Zone A. The entire watershed of Tanuri Wash is 1.8 sq miles with a mean slope of 0.025. The watershed is mostly in a suburban foothills area covered with desert brush.

Methods

Hydrologic and hydraulic analyses were conducted using Pima County Hydrology Procedures (PC-Hydro), Version 5.3.1, Hec-Ras 4.0 Beta version (HEC-RAS), HEC-GeoRAS, Version 4.1.1 (HEC-GeoRAS), and ArcGIS, Version 9.2.

A triangular Irregular Network (TIN) derived from Light Detection and Ranging (LiDAR) data was used to create a topographic map. The locations of the stream centerline, cross-sections, river banks, culverts, and other physical attributes of the wash were determined by using the topographic map and aerial photos taken in 2005. The physical attributes of the wash were digitized in ArcGIS using the HEC-GeoRAS extension and then exported to HEC-RAS to create geospatially referenced geometric data. Other parameters for the steady-state analysis, such as Manning's n-values, culvert data, expansion and contraction coefficients, normal depth boundary condition, ineffective flow areas, and peak discharge rates obtained from PC-Hydro were manually input into HEC-RAS. The hydraulic data obtained from HEC-RAS were then imported into HEC-GeoRAS to delineate a floodplain in the study area.

Hydrologic analysis

The 100-year return interval peak discharge rates were computed at three concentration points using PC-Hydro (Arroyo Engineering, 2007). NOAA Atlas 14, upper 90% confidence interval, rainfall data were used for the analysis.

Hydrologic Soil Group B is the dominant soil type (98%). The Basin Factor used for the hydrologic analysis ranges from 0.032 to 0.034. A vegetation cover density of 30% was used to select the SCS Curve Number for the hydrologic calculation of all the concentration points. Impervious cover percentage of 10% was determined using aerial photos.

The 100-year peak discharge rates are 1884 cubic feet per second (cfs) at the concentration point 1, 1092 cfs at the concentration point 2., and 2409 cfs at the concentration point 3. The hydrologic computations are shown in Appendix 1.

Hydraulic analysis and floodplain delineation

Hydraulic analysis was performed in the area currently mapped as FEMA Zone A. Steady flow analysis was performed to determine 100-year water surface elevations in the study area by using HEC-RAS. As described above, geometric data for HEC-RAS including stream centerline, cross-sections, river banks, and culvert were obtained by using HEC-GeoRAS. The Hec-Ras data, TIN, aerial photos and shape files (lidar data, contour lines, existing FEMA floodplain limit, section grid, street, study watersheds, hydrologic soil groups, proposed floodplain limit) used in the analysis are included in an attached CD.

Manning's roughness coefficients for the main channel and the over-bank areas were determined by using aerial photos taken in 2005. The roughness coefficient of 0.035 was used for the main channel and 0.045 was used for the over-back areas.



Photo 1. Culvert at Tanuri Drive (left: upstream, right: downstream)

There are two box culverts installed for a road crossing at Tanuri Drive. Contraction and expansion coefficients are 0.3 and 0.5 for immediately upstream and downstream of the culvert, and 0.1 and 0.3 for other cross sections, which were obtained from HEC-RAS Hydraulic Reference Manual. Normal depth with a slope of 0.02 was used as a boundary condition for the steady flow analysis.

A floodplain map was created based on the hydraulic analysis. The map was created using the coordinate system of 1983 HARN Stateplane Arizona Central, while the UTM projection will be utilized for a final map. The two islands located between the cross sections of St. 6424.835 and St. 6199.39, and St. 2921.178 and 2597.16 were removed from the final work map. This is because the islands are considered to be unstable due to the braded nature of Tanuri Wash. The final floodplain map is included in Appendix 2. The floodplain map including the two islands is included in Appendix 3. The analysis corrects several errors in the existing FEMA Zone A mapping. Current mapping shows the floodplain extending over ridgelines and away from the actual channel. This analysis shifts the FEMA Zone A floodplain toward the east north of the intersection of Wilmot Rd. and Calle Vista Ciudad. The corrected floodplain is shifted toward the west south of River Road. Additional information provided in this analysis shows hazardous conditions exist for motor travel at Tanuri Drive which is inundated by approximately 2-feet during the 100-year flood event.

References

HEC-RAS Hydraulic Reference Manual version 3.1, US Army Corps of Engineering Center, November 2002.

PC-Hydro User Guide, PC-Hydro V5 Pima County Hydrology Procedures, A computer program for predicting peak discharge of surface runoff from small semi-arid watersheds in Pima County, Arizona, Arroyo Engineering, LLC, 2007

Appendix 1

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Pima County Regional Flood Control District



Client: RFC Prepared by: Lynn Orchard
 Project Name: Tanuri Wash Date: 5/20/2008
 Concentration Point: 2 Job #: _____

Watershed Area: 0.5 sm Watershed Type: Suburban-Foothills

Watercourse Data By Reach				
<u>Reach No.</u>	<u>Height (Hi)</u>	<u>Length (Li)</u>	<u>Slope (Si)</u>	<u>Basin Factor (Nb)</u>
1	36.0	1,024	0.0352	.032
2	88.0	3,029	0.0291	.034
3	78.0	3,314	0.0235	.034
4	102.0	3,500	0.0291	.032

Length of Watercourse (Lc): 10,867 feet Mean Slope: 0.0277
 Length to Cen. of Gravity (Lca): 5,433 feet Weighted Basin Fac.: 0.033
 Veg. Cover Type(s): Desert Brush Veg. Cover Density: 30 %

RETURN PERIOD: 100-years

Rainfall Depths:		NOAA Atlas 14 (90% UCL) @ Latitude: 32.2835					Longitude: 110.8565			
Duration:	<u>5-min</u>	<u>10-min</u>	<u>15-min</u>	<u>30-min</u>	<u>60-min</u>	<u>2-hr</u>	<u>3-hr</u>	<u>6-hr</u>	<u>12-hr</u>	<u>24-hr</u>
Point Values (in)	0.89	1.36	1.69	2.28	2.82	3.14	3.29	3.59	3.92	4.27
Areal Values (in)	0.89	1.36	1.69	2.28	2.82	3.14	3.29	3.59	3.92	4.27

Soils Data				
<u>Soil Type</u>	<u>Percent</u>	<u>Curve # (CN)</u>	<u>Adj. Curve # (CN*)</u>	<u>Runoff Coef. (C)</u>
B	88	82.	86.73	0.554
C	12	87.	90.32	0.655
D	0	.	.	0.000
Imp.	10	99.	99.	0.958

Weighted Runoff Coef. (Cw): 0.605
 Time of Concentration: 22.6 min
 Rainfall Intensity (i) @ Tc: 5.28 in/hr
 Runoff Supply Rate (q) @ Tc: 3.20 in/hr

PEAK DISCHARGE: 1,092 cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE
Pima County Regional Flood Control District



Client: RBCD Prepared by: Lynn Orchard
 Project Name: Tanuri Wash ws1 Date: 5/19/2008
 Concentration Point: 1 Job #: _____
 Watershed Area: 1.2 sm Watershed Type: Suburban-Foothills

Watercourse Data By Reach				
Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	94.0	3,982	0.0236	.032
2	154.0	5,570	0.0276	.034
3	84.0	4,023	0.0209	.034
4	48.0	1,785	0.0269	.032
5	20.0	830	0.0241	.034

Length of Watercourse (Lc): 16,190 feet Mean Slope: 0.0245
 Length to Cen. of Gravity (Lca): 8,100 feet Weighted Basin Fac.: 0.033
 Veg. Cover Type(s): Desert Brush Veg. Cover Density: 30 %

RETURN PERIOD: 100-years

Rainfall Depths:	NOAA Atlas 14 (90% UCL) @					Latitude: 32.2781	Longitude: 110.8599			
Duration:	<u>5-min</u>	<u>10-min</u>	<u>15-min</u>	<u>30-min</u>	<u>60-min</u>	<u>2-hr</u>	<u>3-hr</u>	<u>6-hr</u>	<u>12-hr</u>	<u>24-hr</u>
Point Values (in)	0.89	1.36	1.68	2.27	2.81	3.13	3.28	3.57	3.89	4.23
Areal Values (in)	0.89	1.36	1.68	2.27	2.81	3.13	3.28	3.57	3.89	4.23

Soils Data				
Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	98	82.	86.71	0.553
C	2	87.	90.3	0.653
D	0	.	.	0.000
Imp.	10	99.	99.	0.958

Weighted Runoff Coef. (Cw): 0.595
 Time of Concentration: 33.3 min
 Rainfall Intensity (i) @ Tc: 4.19 in/hr
 Runoff Supply Rate (q) @ Tc: 2.50 in/hr

PEAK DISCHARGE: 1,884 cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE
Pima County Regional Flood Control District



Client: RFC Prepared by: Lynn Orchard
 Project Name: Tanuri Wash Date: 5/20/2008
 Concentration Point: 3 Job #: _____

Watershed Area: 1.8 sm Watershed Type: Suburban-Foothills

Watercourse Data By Reach				
Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	94.0	3,982	0.0236	.032
2	154.0	5,570	0.0276	.034
3	84.0	4,023	0.0209	.034
4	48.0	1,785	0.0269	.032
5	20.0	830	0.0241	.034
6	78.0	3,212	0.0243	.032
7	12.0	273	0.0440	.032

Length of Watercourse (Lc): 19,675 feet Mean Slope: 0.0246
 Length to Cen. of Gravity (Lca): 12,300 feet Weighted Basin Fac.: 0.033
 Veg. Cover Type(s): Desert Brush Veg. Cover Density: 30 %

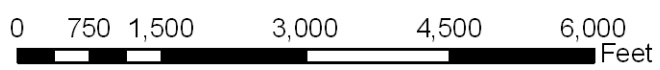
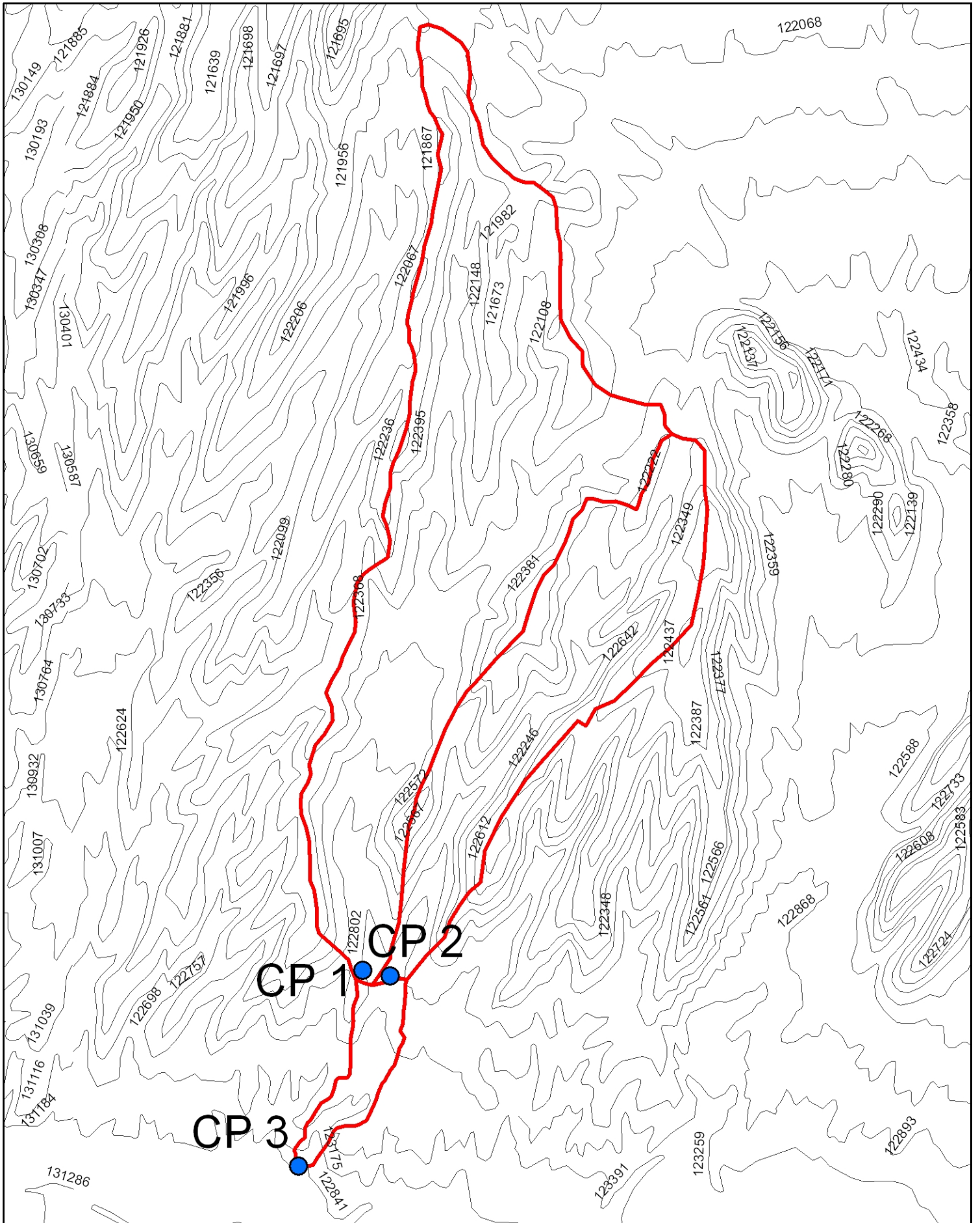
RETURN PERIOD: 100-years

Rainfall Depths:	NOAA Atlas 14 (90% UCL) @ Latitude: 32.2835 Longitude: 110.8565									
Duration:	5-min	10-min	15-min	30-min	60-min	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in)	0.89	1.36	1.69	2.28	2.82	3.14	3.29	3.59	3.92	4.27
Areal Values (in)	0.89	1.36	1.69	2.28	2.82	3.14	3.29	3.59	3.92	4.27

Soils Data				
Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	98	82.	86.73	0.554
C	2	87.	90.32	0.655
D	0	.	.	0.000
Imp.	10	99.	99.	0.958

Weighted Runoff Coef. (Cw): 0.596
 Time of Concentration: 42.5 min
 Rainfall Intensity (i) @ Tc: 3.54 in/hr
 Runoff Supply Rate (q) @ Tc: 2.11 in/hr

PEAK DISCHARGE: 2,409 cfs



Appendix 2

Appendix 3

