



**COCHISE
COUNTY**
Arizona



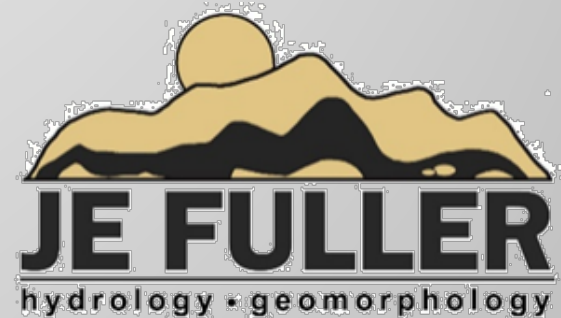
WILLCOX RECHARGE STUDY HYDROLOGIC & HYDRAULICS MODELING USING FLO-2D

Cyrus D. Miller, PE, CFM

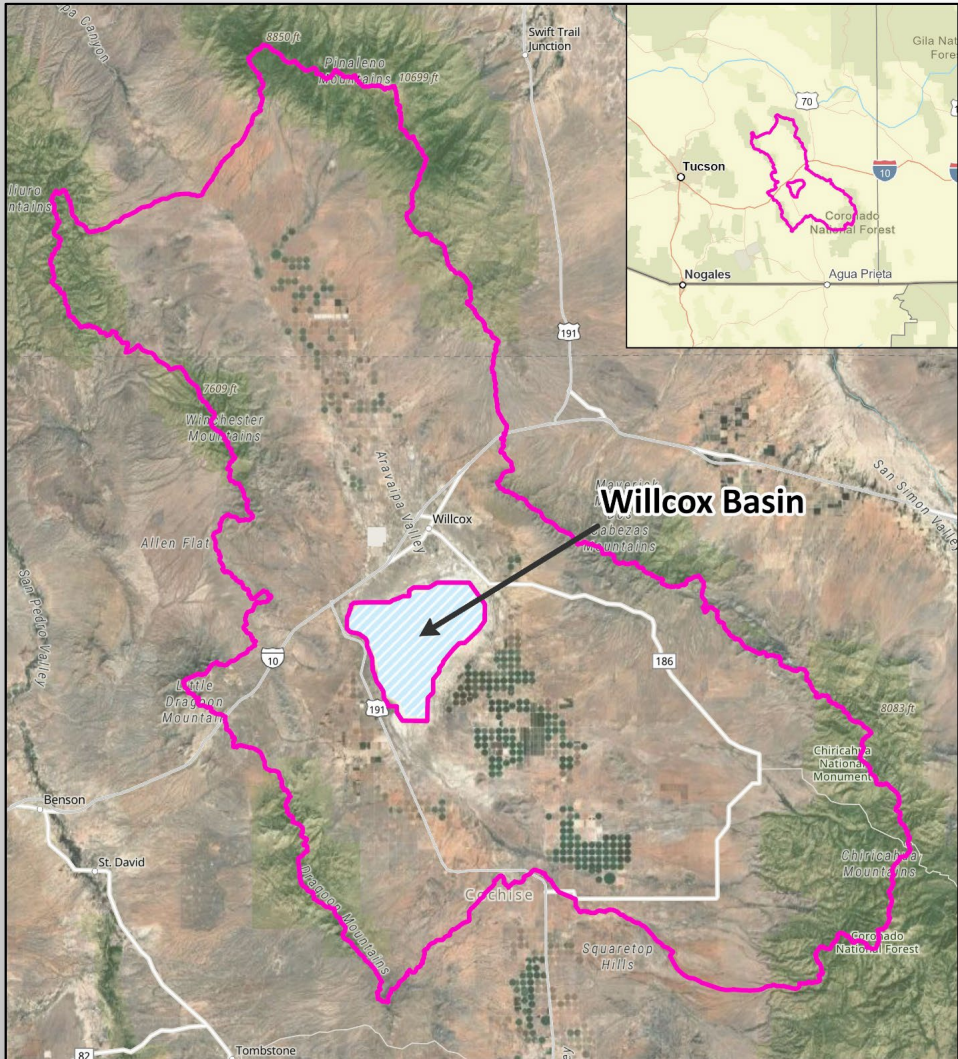
Willcox Recharge Study Review

September 30, 2025

Presentation to County Board of Supervisors



INTRODUCTION



Legend

Study Domain

0 2.5 5 10 Miles

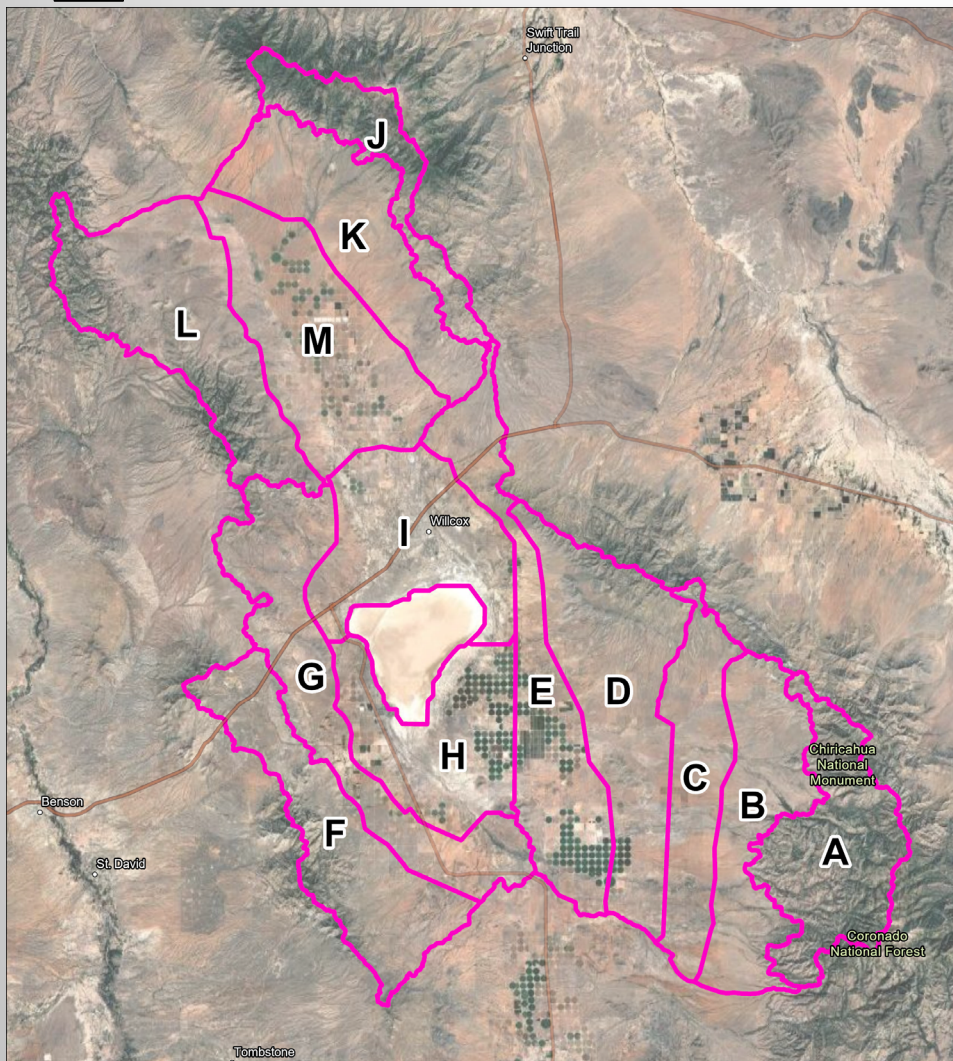


- Hydrologic and hydraulics modeling for approximately 1,694 mi² contributing flow to the Willcox Basin
- FLO-2D – Pro Version Build No. 23.10.25



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PRELIMINARY**

INTRODUCTION



Legend

FLO-2D Domain

0 2.5 5 10 Miles



- Hydrologic and hydraulics modeling for approximately 1,694 mi² contributing flow to the Willcox Playa
- A total of 13 adjoining sub-models were created
- 40ft X 40ft grids

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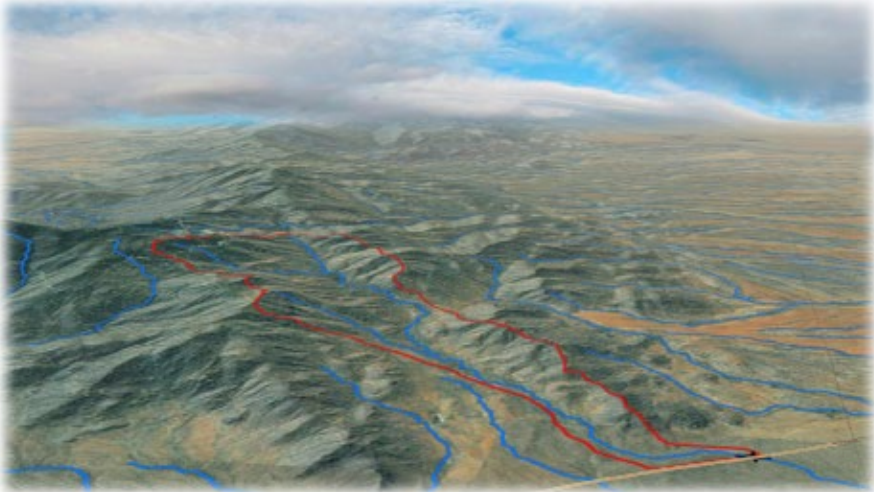
Sub-Models and Grid Counts

Sub-Model	No. of Grids (Million)	Sub-Model	No. of Grids (Million)
A	2.1	H	2.0
B	2.0	I	2.3
C	1.7	J	1.2
D	2.9	K	2.3
E	2.4	L	2.8
F	2.3	M	2.8
G	2.7		

METHODOLOGY

ARIZONA DEPARTMENT OF TRANSPORTATION

Highway Drainage Design Manual



Volume 2

Hydrology

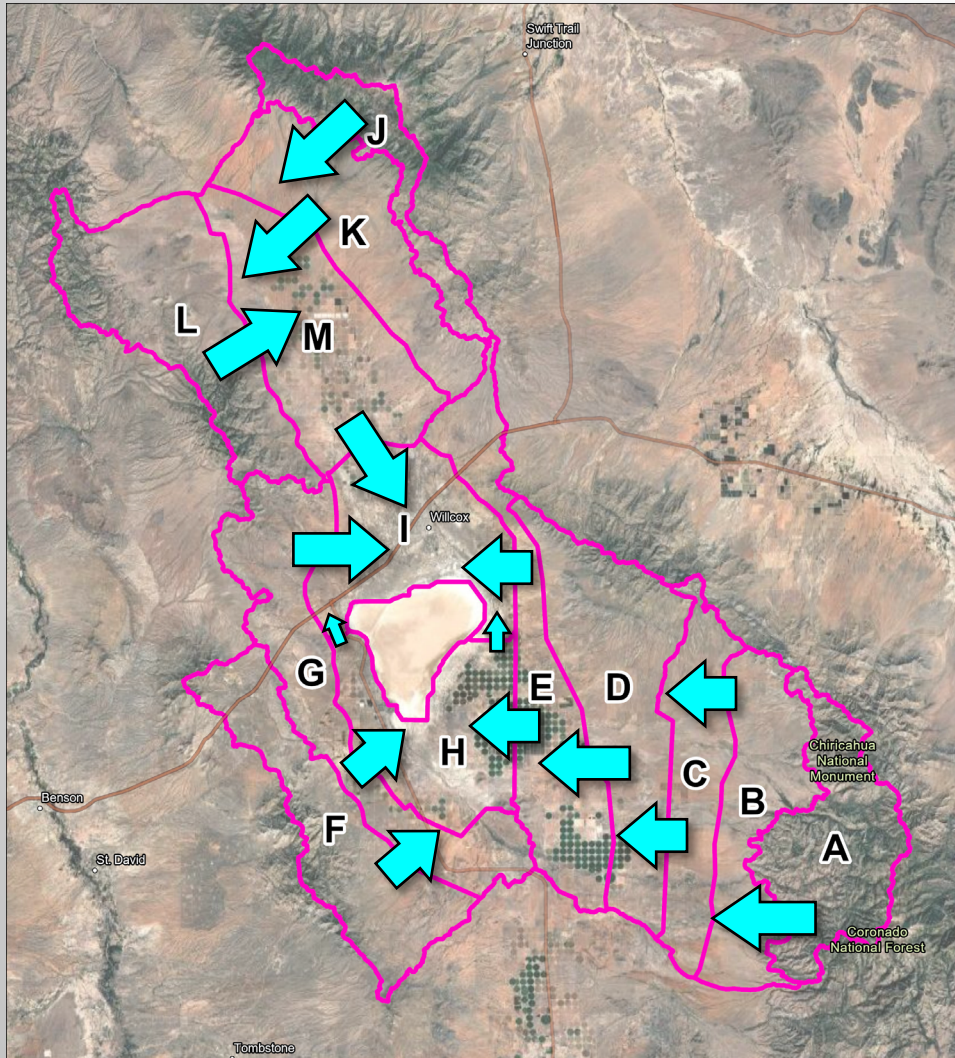
Second Edition, 2014



- Topographic data
 - USGS 1-meter LiDAR
- Rainfall
 - 24-hour SCS Type II storm distribution
 - 100-year, 24-hour rainfall depths are based on the NOAA Atlas 14 raster
- Infiltration
 - Green and Ampt (G&A) loss rate method
 - G&A parameters are obtained from the soil shapefile
- Manning's n-values
 - 2024 National Land Cover Database (NLCD)
 - n-values for the upper mountain regions are adjusted
- Hydraulic structures are incorporated into the model by modifying the terrain
- Manning's n-values, shallow n-values, limiting depth, G&A parameters adjusted for verification

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FLOW TRANSFERS AND RAINFALL HYETOGRAPH



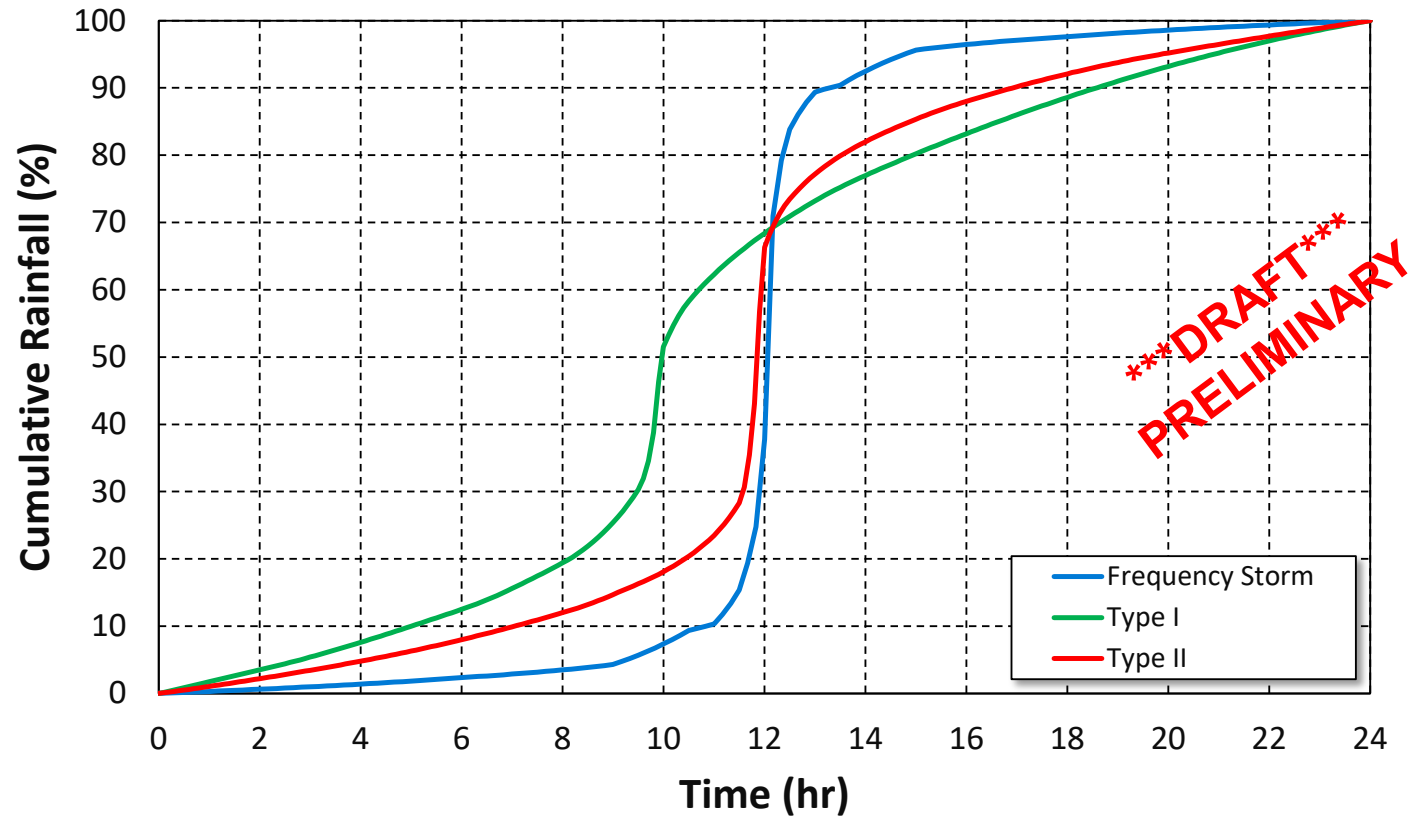
Legend

FLO-2D Domain

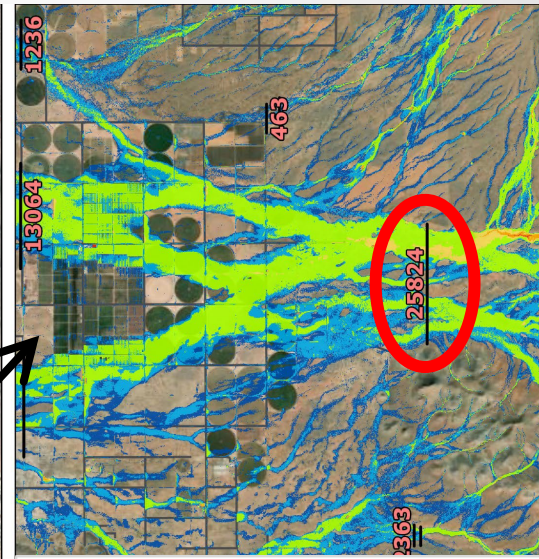
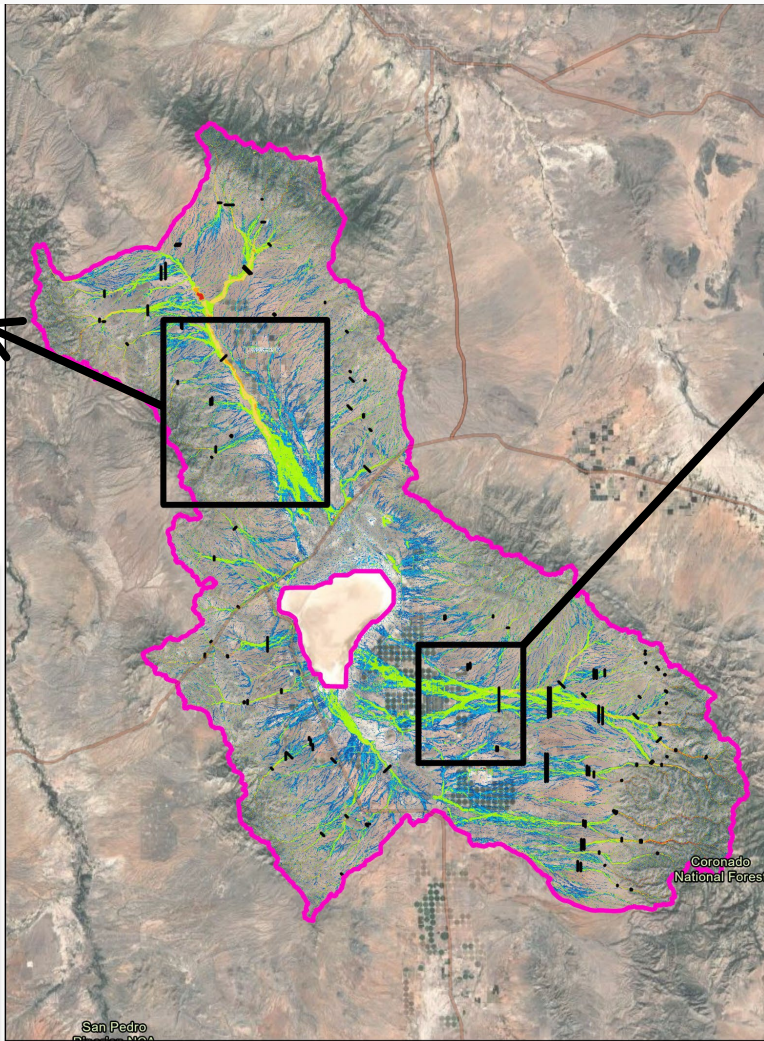
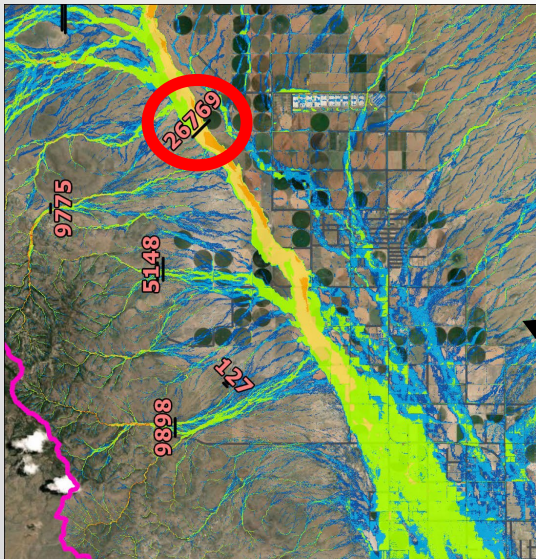
0 2.5 5 10 Miles



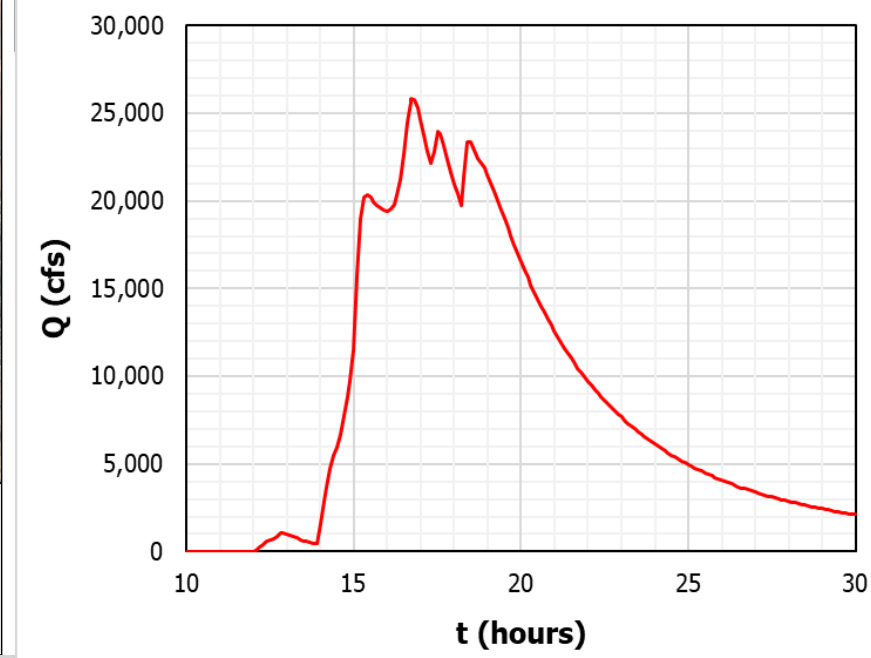
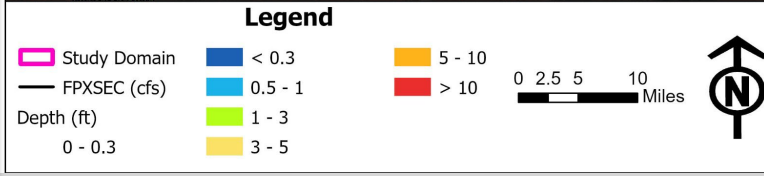
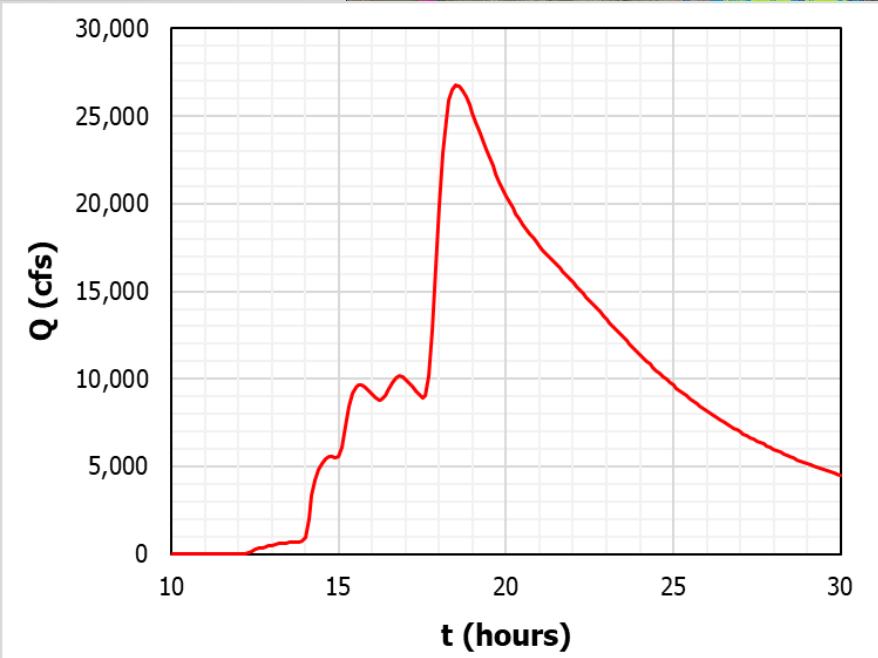
100-year 24-hour Rainfall Hyetograph



FLO-2D MODEL RESULTS



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VERIFICATION OF RESULTS

- JE Fuller verified the FLO-2D model results based on the USGS regression equation



Prepared in cooperation with the Flood Control Districts of Maricopa County, Pima County, Pinal County, Yavapai County, Mohave County, Cochise County, Navajo County, Greenlee County, and Salt River Project, U.S. Forest Service, and Bureau of Reclamation

Methods for Estimating Magnitude and Frequency of Floods in Arizona, Developed with Unregulated and Rural Peak-Flow Data through Water Year 2010



Scientific Investigations Report 2014–5211

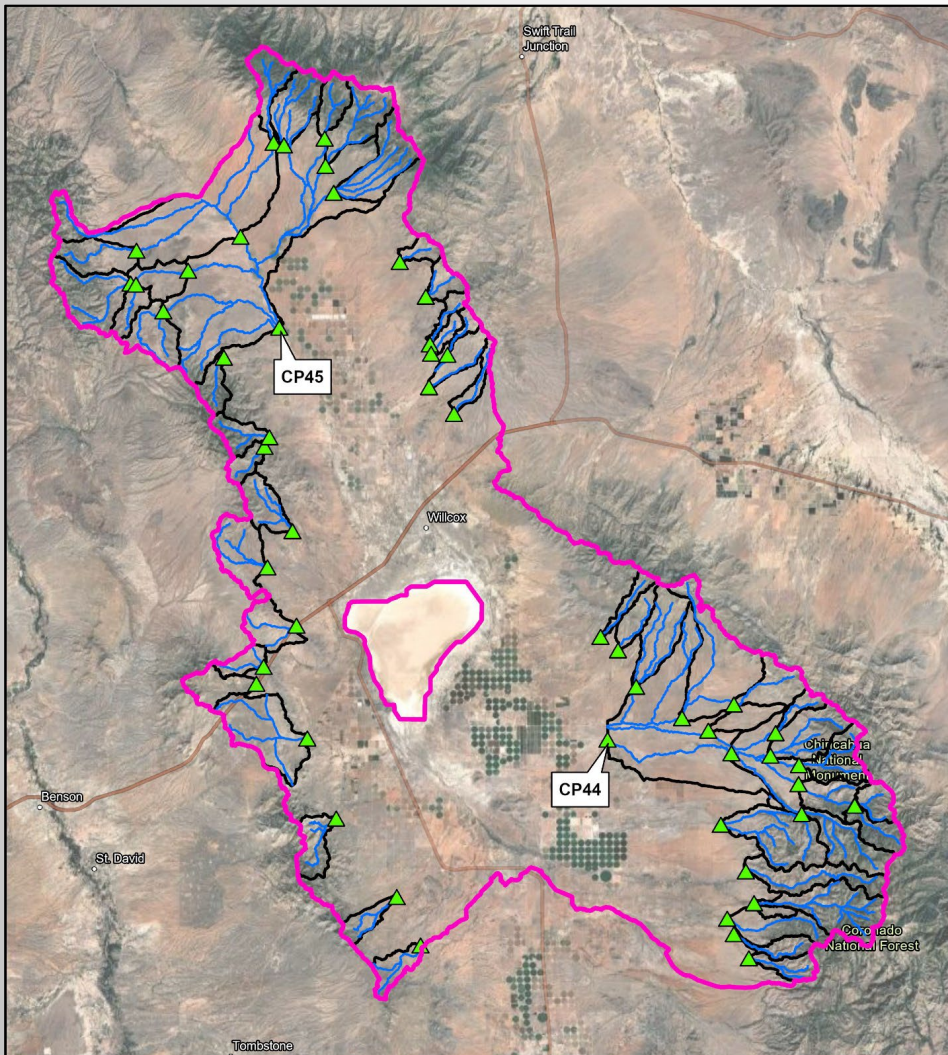
Flood region 5 (Southeastern Basin and Range) regression equation

50	$10^{(6.363-4.386 DRNAREA-0.060)}$
20	$10^{(5.868-3.506 DRNAREA-0.080)}$
10	$10^{(5.778-3.218 DRNAREA-0.090)}$
4	$10^{(5.757-2.988 DRNAREA-0.100)}$
2	$10^{(5.696-2.795 DRNAREA-0.110)}$
1	$10^{(5.651-2.634 DRNAREA-0.120)}$
0.5	$10^{(5.761-2.638 DRNAREA-0.120)}$
0.2	$10^{(5.750-2.502 DRNAREA-0.130)}$

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MODEL VALIDATION AND ADJUSTMENT

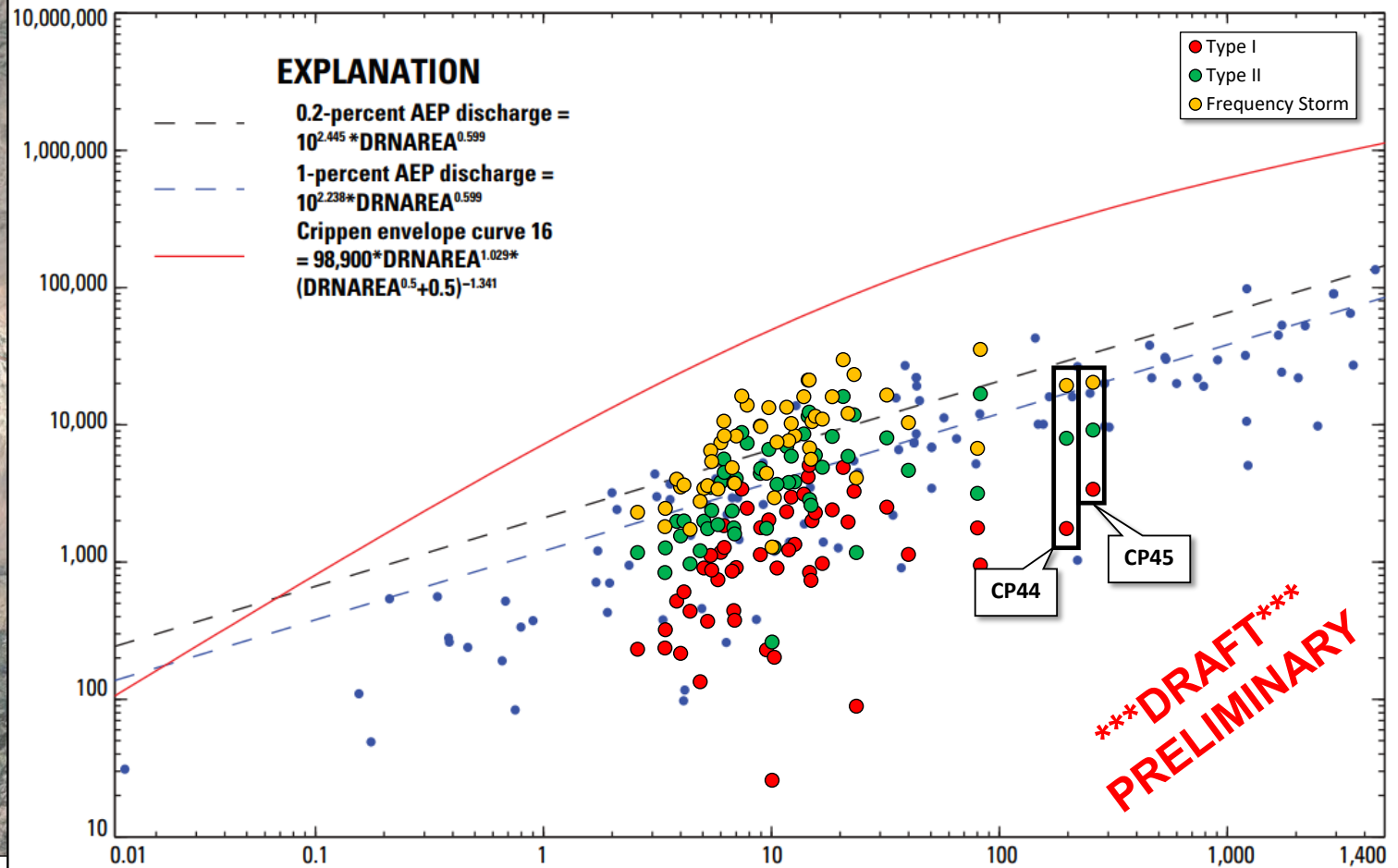
- 51 sub-basins and concentration points created



Legend

- ▲ Comparison Locations
- Subbasin
- Watercourse
- ▭ Study Domain

0 2.5 5 10 Miles



MODEL & MAPPING POTENTIAL BENEFITS

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- FLO-2D depth mapping on 40'x40' grids and 100-year discharges (Q_{100})
- Differences identified with current conditions compared to FEMA SFHAs



- Potential for use in floodplain permitting and future studies



CLOSING & NEXT STEPS

- Detailed FLO-2D hydrologic and hydraulic models have been developed and submitted for County Review
- Recharge potential has been discretized into 40-acre 'parcels' via Sub-consultant GSA's efforts
- Next steps include:
 - Identifying potential recharge sites and activities
 - Creating floodplain cross-sections at the potential sites to capture incoming/outgoing hydrographs and 100-year peak discharges

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