Upper East Fork Cave Creek Area Drainage Master Plan Update: Flood Identification with 2D Modeling

Prepared By

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Acknowledge

City of Phoenix

FEMA

Flood Control District of Maricopa County

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“

Good, Better, Best
-Dallin H. Oaks

Outline

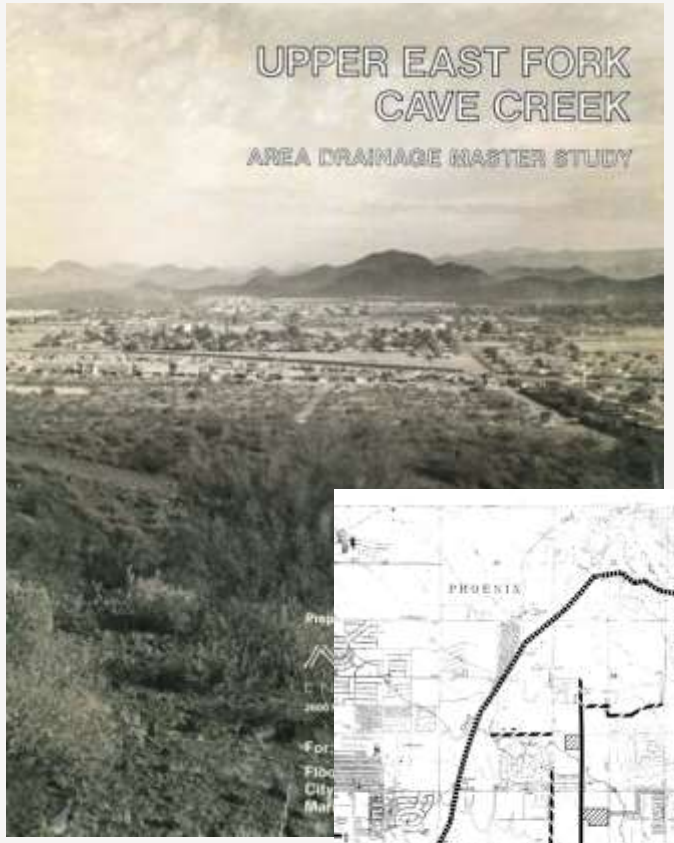
- Project Overview
- Model Development
- Project Outcomes

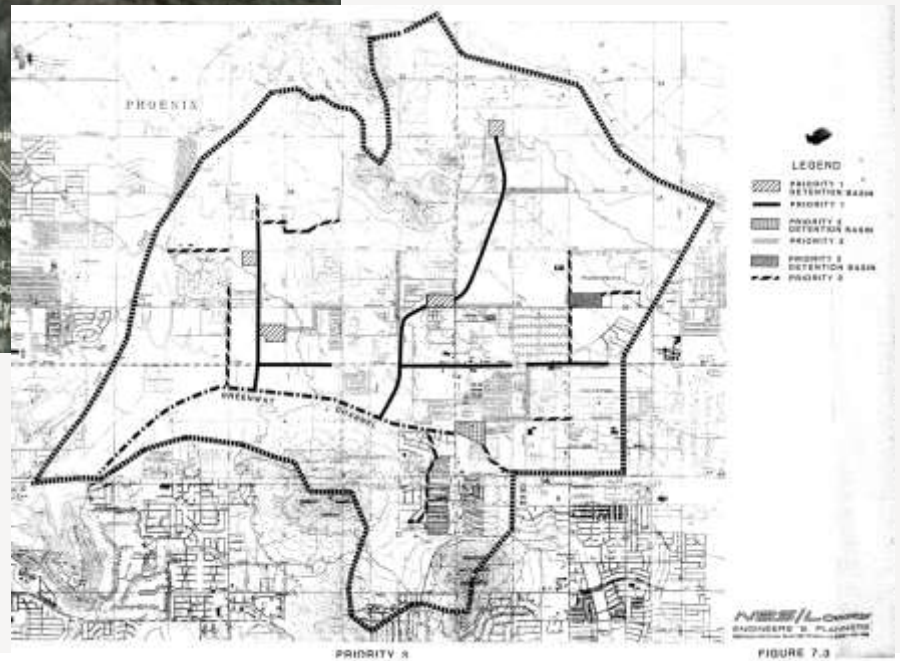
Project Overview

Upper East Fork Cave Creek Master Plan Update

Project Overview

- Initial UEFCC ADMS, 1986
- TR-20 Runoff Model
- Recommended Projects





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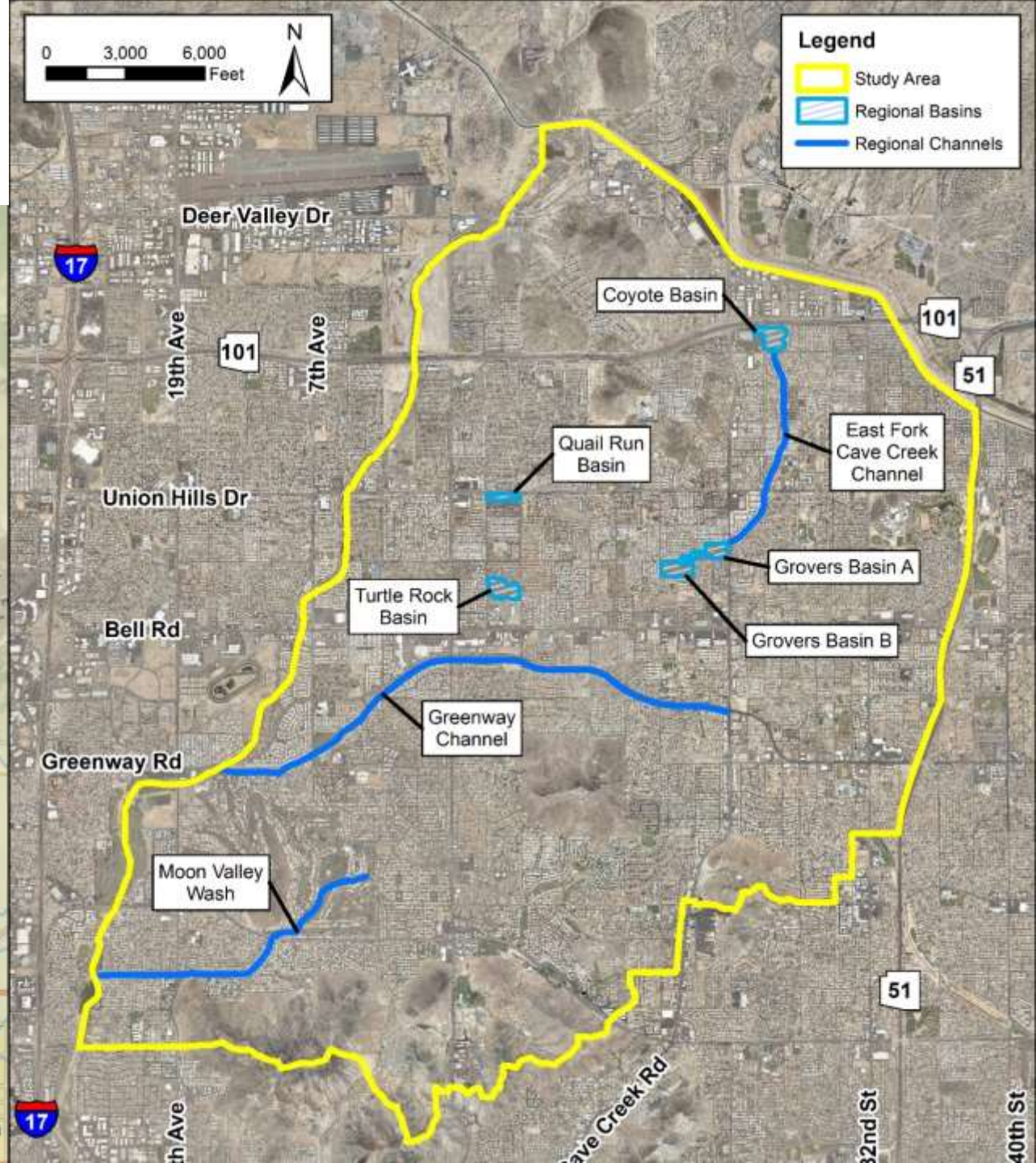
27 Square Miles



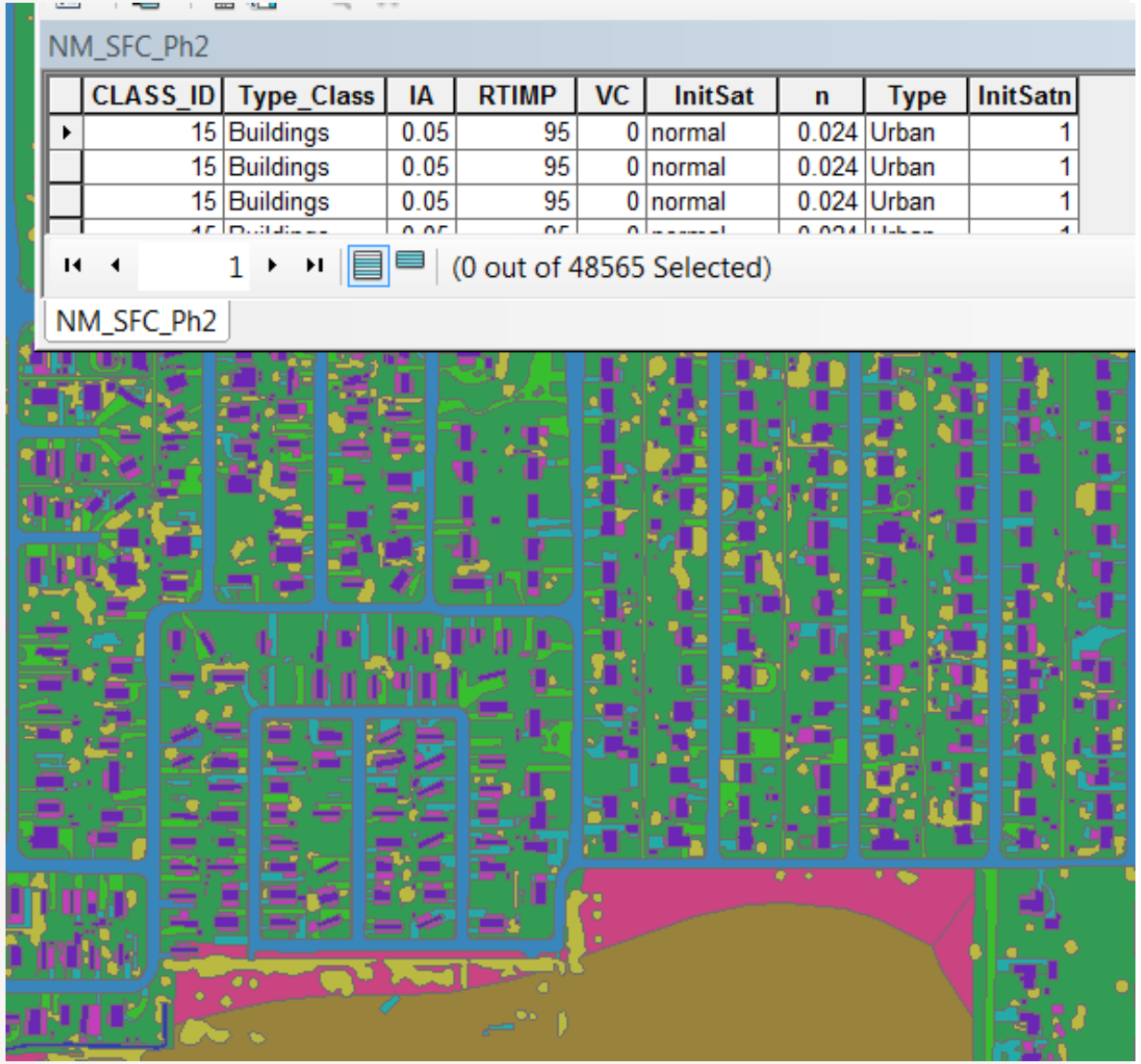
Model Development

Upper East Fork Cave Creek Master Plan Update

Greenway Channel

Grid Development

- LiDAR, 2-ft contours
- Grid cell 20’x20’ (1.9 mil.)
- Detailed Surface Features
  - Manning’s Roughness
  - Buildings (ARF)
  - Infiltration
- Python Scripts



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15	Buildings	0.05	95	0	normal	0.024	Urban	1
15	Buildings	0.05	95	0	normal	0.024	Urban	1
15	Buildings	0.05	95	0	normal	0.024	Urban	1

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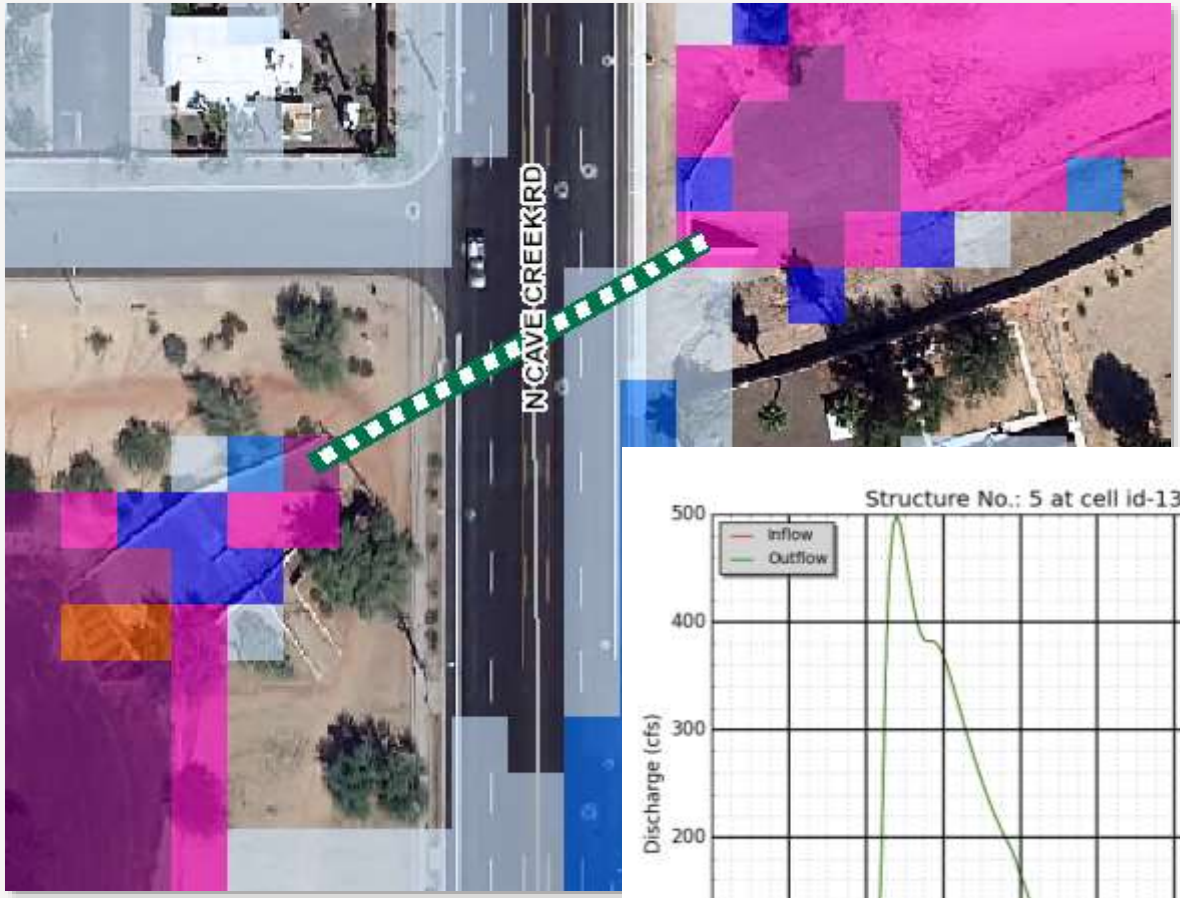
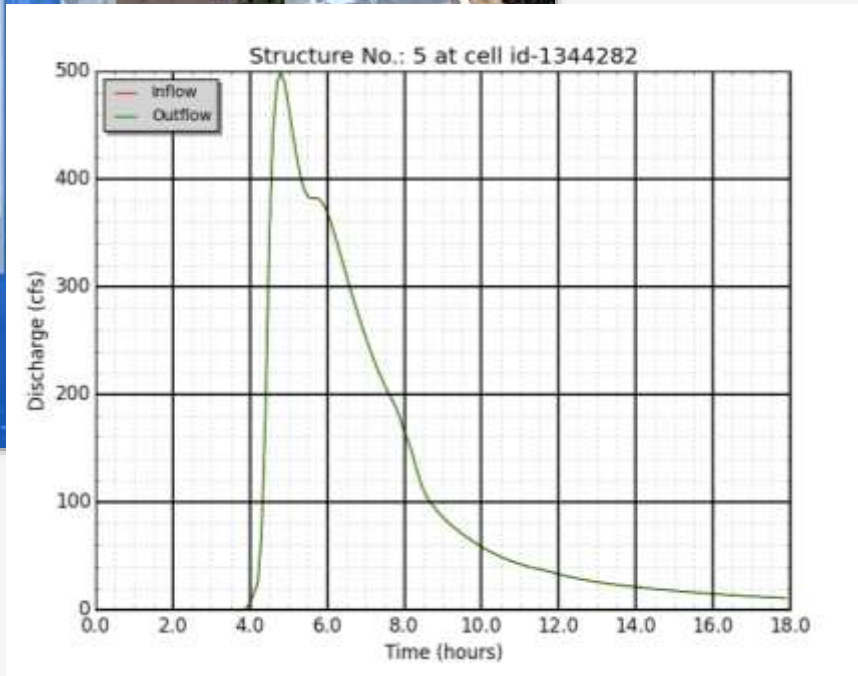
Hydraulic Structures

- 150 bridges/culverts
- HY-8
  - Script for models
- Debris





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After

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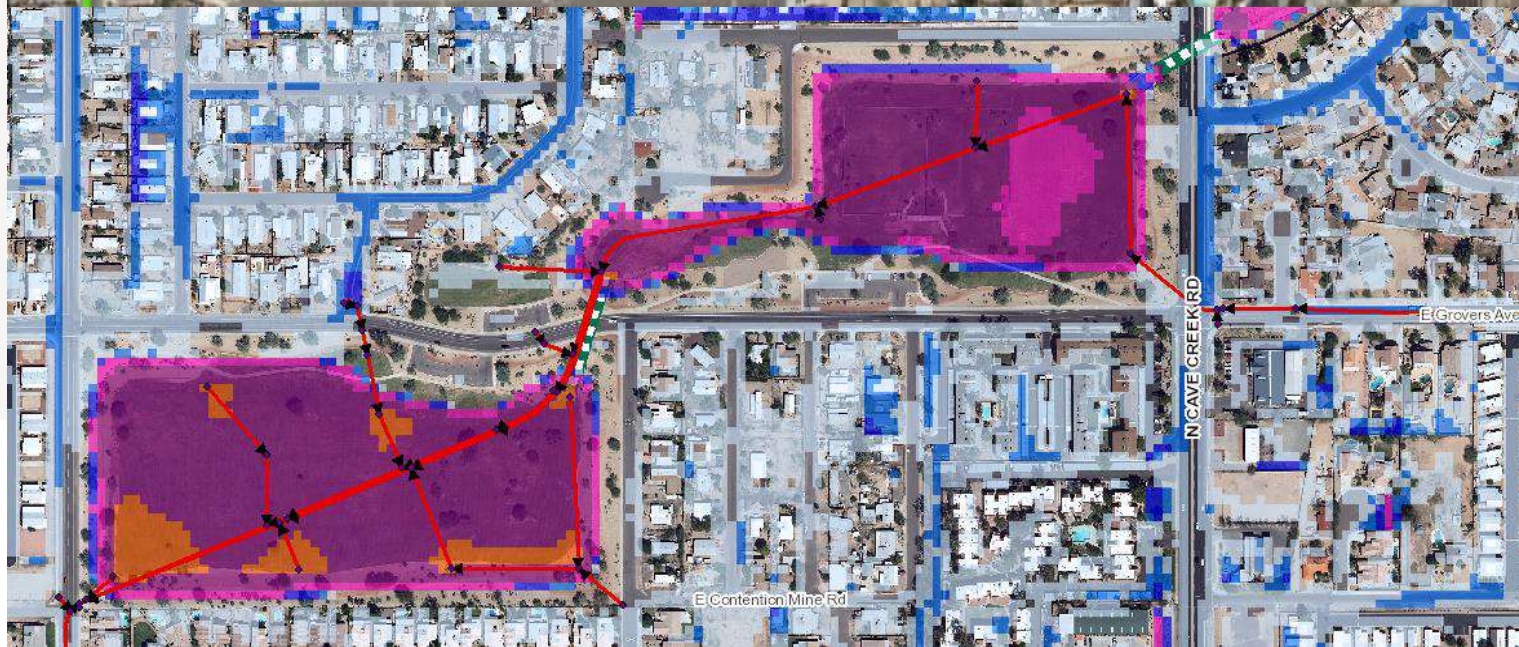
Storm Drains

- 26 Trunk Lines
- Over 2,700 different pipes
- ~60 miles of pipe
- 2028 inlets, 97 outfalls
- Flows from 2 cfs to 3,500 cfs



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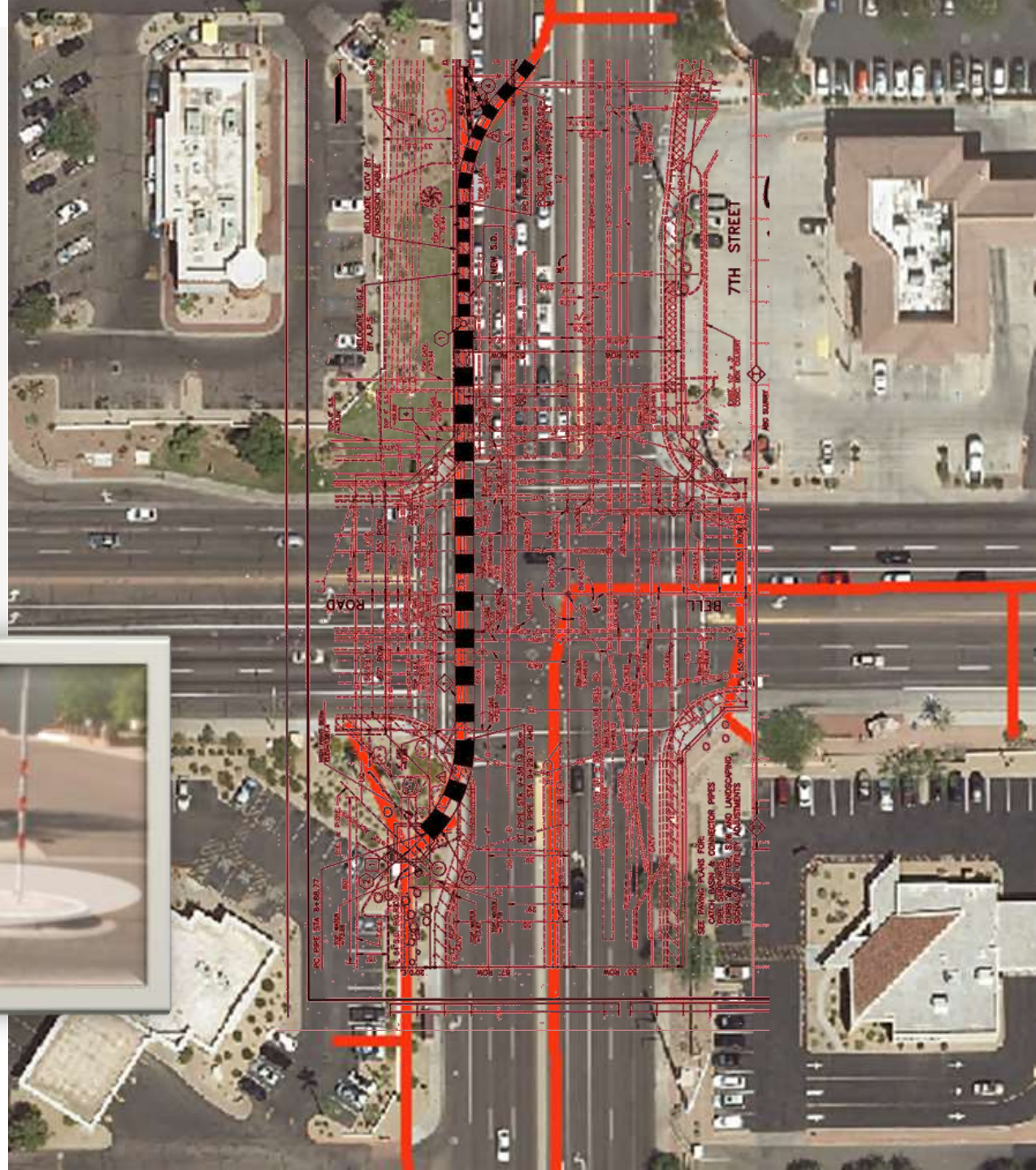
Grovers Basin (Cave Creek Rd/Grovers Ave)
August 8, 2014

Storm Drains

- Georeference Asbuilts
- Use Google Streetview & standards for missing data



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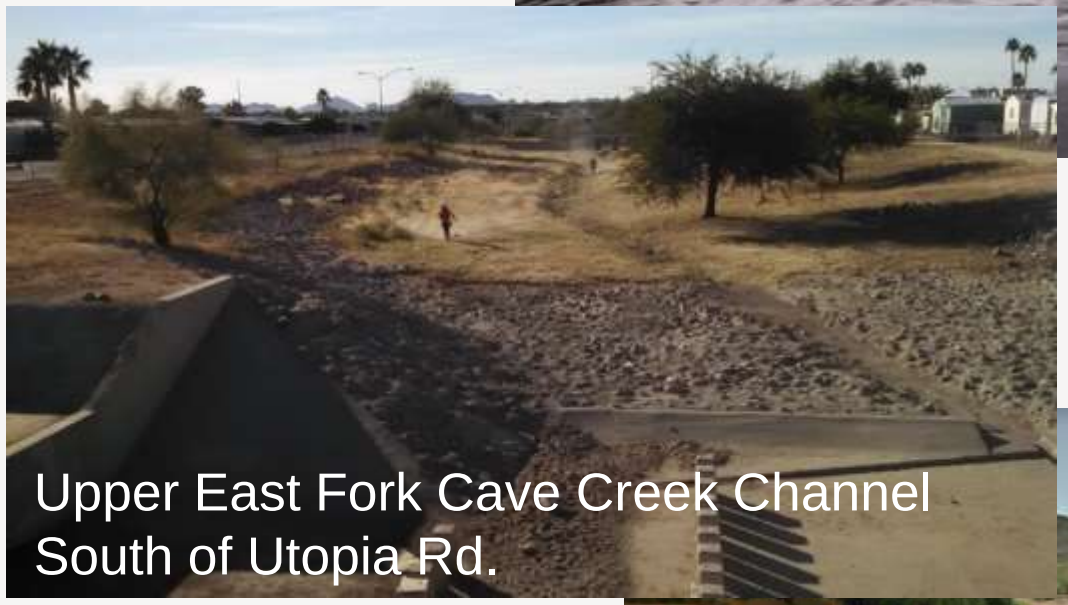
Channels

- Greenway Channel (4.1 mi)
- East Fork Cave Creek Channel (1.5 mi)
- Moon Valley Wash (3.5 mi)

Greenway Channel at 7th Ave.
August 8, 2014



Upper East Fork Cave Creek Channel
South of Utopia Rd.

Moon Valley Wash
Thunderbird Road Crossing
*Source: Google Maps

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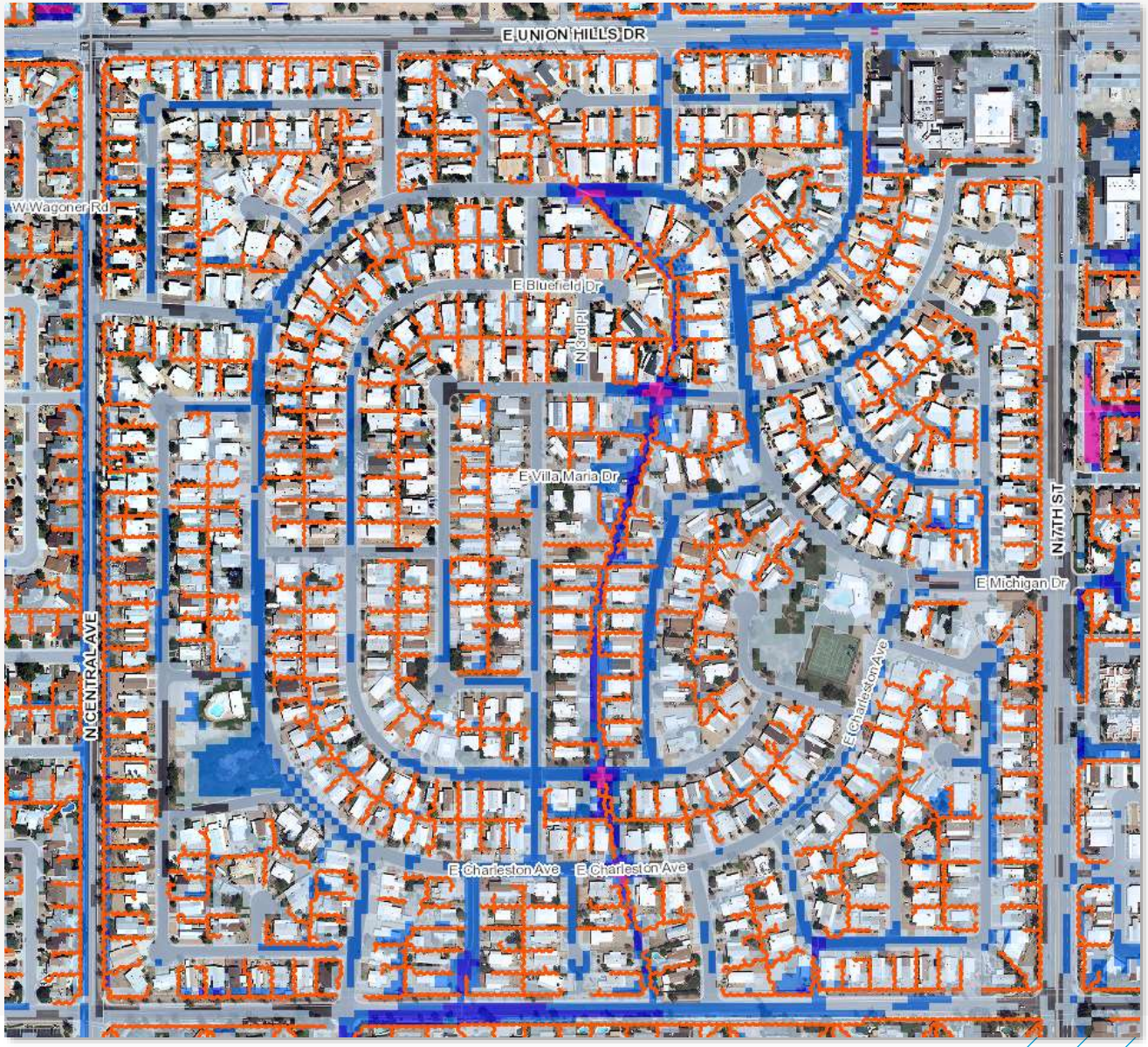
Walls/Levees

- Over 700,000 wall features
- Assumed 6-ft Height
- Wall Sensitivity
  - 2-ft/3-ft failure
  - No walls



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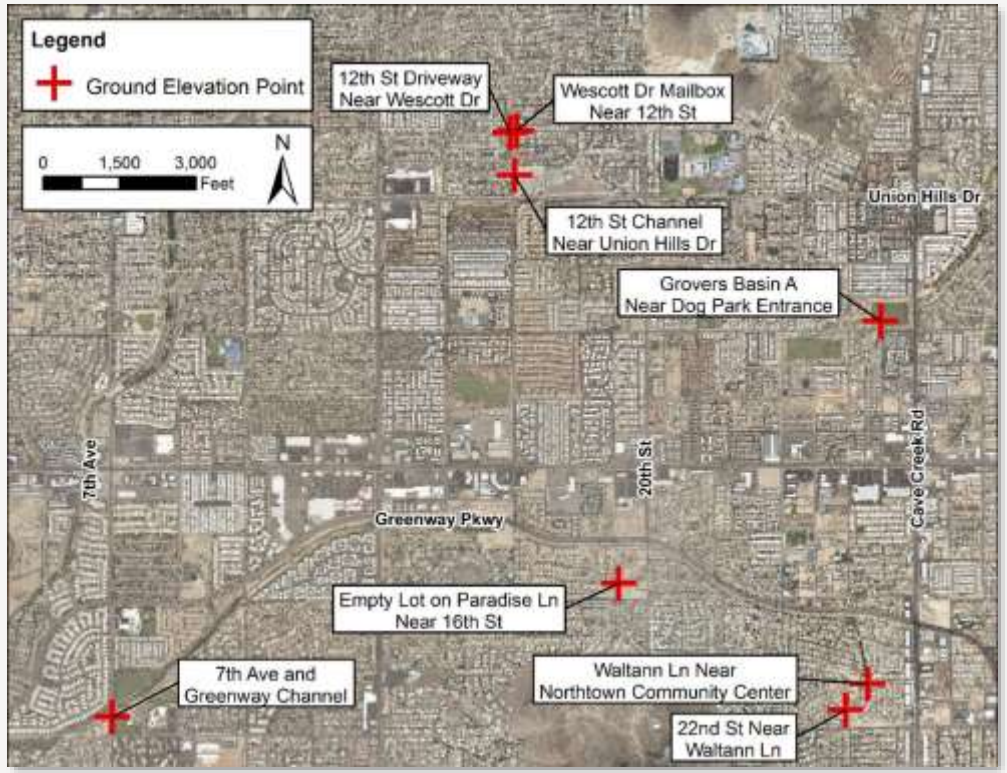
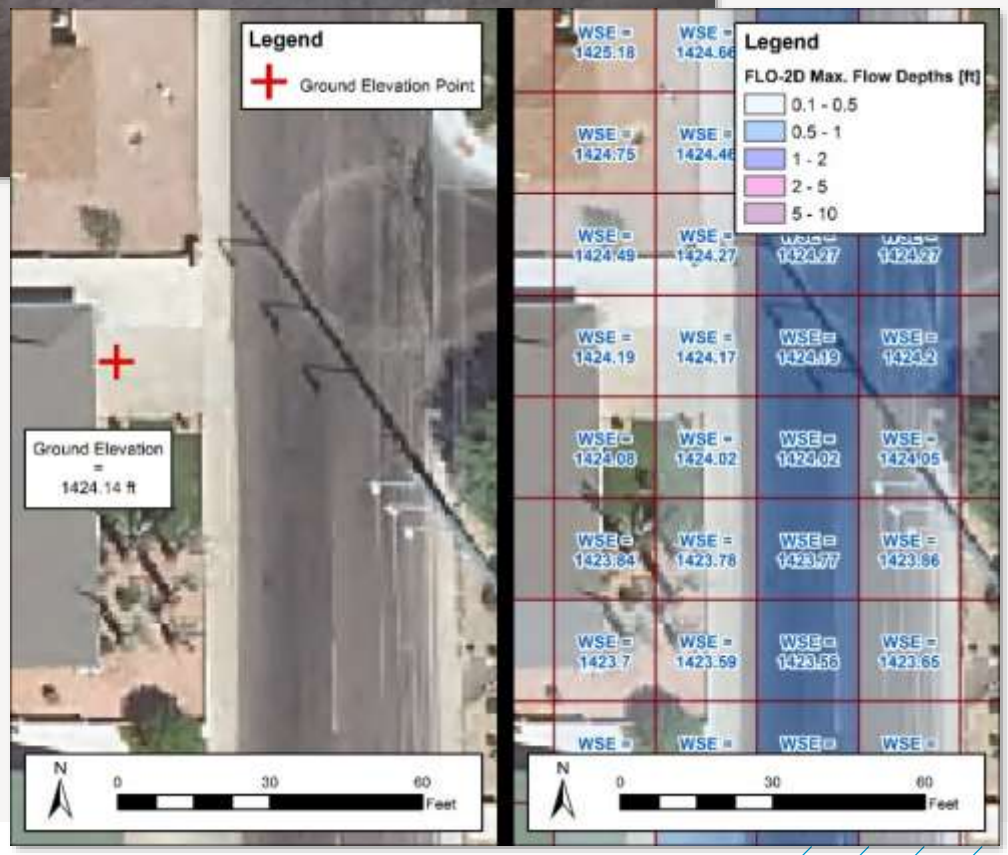
Impacts of walls

Verification

- August 2014 Storm





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Sensitivity Analysis

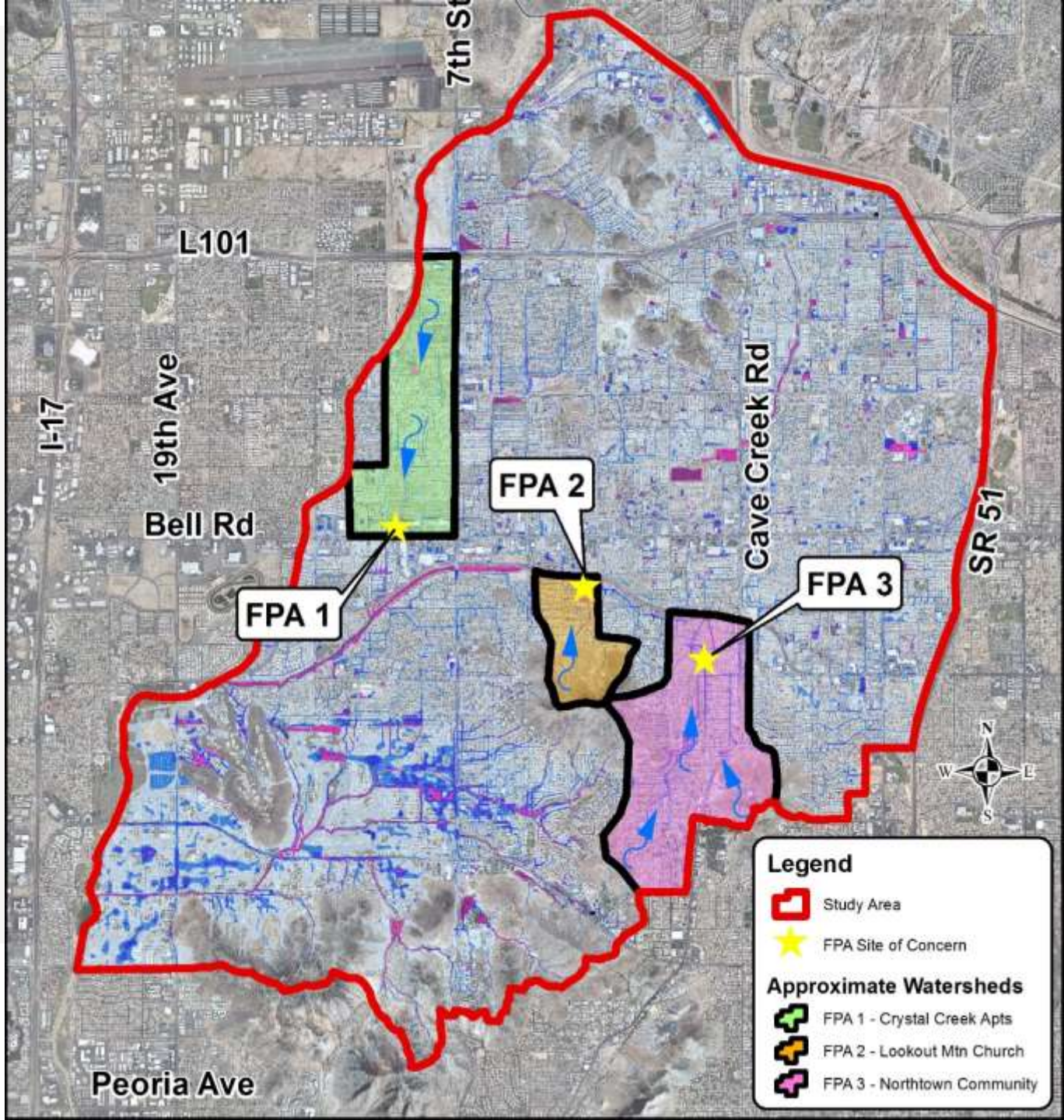
- Manning's n-values (+20% and -20%)
- Limiting Froude Numbers (+20% and -20%)
- No property walls and wall failure for flow depths of 2 feet and 3 feet
- Courant Number (0.3, 0.5, 0.7)
- Hydraulic structure (culvert) conveyance (+25% and -25%)
- Storm drain clogging (+25% and +50%)

Project Outcomes

Upper East Fork Cave Creek Master Plan Update

Mitigation Alternative Analysis

- 3 Flood Prone Areas
- 17 Conceptual Alternatives
- Discharge Reduction Calculated
- Cost Estimate
- 3 Selection Criteria
  - Flood Reduction of Area
  - No Adverse Impact
  - “Biggest Bang for the Buck”



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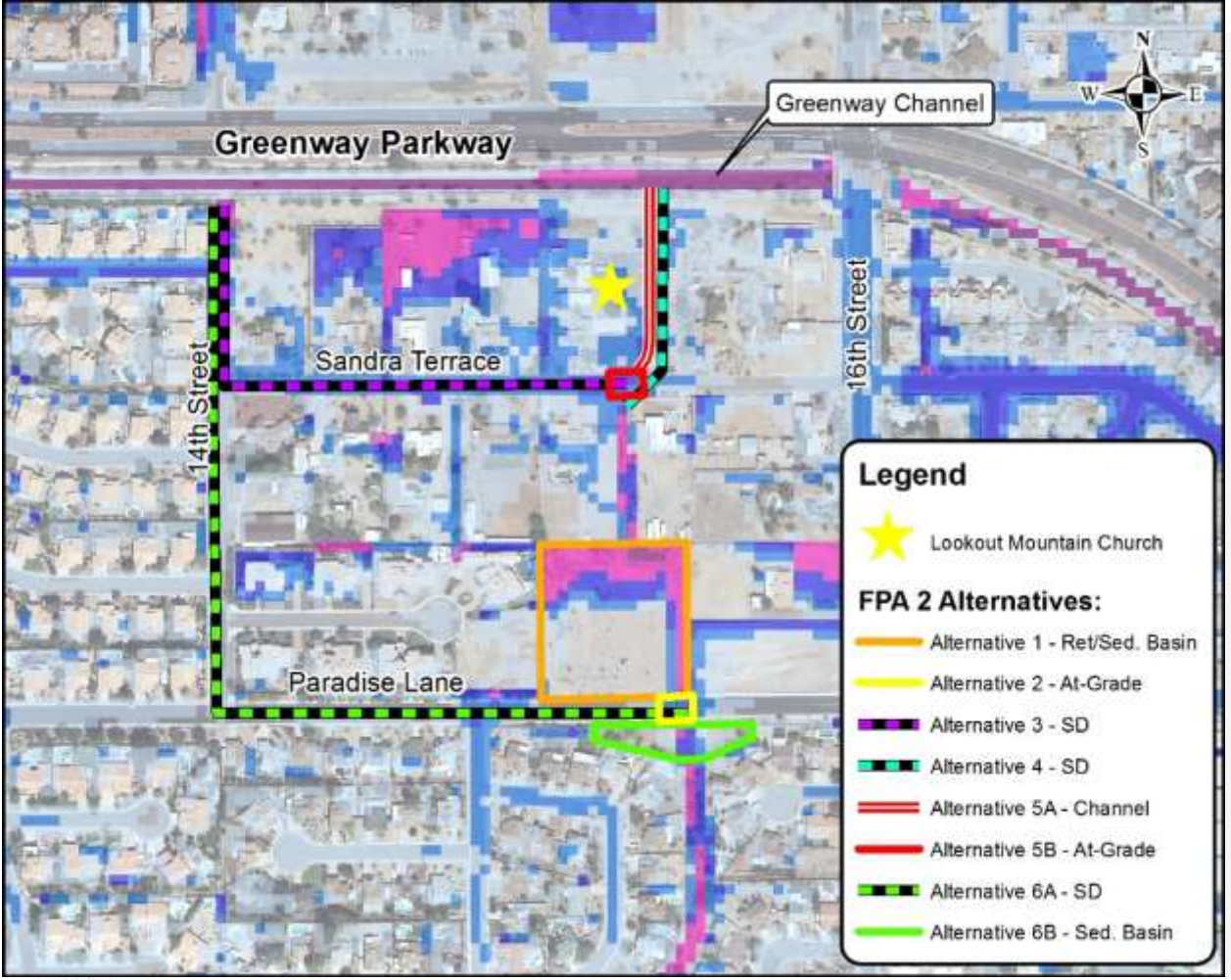
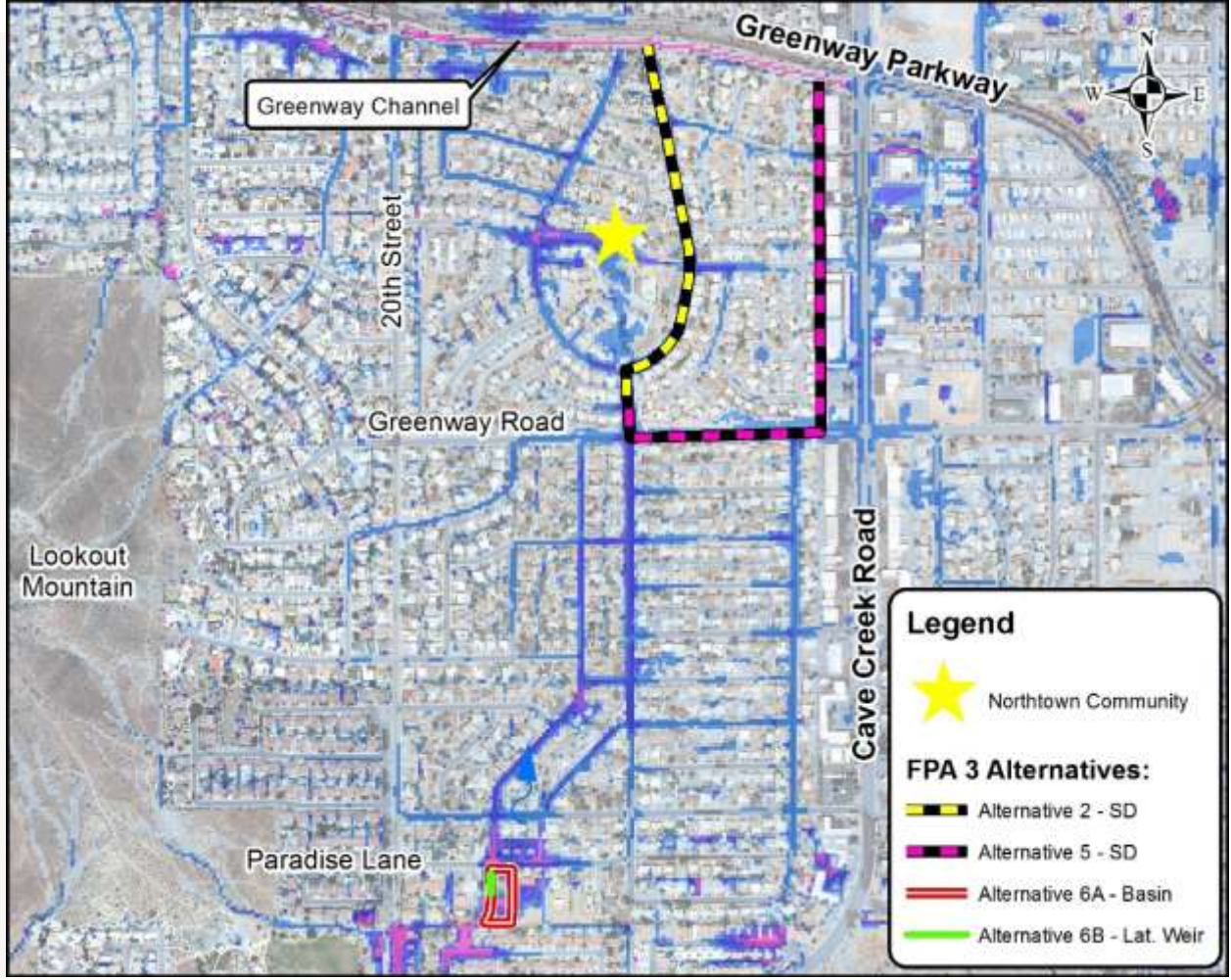
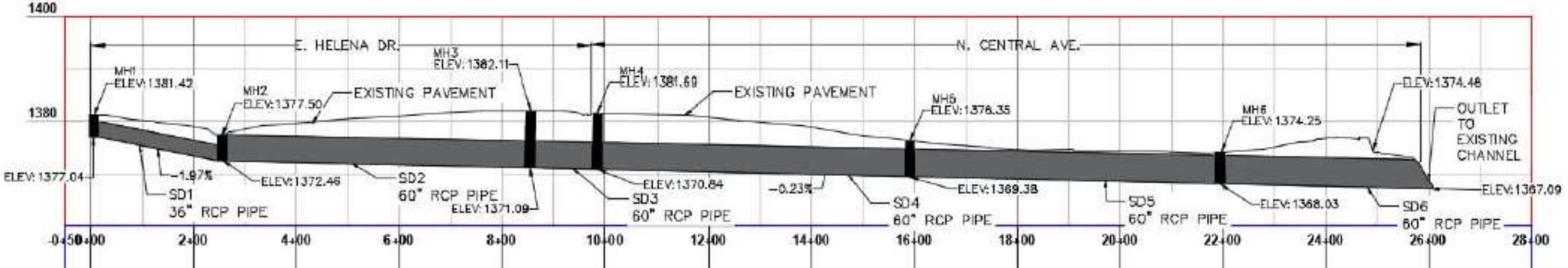
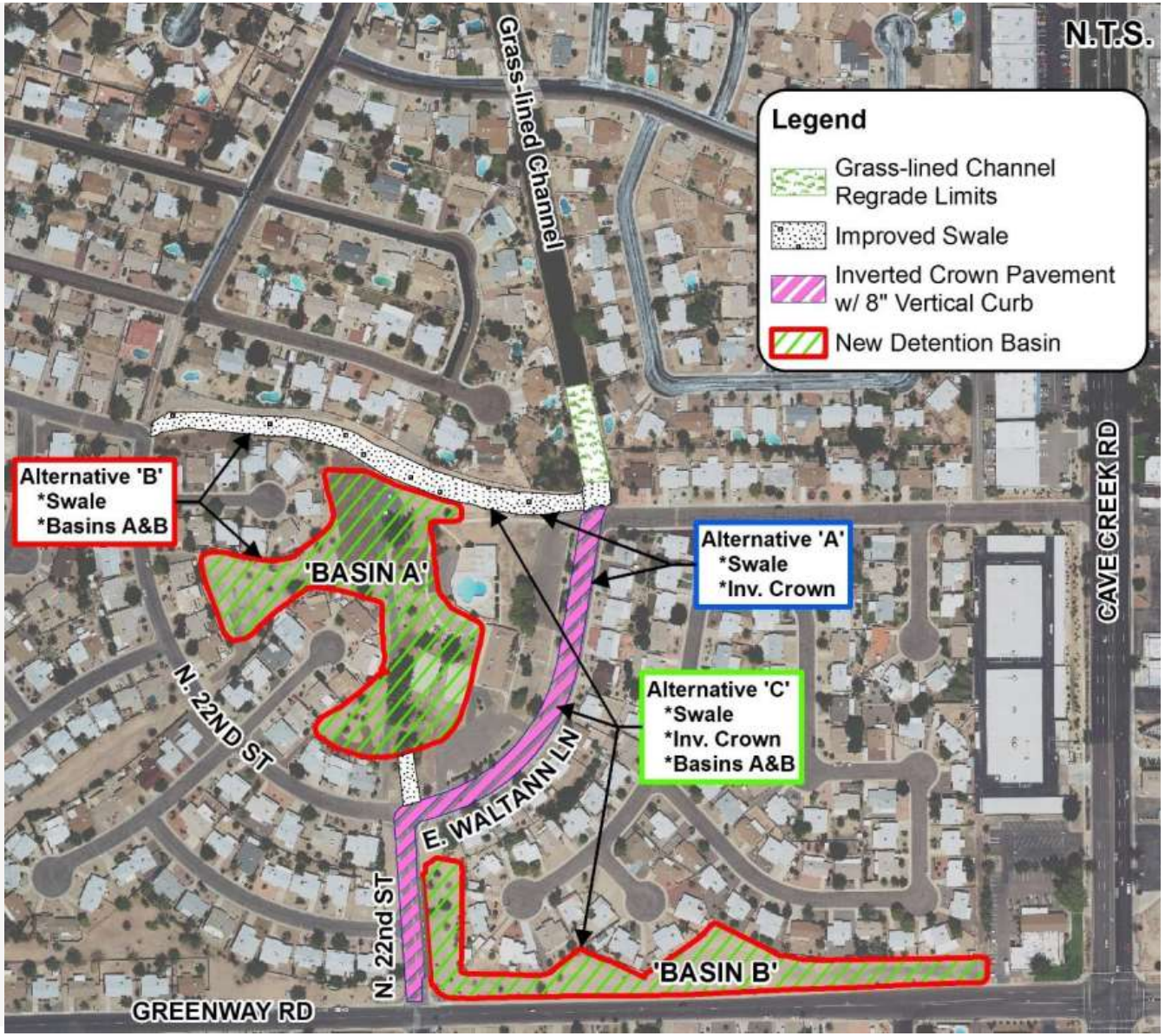

Greenway Parkway
Greenway Channel
Sandra Terrace
14th Street
16th Street
Paradise Lane
N
S
E
W
Legend
Lookout Mountain Church
FPA 2 Alternatives:
Alternative 1 - Ret/Sed. Basin
Alternative 2 - At-Grade
Alternative 3 - SD
Alternative 4 - SD
Alternative 5A - Channel
Alternative 5B - At-Grade
Alternative 6A - SD
Alternative 6B - Sed. Basin


Greenway Parkway
Greenway Channel
20th Street
Greenway Road
Lookout Mountain
Cave Creek Road
Paradise Lane
N
S
E
W
Legend
Northtown Community
FPA 3 Alternatives:
Alternative 2 - SD
Alternative 5 - SD
Alternative 6A - Basin
Alternative 6B - Lat. Weir


1400
1380
E. HELENA DR.
N. CENTRAL AVE.
MH1 ELEV: 1381.42
MH2 ELEV: 1377.50
MH3 ELEV: 1382.11
MH4 ELEV: 1381.60
MH5 ELEV: 1376.35
MH6 ELEV: 1374.25
EXISTING PAVEMENT
EXISTING PAVEMENT
ELEV: 1374.48
OUTLET TO EXISTING CHANNEL
ELEV: 1377.04
-1.97%
SD1 36" RCP PIPE
ELEV: 1372.46
SD2 60" RCP PIPE
ELEV: 1371.09
ELEV: 1370.84
SD3 60" RCP PIPE
-0.23%
ELEV: 1369.38
SD4 60" RCP PIPE
SD5 60" RCP PIPE
ELEV: 1368.03
SD6 60" RCP PIPE
ELEV: 1367.09
0+50
2+00
4+00
6+00
8+00
10+00
12+00
14+00
16+00
18+00
20+00
22+00
24+00
26+00
28+00

10-Year Storm Alternatives Evaluation

- FPA3 Northtown Community
- Three Alternatives for smaller storm event (10 Year)
- Clipped FLO-2D Model
- Improve Open Space Areas
- Improve Existing Conveyance



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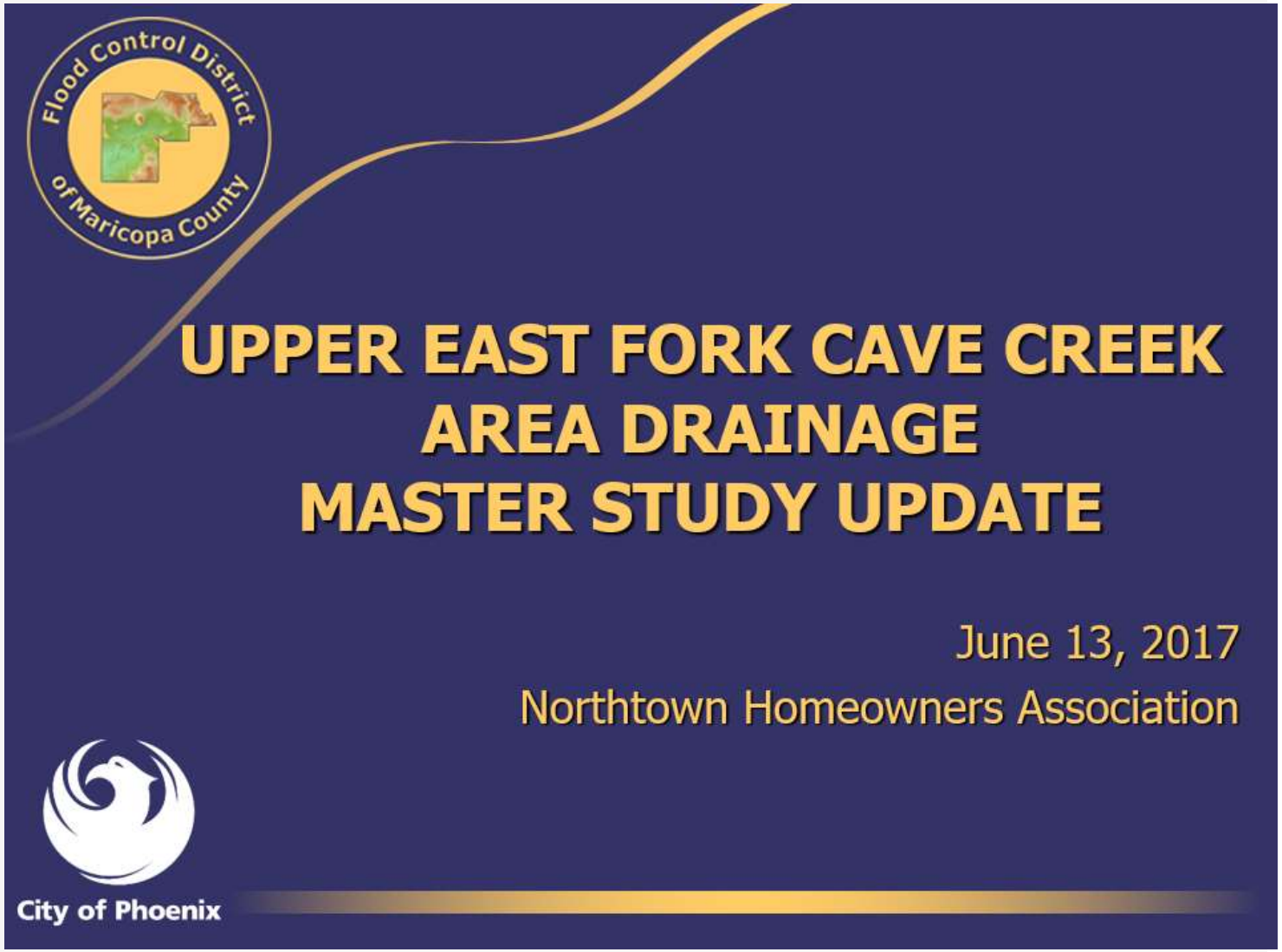
Public Outreach

- Multiple Public Meetings
- Provide Update on Area
- Discuss Mitigation Options



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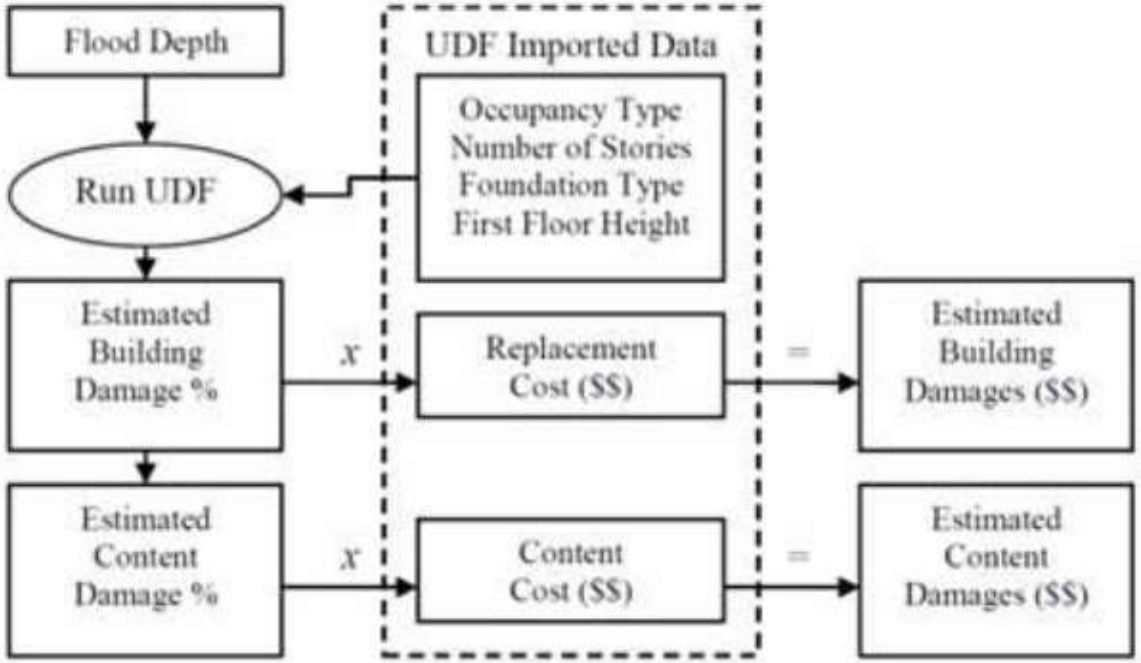
Hazus Analysis

- UDF Method
- 40K points
- Depth Filter Method

- **UDF:** Analysis is run based on the geographic coordinates of each building's centroid – or single point location – and the attributes for the individual buildings.



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2D Hazus Challenge

- Max Depth at Centroid
- Overestimated depth at footprint
- Script to filter results Depth & % WPerim

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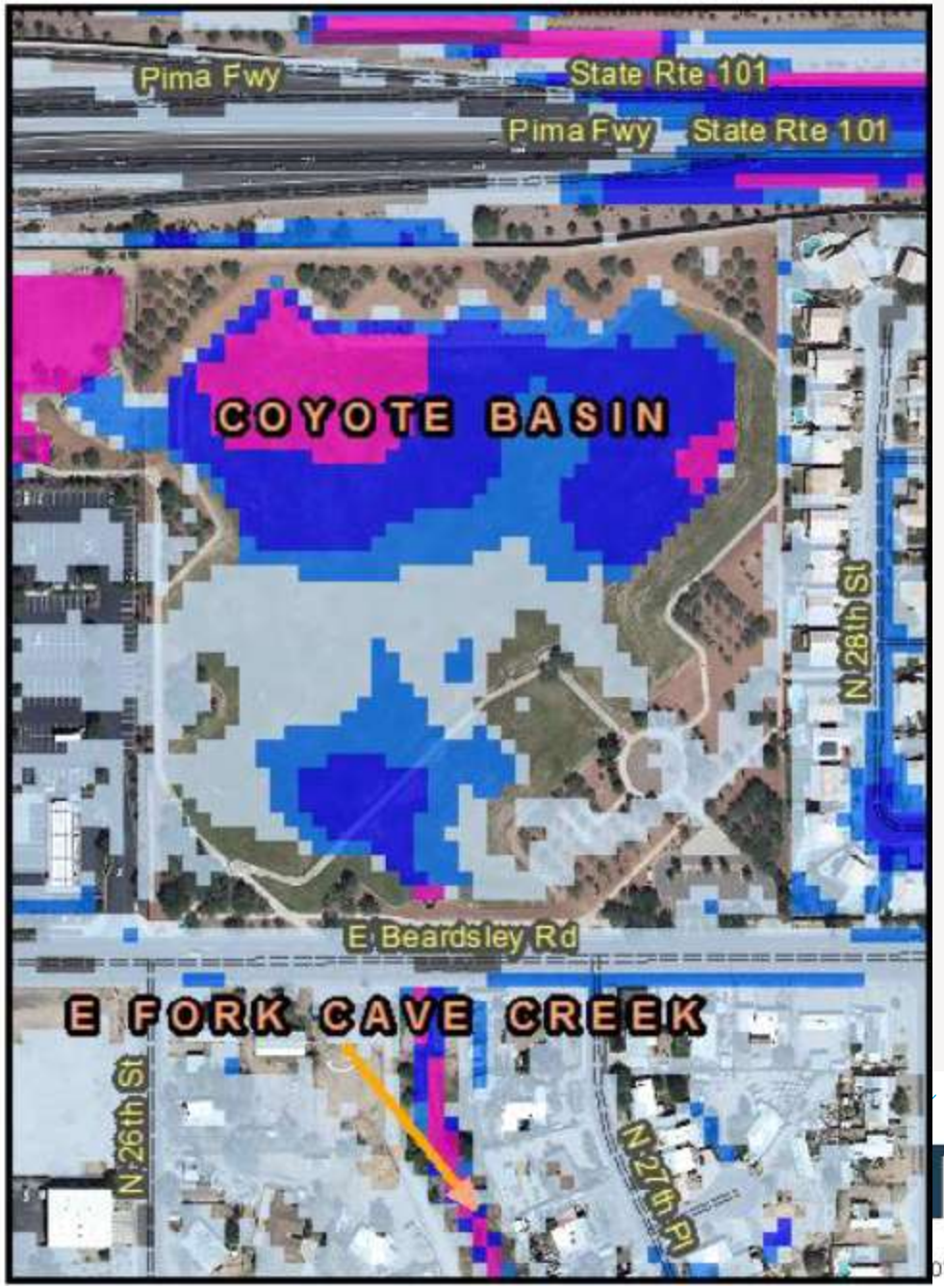
Losses Avoided

- Quantify losses avoided due to drainage facilities
- Remove drainage facilities from Model
  - No storm drains, channel improvements, basins
- Compare results to existing conditions model
- Perform Hazus analysis

Existing Conditions

Existing Conditions Model Max. Flow Depth



1986 Conditions

Avoided Losses Model
Max. Flow Depth

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Project Team

- Cameron Jenkins, Atkins **PM**
- Justin Beeler, Atkins
- Eric Coughlin, Atkins
- Brian Schalk, HELM
- Hari Raghaven, HELM
- Ed Kern, HELM
- Jim O’Brien, Riada
- Karen O’Brien, Riada
- Noemi Gonzalez, Riada
- Alex Albert, GUNN Communications
- Tim Murphy, FCDMC
- Doug Williams, FCDMC
- Valerie Swick, FCDMC
- Kathryn Gross, FCDMC
- Spencer Bolen, FCDMC
- Hasan Mushtaq, City of Phoenix
- Tina Jensen, City of Phoenix

Questions

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