

FLOODPLAIN MAPPING USING UAS TECHNOLOGY

Presented by

Nadine Clah, GISP

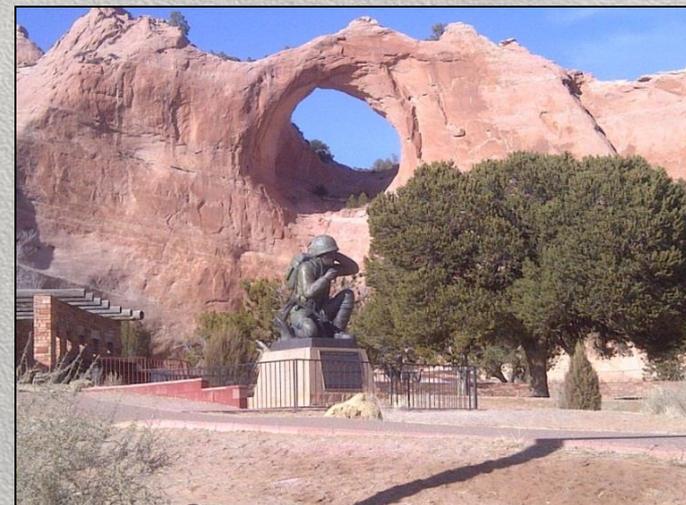
David Turk, CFM, GISP

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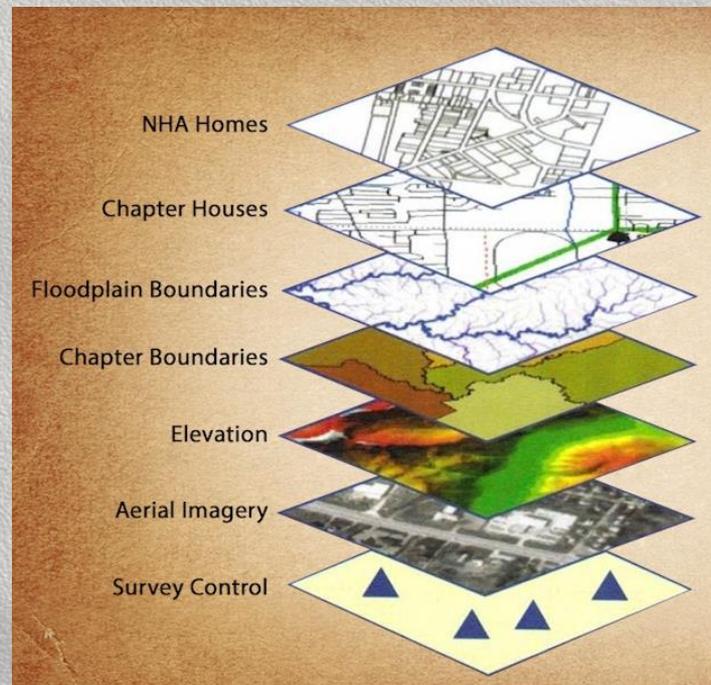
NAVAJO NATION PROFILE

- Largest land area and federally recognized tribe in the United States
- Over 27,000 square miles with a population of over 300,000 people. Covers Arizona, New Mexico, and Utah
- 110 Chapters/communities
- Navajo Housing Authority (NHA) is the largest Tribally Designated Housing Entity (TDHE) in the United States
- NHA manages over 9,000 homes
- Building thousands of new homes



LAND INFORMATION MANAGEMENT SYSTEM

- Compiling all of this data into a single accurate, geographically referenced database system gave NHA the tool necessary to advance its mission of building sustainable communities.
- NHA can now accurately search for, visualize, and identify where their property is geographically and in relation to other features.



NHA REQUIREMENTS

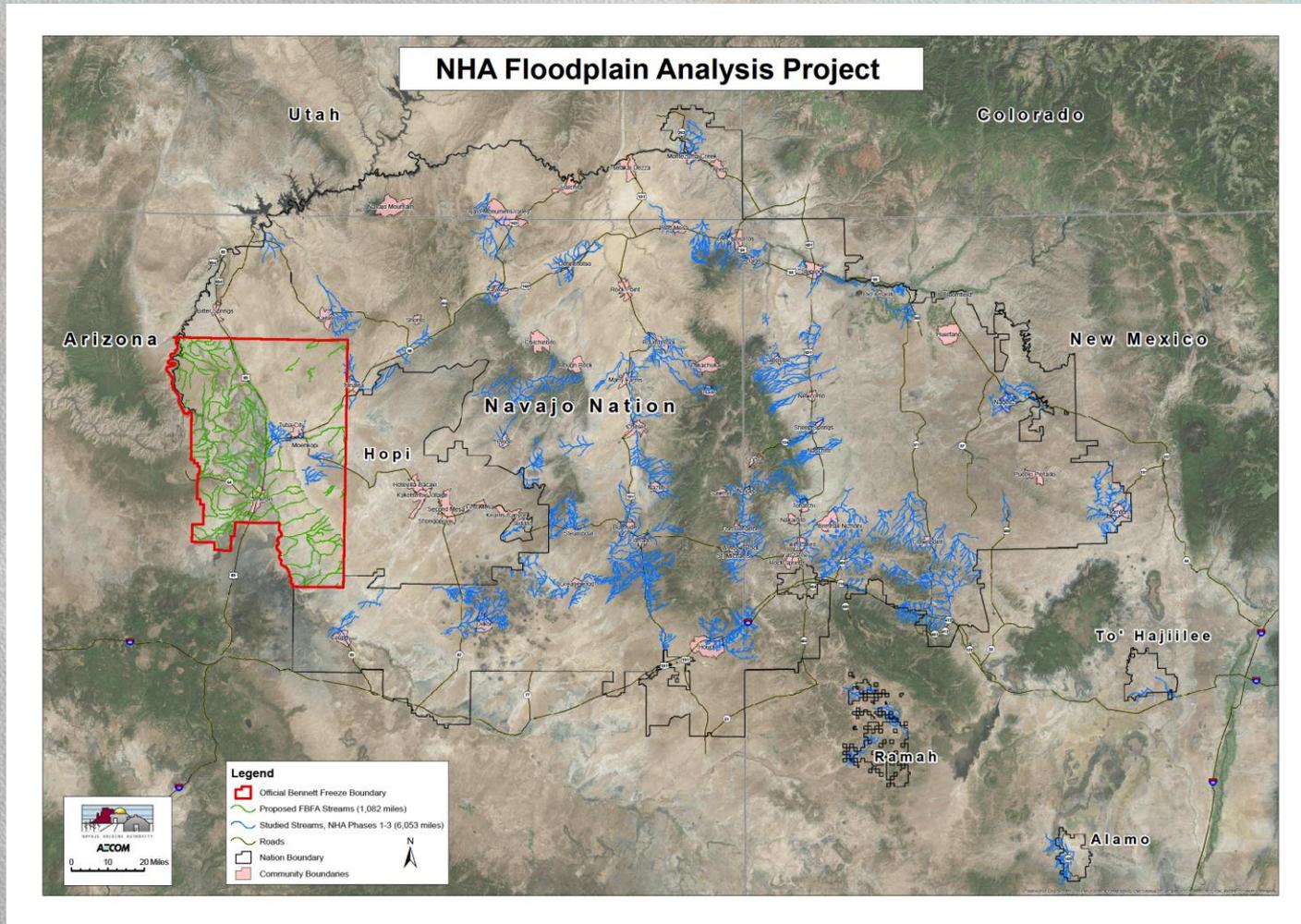
- HUD requirement to develop outside flood hazards
- **Problem: No flood hazards identified on Navajo Nation**
- **Solution: Identify flood hazards for proper NHA planning and development of homes and communities.**



Photo Credit: Navajo Times
Crownpoint, NM
2013

FLOODPLAIN ANALYSIS PROJECT

- 2011- Current (7,000 miles of floodplain study)
- Phases 1-3: 6,000 miles (blue) Former Bennett Freeze Area: 1,000 miles (green)



ISSUE

- Whippoorwill, AZ
- 2 homes mapped in the approximate 1% annual chance floodplain needed substantial improvement.



CLOSER LOOK

- Approximate floodplain based on 8M DEMs



QUESTION

- Will a detailed study still show the homes in the floodplain?
- The approximate floodplain was delineated for general planning.
- For construction, a detailed floodplain is required.



DETAILED FLOOD STUDY

- How do you collect detailed terrain for 250 acres and run a 2D hydraulic model?
- 2D hydraulic modeling recommended for alluvial fan landforms to accurately delineate floodplain and water surface elevations.
- Comparing the detailed flood elevation to the 2 structure elevations will determine if the structures are in or out of detailed floodplain.

SOLUTION

- Collect detailed terrain using UAS technology to save cost and then map the multi-branched floodplain using FLO-2D software.



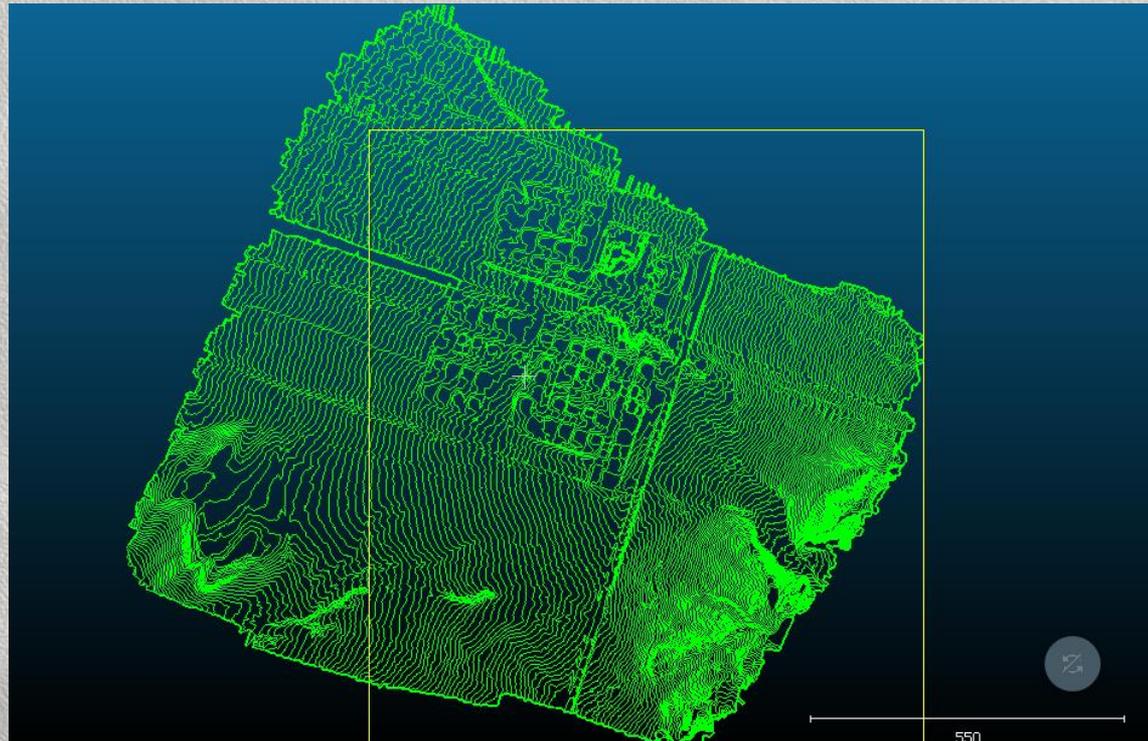
DETAILED TERRAIN

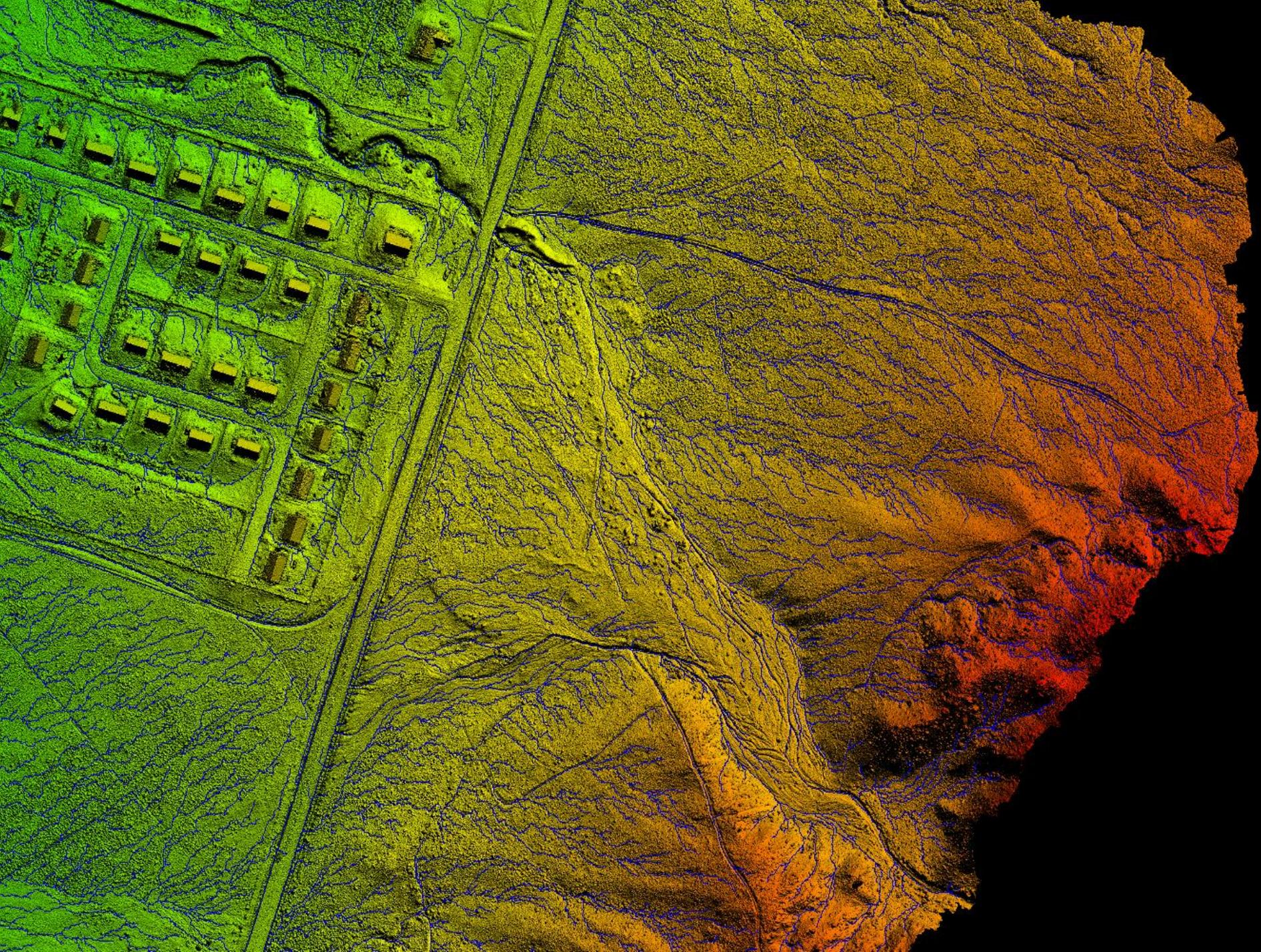
- Detailed imagery collected using an Unmanned Aircraft System (UAS) flown at 200-250 feet.



DETAILED TERRAIN – PROCESSING

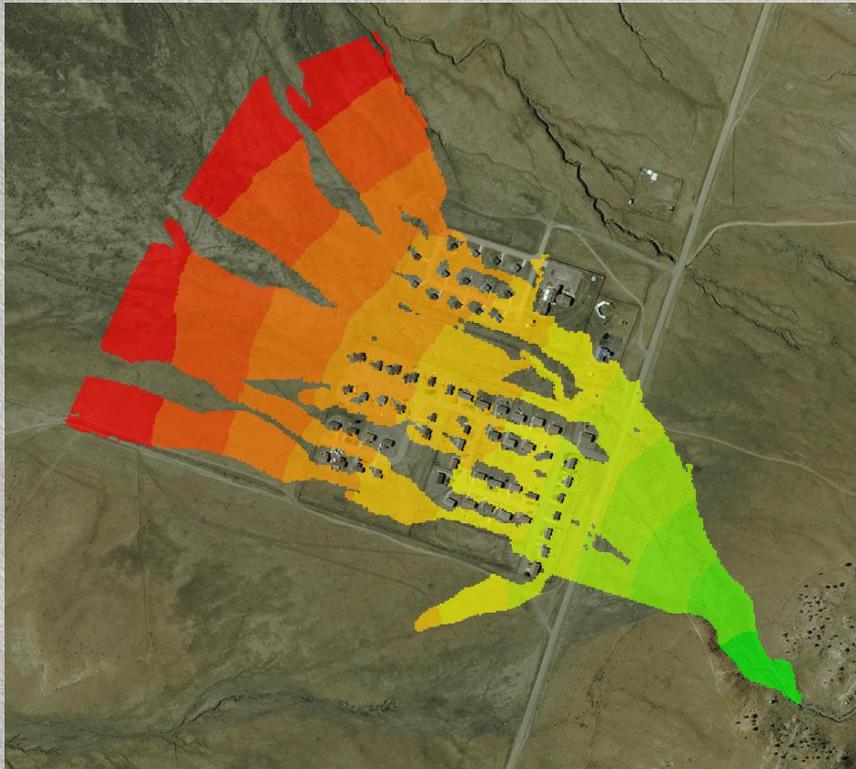
- Data processed using photogrammetric techniques to develop a detailed DEM.
- 0.5 foot DEM was produced capable of 3 inch contours.



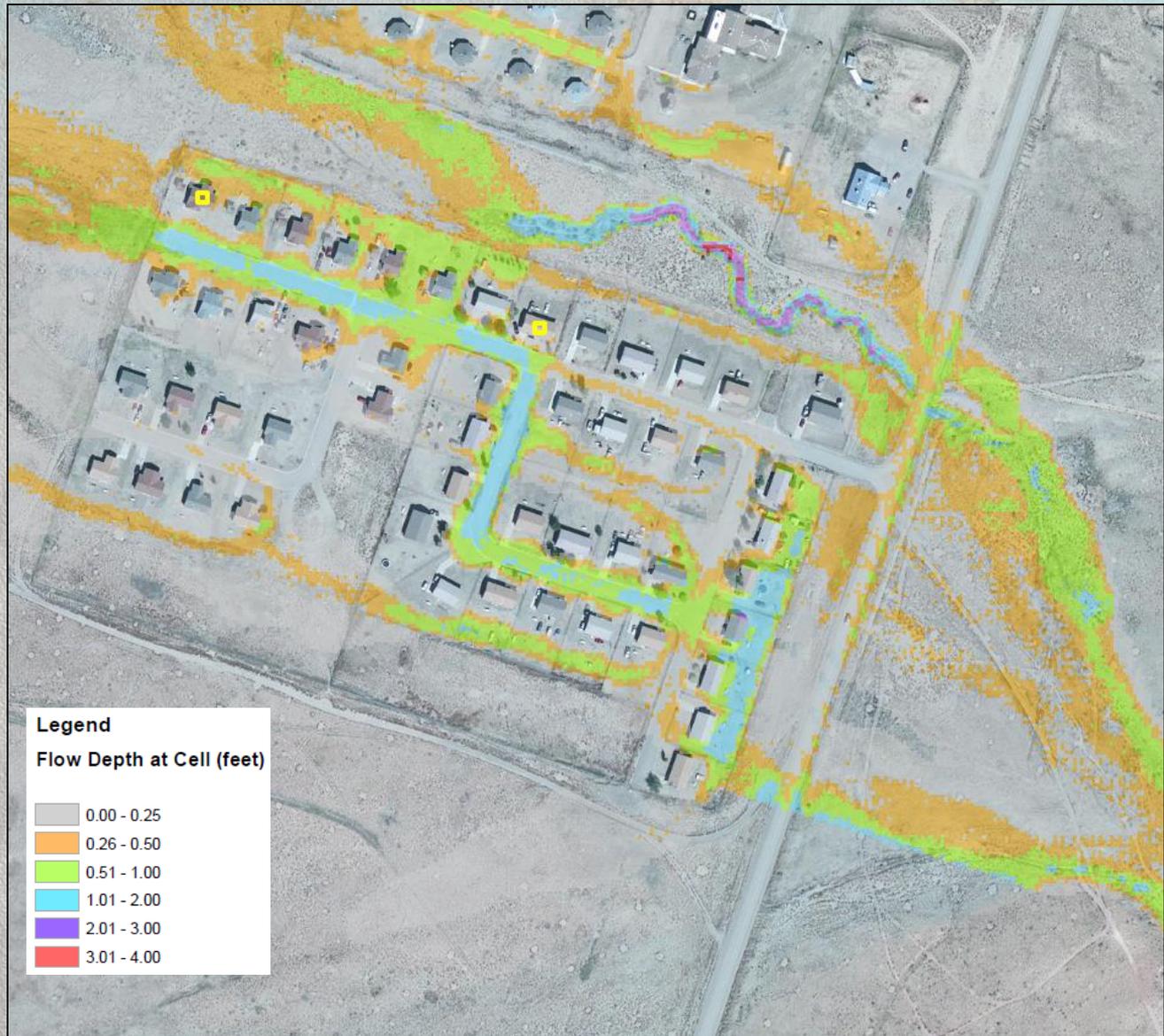


GRID BASED FLO-2D

- Hydrology: HEC-HMS 100-year, 24-hour storm
- Hydraulics: reflects the entire storm flow being conveyed toward the subdivision.



FLOW DEPTH



RESULT

- FLO-2D Maximum Water Surface Elevation / Finished First Floor Elevation Comparison

HOUSING UNIT	HOUSING UNIT LOCATION AND DESCRIPTION	ELEV _{FF}	ELEV _{LAG}	100-YR, 24-HR WATER SURFACE ELEVATION
		[m]	[m]	[FEET]
AZ12-130 #13	Eastern upstream unit	1911.66	1911.31	1911.2
AZ12-155 #37	Western downstream unit	1907.32	1907.01	1907.2

SUMMARY

- UAS provided a low cost method of obtaining detailed terrain.
- 2D modeling defined the flow paths and delineated a multi-branched floodplain across an alluvial fan .
- Results allowed NHA to make informed subdivision planning and housing reconstruction decisions.



THANK YOU!