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SMART Flood Risk Planning using HEC-RAS 2D

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US Army Corps
of Engineers
Los Angeles District

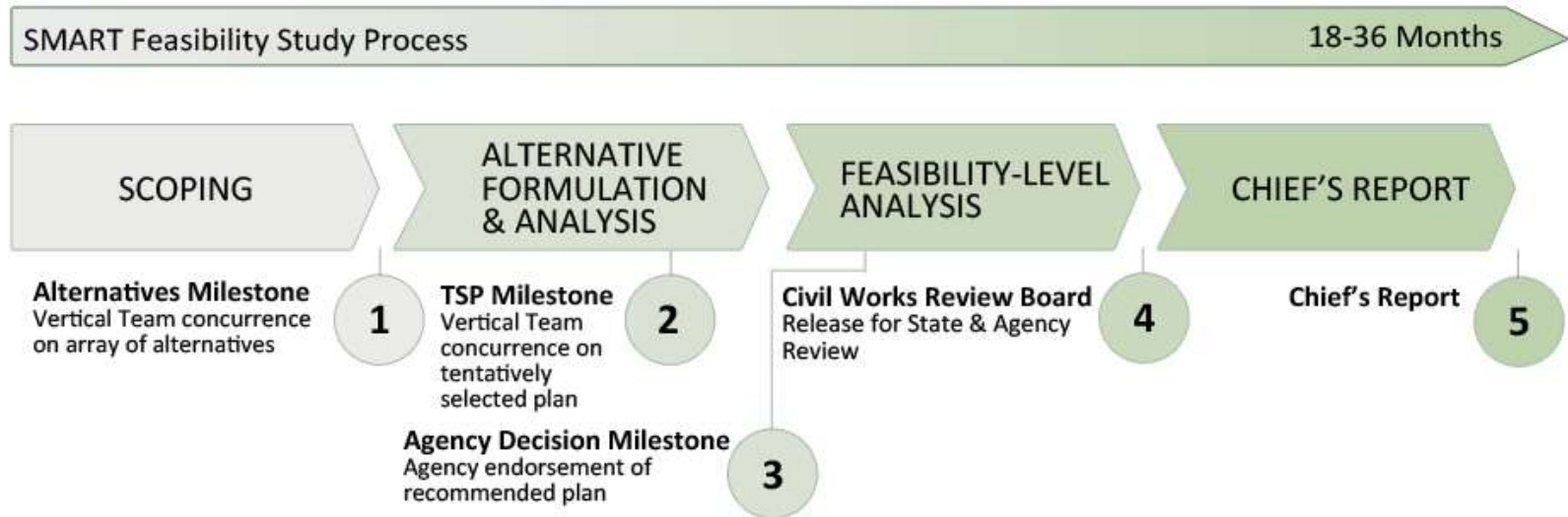
USACE Civil Works Transformation

- Change in Feasibility Studies
- Were too detailed, expensive and time-consuming.
- Process modernization needed



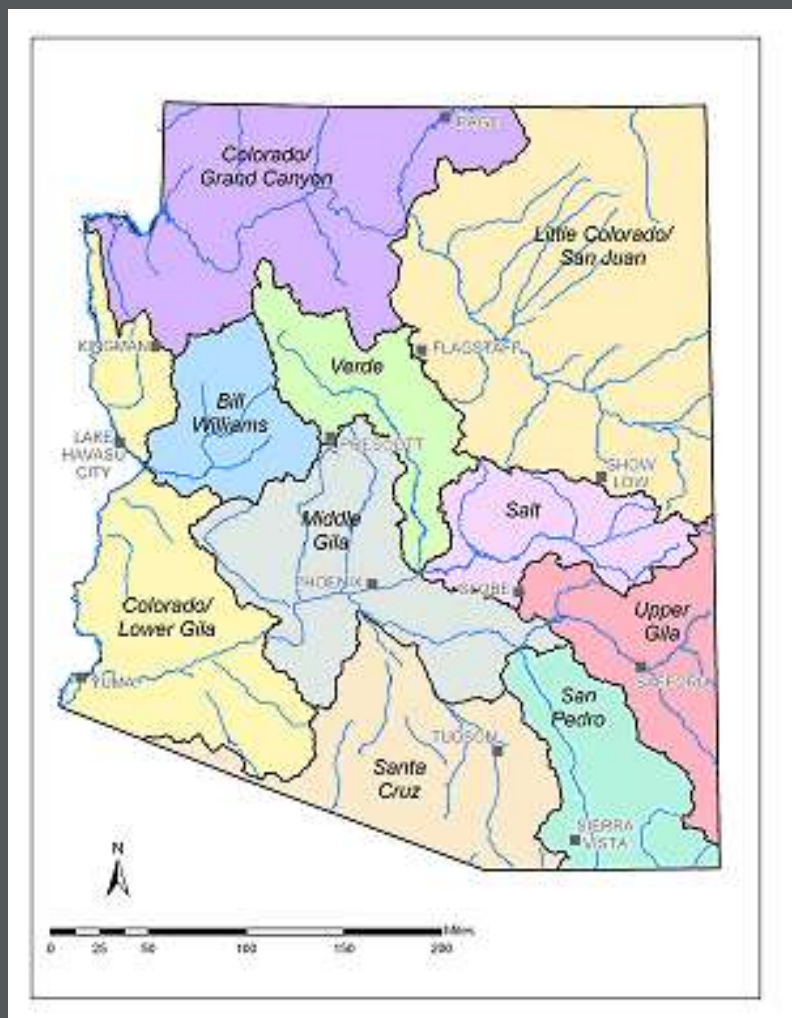
SMART Planning

- SMART (Specific, Measurable, Attainable, Risk-Informed, Timely)
- In 2014, USACE initiated 9 new studies under SMART
- 3 x 3 x 3 Rule (3 years, \$3 mil, 3 levels of vertical coordination)
- Shorter timeframes, lower costs
- Report lengths < 100 pages



Project Background

- Lower Santa Cruz River Feasibility Study
- Watershed: 1,400 sq. mi.
 - Mostly agricultural fields
 - 5 Towns
 - 3 Indian Communities
- Project Reach: 80 miles



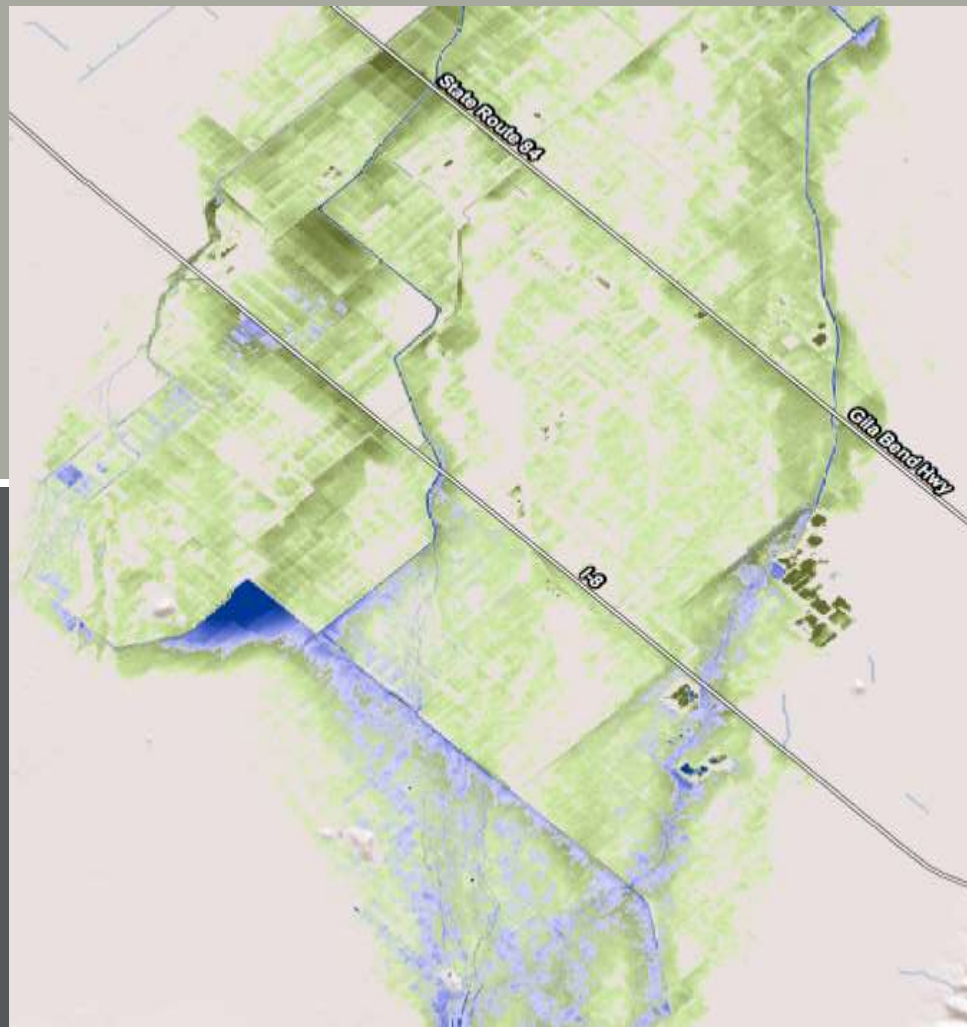
Project History

- Long history of catastrophic flooding
- Severe damage to crops, farms, residents, businesses and infrastructure
- Aerial evacuations, bridge closures, serious river erosion, channel migration and sediment deposition
- Dramatic population growth in the watershed in the past decade



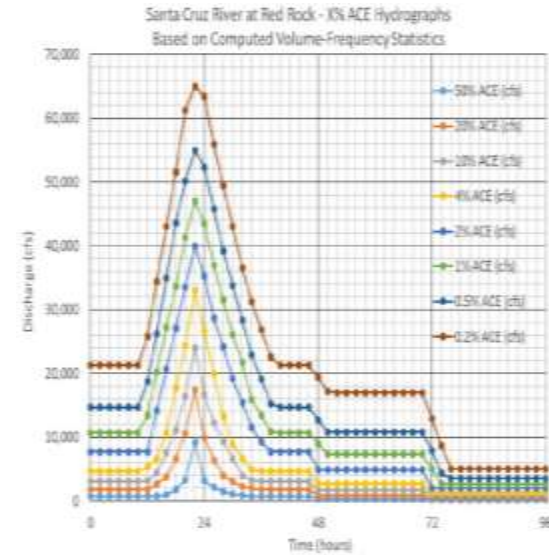
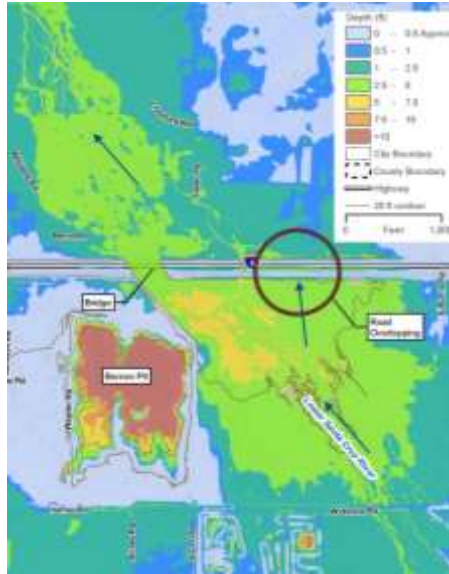
Existing Flow Characteristics

- Wide Range of Conditions
- Highly Braided and Multiple Split Flow Locations
- Shallow Flow
- Multiple Long Linear Features
- Multiple Canals
- Subsidence Areas
- Multiple Complex Tributaries



Scope

- Geotechnical Study
- Hydrology
- Hydraulics
- Sedimentation
- Alternatives Development



Approach

- Flood Risk
 - Hydrology
 - HEC-HMS
 - Historical Data Review
 - **Hydraulics**
 - HEC-RAS 2D
 - **Sedimentation**
 - HEC-RAS 1D Sediment
 - **Economics**
 - HEC-FDA

*Collaborate with Corps

Desert



Flood Control
Facilities



Residential



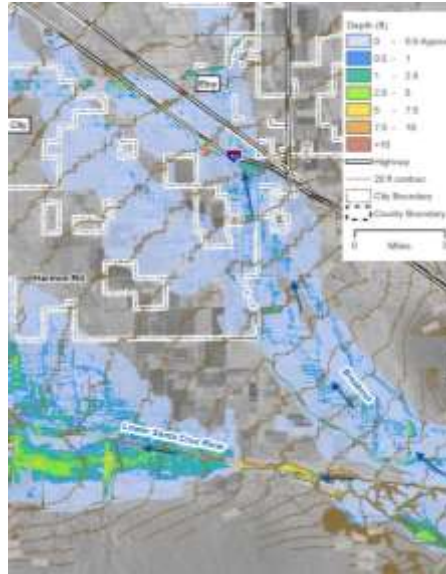
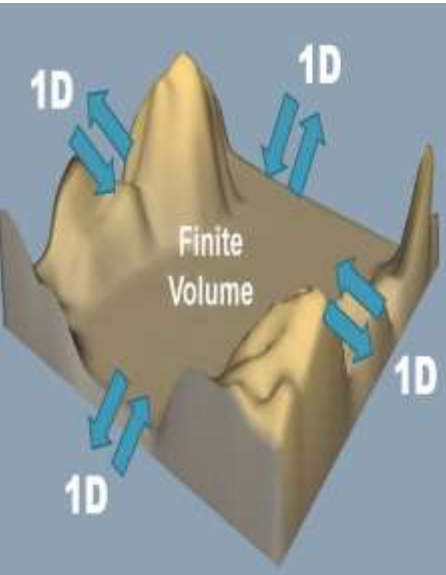
Agricultural



HEC-RAS 2D

- Efficient model
- Good terrain representation
- Split flow paths
- USACE preferred*

*For this project



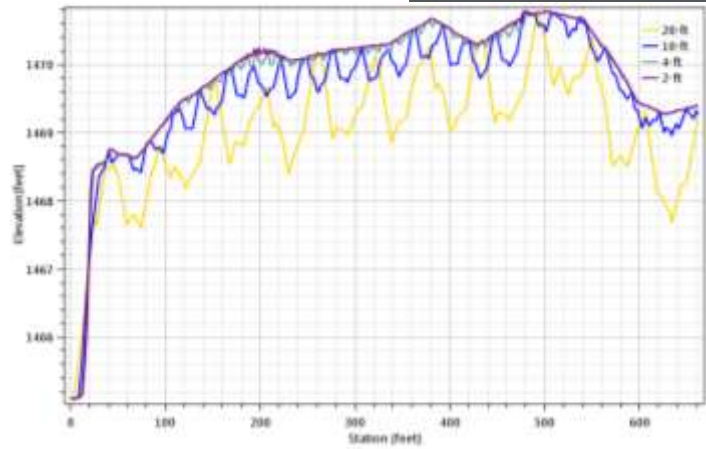
HEC-RAS Sediment

- Well established model
- Fairly easy to use
- Stable platform
- USACE preferred*



Hydraulic Modeling Inputs (ground breaking...)

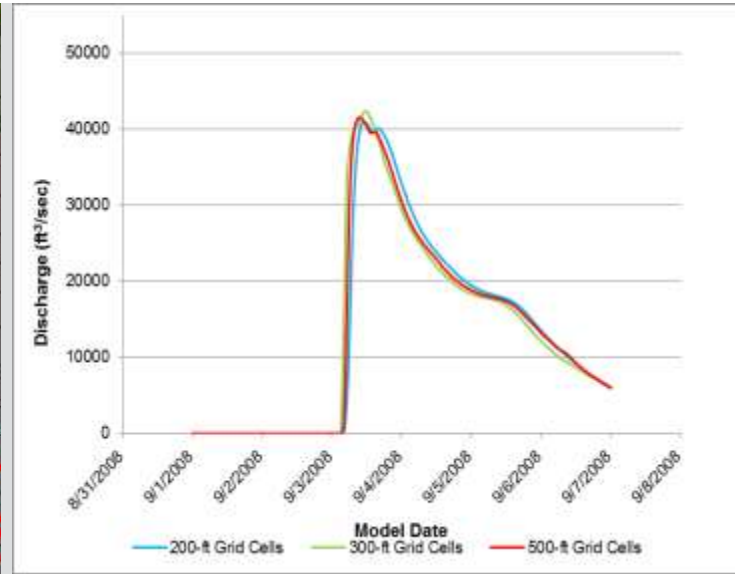
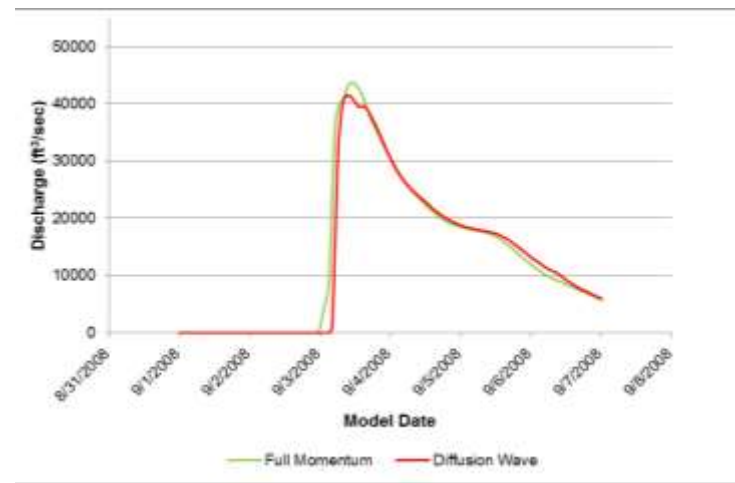
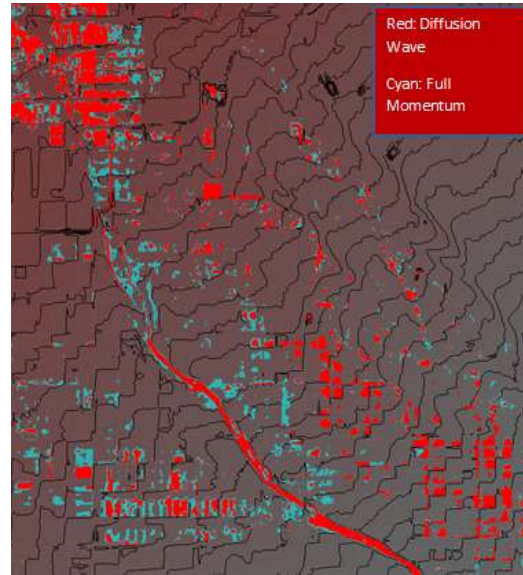
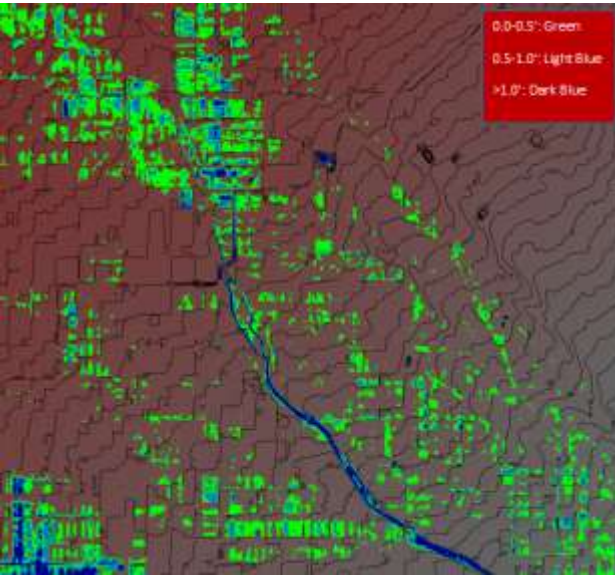
- Approach Based!
 - GIS Database
 - Sediment samples
 - Joint effort with USACE
- Topography
 - Very detailed
- Aerial imagery



*Have approximate flow paths identified
before going into the field

Sensitivity Analysis

- Grid Size
- Computation Equations
- Time Step
- Boundary Conditions
- Breaklines, Breaklines, Breaklines



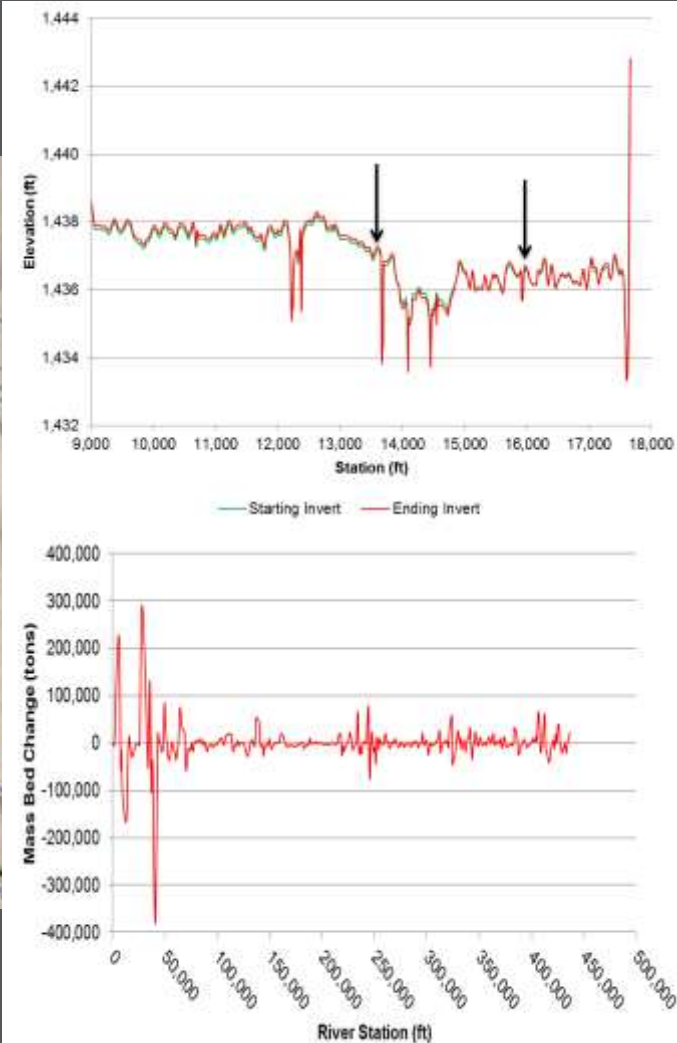
Long Term Channel Evolution

- Concerns

- Indicators of deposition and erosion
- Channelized reaches and braided reaches
- Crossing structures
- Flood impacts

- Approaches

- Use 2D results to inform 1D sediment model
- Identify TRENDS
- Confirm horizontal TRENDS



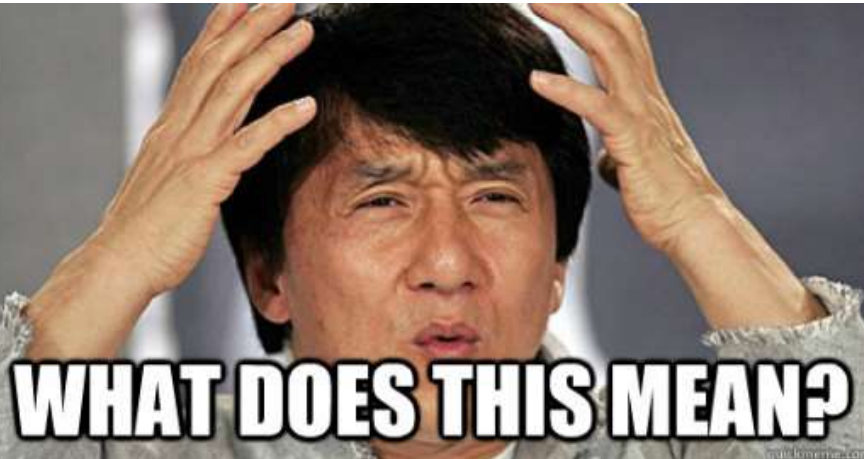
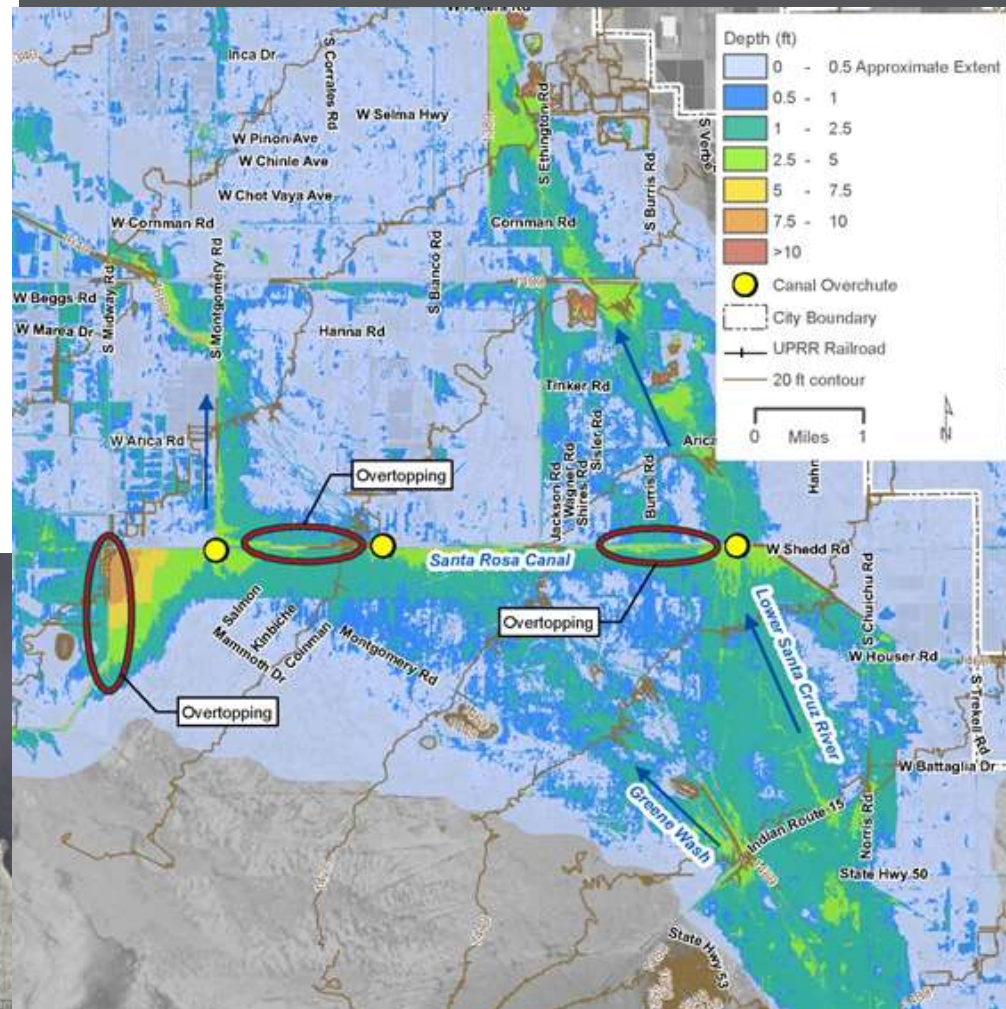
1D Channelized Approaches with 2D Tools...

- Flood breakout areas
 - Levee vs. Braided
- Similar land use areas
 - Desert vs. Rural
- Flood frequency analysis
 - Levee vs. Braided



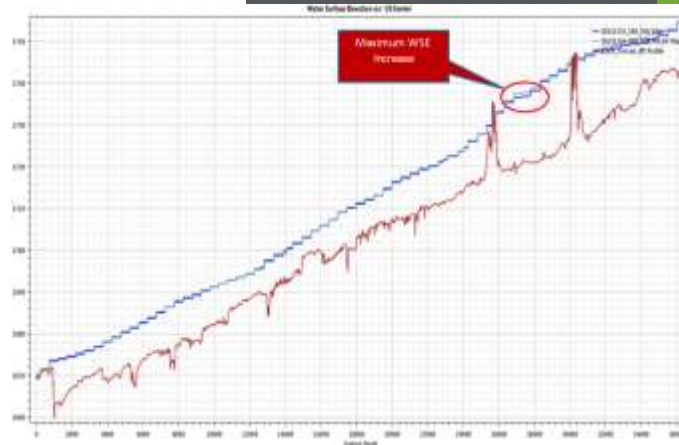
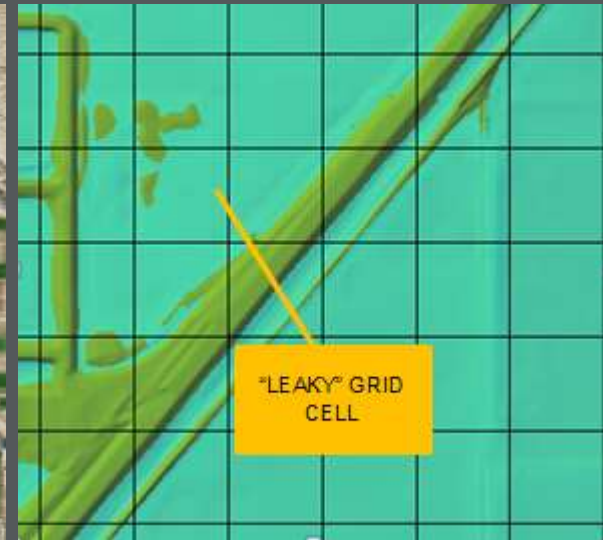
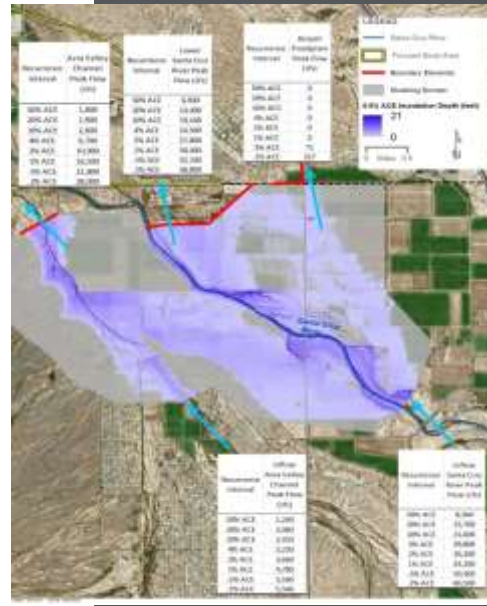
What did we learn?

- Modeling Approaches
- Modeling Result Application
- Presentation of Results
- All Hands on Deck!



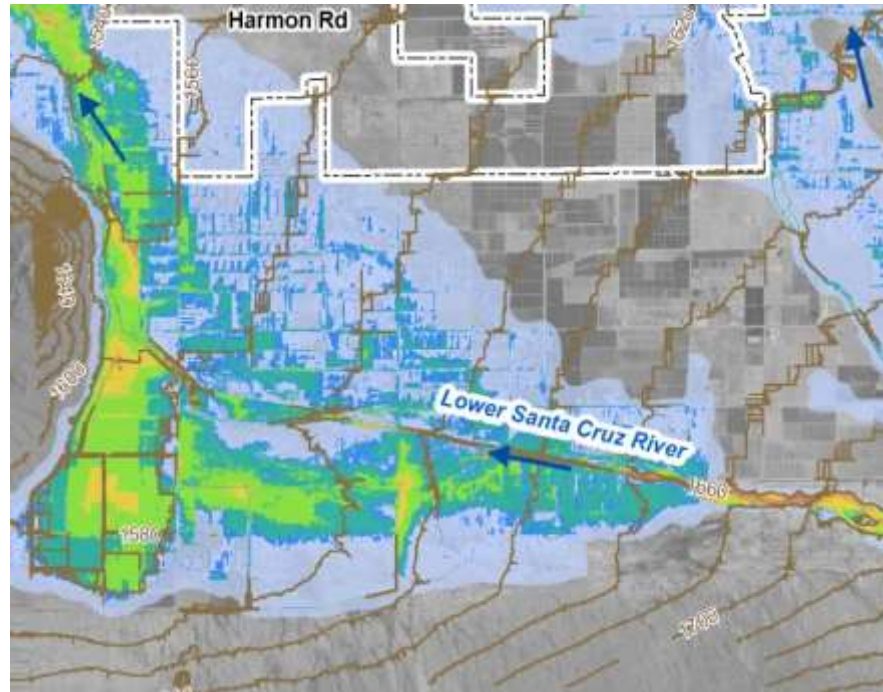
Modeling Approaches

- Understand Model Limitations/Benefits
- Complete Sensitivity Analysis!!
- Agree on Model Purpose
 - Inundation Mapping
 - Flow Concentration
 - Accuracy
- Understand Modeling Approach
 - Bridges
 - Breaklines
 - Culverts
 - Equations
 - Boundary Condition



Modeling Result Application

- Understand Results
- Establish Confidence in Results



Presentation of Results

- Internal/External Audience
- Discussion Based
- Detail Based
- What are we showing?
- Modeling Result Application



OR?



All Hands on Deck!

- New Process and Software Requires:
 - Communication at all Levels!
 - Addressing all Concerns!





THANK YOU!