



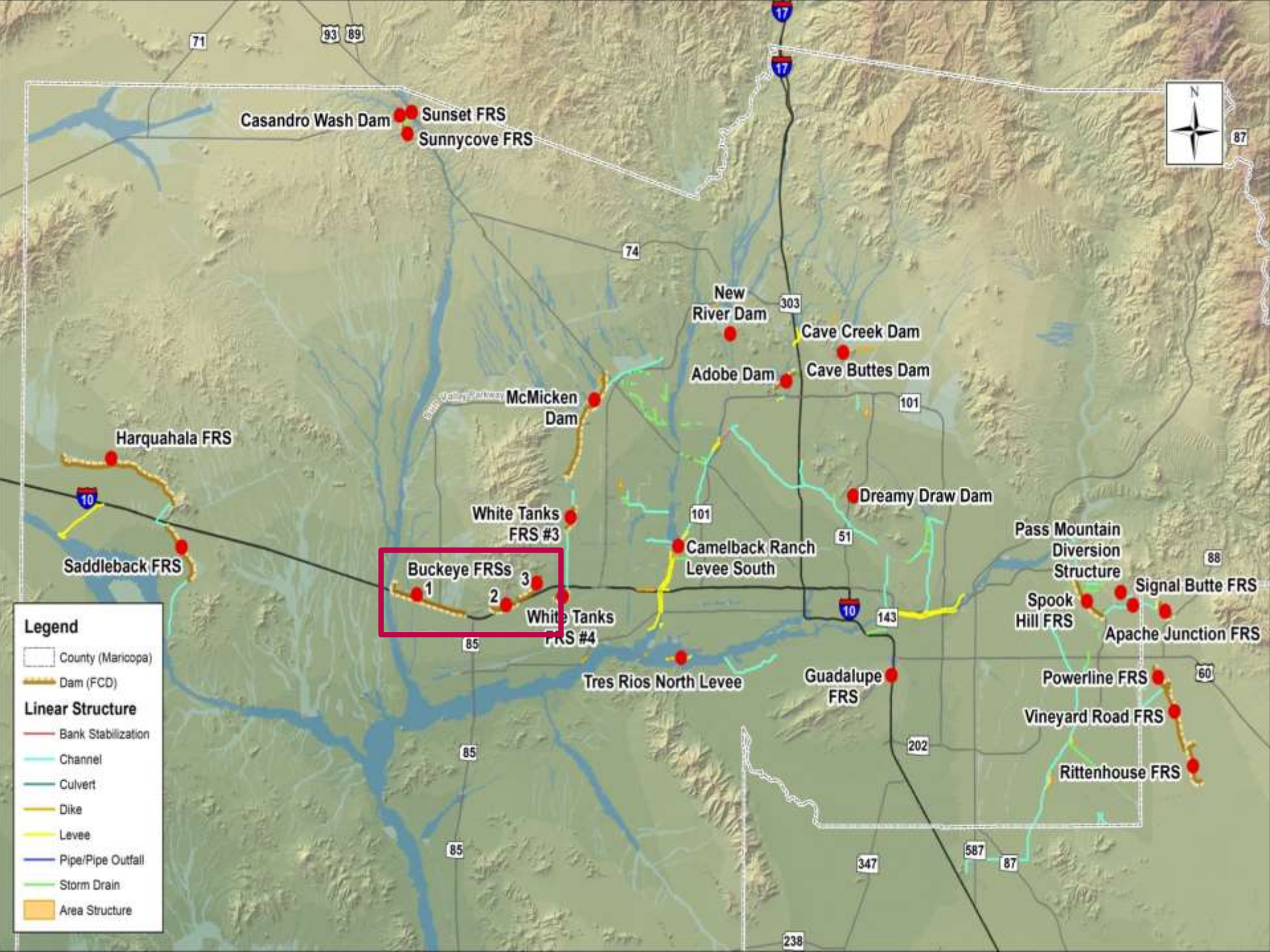
Is Detailed 2D Modelling of Dam Breach Inundation Worth the Expense?

Hussein M. Hussein, PE, CFM

Agenda

- Background about FCDMC dams
- Why do we need EAPs?
- Buckeye Structures
 - History
 - Dam Breach Analysis
 - Hazard Identification
- Inundation limits 1D vs 2D
- Recap





Why do we have EAP's?

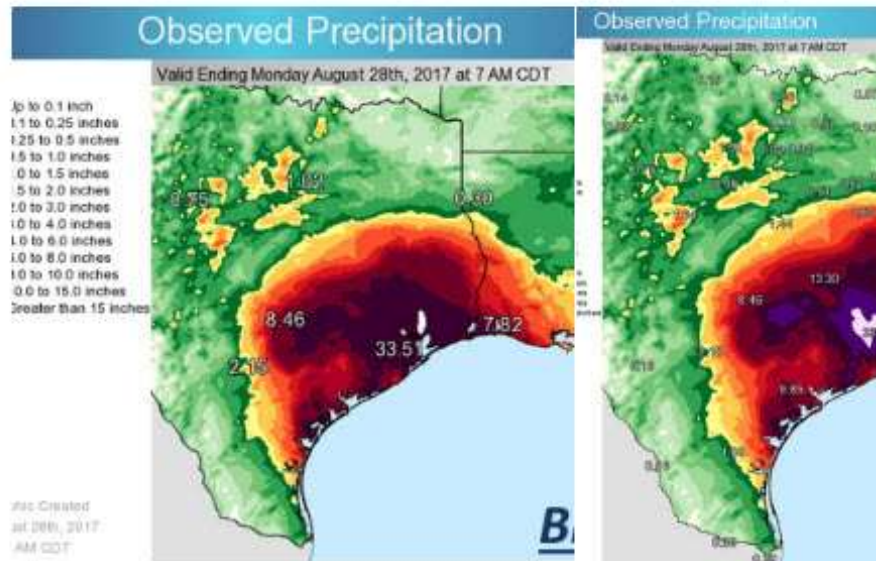


Why do we have EAP's?



NWS
@NWS

#Harvey in perspective. So much rain has fallen, we've had to update the color scale on our graphics in order to effectively



7:21 AM - 28 Aug 2017

NOTICE:

The levee at Columbia
Lakes has been
breached!!

GET OUT NOW!!



Brazoria County
@BrazoriaCounty

Follow

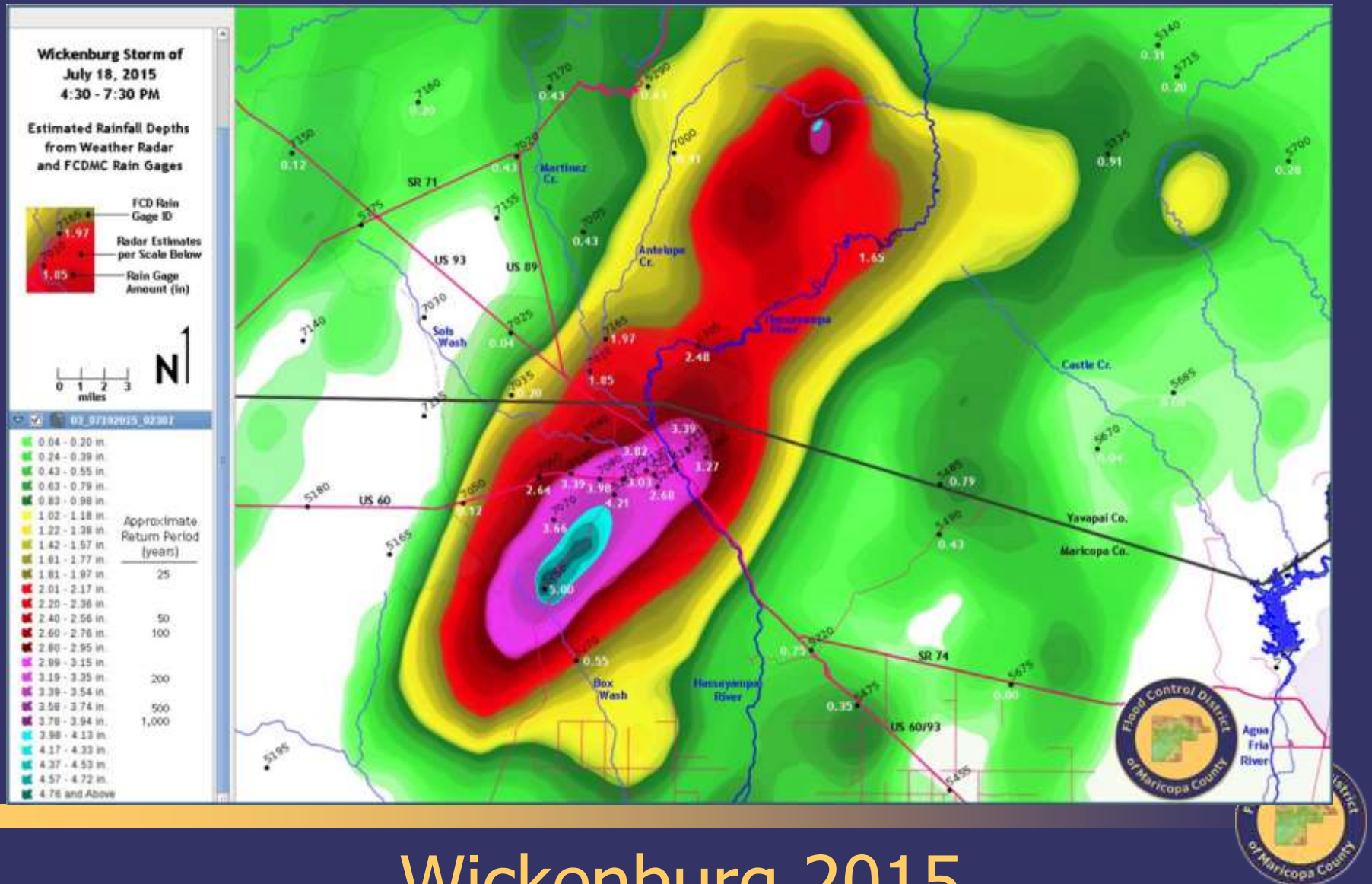
7:31 AM - Aug 29, 2017

39 1,250 333

Hurricane Harvey



Why do we have EAP's?



Why do we have EAP's?



Wickenburg 2015



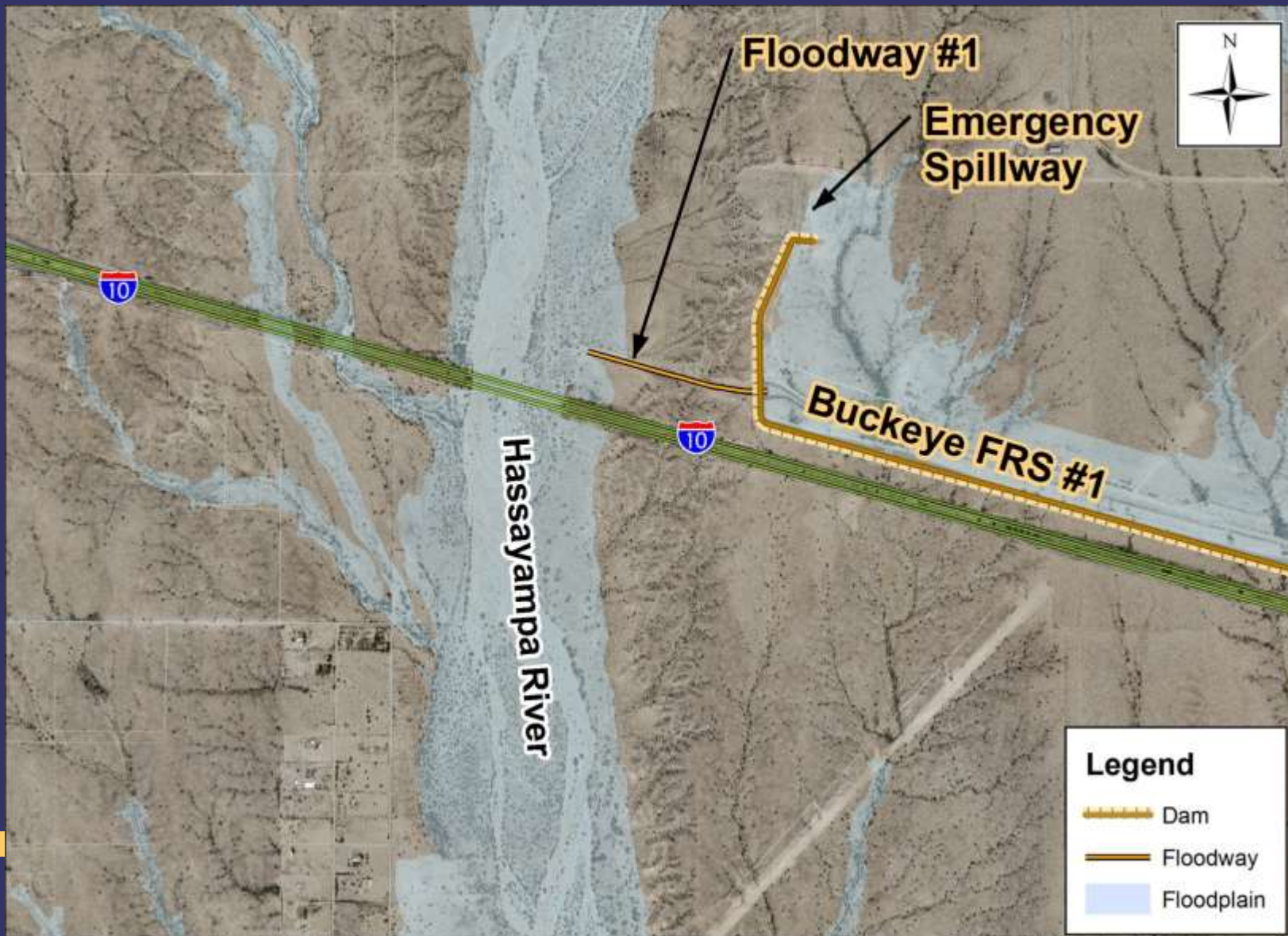
Buckeye Structures



Structure	Length (mi)	Dam Height (ft)	Drainage Area (mi ²)	Storage Capacity (ac-ft)
Buckeye FRS No.1	7.14	27.7	76.2	10,012
Buckeye FRS No.2	2.29	22	5.7	842
Buckeye FRS No.3	3.19	24.6	8.7	1290



Buckeye Structures



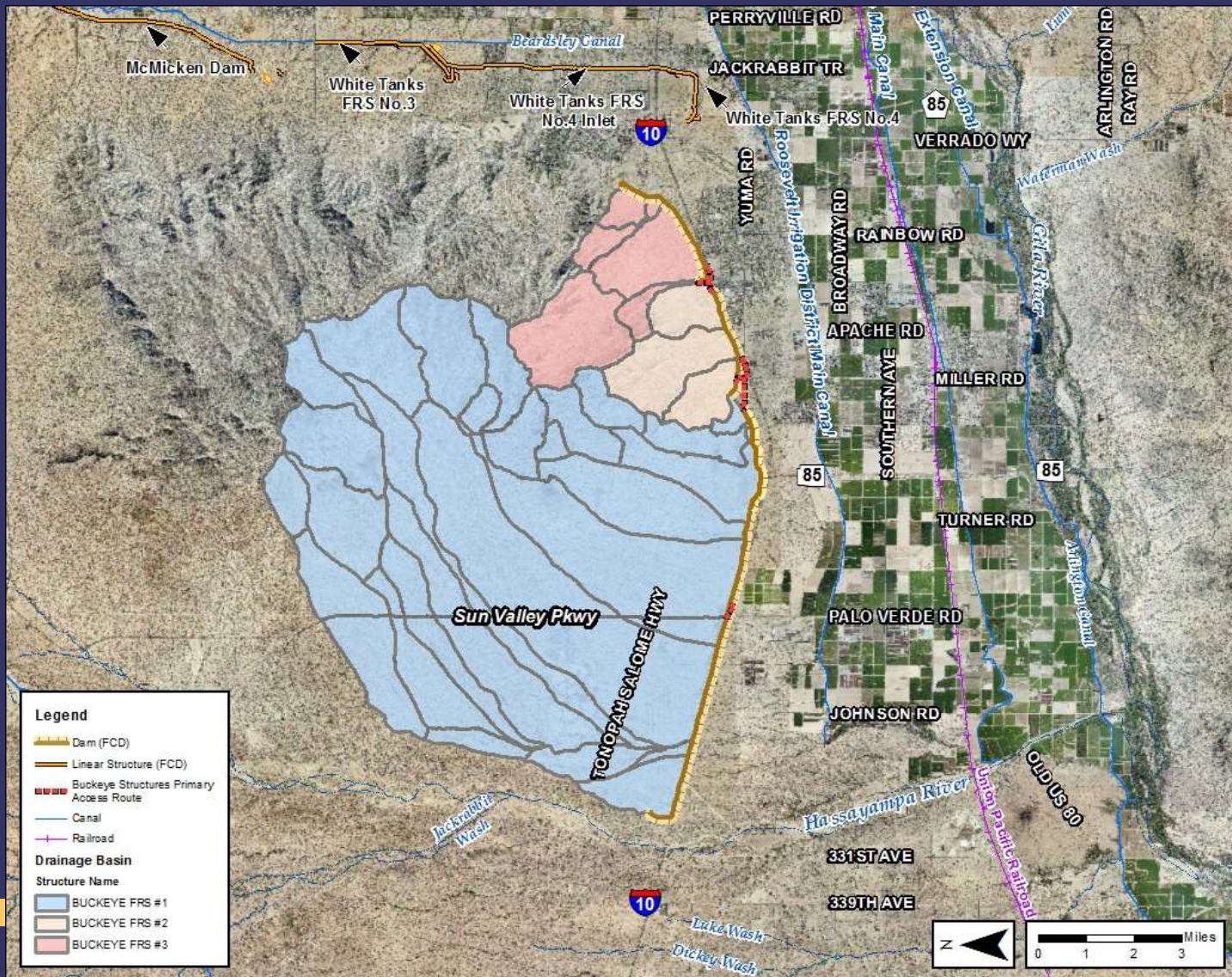
Buckeye FRS # 3



Buckeye FRS # 1



Drainage Basins



Inflow Hydrographs

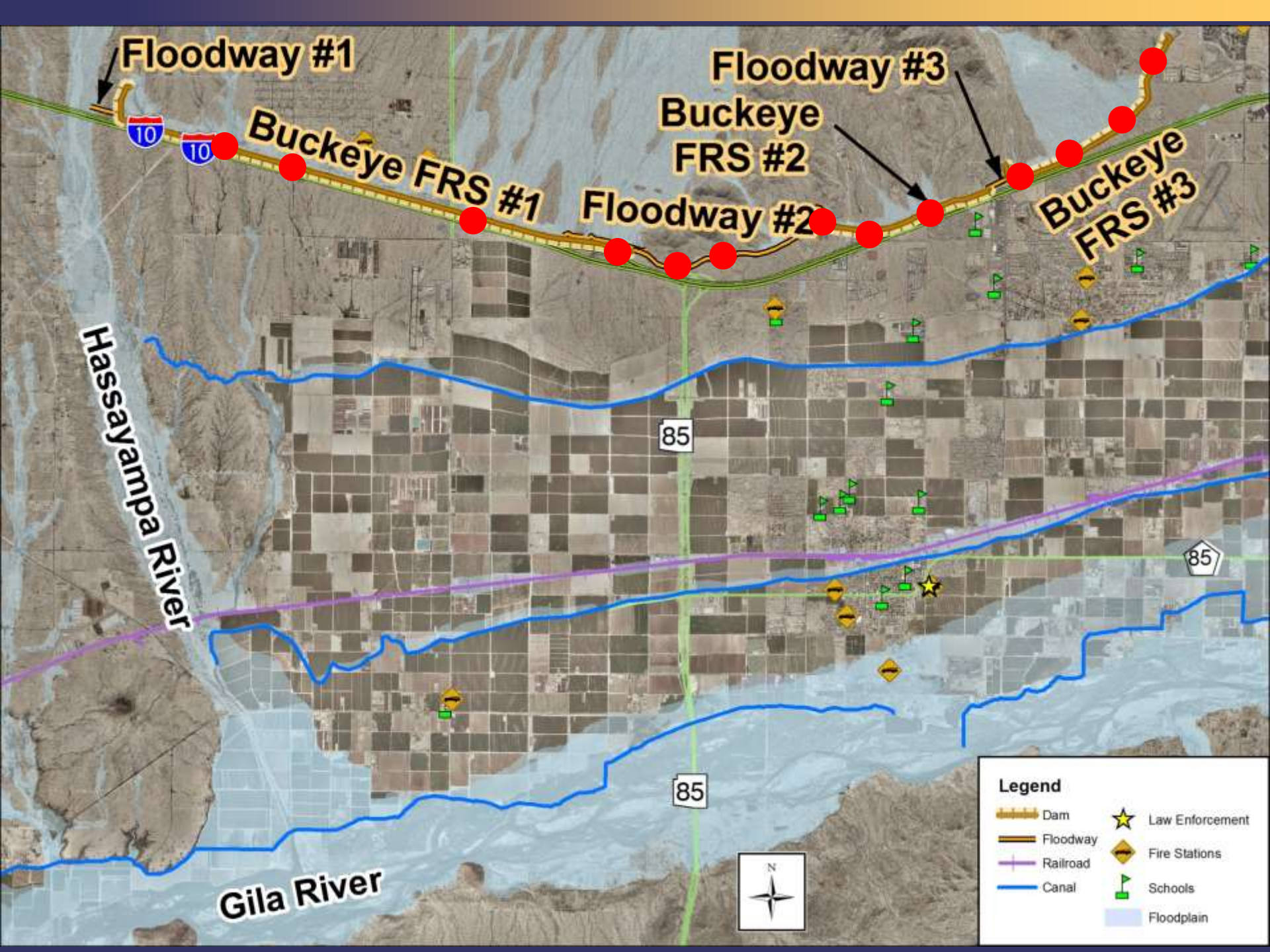
- HEC-1 Model for the reservoir inflow
 - 6-hr PMF
 - Sunny day
 - One ft over ES crest elevation
 - One percent annual chance event
- Hassayampa River



Hydraulics

- HEC-RAS model (unsteady) for routing the HEC-1 inflow and dam breach scenarios
- HEC-RAS model (unsteady) for the Hassayampa River. Buckeye FRS # 1 ES spills into the Hassayampa River.
- FLO-2D for Inundation limit mapping.





Floodway #1

Floodway #3

Buckeye FRS #1

Buckeye FRS #2

Floodway #2

Buckeye FRS #3

Hassayampa River

85

85

85

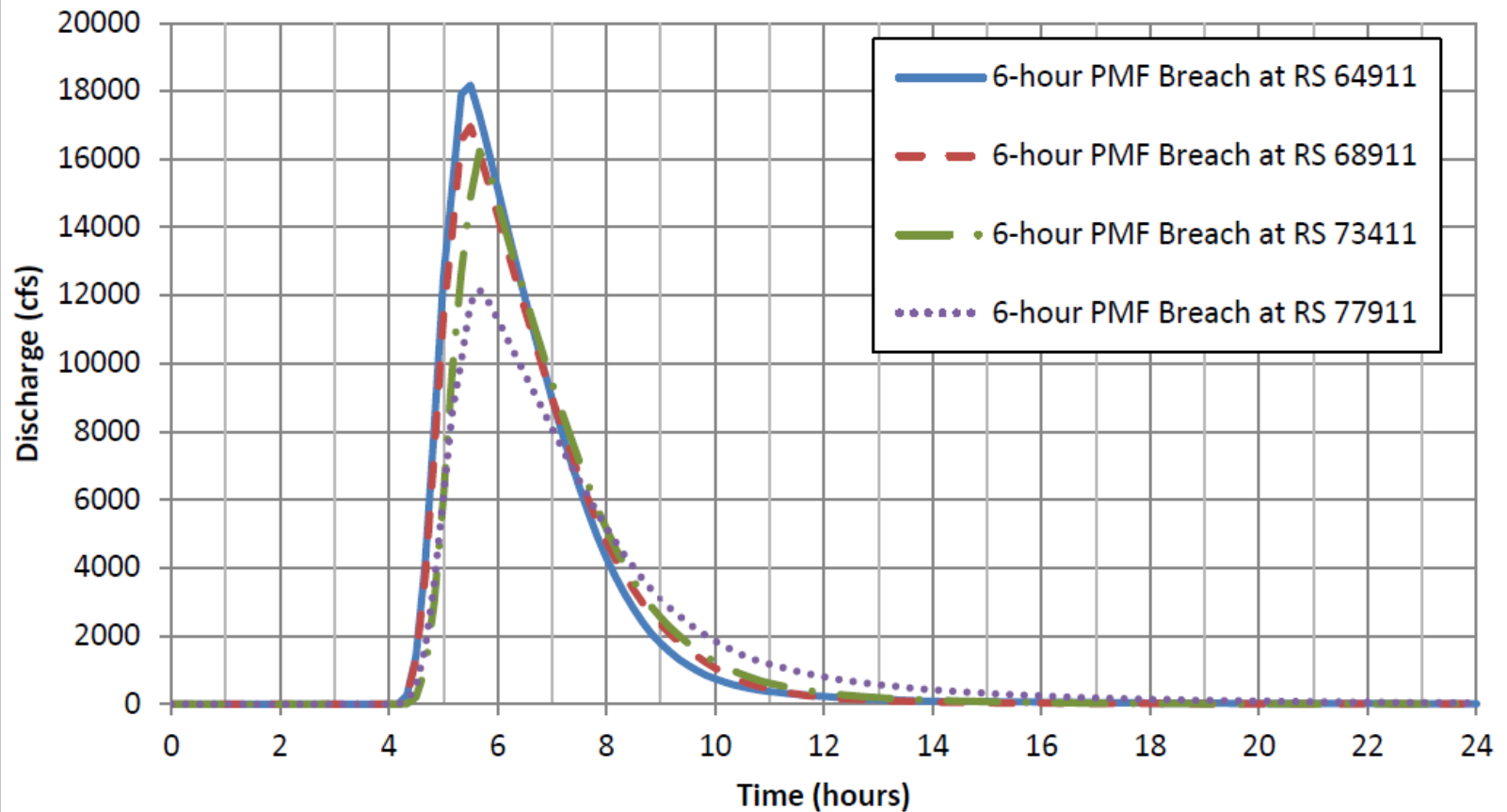
Gila River

Legend

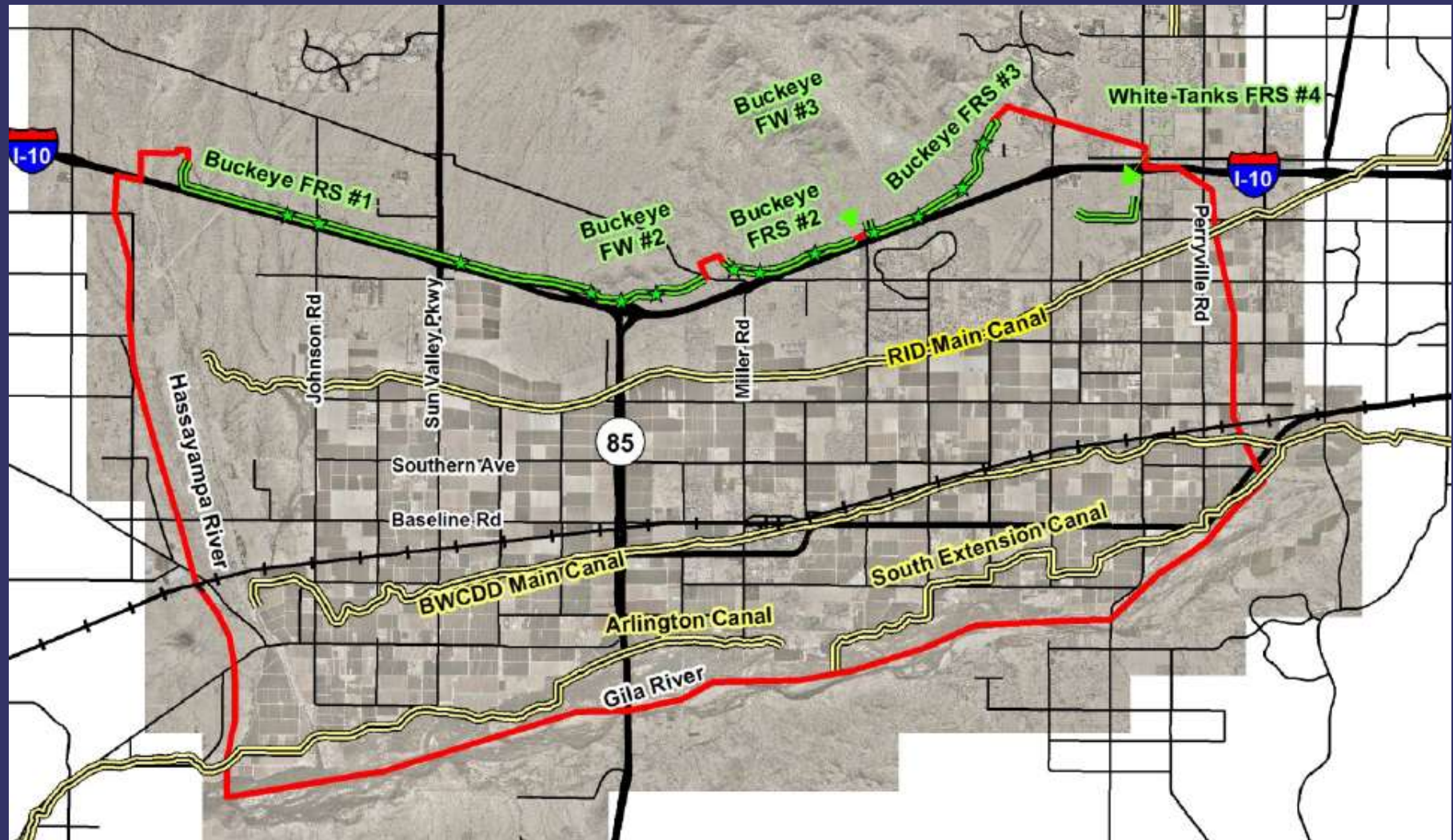
	Dam		Law Enforcement
	Floodway		Fire Stations
	Railroad		Schools
	Canal		Floodplain



Buckeye FRS # 3 – Dam Breach Outflow



Inundation Mapping



Inundation Mapping Issues

- Developments downstream
- Channel conveyance for the most part does not exist
- Facilities that affect inundation limits include:
 - Washes
 - Freeways/roadways
 - Railroad
 - Large irrigation canals
 - Walls
 - Residential and commercial buildings



Buildings



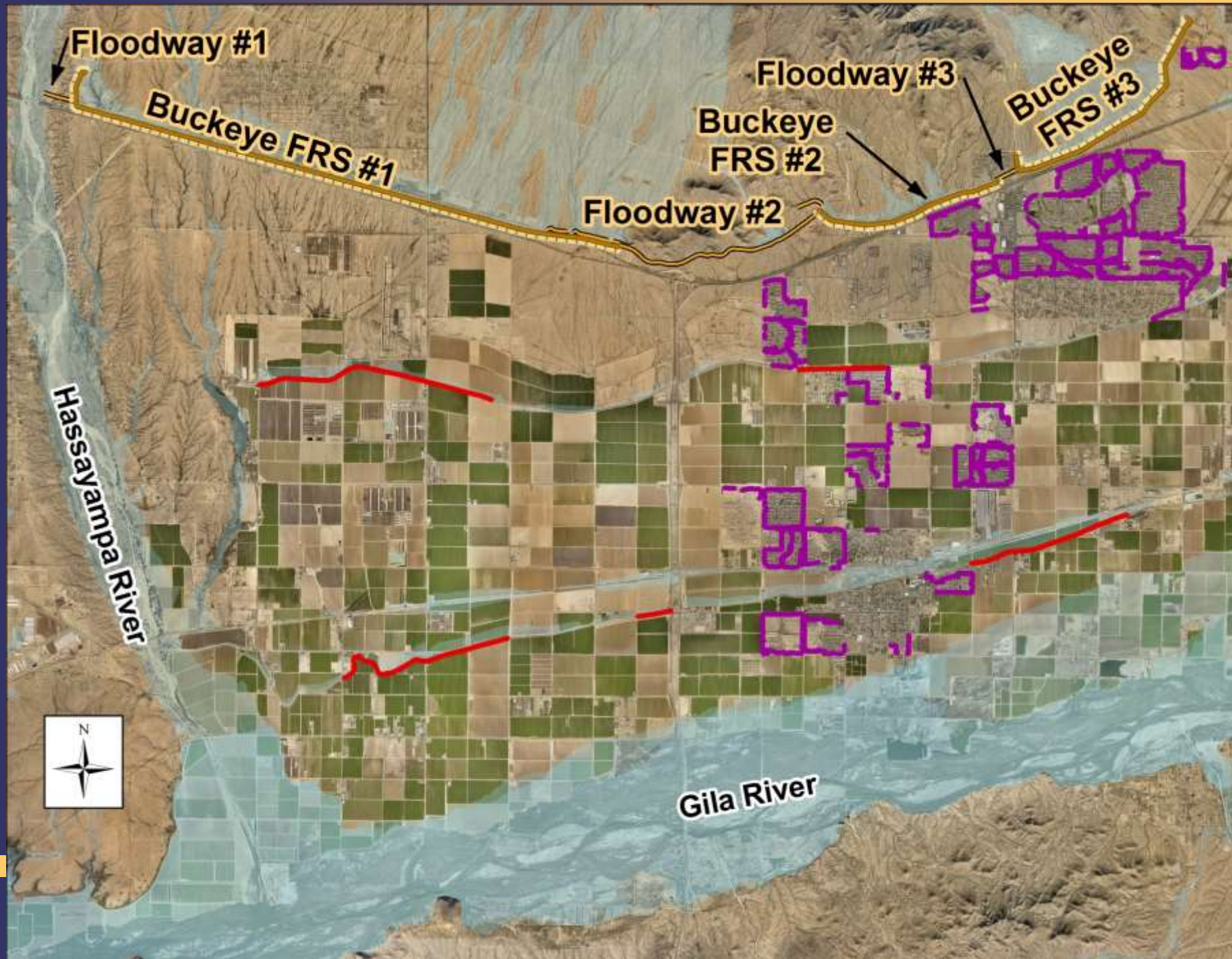
Walls



Wall Description	Inundation Depth Triggering Failure (ft)
Low quality masonry, chain-link	Not modeled
Medium quality	2.5
High quality masonry	3.0
Noise barriers along I-10	3.5

Irrigation Canals

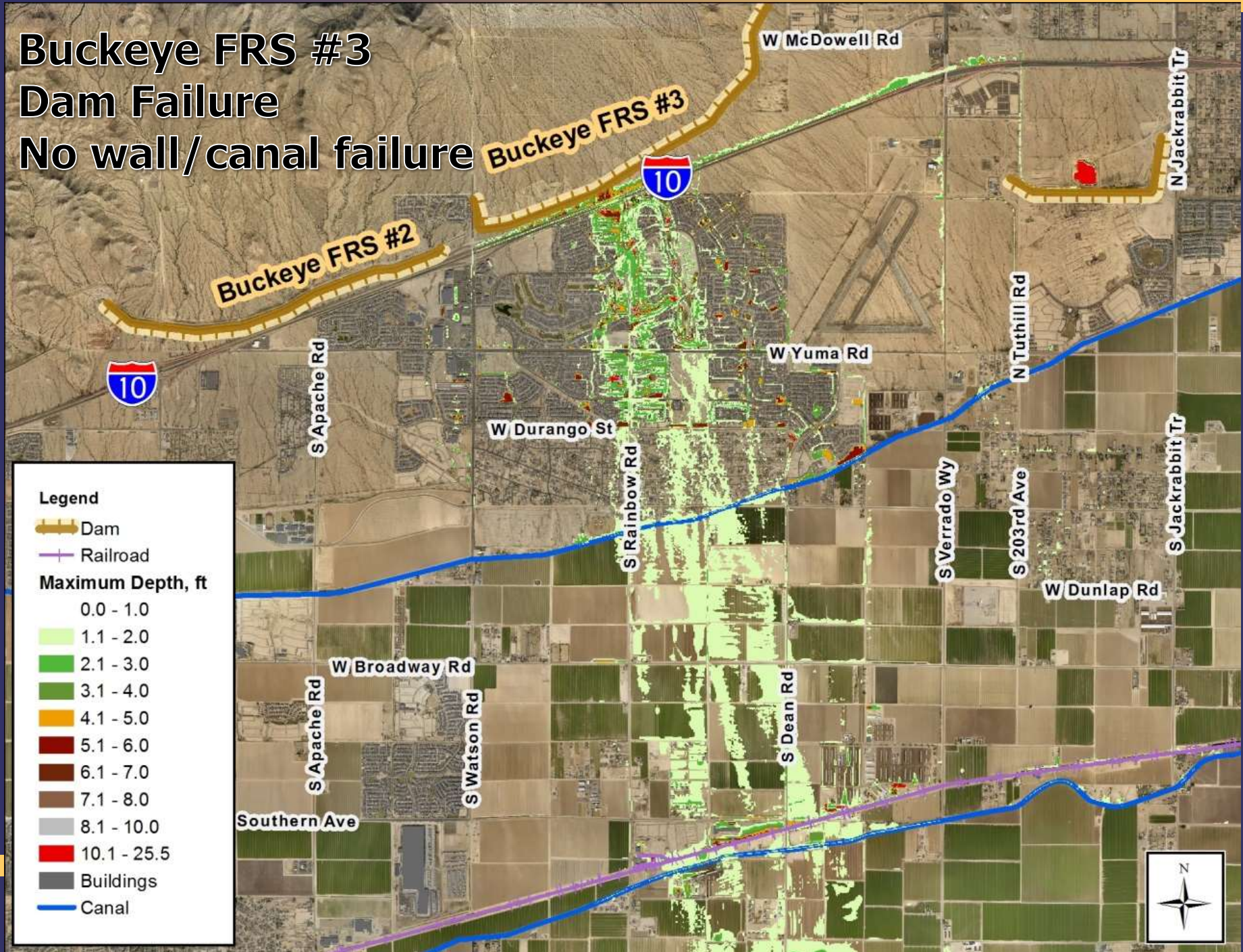




Buckeye FRS #3

Dam Failure

No wall/canal failure



Video



Inundation Limits

- Maximum depth
- Maximum velocity
- Time to one foot
- Isochrones for time to one foot
- Critical intersections
- Hazard classifications within the inundation limits



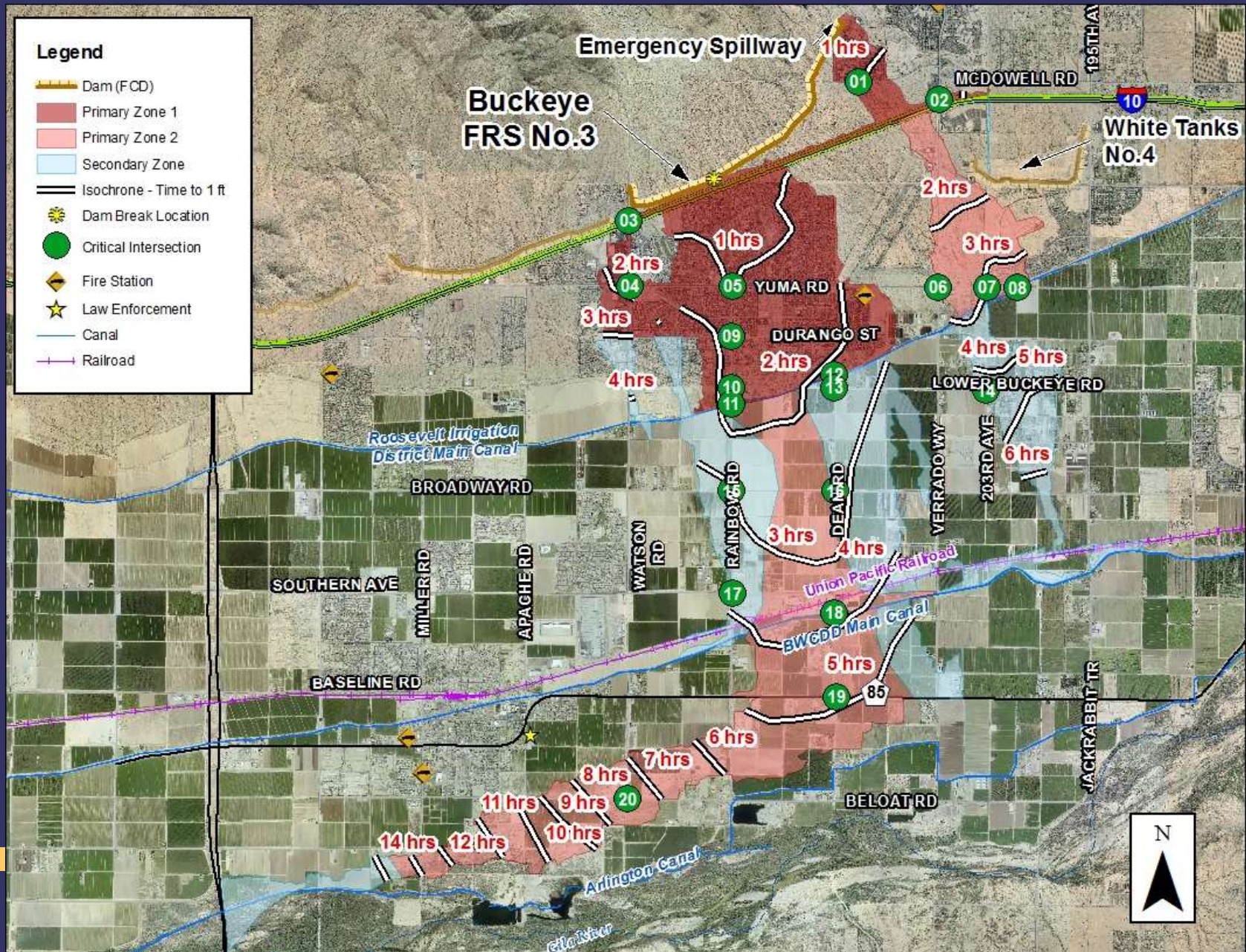
Hazard Mapping

- Composite hazard mapping
 - Flood severity (depth * velocity, depth)
 - Flood wave arrival

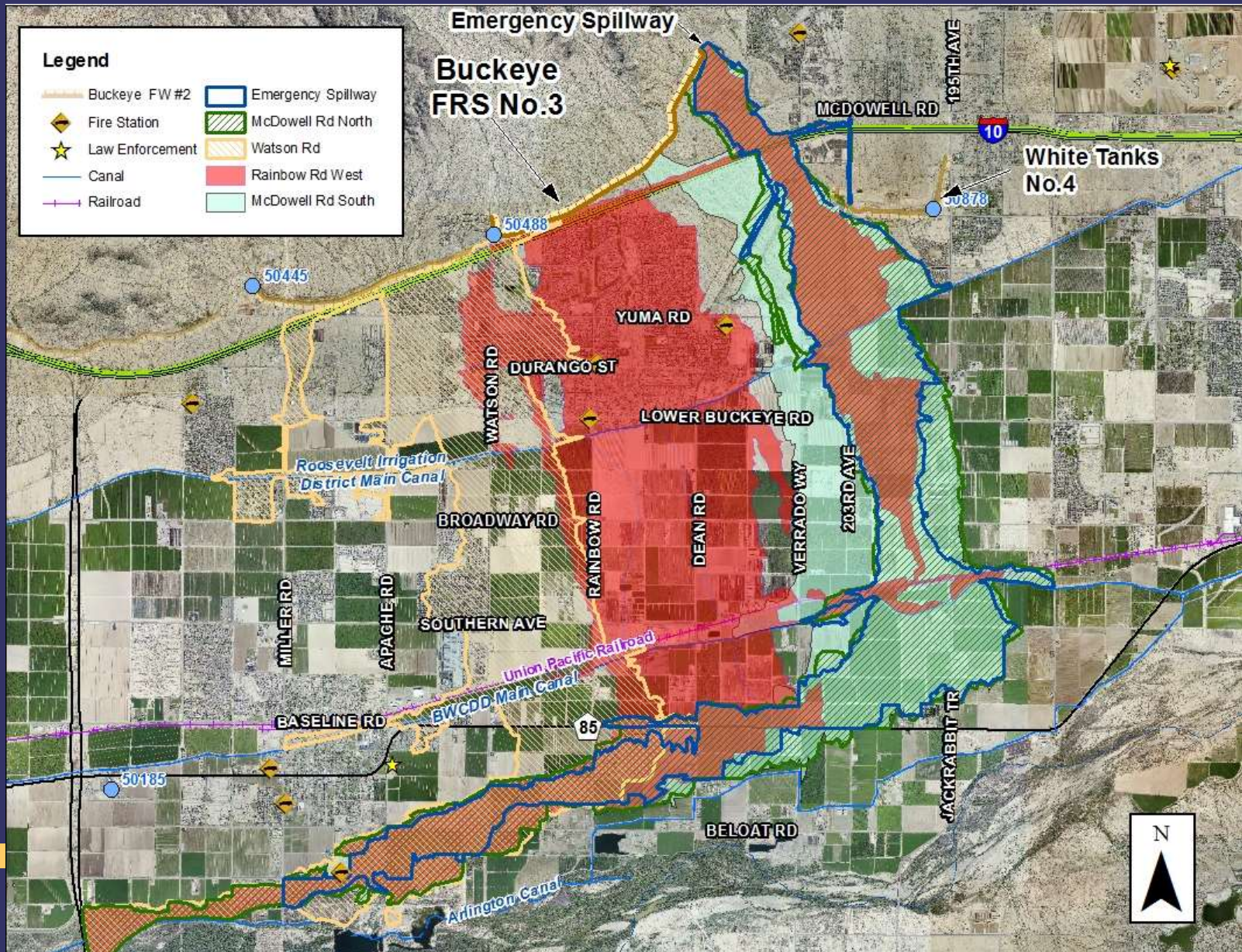
Flood Severity	High Severity	Primary Zone 1	Primary Zone 1	Primary Zone 1
	Medium Severity	Primary Zone 1	Primary Zone 2	Primary Zone 2
	Low Severity	Primary Zone 2	Secondary Zone	Secondary Zone
		< 45	45 - 90	> 90
		Flood Wave Arrival Time (min)		



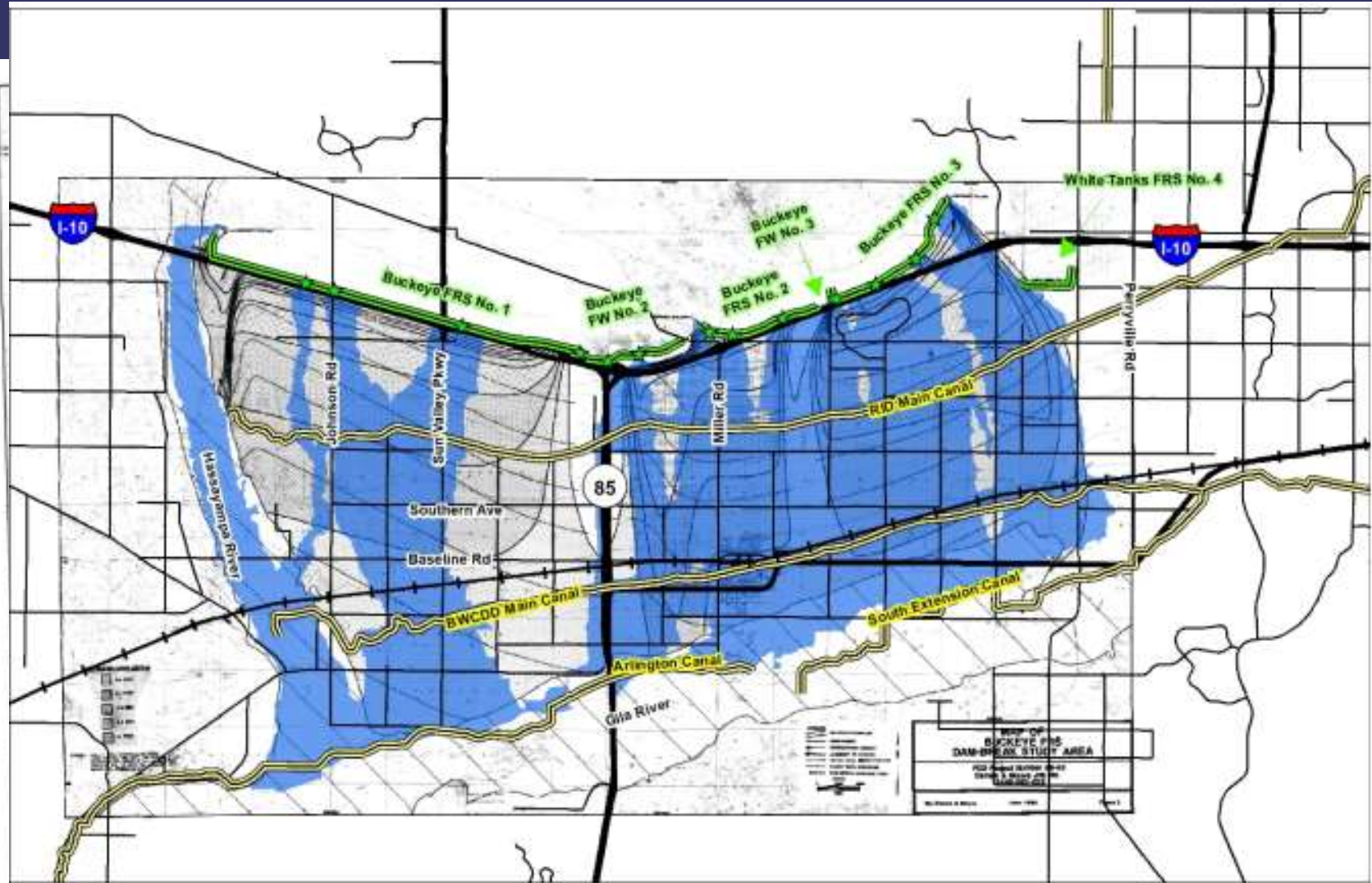
FRS # 3 – Dam Breach Scenarios



FRS # 3 – Dam Breach Scenarios



Comparison of Results



Legend

- ★ Breach Locations
- Current Study Maximum Inundation Extent
- Canal
- Flood Control Structure



Mapping Requirements

- Two-dimensional modeling (FLO-2D)
 - Surface Feature characterization
 - Detailed topography
- Traditional one dimensional modeling (HEC-RAS)
 - Detailed topography



Recap

- Reduce risk due to flooding so that property damage and loss of life is minimized
- Communicating the risks so that emergency managers can utilize the available resources
- Hazard zones assist emergency managers with a realistic number of individuals to evacuate
- Animation tools visually illustrate the flooding extents



Questions ???



Questions ???

