

North Central Texas  
Council of Governments

# Technical Advisory Group Meeting

December 5, 2025



Funded by the Texas General Land Office,  
Community Development Block Grant,  
Disaster Recovery Program.



Also Funded by the Texas Water Development Board  
and Texas Department of Transportation.

# Agenda

- I. Update on Project Progress**
- II. Impacts of Valley Storage Loss**
- III. Model Development Codes & Floodplain Ordinances**

- V. Watershed Modeling & Optimization**
- VI. Flood Warning System Evaluation**
- VII. Outreach to Local Governments**
- VIII. Next Steps & Upcoming Events**

# Update on Project Progress

NCTCOG

Jeff Neal, PTP

# Progress to Date

## Outreach Tasks

- 4 rounds of meetings in study area
- 9 Technical Advisory Group meetings
- 8 Steering Committee meetings
- 4 Workshops
- 24 Community site visits
- 1 Multi-community site visit
- Stakeholder Engagement Plan
- Local Government FAQ

## Technical Tasks

- Literature review
- Pilot studies
- H&H SOPs
- Storm shifting SOPs
- H&H – West Study Area
- Stacking model – West Study Area
- Optimization study – West Study Area
- H&H launch – North Study Area



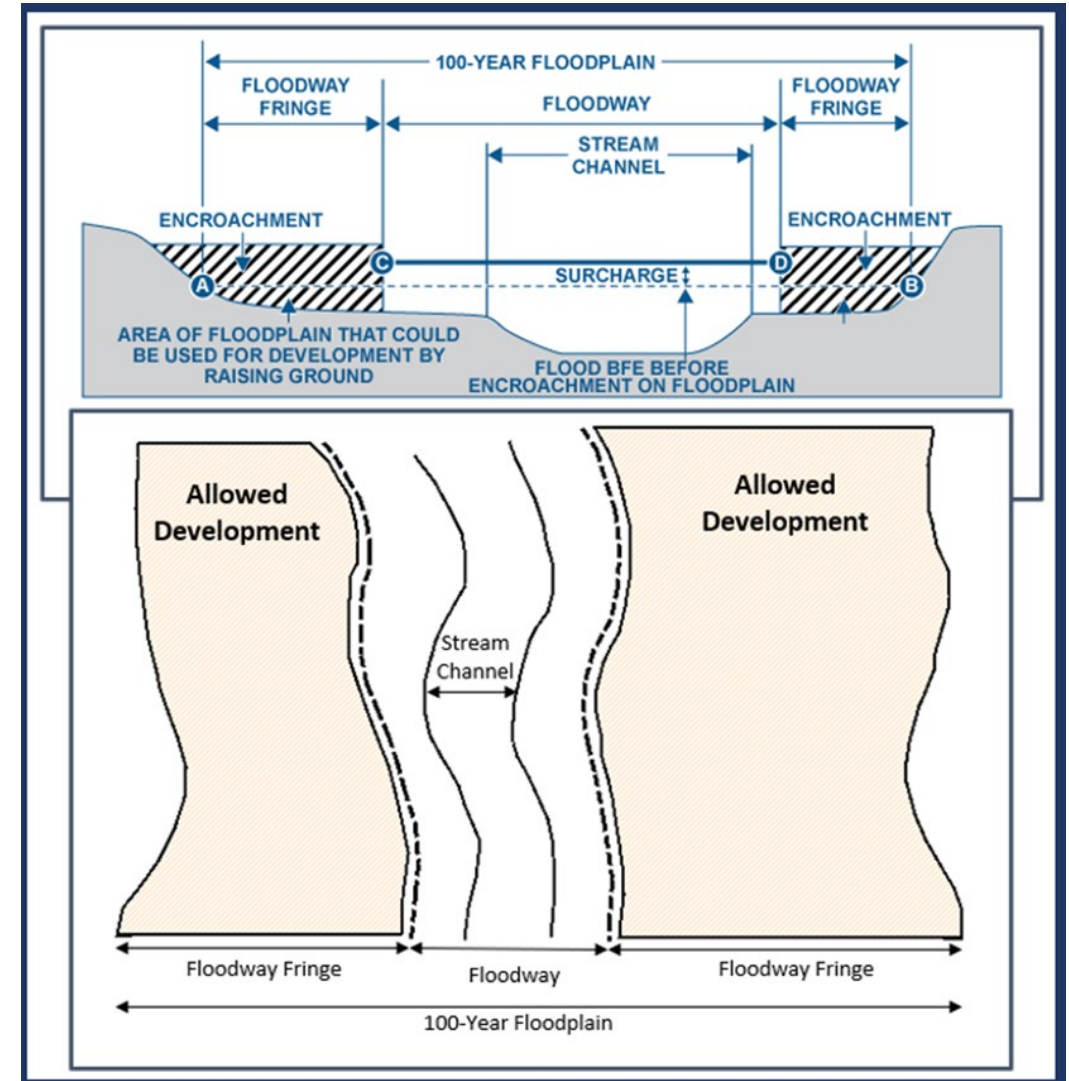
# Impacts of Valley Storage Loss

U.S. ARMY CORPS OF ENGINEERS

Landon Erickson, PE

# Preliminary Findings on Valley Storage

- **Definition** – The volume of water in a river's floodplain during a flood
- **Function** – Flood water storage...like a reservoir
- **Regulation** – FEMA NFIP
  - Development allowed within Floodway Fringe
- **Impacts of Valley Storage Loss**
  - Peak flow increases
  - Peak water surface elevation increases
  - Deeper and more frequent roadway overtopping
  - Shorter flood response times
  - Life safety threat



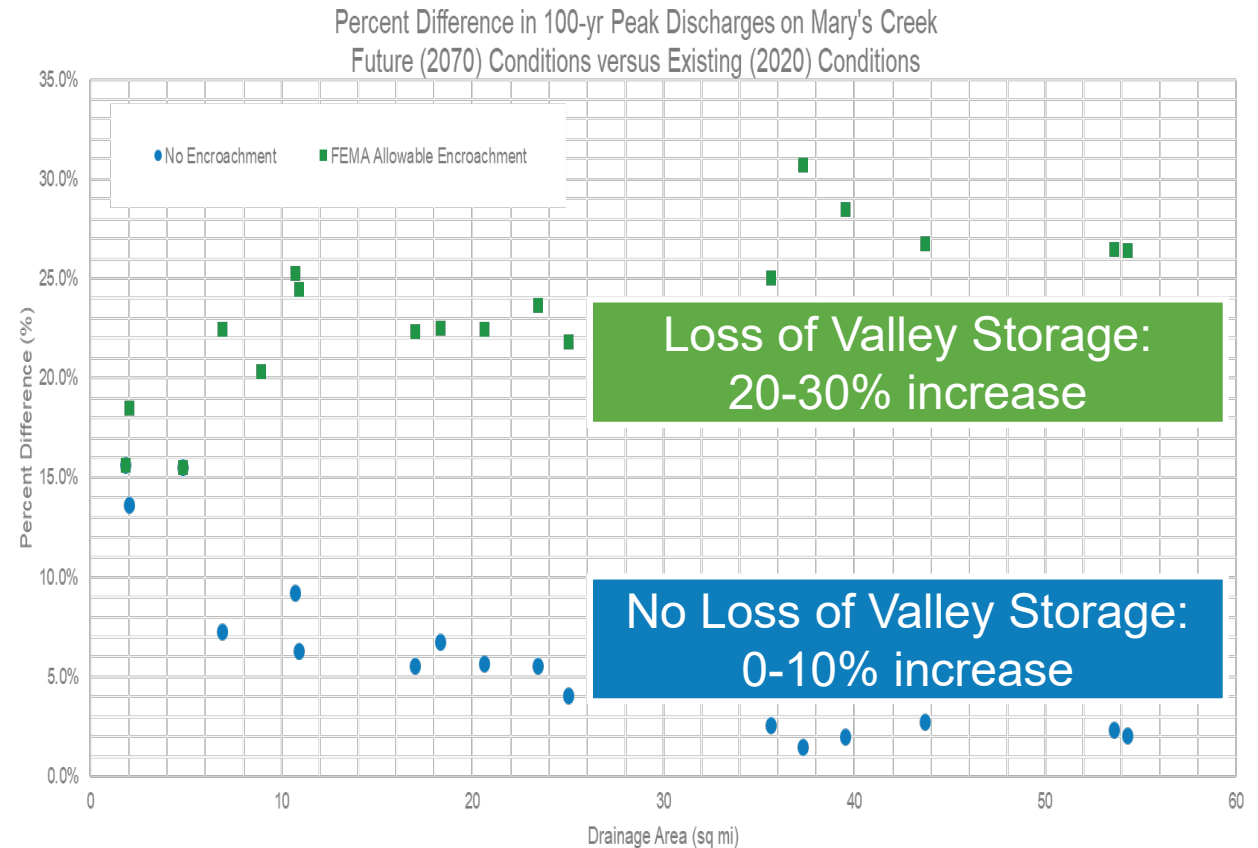
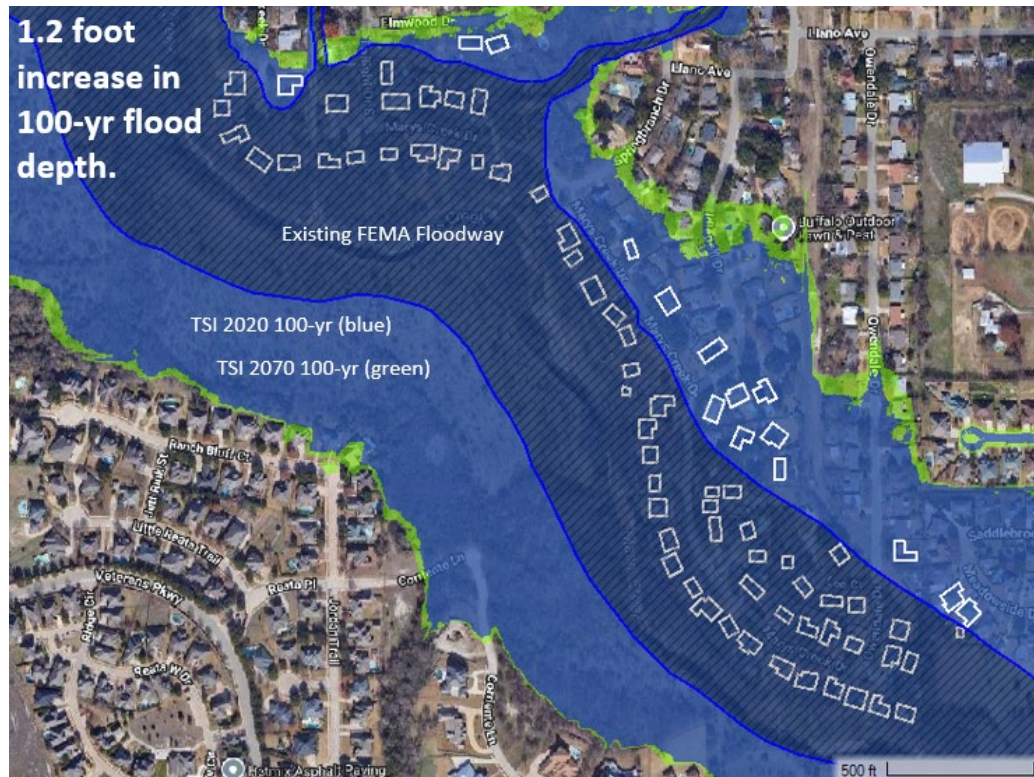
# How Does Valley Storage Loss Occur?





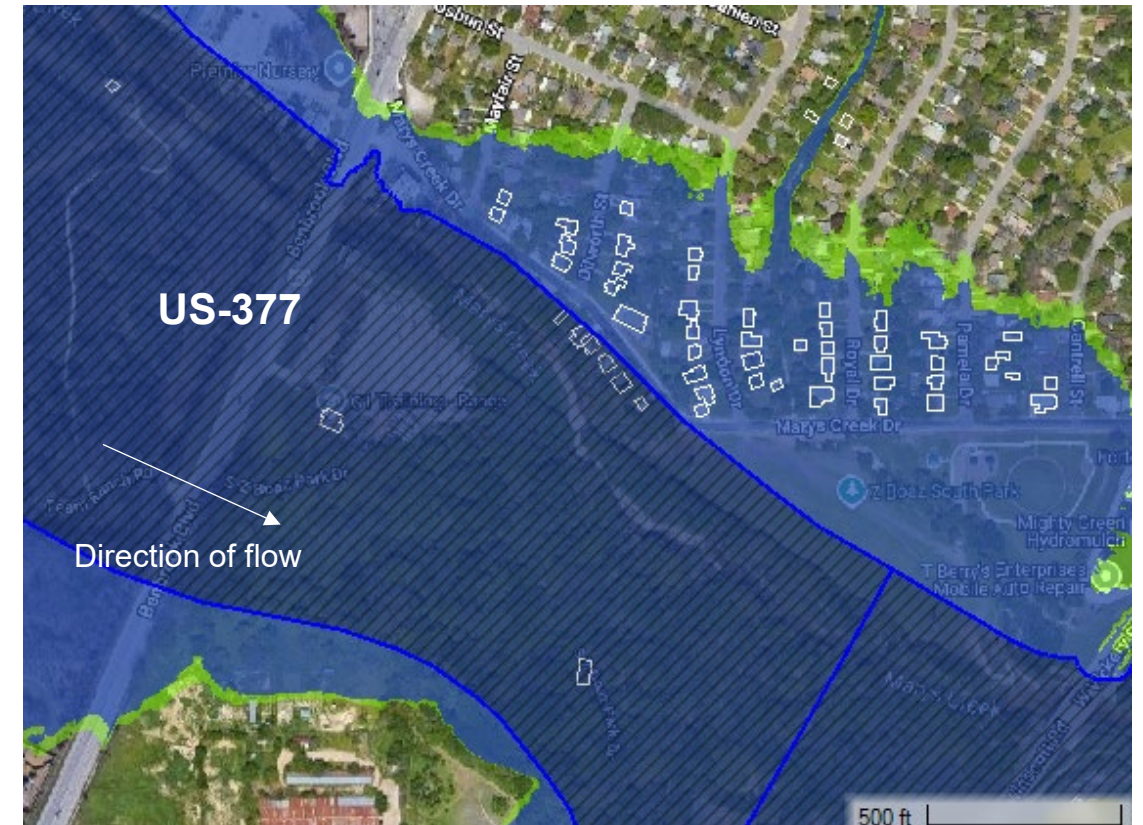
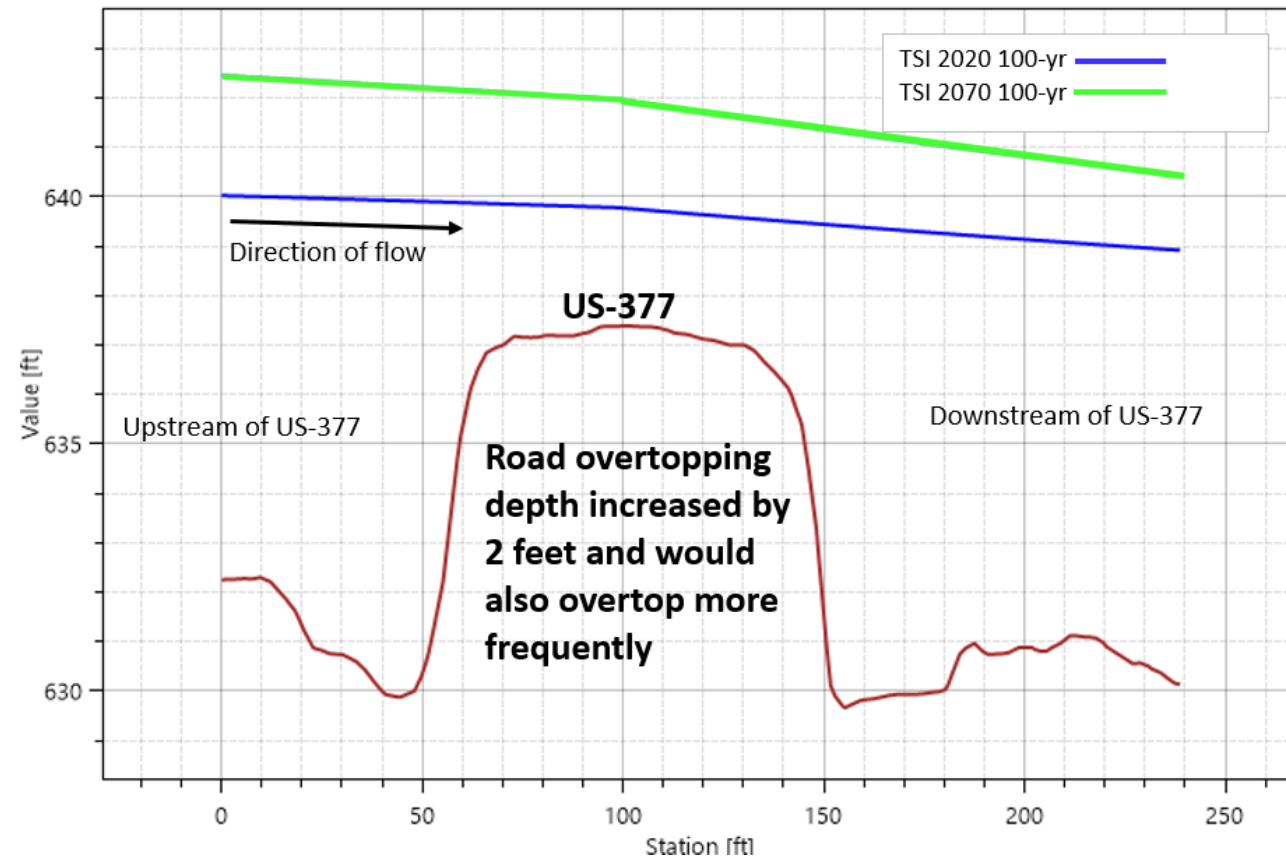
# Impacts of Valley Storage Loss

- Peak flow increases
- Peak water surface elevation increases



# Impacts of Valley Storage Loss

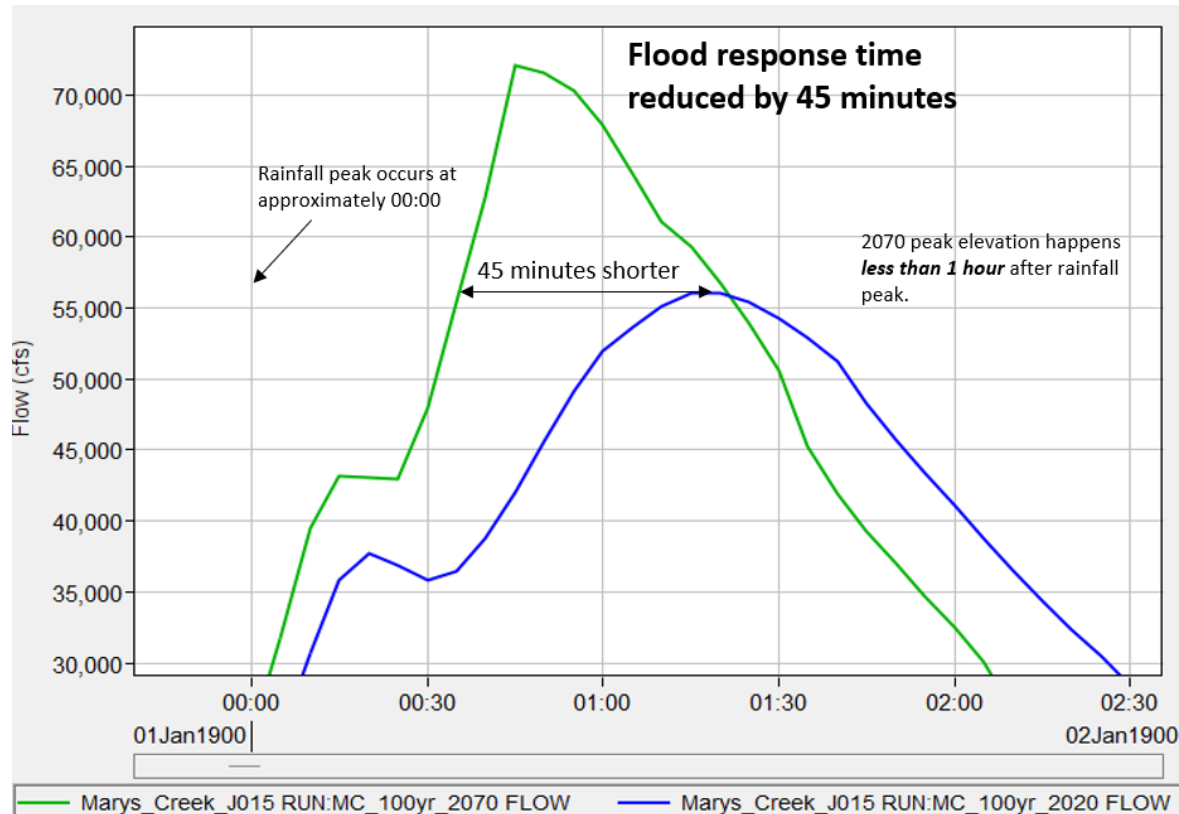
- Deeper and more frequent roadway overtopping



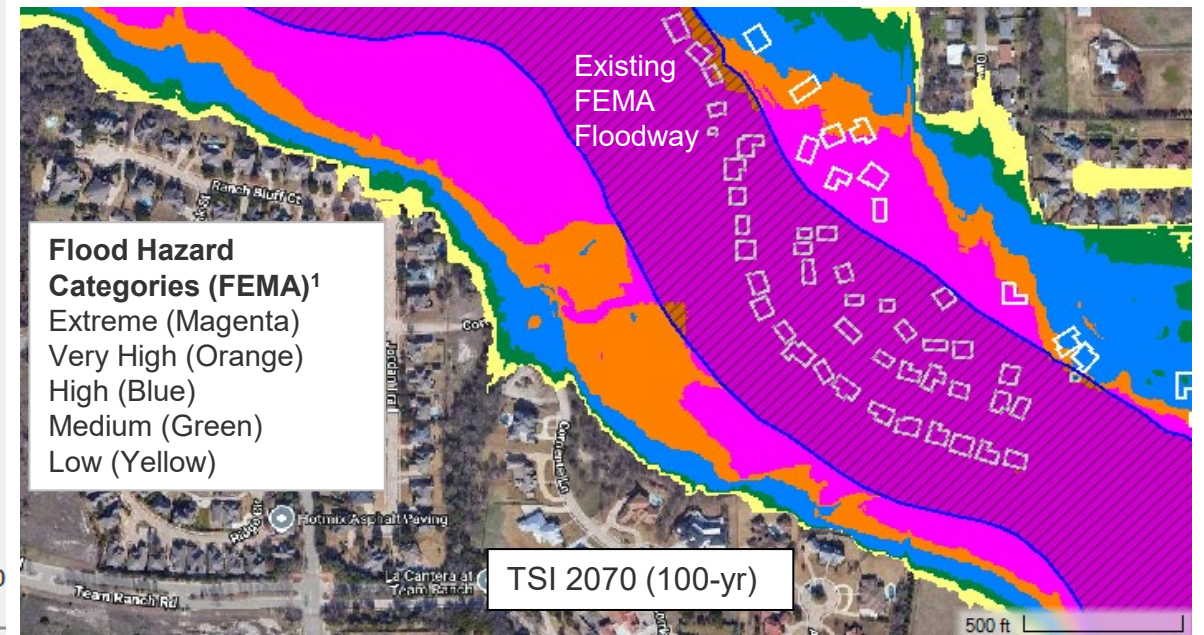


# Impacts of Valley Storage Loss

- Shorter flood response times
- Life safety threat



- ❖ 100-yr Flood Depths, **7-9 feet**
- ❖ 100-yr Flood Velocities, **7-10 ft/sec**



# Options for Preserving Valley Storage

- Prevent new development within the floodplain
  - Maintains natural flood storage and environmental benefits of the floodplain
  - Minimizes new hazard exposure to people and property
- Adopt compensatory volume ordinance
  - May allow development in floodplain but minimizes loss of valley storage (e.g. Corridor Development Certificate Program, CDC)



# Preliminary Findings on Valley Storage

- **Impacts of Valley Storage Loss**

- Peak flow increases
- Peak water surface elevation increases
- Deeper and more frequent roadway overtopping
- Shorter flood response times
- Life safety threat

*The infrastructure we've built may not have the same level of service/safety intended...*





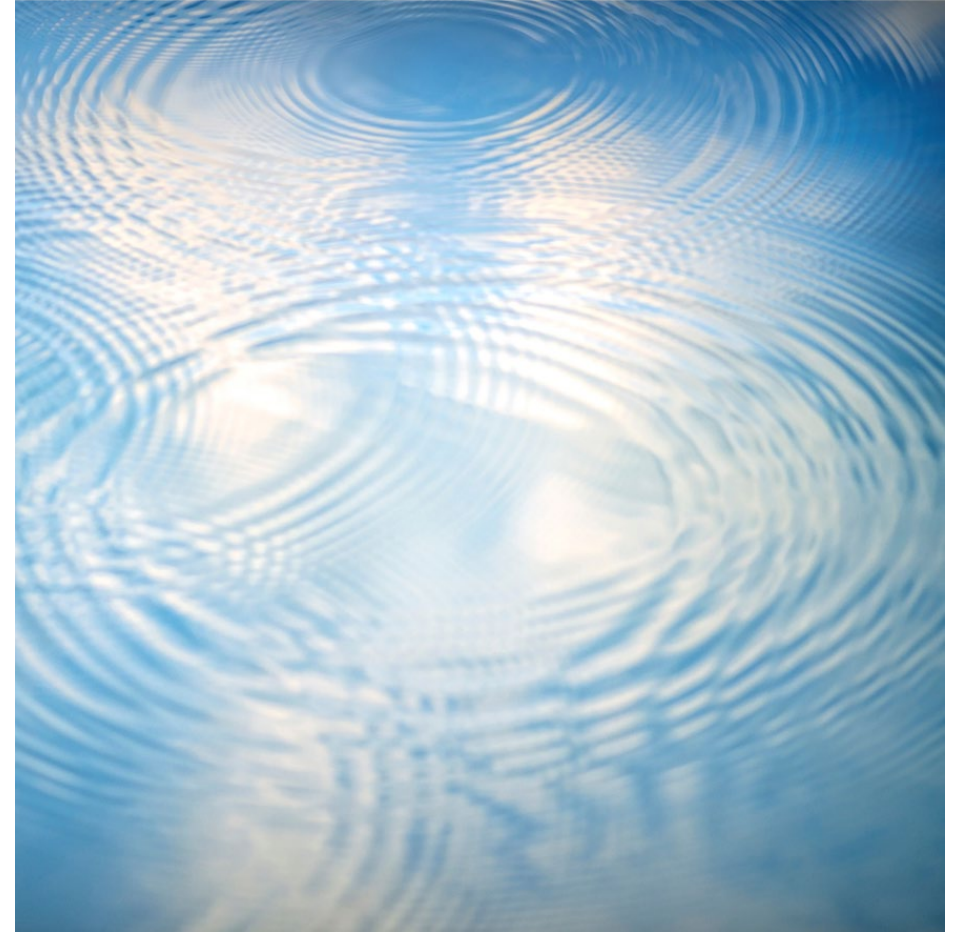
# Model Development Codes & Floodplain Ordinances

NCTCOG

Erin Blackman, CFM

# Model Codes Task Overview

- Develop model development codes that support TSI Study goals for reducing flood risk and integrating transportation, stormwater, and environmental planning
- Identify enabling or supportive State code provisions
- Receive input from stakeholders on draft code elements
- Incorporate feedback to refine model codes
- Local governments may choose to use the model codes as a resource for regulatory updates to improve flood prevention and mitigation



# Development Regulations Model Code

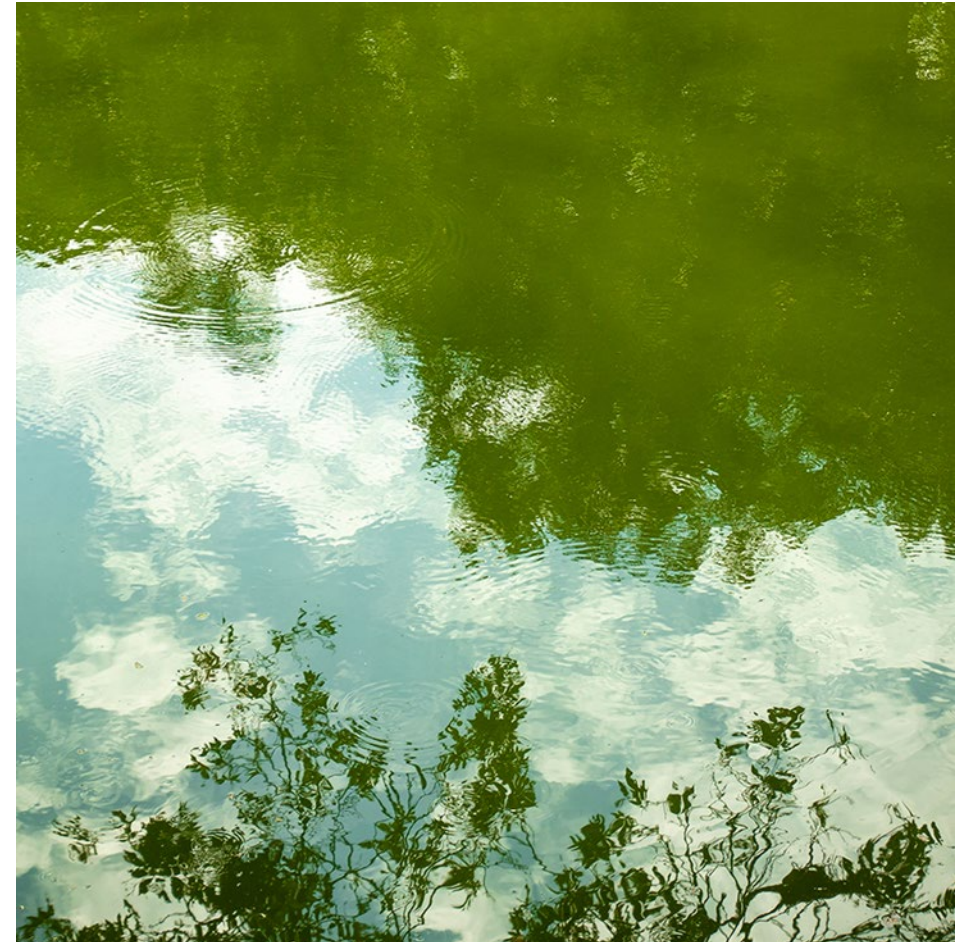
- Identifying best practice strategies that can be incorporated into development (land use/zoning/subdivision) codes to help prevent and/or mitigate future flood events
- Model codes can address green stormwater infrastructure, nature-based solutions, low-impact development, and other strategies
- Examples:
  - Impervious cover limits
  - Clustered development
  - Creation/preservation & maintenance of open space
  - Green parking lot infrastructure
  - Incentive zoning
  - Match pre-developed site runoffs
  - Regional (on or off stream) detention





# Floodplain Ordinance Model Code

- Identifying higher standards that can be incorporated into flood damage prevention ordinances to help reduce economic losses, prevent future flood hazards, and protect public health/safety
- Model codes can address higher construction standards for development in flood-prone areas
- Examples:
  - Require freeboard based on fully-developed watershed conditions
  - Ensure accessibility during floods
  - Preserve valley storage
  - Protect critical facilities and development
  - Create stream buffers/setbacks
  - Prohibit rise in flood waters



# We Want to Hear from You!

- What development code (e.g., zoning, subdivision design, street design standards, etc.) or floodplain ordinance elements have you adopted to prevent or mitigate flooding?
- Please complete this 3-question survey

Preventing Flooding Through Local  
Development Codes: City Survey



<https://tinyurl.com/TSICodes>

# Model Development Code and Floodplain Ordinances Workshop

Purpose: To review green stormwater infrastructure, nature-based solutions, and enhanced floodplain standards across the region, assess what's working, and explore strategies to improve the effectiveness and ease of implementation through model development code/floodplain ordinances.

Intended Audience: Anyone with technical expertise, experience, or interest in the areas of flood prevention or mitigation using development or floodplain regulatory tools.



Thursday, January 29, 2026, 10:00 AM-12:00 PM



NCTCOG, 616 Six Flags Drive, Centerpoint II,  
Arlington, Transportation Council Room



Hybrid meeting format



For more info, visit <http://www.nctcog.org/tsi>

Register Here:



<https://www.addevent.com/event/fcq17r29868>

# Watershed Modeling & Optimization

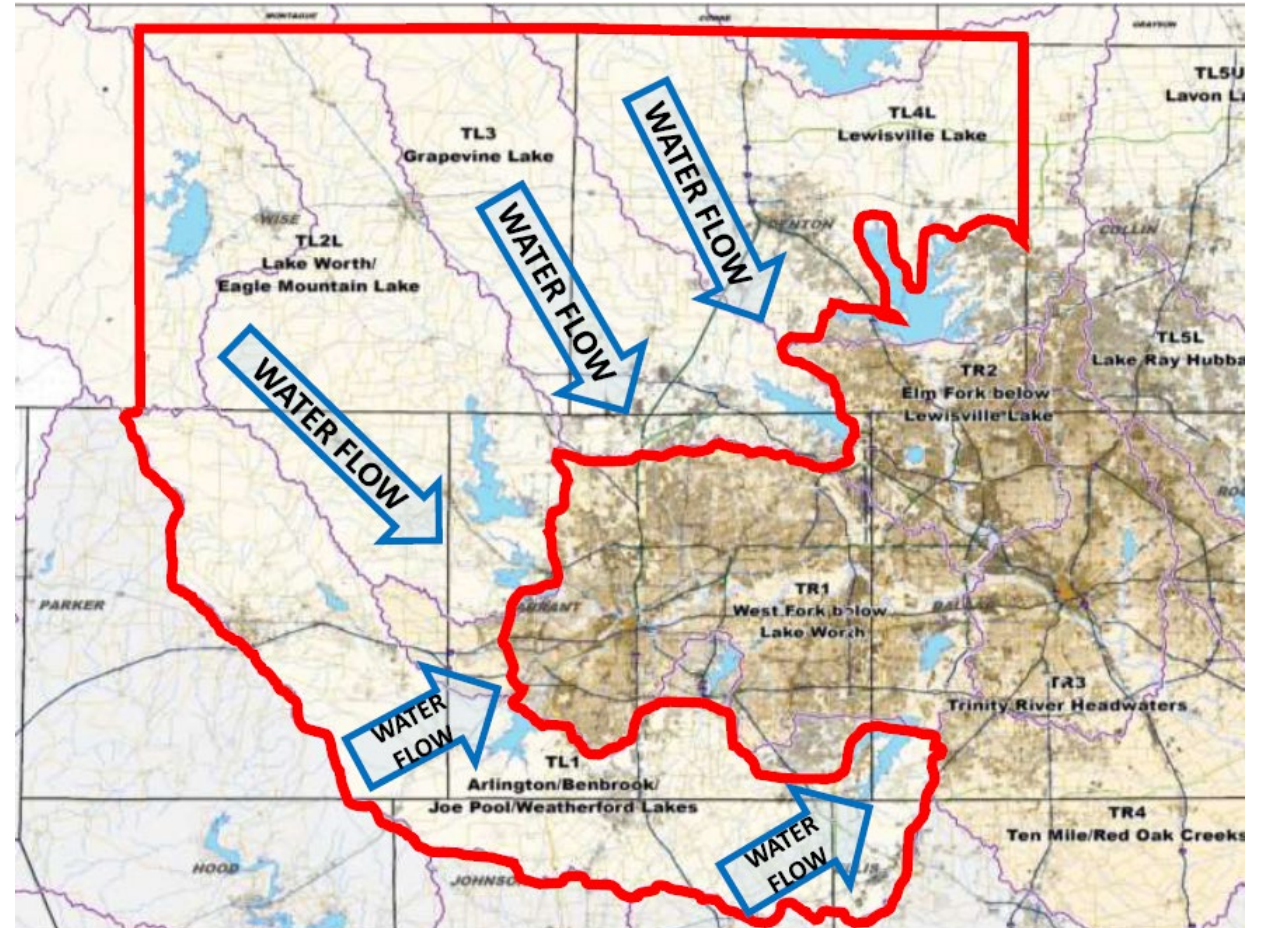
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Matt Lepinski, PE and Jeff Neal, PTP



# Optimization Motivation

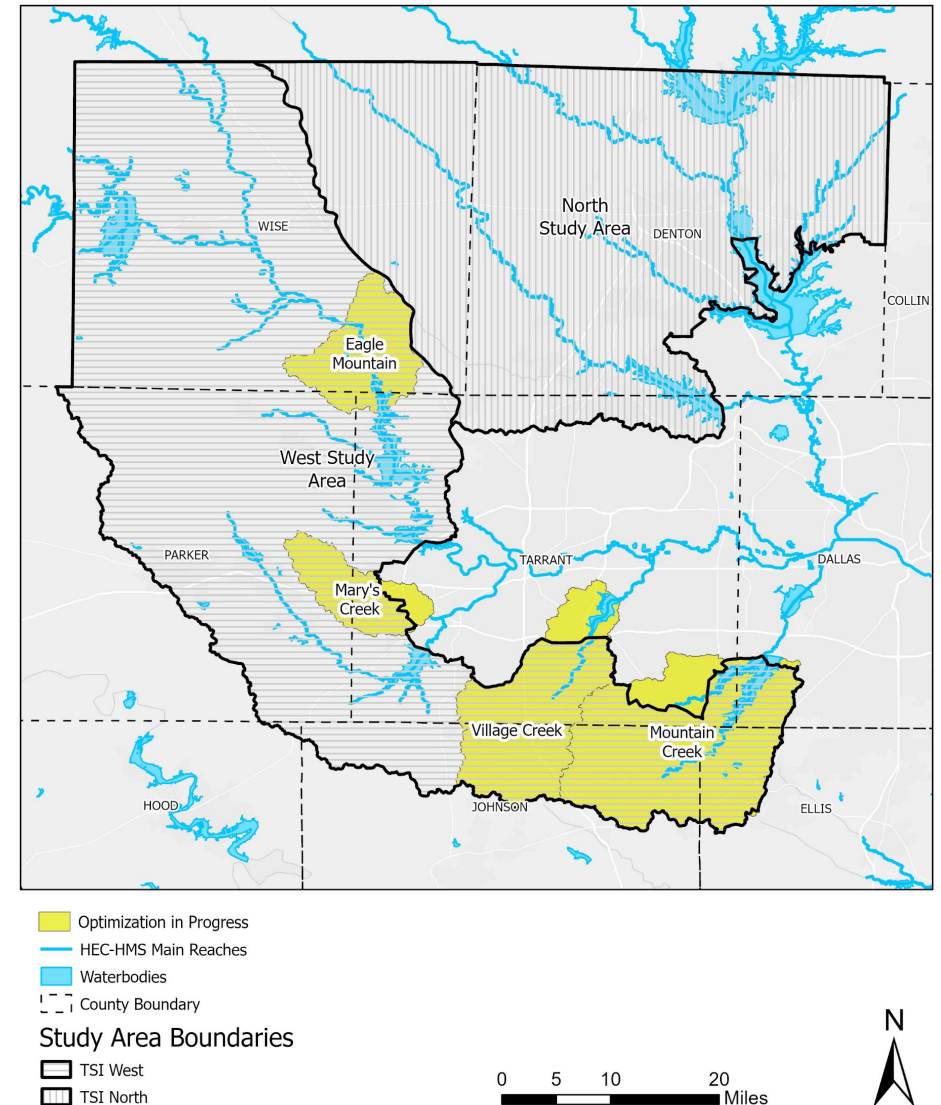
- Increased Growth and Development
  - Increased Impervious Surface
    - Increased Runoff
- Conceptualize **storage** alternatives to address increases in runoff through local or regional storage.
- Determine **locations** that would result in the lowest combined required storage to limit runoff in the future to current levels.





# Optimization Overview

- The optimization study aims to model ideal **location and sizing** for storage and consider potential alternatives (e.g., detention, GSI/NBS) to **reduce future flows to current levels** due to anticipated changes in imperviousness, using updated HEC-HMS models.
- Collaboration with Study Partners:
  - Transportation: Locations for flow limits
  - Environmental: GSI/NBS alternatives for storage allocation

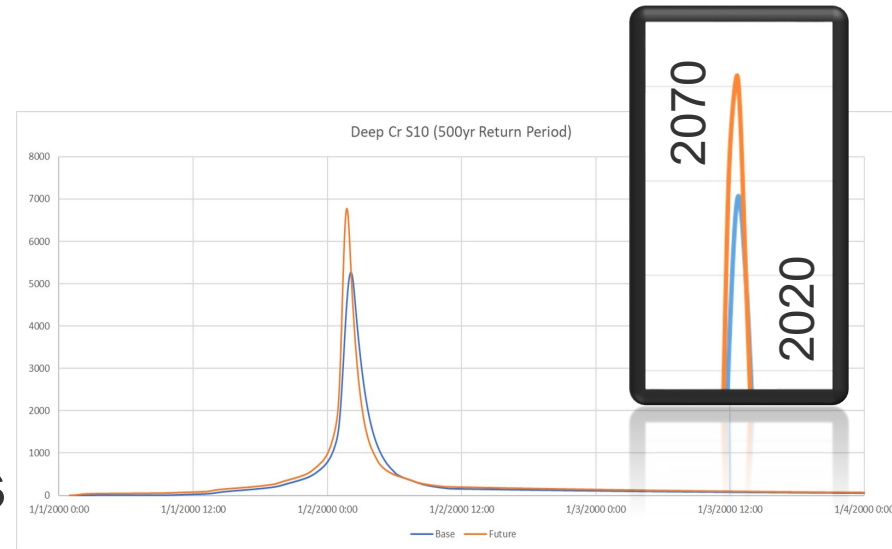


# Optimization Methodology

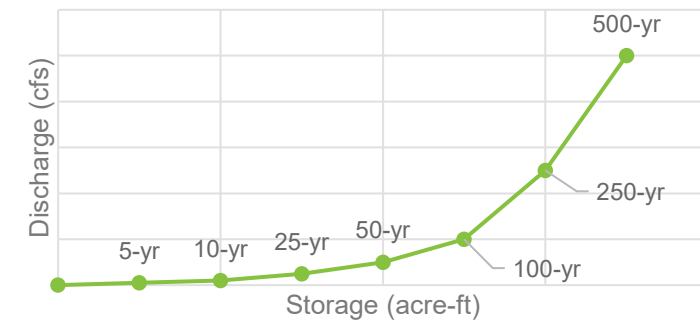


# Determine Future Storage Requirements

- Obtain HEC-HMS models containing **current and future flows** considering valley storage encroachments and compare for various frequency storms.
- Calculate **difference in volumes** to determine theoretical future storage required.
- Construct **storage-discharge curves** using current flow values and theoretical future storage values.



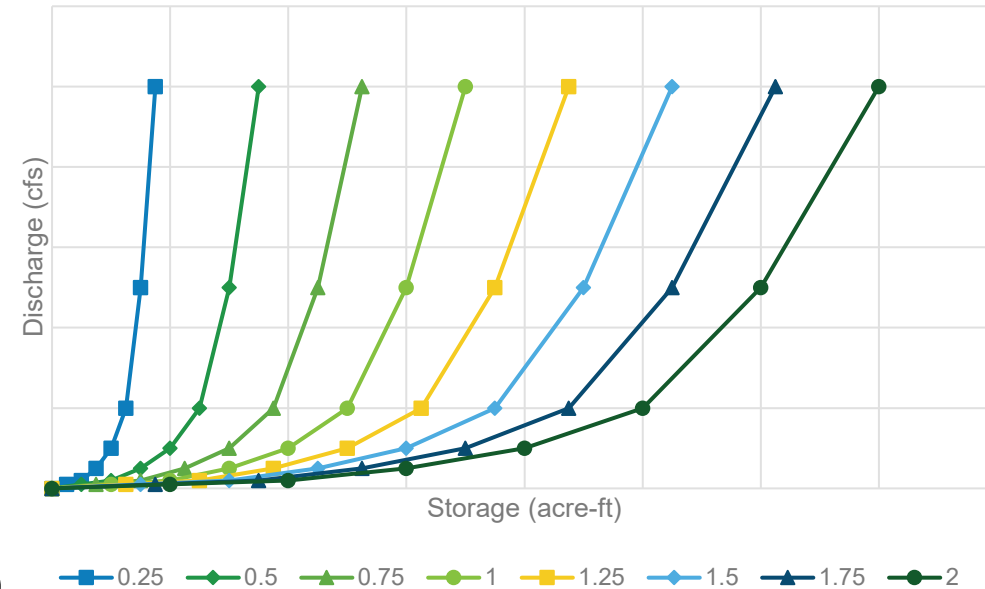
Storage-Discharge Curve



# Optimize to Allocate Future Storage

- Modify HEC-HMS models for the local and regional scenarios.
- Determine the desired flow constraints.
  - Bridge prioritization (Transportation)
- Using multipliers and code, determine the **optimal curves** to minimize storage while meeting constraints.

Storage-Discharge Curve with Multipliers



```
class DiscreteInference:
    def __init__(self, datafiles_path="Output", skipHeader=
        columns_of_interest=None,
        num_runs=100000, no_groups=10, no_pick=2,
        no_of_classes=10, conservativeEstimate=True):
        self.datafiles_path = datafiles_path + os.sep
        self.skipHeader = skipHeader
        self.skipLastRow = skipLastRow
        if columns_of_interest is None:
            columns_of_interest = [9] + list(range(12, 12+
                first column is objective function to minimize
            self.columns_of_interest = [num - 1 for num in col

        self.num_runs = num_runs
        self.no_groups = no_groups
        self.no_pick = no_pick
        self.histogram = histogram
        self.CI = CI
        self.no_of_classes = no_of_classes
        self.no_of_top_results = 50
        self.batch_big = batch_big
```

# Analyze Storage Alternatives

- Determine resulting allocated future storage and create **storage allocation maps** (*via input/models from Texas A&M AgriLife*).
- Analyze how the required storage can be achieved with:
  - Detention Ponds
  - GSI/NBS (*Environmental Input*)
  - Combination
- Compare alternatives (*“menu of options”*).



Figure 2.1 Bioretention Area Examples

Source: NCTCOG iSWM Site Development (2014)



Figure 23. The Green at College Park (University of Texas – Arlington).



Figure 71. The Perot Museum parking lot bioswales uses native and drought-tolerant plants.

Source: NCTCOG Green Infrastructure Guide (2017)



# Transportation Inputs for Optimization

## *Data Sources/Analysis & Methodology – Bridges/Culverts*

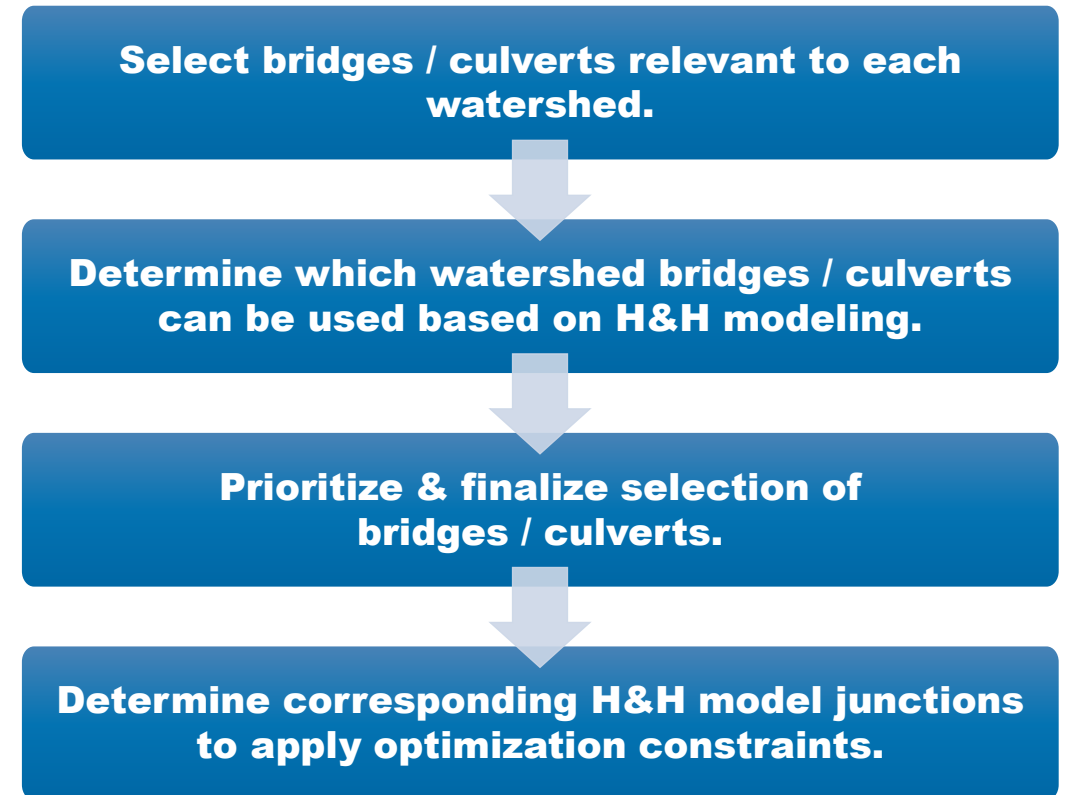
### DATA SOURCES (*within GIS*):

- TSI North/West Study Area
- Future Road Locations (2045) – TxDOT
- Bridges/Culverts – TxDOT/National Bridge Inventory (NBI)
  - Dallas District (*Dallas, Denton, & Ellis*)
  - Fort Worth District (*Hood, Johnson, Parker, Tarrant, & Wise*)
- H&H Model Elements – USACE/UTA/Texas A&M AgriLife
  - Watershed Subbasins
  - Junctions & Reaches

### ANALYSIS:

- Only bridges/culverts co-located with junctions are viable.
- Bridges/culverts most upstream in watershed are removed.
- All bridges/culverts on the main stem are included.
- At least one bridge/culvert per tributary should be included.

### METHODOLOGY:

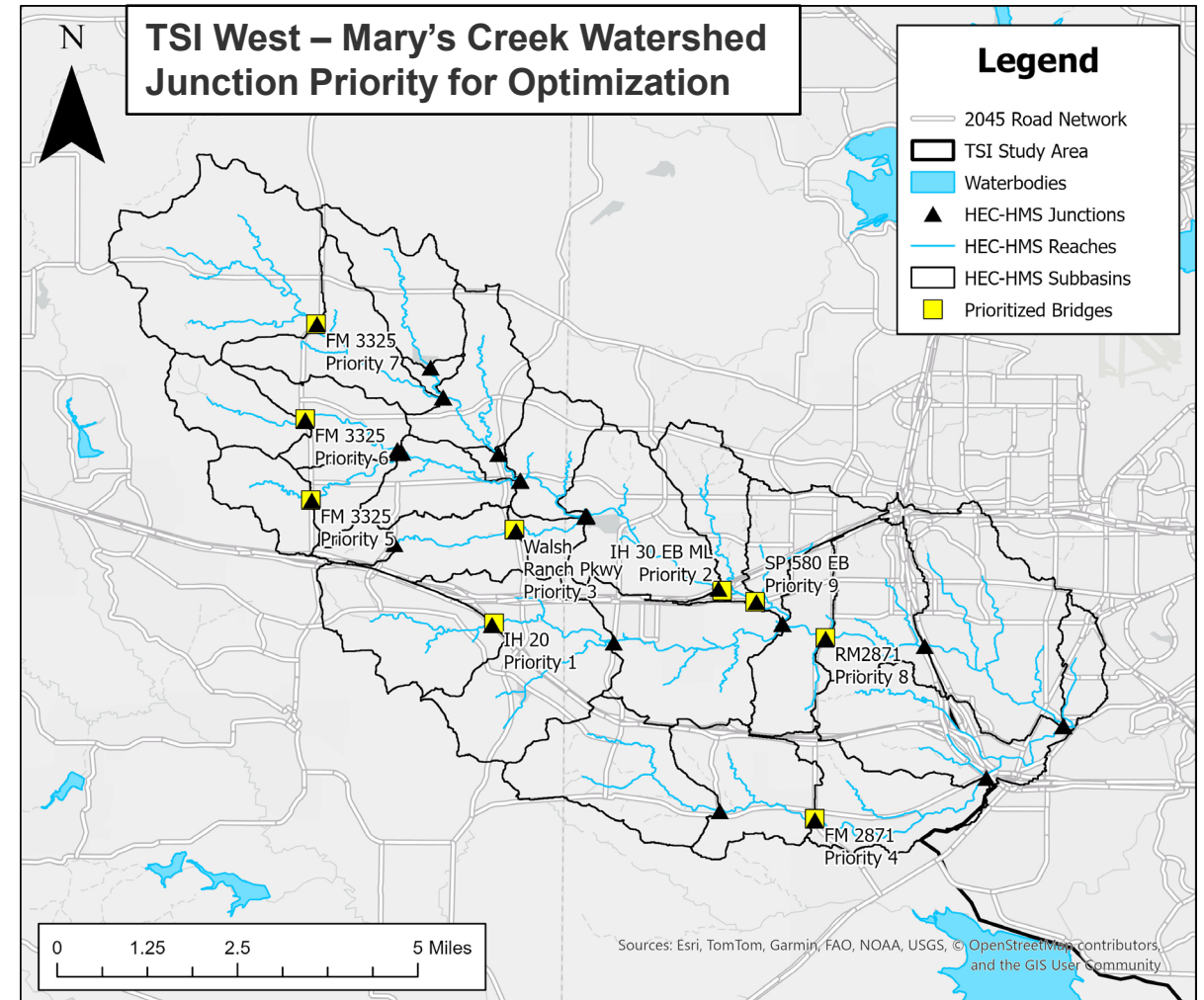


# Transportation Inputs for Optimization

## *Sorting & Prioritizing Bridges/Culverts by Watershed*

### ATTRIBUTES FOR PRIORITIZATION:

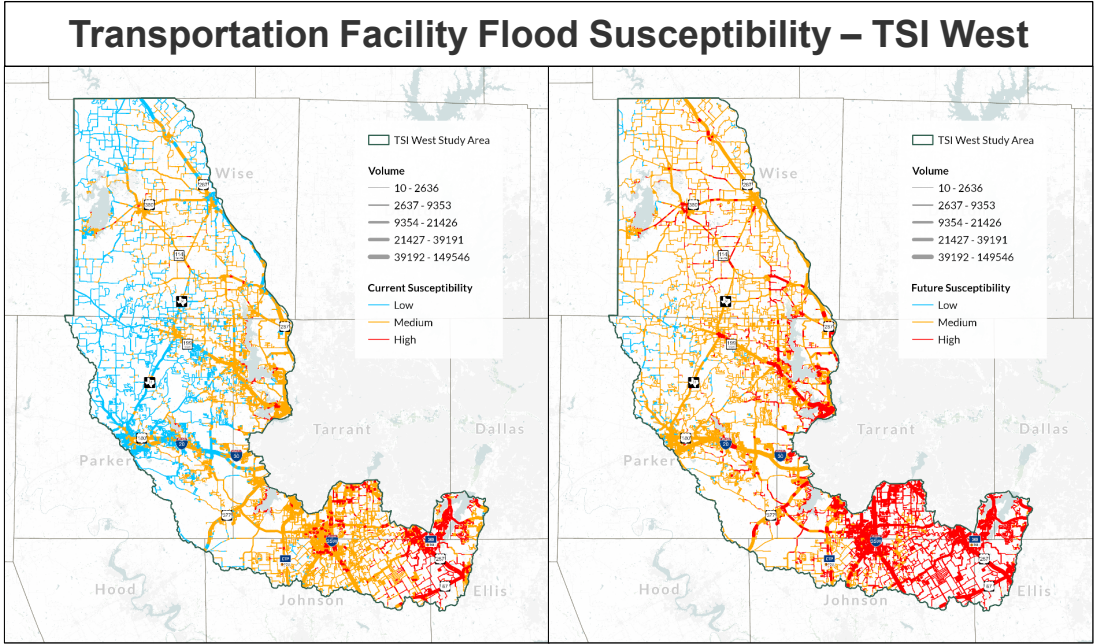
- “Scour-Critical” Bridges – Bridge piers/abutments already unstable due to flood scouring (*via inspection*)
- Average Daily Traffic (ADT) –
  - ▣ Current (*TxDOT/NBI – Inspection Year*)
  - ▣ Future (*see below*)
    - ▣ Federal Highway Administration (*FHWA*) requires future ADT projected between 17-22 years from inspection date (*variable*)
    - ▣ If available, year 2050 NCTCOG Travel Model volumes used for more robust planning horizon & improved H&H consistency
- Inventory Route Functional Classification (*FC*)
- Detour Length
- Historical Significance
- Other factors depending on watershed relevance:
  - ▣ Intersecting Routes (*ADT, FC, & Detour Length*)
  - ▣ Critical Facility & Navigational Control Indicators



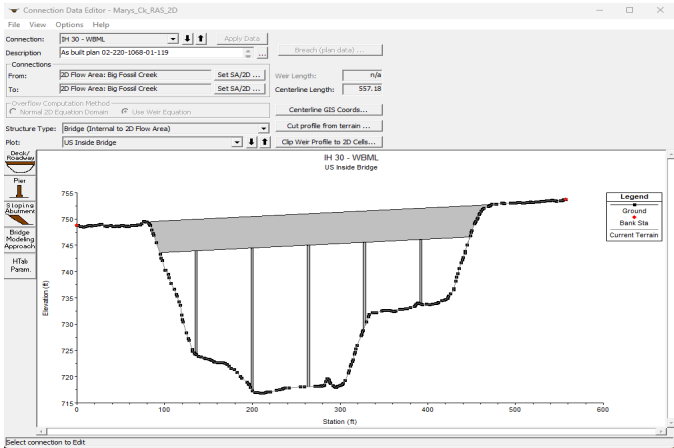
# TSI Optimization – Progress & Next Steps

## Alternative Analysis Alignment/Expansion Over TSI Study Area

- Initial junction priority created for several pilot study watersheds (*Eagle Mountain outputs in slides to follow*)
- Initial flood vulnerability & susceptibility (*shown right*) maps for transportation facilities completed using Texas A&M AgriLife environmental stacking model
- General Land Office (GLO) Combined River Basin Flood Studies (RBFS) Hotspot ID screening underway in various TSI North pilot watersheds
- Reconciling Base Level Engineering (BLE) 1D vs. 2D model considerations between TSI North/West watersheds
- Deploy incorporated H&H, stacking model, & optimization scenario inputs for analysis across TSI Study Area:

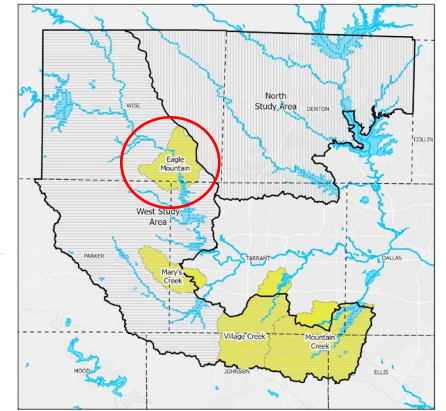



MILESTONE	DELIVERY DATE
Draft Identification of Flood Mitigation Projects, Strategies, & Evaluations with Economic Results	March 2026
Document Final Alternatives Analysis Results in Final TSI Study Report & Replication Plan	July 2026

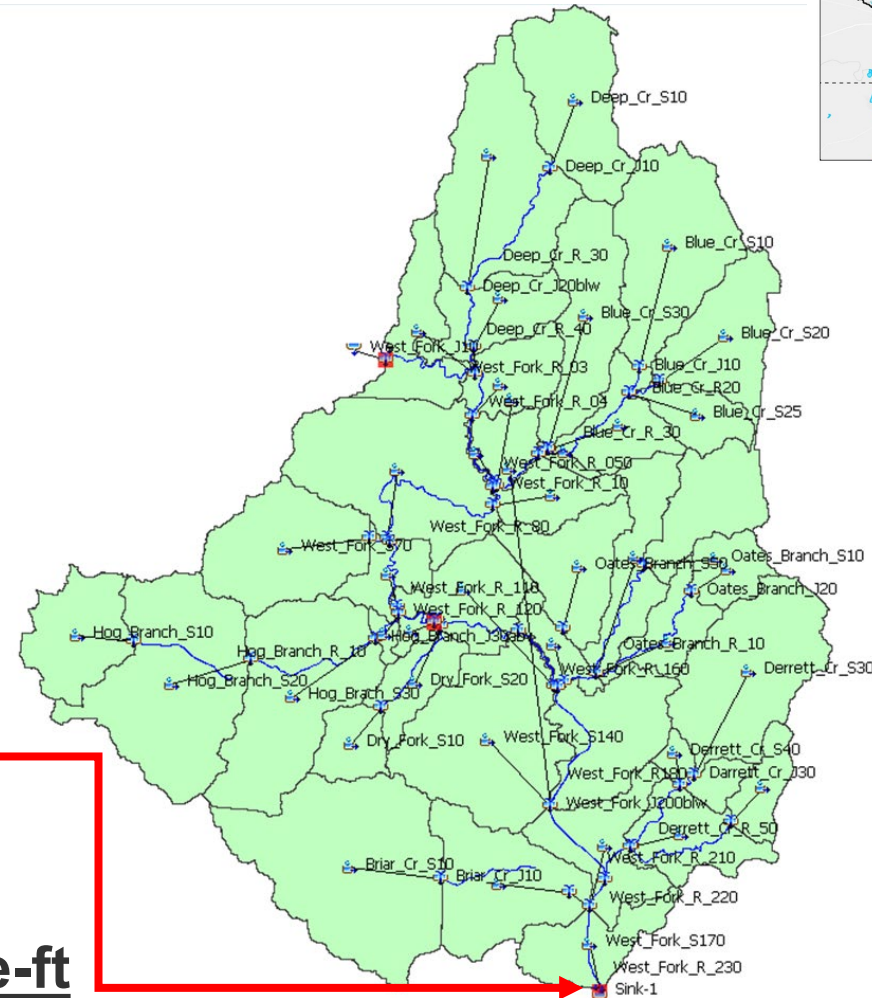




# Eagle Mountain Pilot Study Area



- Basin Model Information
  - ~75 square miles
  - 41 Subbasins and 42 Reaches
- Anticipated Imperviousness Increase
  - Avg: **25%**
  - Max: **47%**
- Anticipated Reduction in Response Time
  - Avg: **-0.41 hr**
  - Max: **-0.67 hr**
- Downstream Peak Discharge 
  - 2020: **40,300 cfs**
  - 2070: **51,100 cfs**
- Theoretical Storage Required: **6,200 acre-ft**



# Optimization Scenarios



## Scenario 1 (Local)

- Reservoir elements placed downstream of *subbasin* elements
- Captures water from individual subbasins

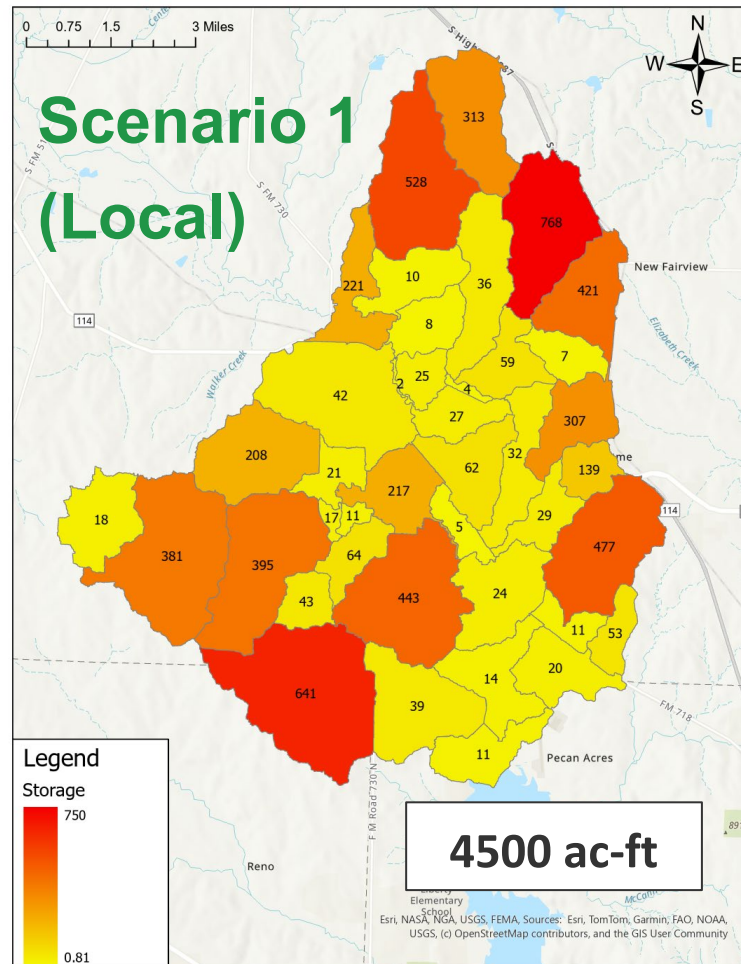


## Scenario 2 (Regional)

- Reservoir elements placed downstream of *junction* elements
- Captures water from all upstream subbasins

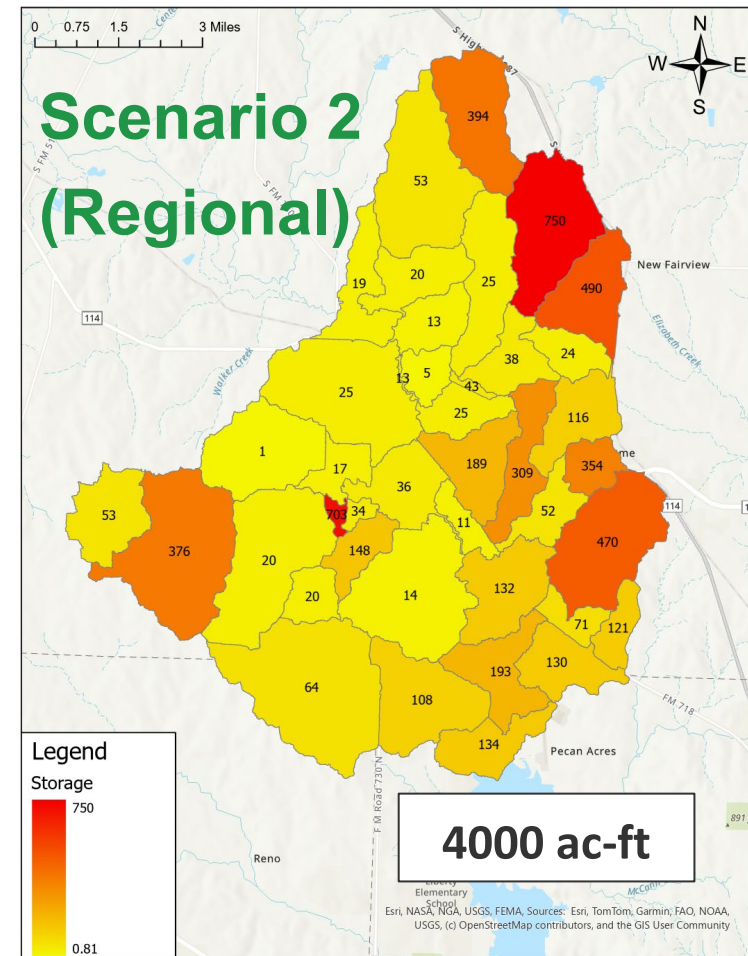


# Eagle Mountain Results



- Flows limited at 10 points (including most downstream) to current levels
- ~11% reduction in required storage for regional implementation

Note: All results are considered preliminary and are subject to change.



# Flood Warning System Evaluation

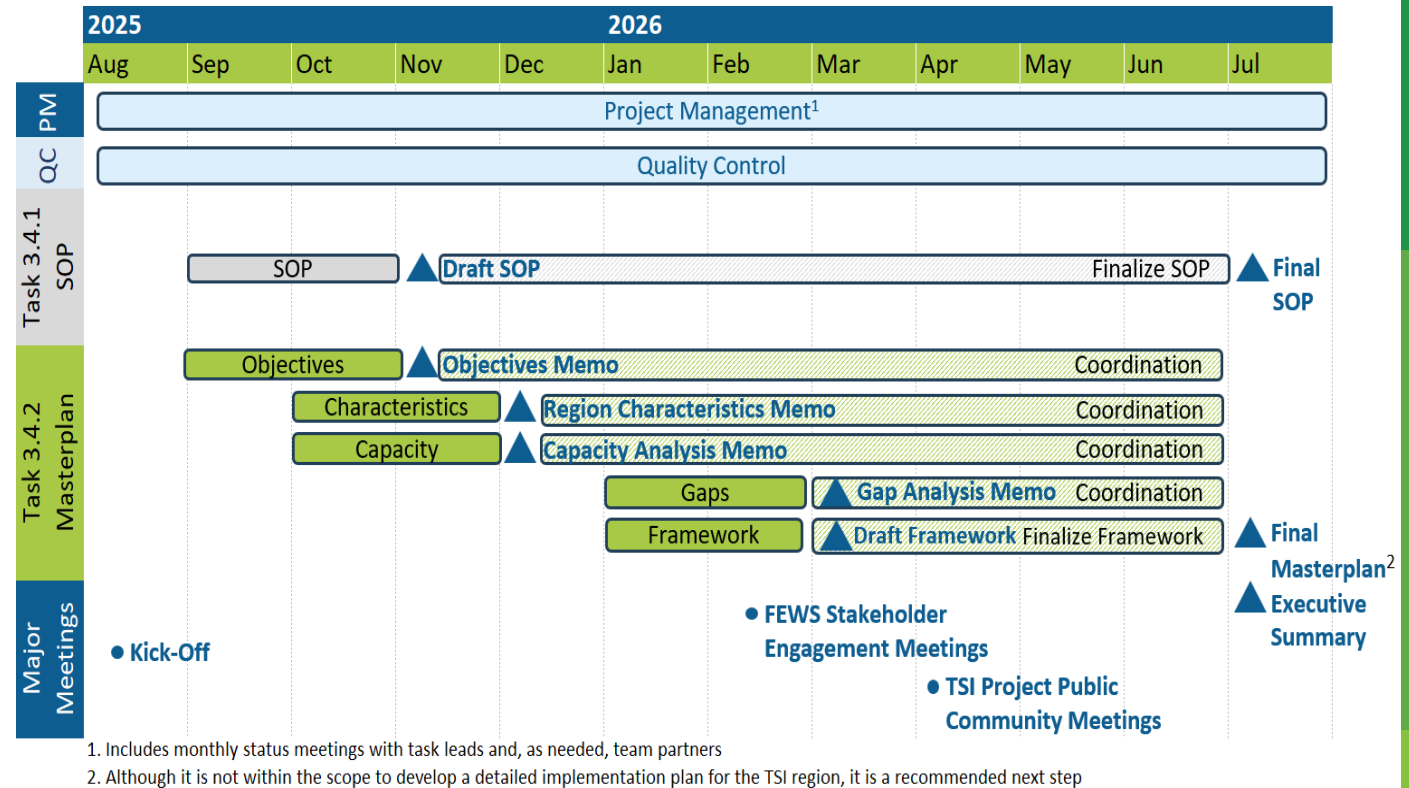
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Matt Lepinski, PE



# TSI Flood Warning System Planning

- **Flood Warning System Task Purpose**
  - Develop fully transferrable “roadmap” to develop or strengthen Flood Early Warning System (FEWS) understanding and capacity
- **FEWS Standard Operating Procedure (SOP)**
  - Transferrable and scalable SOP
    - Assists entities in creating a FEWS Masterplan and guides them through the process
- **FEWS Masterplan**
  - Used to enhance or kick-start development of FEWS implementation
    1. *Define objectives*
    2. *Summarize regional characteristics*
    3. *Document existing capacity*
    4. *Perform gap analysis*
    5. *Develop framework or “roadmap” for increasing capacity*
    6. *Develop implementation plan (beyond TSI scope)*



Hydrological Value Chain in Flood Forecast and Early Warning (WMO, 2022)

# TSI Flood Warning System Details

- **Develop FEWS SOP**

- Develop a concise, brief step-by-step SOP,
  - Like other TSI SOP's, helps entities how to develop or enhance flood warning capacity.
  - Guide communities through the FEWS Masterplan process
    - Based on the TWDB FEWS Guide and Alternative FEWS Guide.

- **FEWS Masterplan**

- Follows Steps 1 through 5 of the SOP. The final deliverable will be a TSI regional FEWS Masterplan that includes a Framework (roadmap)
  1. *Define objectives*
  2. *Summarize regional characteristics*
  3. *Document existing capacity*
  4. *Perform gap analysis*
  5. *Develop framework or “roadmap” for increasing capacity*
  6. *Develop implementation plan (beyond TSI scope)*

- **Objectives Analysis Memo**

- Through internal team discussions and external stakeholder engagement, document the goals, vision(s), and expectations of FEWS for the TSI region.

- **Regional Characteristics Analysis Memo**

- Summarize, at a high-level, characteristics of the TSI region that are relevant to FEWS (e.g., flood hazards, demographics, etc.).

- **Capacity Analysis Memo**

- This task documents existing FEWS capacity across the TSI region (e.g., hardware, software, and operational).

- **Gap Analysis Memo**

- A gap analysis will be performed to document where capacity is lacking across the region.

- **Framework Memo**

- The Framework will provide the region with planning level recommendations on how to increase FEWS capacity.
- Recommendations should try to address the “last mile” problem of connecting flood warning with response so that data is used effectively to reduce risk.
- Lastly, the Framework should highlight opportunities to integrate with existing regional efforts (e.g. NCTCOG Flooded Roads project, Flood Data North Texas, etc.) to maximize value and effectiveness across the region.

- **Compile Masterplan**

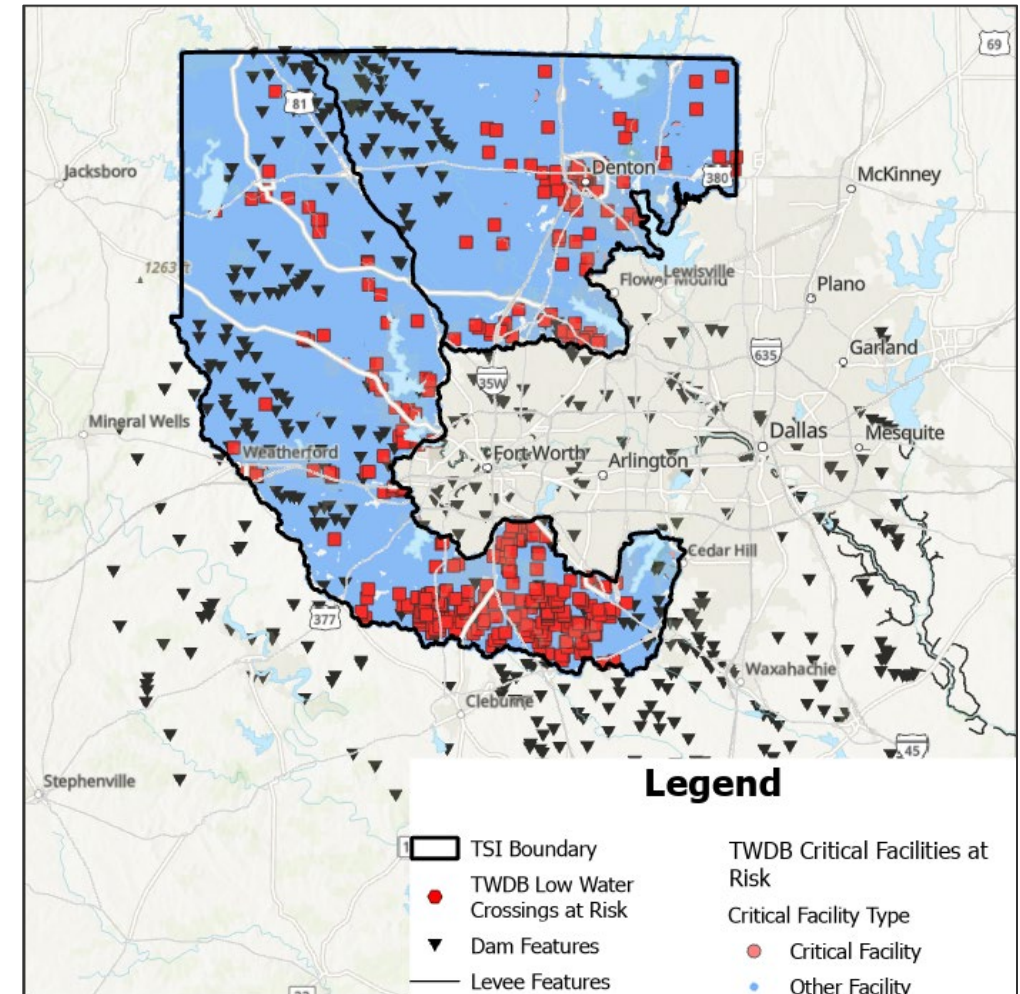
- The memos should “drop in” seamlessly with some additional narrative added, such as an introduction, conclusion, table of contents, and references.

# Regional Characteristics Memo

- **Regional Characteristics Memo**

- **Intent:** Summarizes the setting of the western eight-county Dallas/Fort Worth region so that the Flood Early Warning System (FEWS) can be sized and sited for real world conditions.
- **Key memo information includes:**
  - Geographic Extent and Political Boundaries
  - Climate
  - Natural Environment
  - Built Environment
  - Hydrology and Watershed Response

County	2025 Population Estimate	TSI Study Region
Dallas	2,762,279	West
Tarrant	2,260,330	West, North
Denton	1,068,355	North
Ellis	239,923	West
Johnson	217,867	West
Parker	163,878	West
Wise	72,674	West, North
Hood	66,549	West



*TWDB Structures at Risk, Critical Infrastructure, and Low Water Crossings*

# Capacity Analysis Memo

## • Capacity Analysis Memo

- **Intent:** Summarizes available resources including key regional partners, monitoring hardware, software, and operations in the TSI region.
- **Key memo information includes:**
  - Flood Warning System Available Hardware
    - Monitoring hardware
    - Available monitoring by entity
  - Flood Warning System Software
    - Data management
  - Flood Warning Systems Operations
    - Institutions and operational structure

### 2.2 AVAILABLE MONITORING BY ENTITY

In Denton, Wise, and Tarrant County, there are at a minimum 134 rainfall and flood monitoring locations. These monitoring sites are owned and operated by the following entities:

- City of Fort Worth,
- National Weather Service (NWS),
- Trinity River Authority (TRA),
- Tarrant Regional Water District (TRWD),
- Texas Department of Transportation (TxDOT),
- United States Geological Survey (USGS) and
- Wise County.

Entity	Subcategory	Communication Method	Transmission Frequency	Notes
City of Fort Worth (CFW)	WARN Dashboard	Radio	Every 1 to 10 minutes	ALERT2 protocol with TDMA time offsets; during flooding events, water level is reported by change in 1/10th foot or on an accelerated schedule (up to 16 reports/hour).
North Central Texas Council of Governments (NCTCOG)	FloodDataNTX Portal	Cellular; radio	Every 5 to 15 minutes	Aggregated cellular/radio feeds
Trinity River Authority (TRA)	Hydrology Dashboard	Cellular; radio	Every 5 to 15 minutes	ALERT2 protocol
Tarrant Regional Water District (TRWD)	AEM Elements 360	Cellular; radio	Every 5 to 15 minutes	ALERT2 protocol
Texas Department of Transportation (TxDOT)	RWIS / Environmental Stations	Cellular; IP	Every 1 to 5 minutes	LTE/4G cellular supported by LoneStar Advanced Traffic Management System (ATMS); wireless IP-based links for rural areas in Wise County
United States Geological Survey (USGS)	NWIS	Satellite	Hourly	Geostationary Operation Environmental Satellite (GOES)

*Communication Methods by Entity*



# TSI Flood Warning System Events

## Flood Warning System Pre-Workshop Meeting

- **Date:** January 15, 2026
- **Time:** 2:00 to 3:00 p.m.
- **Location:** Virtual via Microsoft Teams
- **Add to Your Calendar:** <https://www.addevent.com/event/yyqpm7vd2cgh>
- **Details:** Before the FWS Stakeholder Workshop on February 17, 2026, the TSI study team will review goals, outline what to expect, and gather your input. The TSI study team will preview the draft TSI FWS Standard Operating Procedure (SOP) and FWS Masterplan concept that will be discussed in detail at the workshop. This pre-workshop meeting is an opportunity to share your early insights and help shape a productive and collaborative workshop.

## Flood Warning System Stakeholder Workshop

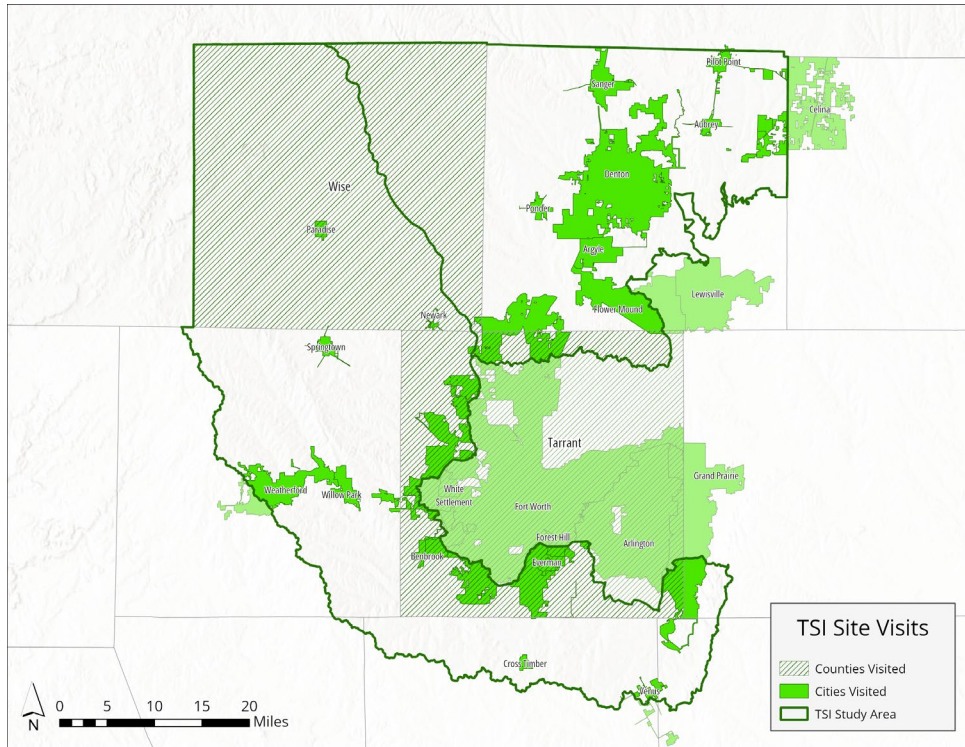
- **Date:** February 17, 2026
- **Time:** 10:00 a.m. to 12:00 p.m.
- **Location:** NCTCOG Offices and Virtual via Microsoft Teams
- **Add to Your Calendar:** <https://www.addevent.com/event/skb38xv9sqjc>
- **Details:** The TSI study team will share the draft TSI FWS Standard Operating Procedure (SOP) and the resultant FWS Masterplan concept and initial results within the TSI study area. The transferable and scalable SOP can be used by entities to develop or enhance their flood warning capacity and outlines the components included in the Masterplan: (1) define objectives, (2) summarize regional characteristics, (3) document existing capacity, (4) perform gap analysis, (5) establish a framework, and (6) develop an implementation plan (beyond the scope of TSI).

# Outreach to Local Governments

NCTCOG

Erin Blackman, CFM and Jeff Neal, PTP

# Community Site Visits

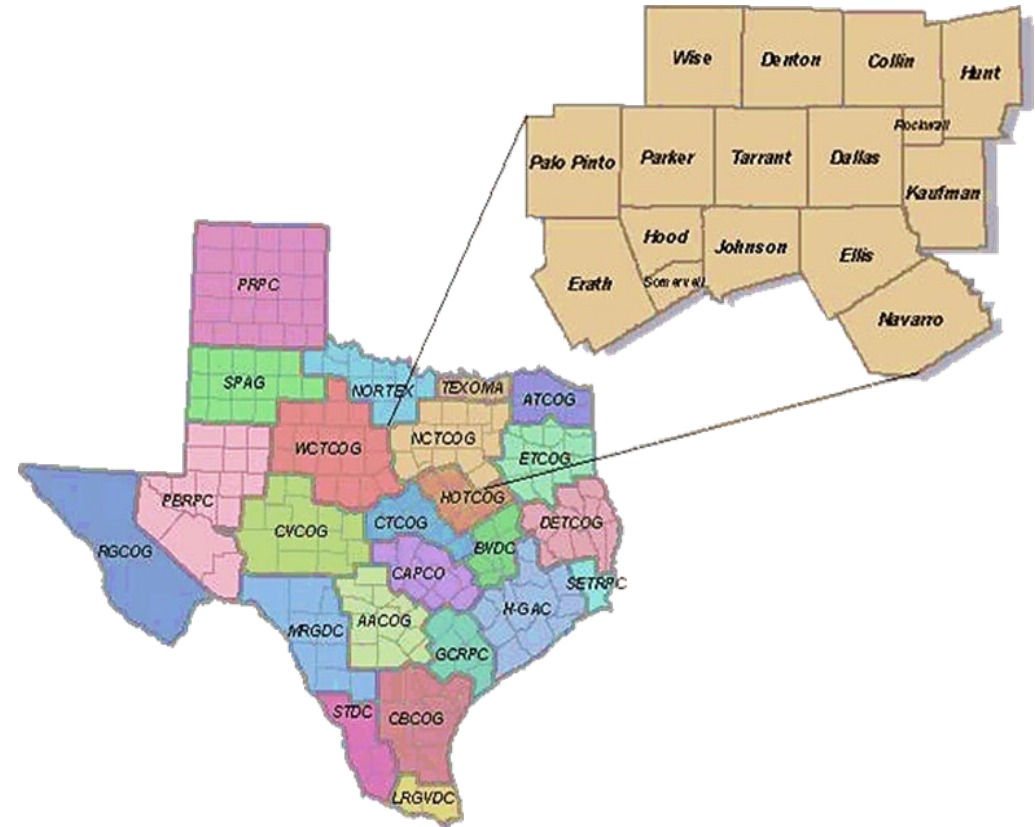


To schedule a site visit, please email [khunter@nctcog.org](mailto:khunter@nctcog.org)



# County Watershed Workshop (Hybrid)

- Held July 31, 1-4 PM
- Discussed transportation, stormwater, and floodplain regulations that counties may implement and enforce
- ~92 people attended
- Workshop materials and video recordings available at: [www.nctcog.org/tsi](http://www.nctcog.org/tsi), “Events”





# Stakeholder Subarea Meetings – Round 4

- Held 10:00 AM – Noon:
  - September 15<sup>th</sup> (Weatherford)
  - September 22<sup>nd</sup> (Burleson)
  - September 23<sup>rd</sup> (Decatur)
  - October 1<sup>st</sup> (Flower Mound)
- Provided an overview on progress and breakout stations with more detail
- ~40 stakeholders attended
- Meeting materials available at: [www.nctcog.org/tsi](http://www.nctcog.org/tsi), “Events”



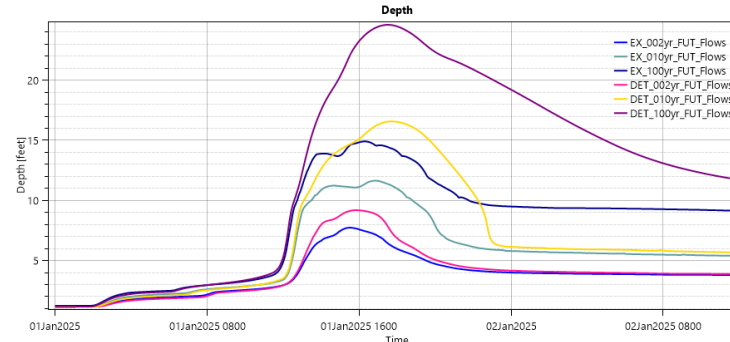


# TxDOT Coordination – October 22, 2025

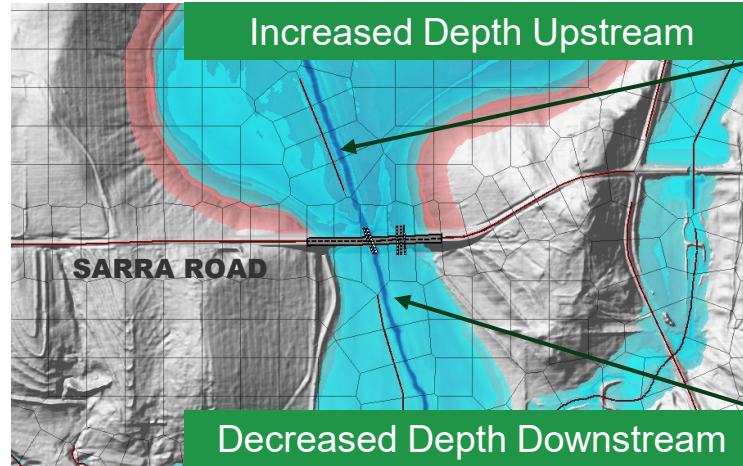
## Visualizing Optimization Opportunities

**EXAMPLE:  
SARRA ROAD  
(Parker County)**

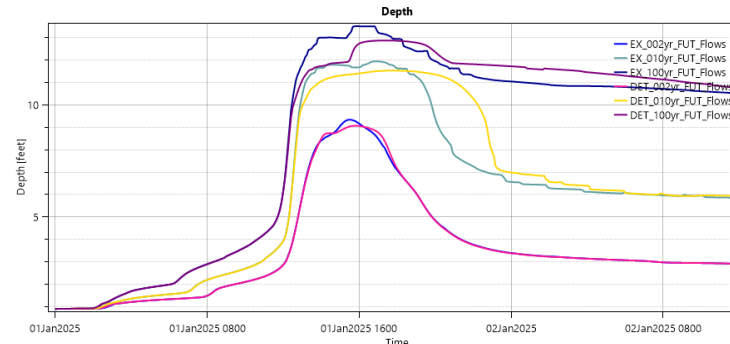
**BEFORE**



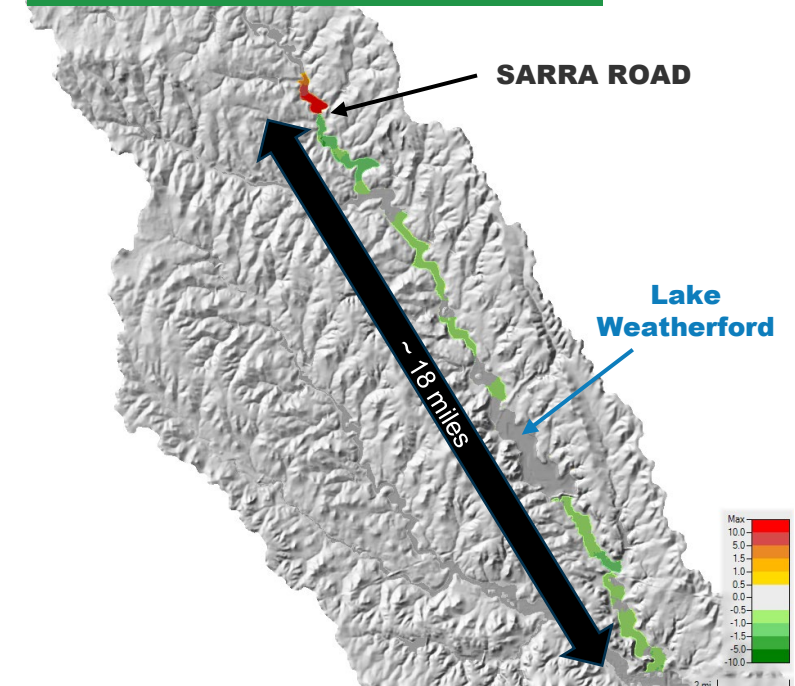
**Increased Depth Upstream**



**Decreased Depth Downstream**



**Reduced Flow Downstream**

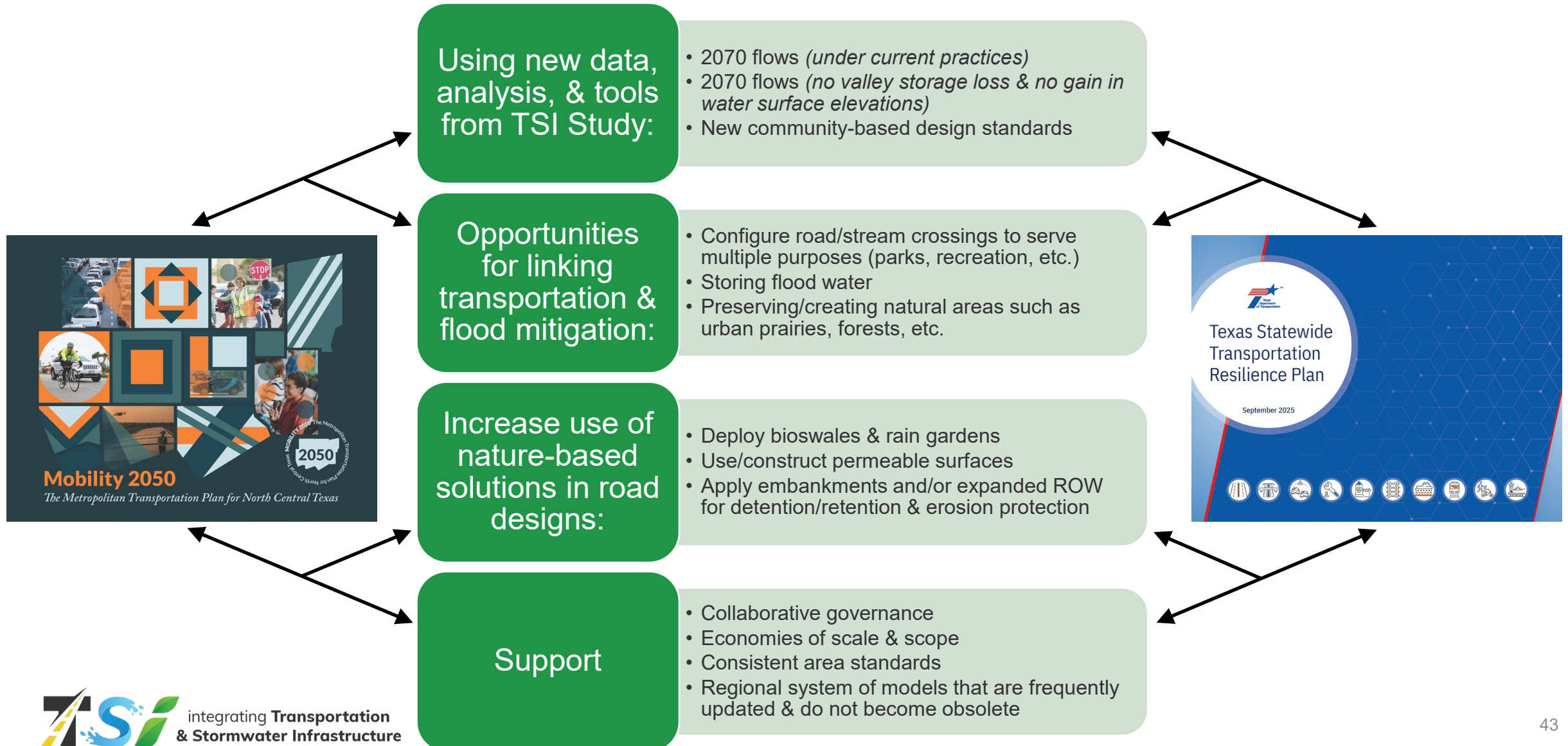


**Key Summary Statistics – 2070**

- **100-year Conditions (upstream):**
  - ▣ Valley Storage: + 2,000 acre-ft
  - ▣ Flow Rate: - 3,000 ft<sup>3</sup>/sec
- **10-year Conditions (downstream):**
  - ▣ Flow Rate: - 1,000 ft<sup>3</sup>/sec
  - ▣ Elevation Reduction: 0.5-1.0 ft

# TxDOT Coordination – November 25, 2025

## Sharing Data, Methodologies, & Tools



# Next Steps and Upcoming Events

NCTCOG

Jeff Neal, PTP



# Next Steps

## West

Finalization of storm shifting SOPs

Hydraulic work

Finalization of optimization study

Policy inventory and research

Community site visits

## North

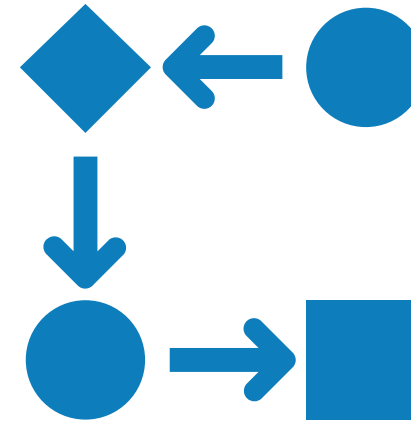
Continued hydrologic work

GIS stacking model

Alternatives analysis SOP

Policy inventory and research

Community site visits



# Upcoming NCTCOG Committee Events

- Regional Transportation Council (RTC) – January 8<sup>th</sup>, 1:00 – 3:00 PM,  
<https://www.nctcog.org/trans/about/committees/regional-transportation-council>
- iSWM Subcommittee Meeting – January 13<sup>th</sup>, 1:30 – 3:30 PM,  
<https://www.addevent.com/event/JU27069573>
- Water Resources Council – January 14<sup>th</sup>, 10:30 AM – 12:30 PM,  
<https://www.addevent.com/event/Rf26239677>
- Surface Transportation Technical Committee (STTC) – January 23<sup>rd</sup>, 1:30 – 3:30 PM,  
<https://www.nctcog.org/trans/about/committees/surface-transportation-technical-committee>
- RISE Coalition Meeting – January 28<sup>th</sup>, 9:30 – 11:30 AM,  
<https://www.addevent.com/event/wm26642059>
- Public Works Council Meeting – February 19<sup>th</sup>, 10:00AM – Noon,  
<https://www.addevent.com/event/BX26489382>

All NCTCOG E&D Events: <https://www.nctcog.org/envir/Events>

# Upcoming TSI Study Workshops

## Flood Warning System (FWS)

### Pre-Workshop Meeting

**January 15, 2026 – 10:00 a.m. to 11:00 a.m.**

Virtual via Microsoft Teams

Details & Add to Your Calendar:

<https://www.addevent.com/event/yyqpm7vd2cgh>

## Flood Warning System (FWS)

### Workshop

**February 17, 2026 – 10:00am to Noon**

Hybrid – NCTCOG Transportation Council Room

(Virtual via Microsoft Teams)

Details & Add to Your Calendar:

<https://www.addevent.com/event/skb38xv9sgjc>

## Model Development Code & Floodplain Ordinances Workshop

**January 29, 2026 – 10:00 a.m. to 12:00 p.m.**

Hybrid – NCTCOG Transportation Council Room

(Virtual via Microsoft Teams)

Details & Add to Your Calendar:

<https://www.addevent.com/event/fcqy17r29868>

# Speaker Contacts

## NCTCOG

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