North Central Texas Council of Governments

Technical Advisory Group Meeting

January 24, 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.

Update on Project Progress

Update on Project Progress

Progress to Date

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Progress to Date

3 Rounds of meetings with stakeholders in the study area
7 Technical Advisory Group meetings
6 Steering Committee meetings
3 Workshops conducted
- Water Rights & Green Stormwater Infrastructure
- E&D Flooding, Stormwater, & Water Quality Programs
- Green Asset Management Workshop

9 Visits to observe challenges faced by communities
- Equity Engagement Plan written (FEMA)
- Stakeholder Engagement Plan written
- Literature review has been completed
- 1D H&H Pilot Study completed
- H&H SOPs drafted
- H&H consultant work launched – West
- Optimization Study underway
- Stacking Model underway

Guest Presentation

Guest Presentation

Texan By Nature – Environmental Restoration Tool

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TEXAN by NATURE™
Texan by Nature exists to **advance conservation**.
We act as an **accelerator** for conservation groups and a **strategic partner** for business.

Catalyze

Provide resources, recognition, thought leadership, and capacity for acceleration.

- Conservation Wrangler
- Texas Water Action Collaborative
- Texan by Nature 20
- TxN Certification

Convene

Bring experts, partners, and members together for action.

- Conservation Summit
- Roundtables
- Statewide Initiatives (ROC, TxWAC)

Connect

Develop and broker trusted relationships.

- Conservation Partner
- Membership


TEXAN by NATURE™
RETURN ON CONSERVATION™ REPORT
TEXANBYNATURE.ORG

$639 million

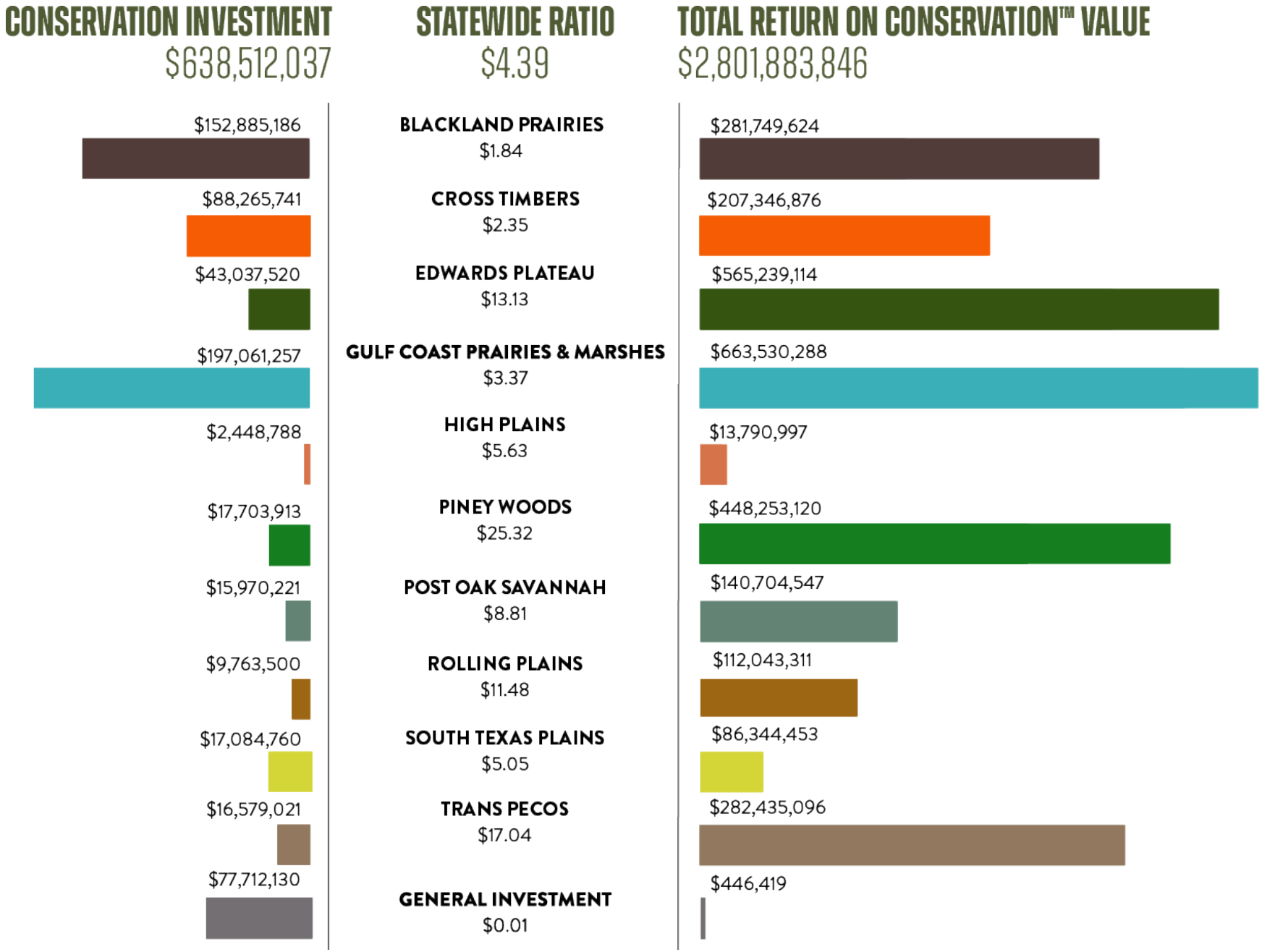
in conservation investment

$2.8 billion

in Return on Conservation™ value
in FY 2019.

4.39 : 1

Return ratio


CONSERVATION INVESTMENT
$638,512,037
STATEWIDE RATIO
$4.39
TOTAL RETURN ON CONSERVATION™ VALUE
$2,801,883,846
$152,885,186
BLACKLAND PRAIRIES
$1.84
$281,749,624
$88,265,741
CROSS TIMBERS
$2.35
$207,346,876
$43,037,520
EDWARDS PLATEAU
$13.13
$565,239,114
$197,061,257
GULF COAST PRAIRIES & MARSHES
$3.37
$663,530,288
$2,448,788
HIGH PLAINS
$5.63
$13,790,997
$17,703,913
PINEY WOODS
$25.32
$448,253,120
$15,970,221
POST OAK SAVANNAH
$8.81
$140,704,547
$9,763,500
ROLLING PLAINS
$11.48
$112,043,311
$17,084,760
SOUTH TEXAS PLAINS
$5.05
$86,344,453
$16,579,021
TRANS PECOS
$17.04
$282,435,096
$77,712,130
GENERAL INVESTMENT
$0.01
$446,419

JUST THINK
WHAT WE COULD DO IF
WE **WORKED TOGETHER**
TO **INVEST JUST 0.5%**
OF TEXAS'S
$2 TRILLION GDP –

$10 BILLION
FOR CONSERVATION.

THANK YOU!

Please contact Jenny Burden at jenny@texanbynature.org for questions

Links for Reference:

- Return on Conservation™ Report
  - https://bit.ly/TxNROC2024
- Case Maker Template
  - https://bit.ly/ROCcase
- Feedback Submission
  - https://bit.ly/ROCfeedback

Outreach to Local Governments

Outreach to Local Governments

Equity Based Outreach Site Visits

FEMA Equity-Based Outreach Grant

- FEMA definition: Fair, just, impartial treatment
  - Communities of color
  - Members of LGBTQ+ community
  - Persons with disabilities
  - Persons who may face discrimination based on religion, national origin, and persons with Limited English Proficiency
  - Persons living in rural areas
- Common Themes for Community Visits
  - Developer Relationships and Policy
  - Growth Challenges and Opportunities
  - Green Stormwater Infrastructure

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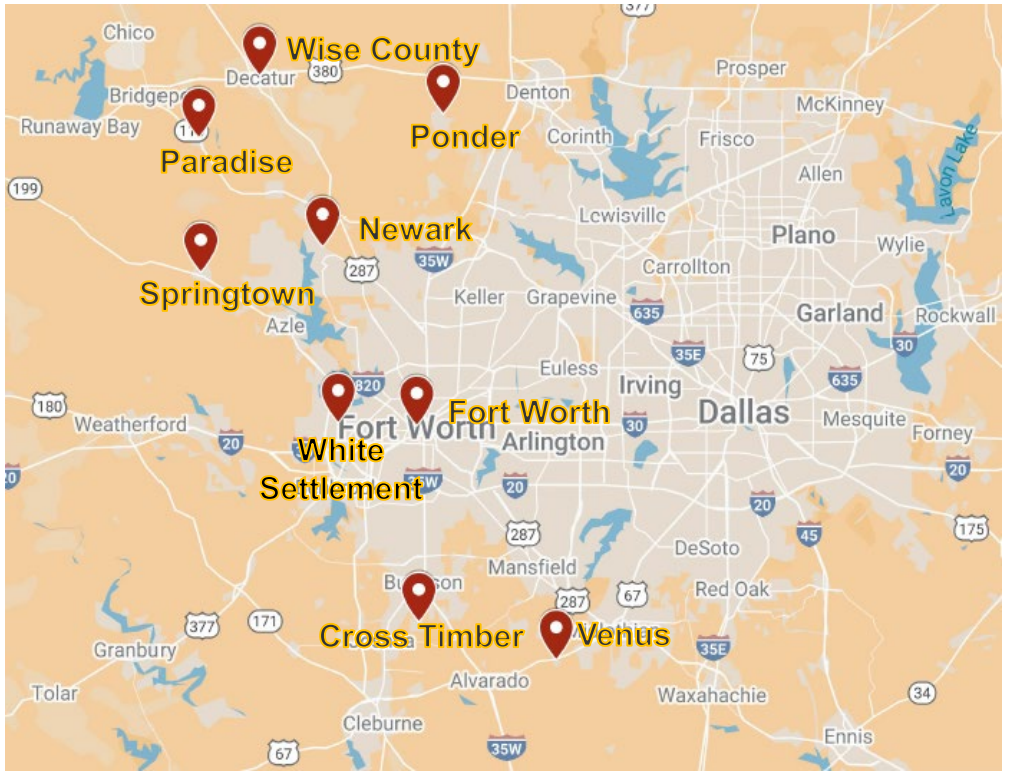
Communities Visited

- Cross Timber
- Fort Worth
- Newark
- Paradise
- Ponder
- Springtown
- Venus
- White Settlement
- Wise County

Communities Being Scheduled

- City of Aledo
- City of Denton
- City of Grand Prairie
- City of Lewisville
- Denton County
- Tarrant County



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Outreach to Local Governments

Developer and Real Estate Outreach

Developer and Real Estate Outreach

NCTCOG and the Urban Land Institute identified development stakeholders and organizations, identified challenges, and developed recommendations and strategies to address the challenges. Challenges include:

- Lack of awareness of flooding
- Negative perceptions of green stormwater infrastructure
- Liabilities the development community
- Added costs

In the outreach to the development community, the study team will focus on the strategies that include:

- Education
- Simplification/Tools
- Incentivization
- Limit Liability

NCTCOG is holding a preliminary meeting with developers regarding how developers can be effectively involved in Spring 2025 with the goal of creating a Developer Advisory Group.

Outreach to Local Governments

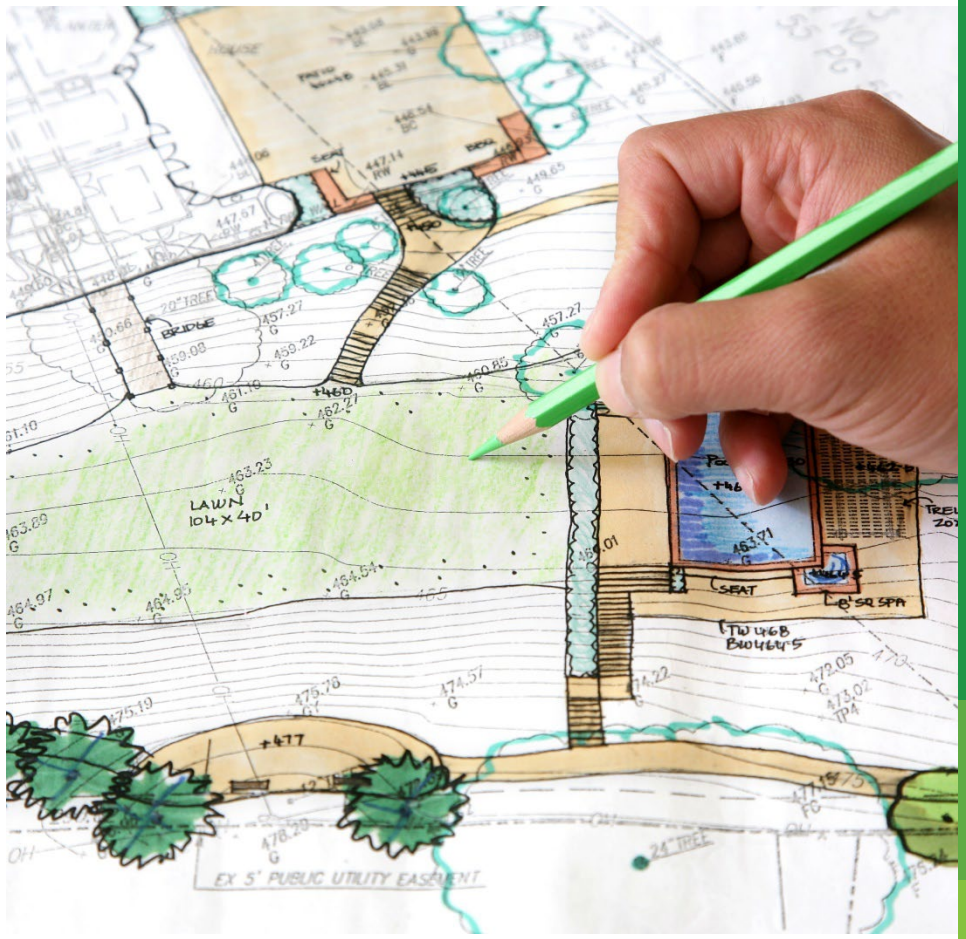
Economic Development Stakeholder Engagement

Economic Development Stakeholder Engagement

NCTCOG is coordinating with the NCTCOG's Economic Development Department to engage business and economic development stakeholders. Outreach to these stakeholders will for will focus on flooding mitigation and economic resilience:

- Reducing costs
- Strategic conservation of open space
- Integrating land use, transportation, and economic plans
- Sustainable growth
- Coordinated regional systems of natural and built infrastructure
- Protecting, retaining, and enhancing the region's natural assets

The study team will be presenting to the North Central Texas Economic Development District Board on Monday, February 3rd.



Outreach to Local Governments

County Watershed Workshop

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County Watershed Workshop

NCTCOG is planning a regional County Watershed Workshop discuss what counties can do to promote higher standards in floodplain management. The workshop will focus on topics such as:

- Why do we need Countywide Watershed management?
- Population growth
- Adequacy of flood hazard mapping
- What are higher floodplain management standards?
- NFIP minimum vs higher standards
- Do Texas cities and counties have legal authority to adopt and enforce higher standards?
- Benefits of higher floodplain standards.

NCTCOG is currently planning to host the workshop May 2025. More details will be available closer to the workshop. Anyone interested, please contact Jai-W Hayes-Jackson at Jhayes-Jackson@nctcog.org.

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Technical Advisory Group Discussion Items

Technical Advisory Group Discussion Items

West Study Area H&H Pilot Study

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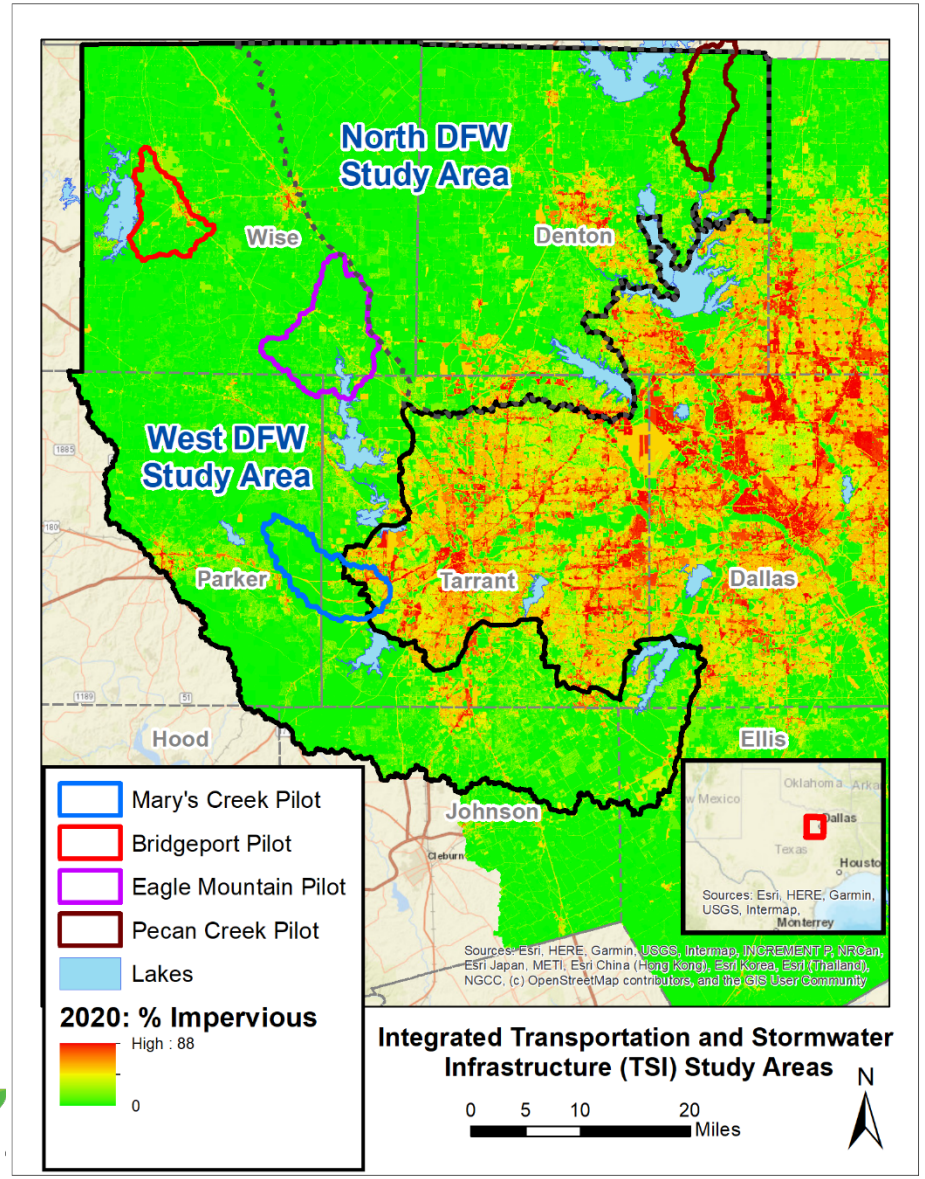
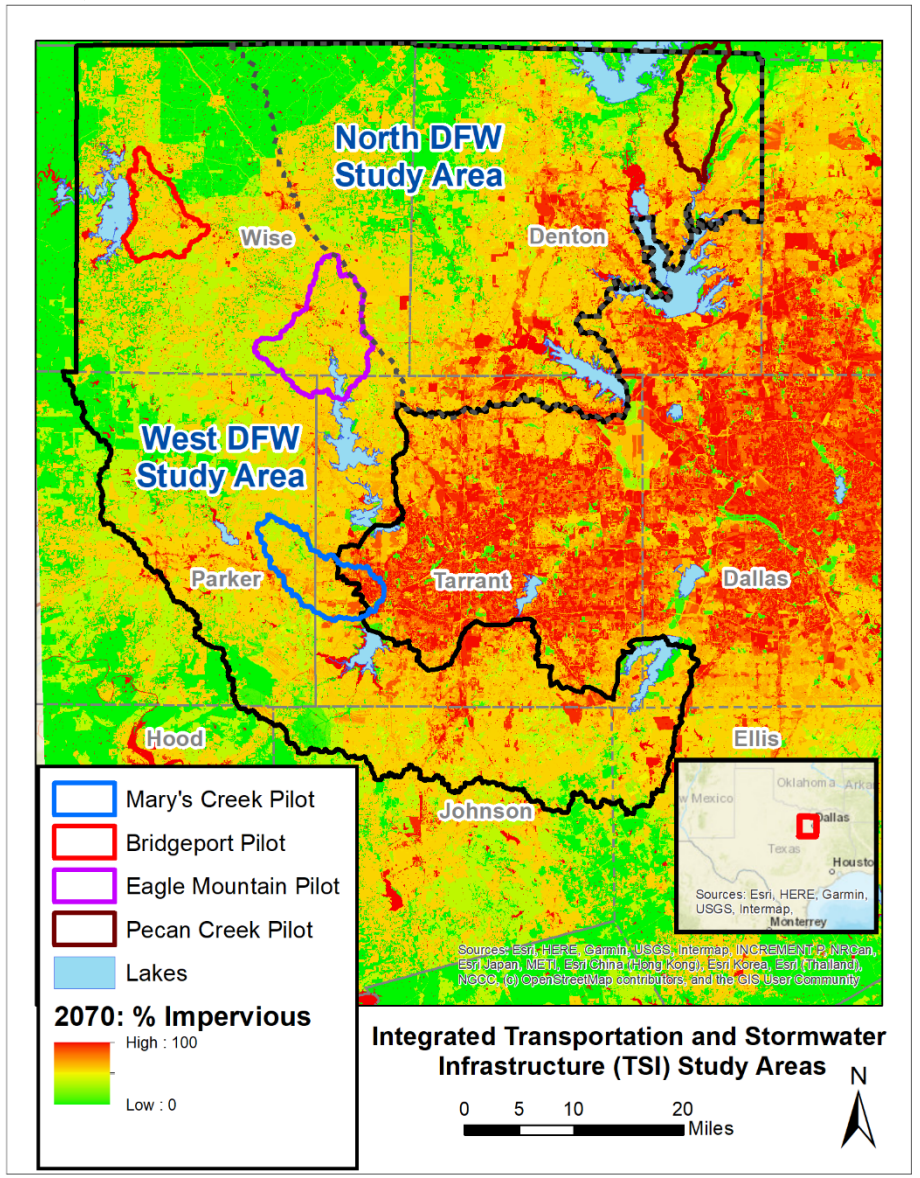
Land Use: Current vs. Future Analysis

2020 (6.4% Impervious)



2070 (35.2% Impervious)



Hydrology Enhancement

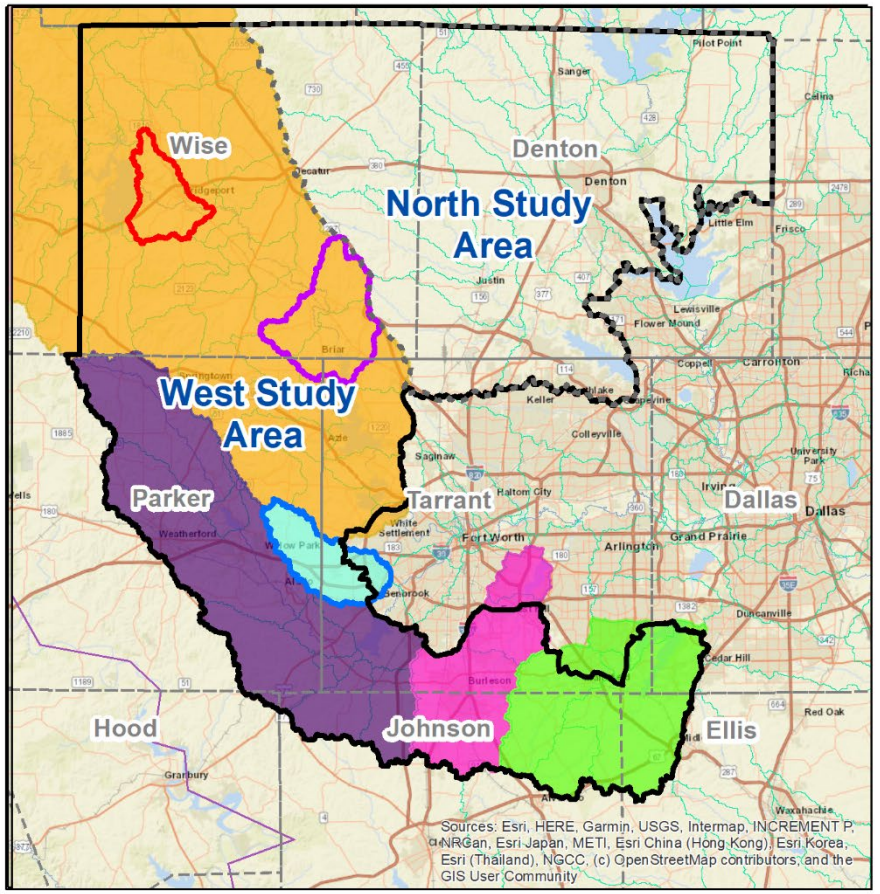
Developed SOP and enhancing hydrology (including new flow locations) across TSI study area:

- Mary's Creek
- Village Creek
- Mountain Creek
- Clear Fork
- West Fork

TSI Project
West Study Region
HEC-HMS Model Development SOP

May 2024

1. Delineate additional subbasins in HEC-HMS
2. Update HMS element names and descriptions
3. Calculate initial HMS parameters
4. Calibrate to InFRM WHA results
5. Update the HMS basin model for TSI current and future conditions
6. Run TSI storm scenarios
7. Model documentation
8. Submit final HMS model for review and use for team members



TSI Pilot and Hydrology Focus Areas

TSI Study Areas
County Boundary
InFRM WHA Subbasins

Eagle Mountain Pilot Area
Mary's Creek Pilot Area
Bridgeport Pilot Area

0 5 10 20 Miles

N

West Hydrology Focus Areas

Clear Fork
Marys Creek
Mountain Creek
Village Creek
West Fork

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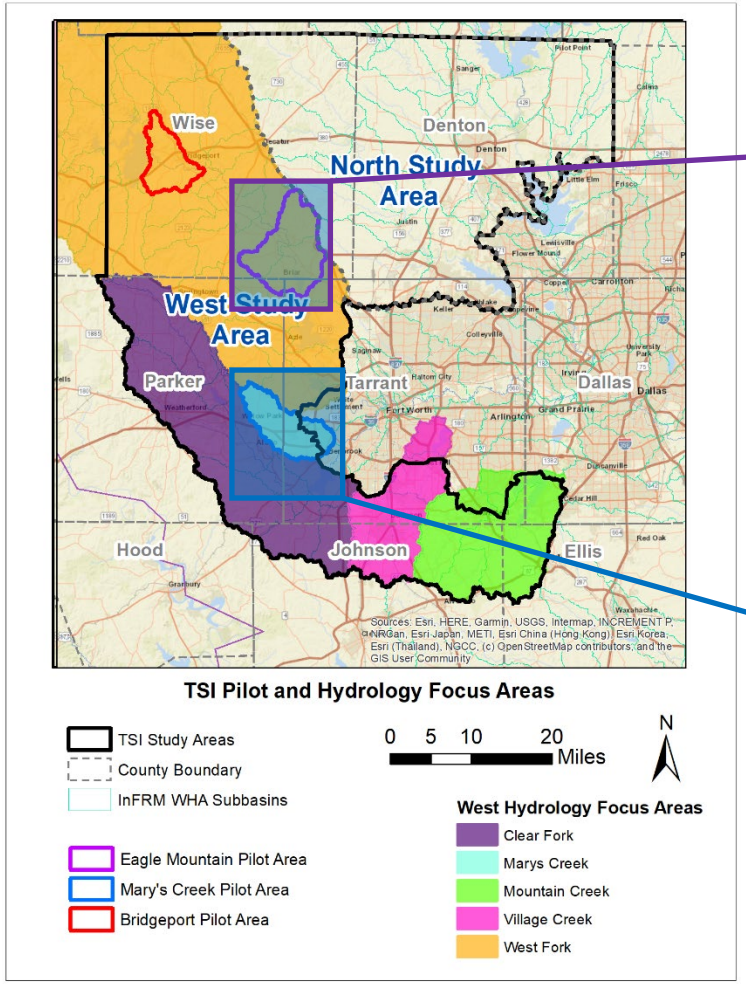
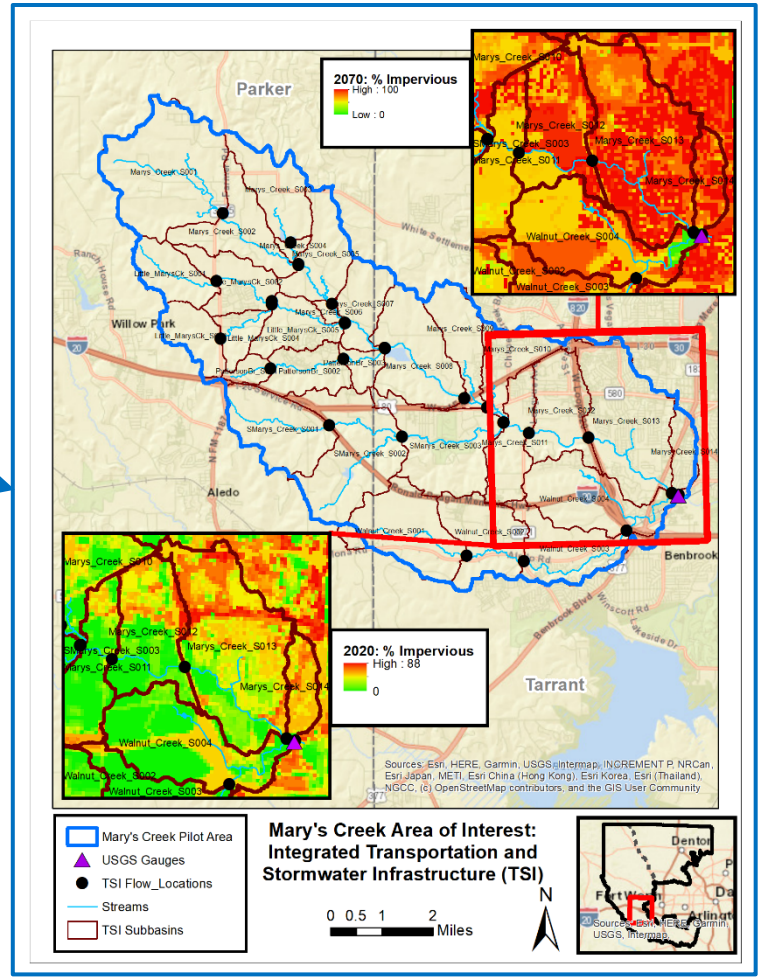
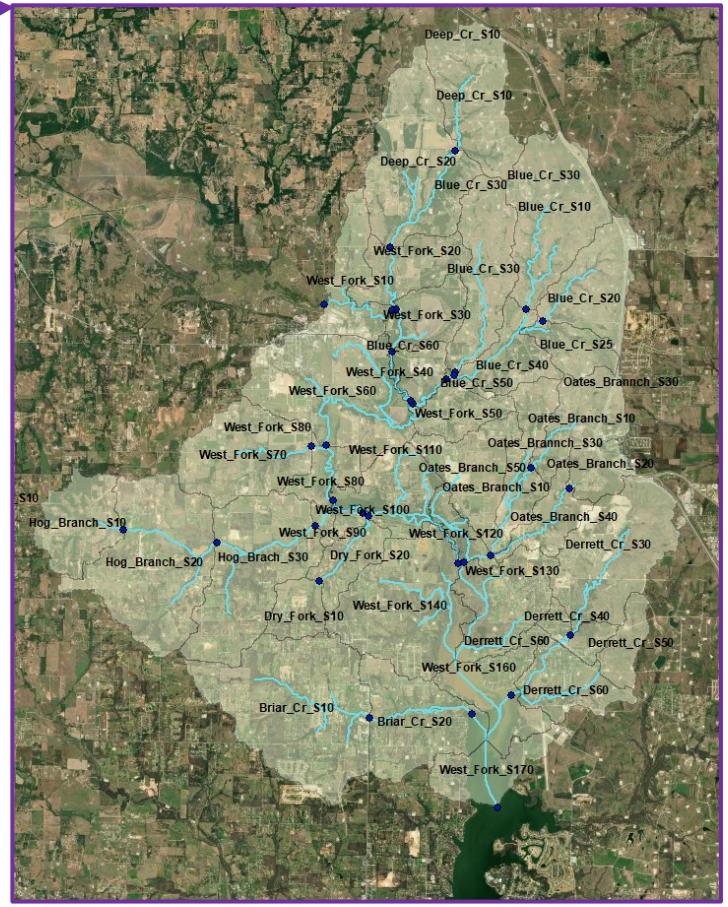
Hydrology Enhancement Examples:







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Final hydrology delineation for TSI Mary's Creek and Eagle Mountain Pilot Areas

Hydraulics Enhancement

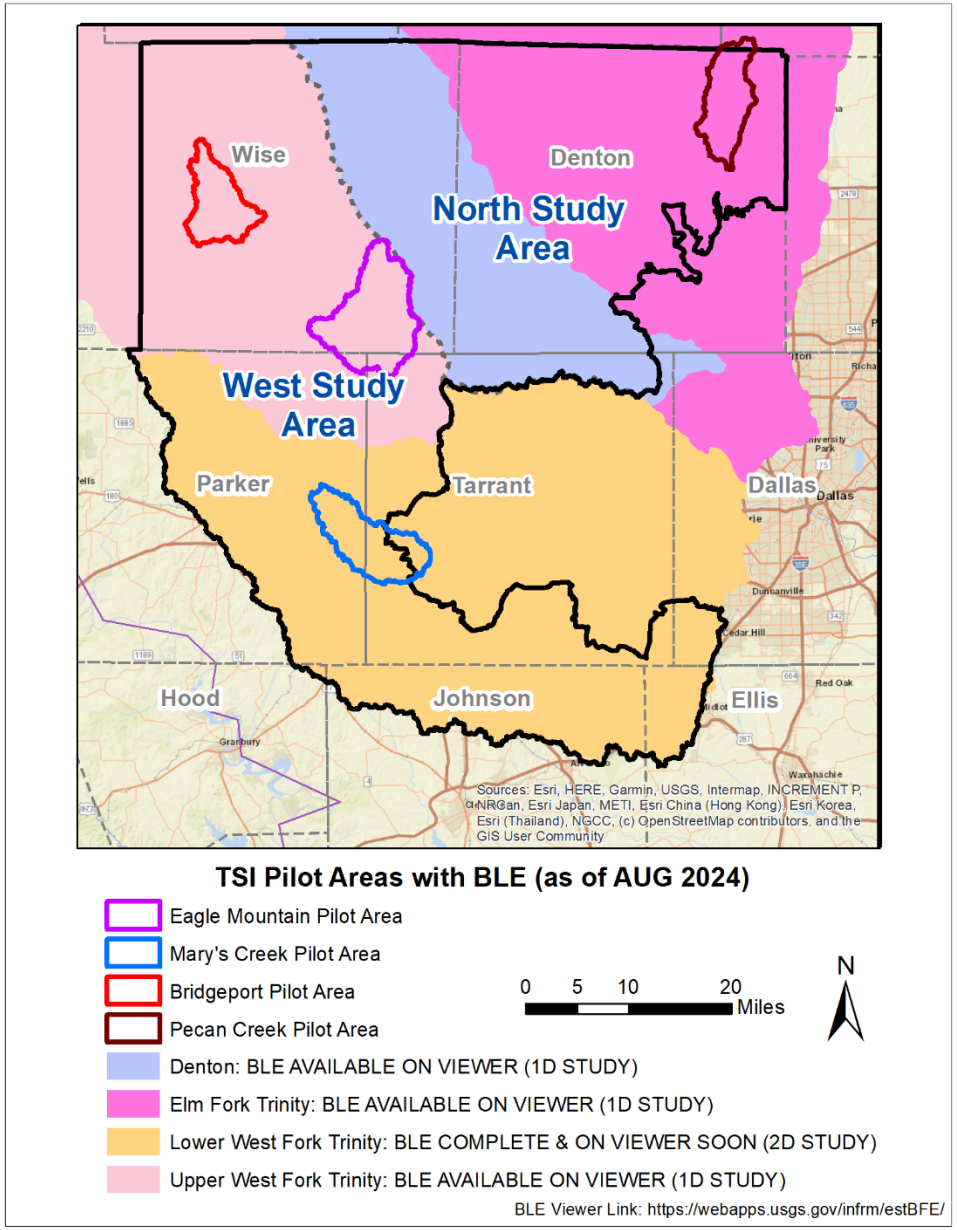
Developed SOP and enhancing hydraulic models to inform flooding considerations:

- **Defining approach for enhancing Base Level Engineering (BLE)**
  - Exploring 1D vs 2D model considerations
  - Testing approaches, adding detail, urban drainage, determining environmental constraints, establish recurrence intervals, incorporate current/future flows, optimization scripting, etc.

TSI Project
West Study Region
HEC-RAS Model Development
May 2024

Defining TSI HEC-RAS Modeling Process for:

1. 1D Individual Models
2. 1D Combined Models
3. 2D Modeling



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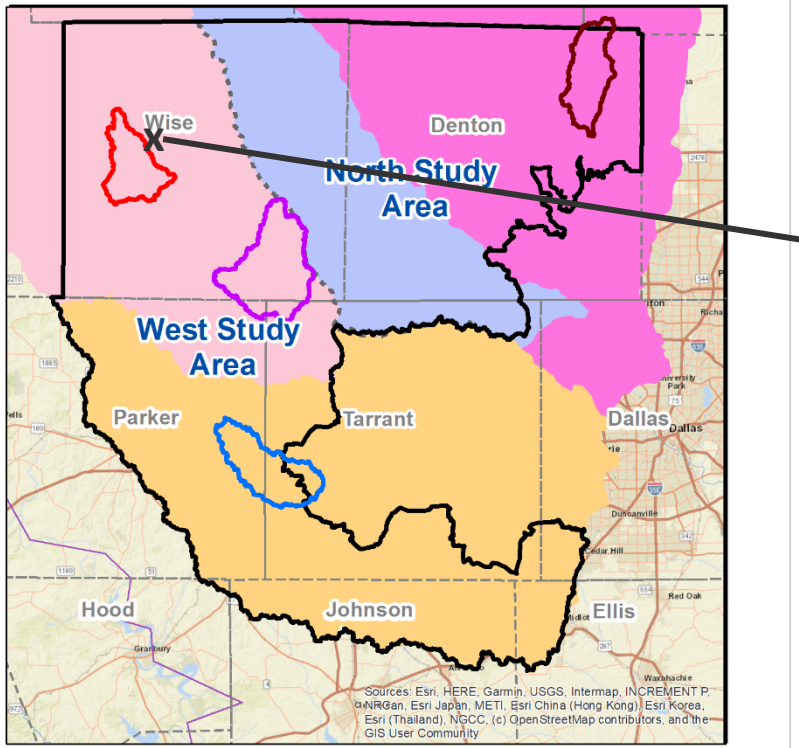
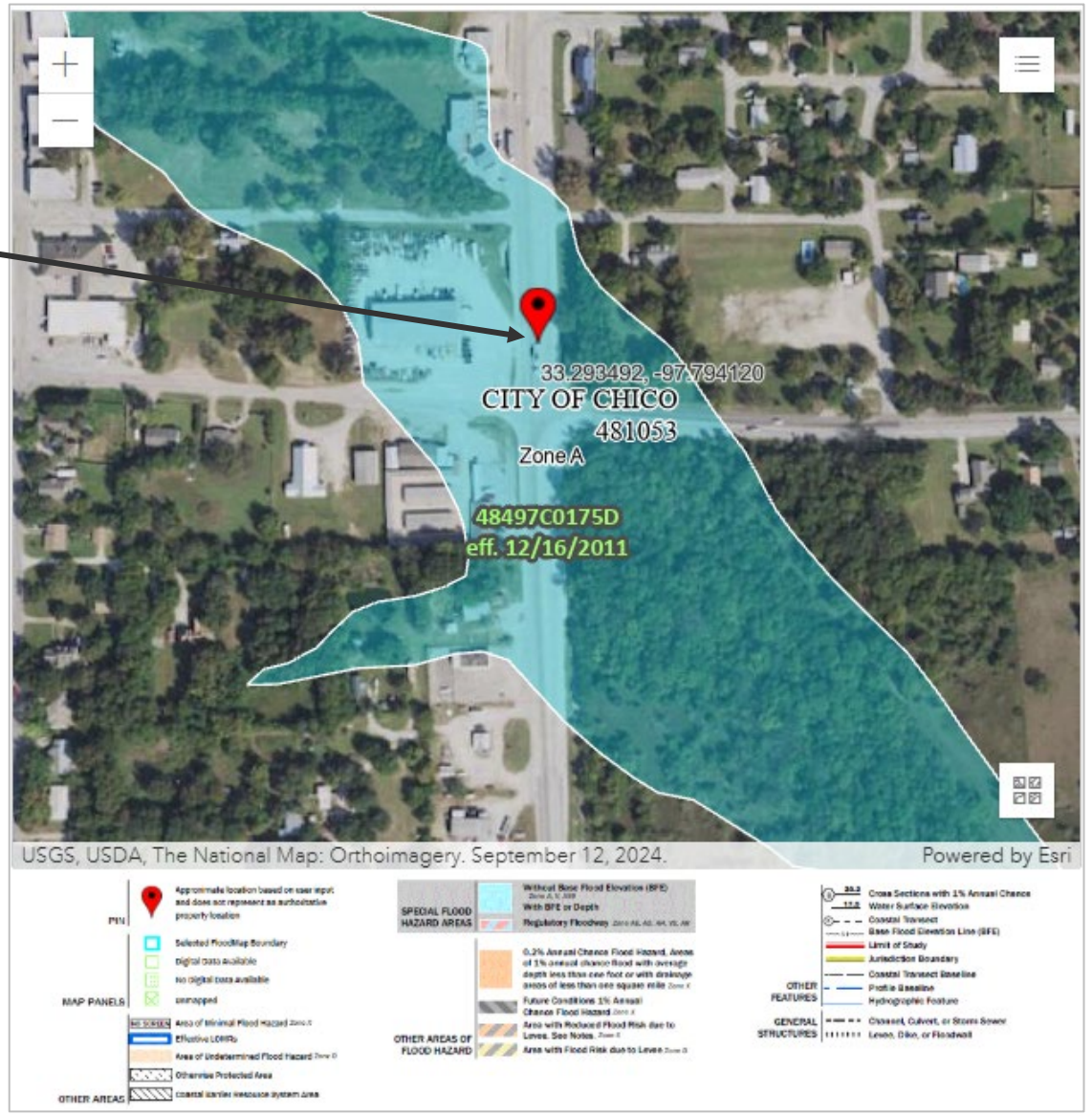
Hydraulics Example: TSI-Area (Chico, Texas)





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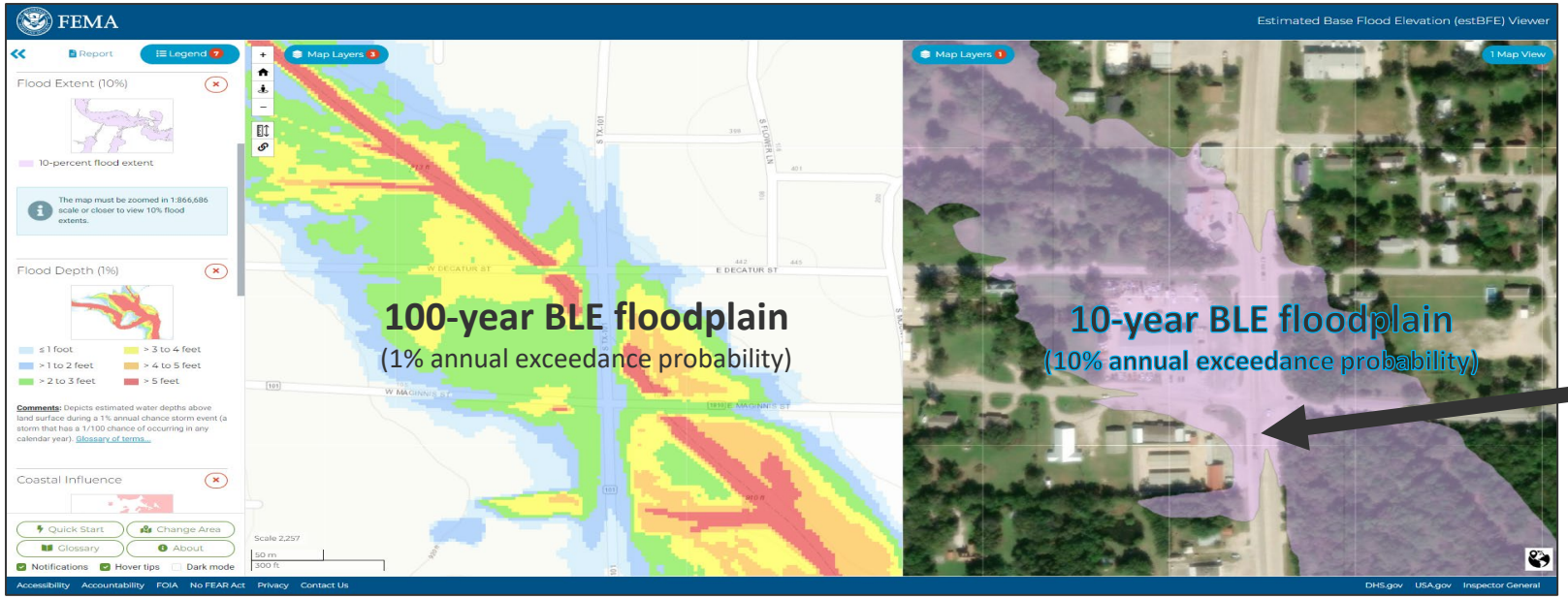
Hydraulics Example: TSI-Area Flooding with BLE (Chico, Texas)



Source: InFRM Estimated Base Flood Elevation Viewer: https://webapps.usgs.gov/infrm/estBFE/

NOWData - NOAA Online Weather Data Enlarge results Print

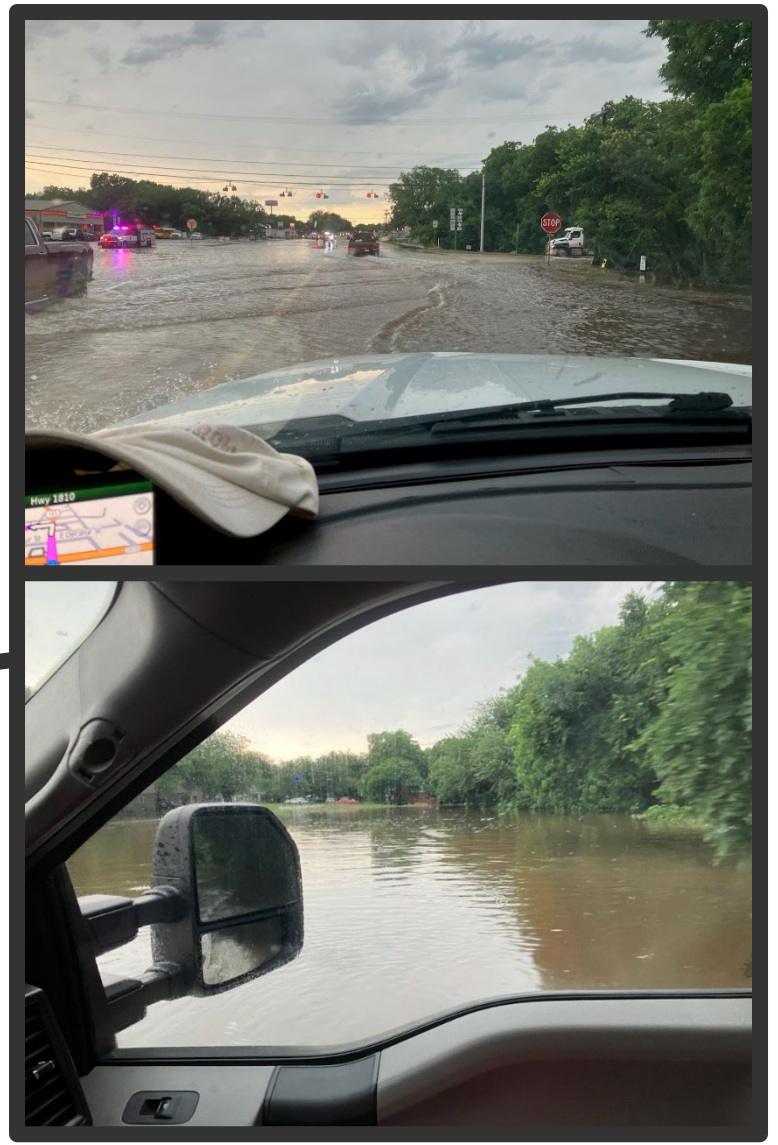
Climatological Data for DECATUR MUNICIPAL AIRPORT, TX - May 2024

Click column heading to sort ascending, click again to sort descending.

Date	Temperature				HDD	CDD	Precipitation
	Maximum	Minimum	Average	Departure			
2024-05-28	80	63	71.5	M	0	7	2.40

Source: NOAA Climatological Data: http://www.weather.gov/climate

Precipitation Duration	Recurrence Interval (years)
15-min	500
30-min	50
60-min	10
2-hr	5
6-hr	1



Dry Creek: May 28, 2024

Source: Tarrant Regional Water District

Source: NOAA Atlas 14 Point Precipitation Frequency Estimates for ~2.4" in Chico, Texas: https://hdsc.nws.noaa.gov/pfds/pfds_map_cont.html

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Base Level Engineering Enhancements

Benefit	1D (Individual Models)	1D (Combined Models)	2D (Flow Hydrographs)	2D (Rain-on-Mesh)
Short RAS setup and runtime	●	●		
Simple and efficient inundation mapping process	●	●		
Simple and straight forward modeling technique	●	●		
Accounts for timing of mainstem backwater on tributaries			●	●
Main reason in support of method	Single RAS and HMS run for different drainage areas.	Single RAS and HMS run for different drainage areas.		
Main reason to avoid method			Multiple RAS run required for different drainage areas. Complicated inundation mapping.	Multiple RAS run required for different drainage areas. Complicated inundation mapping.

Decision:
Enhance 1D individual modes in areas with 1D BLE and 2D individual models with flow hydrographs in areas with 2D BLE

Changes:

- Add bridges/culverts
- Updated flow paths
- Adjust/add cross-sections as needed

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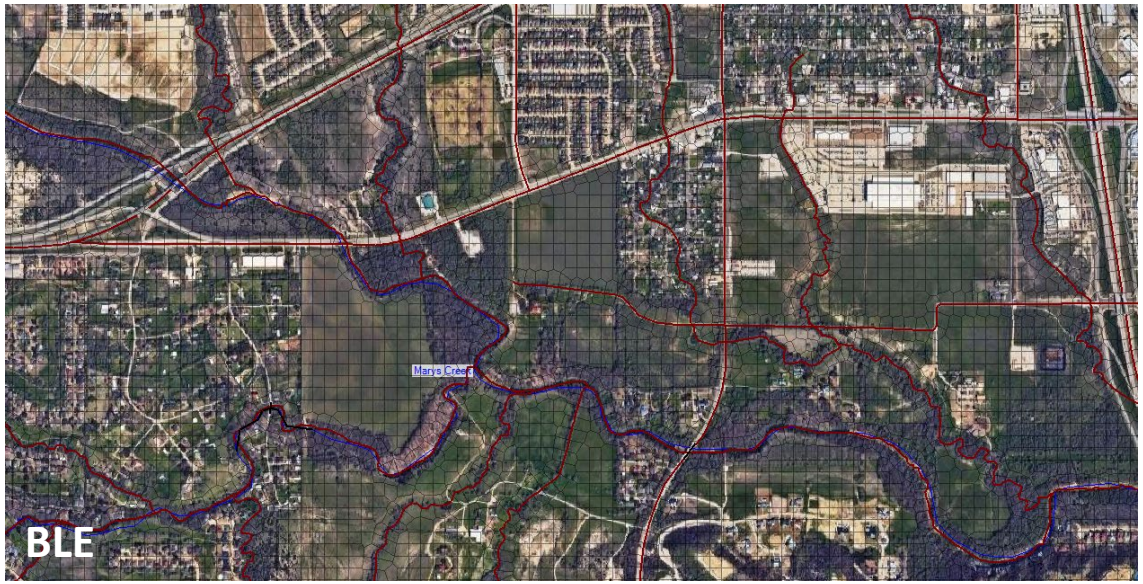
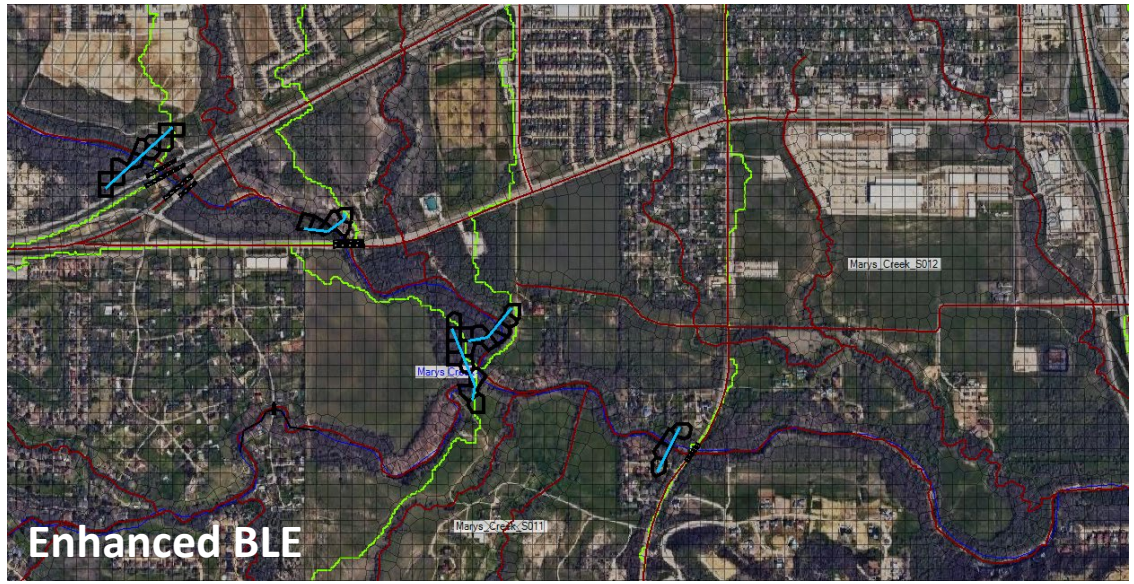
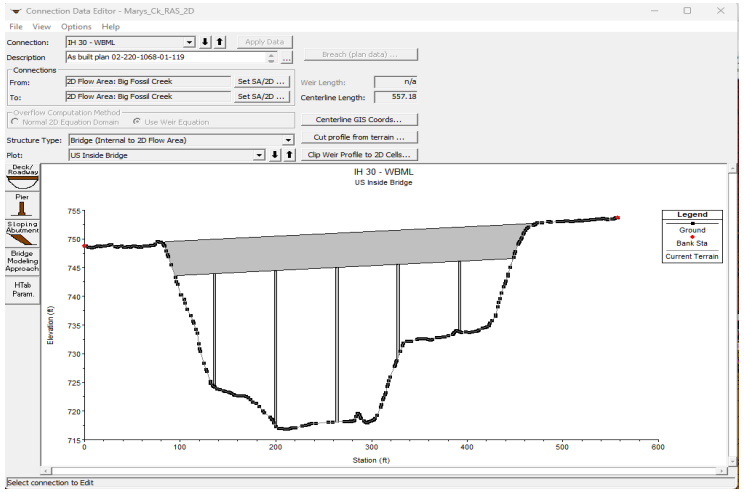
Base Level Engineering Enhancements





Enhancements:

- Refined hydrologic subbasins
- Current and future conditions
- ROM → Flow BCs
- Added bridges and culverts



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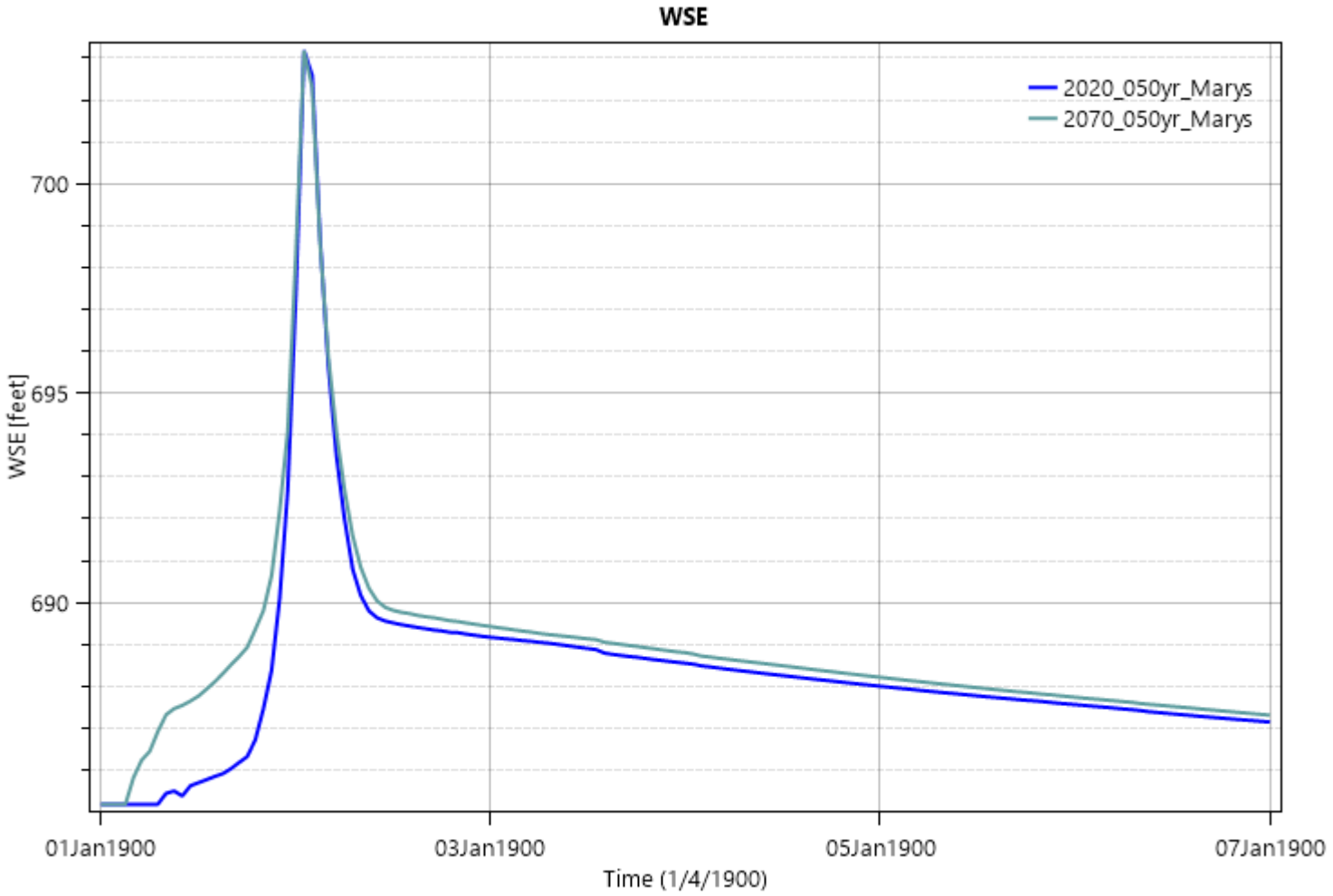
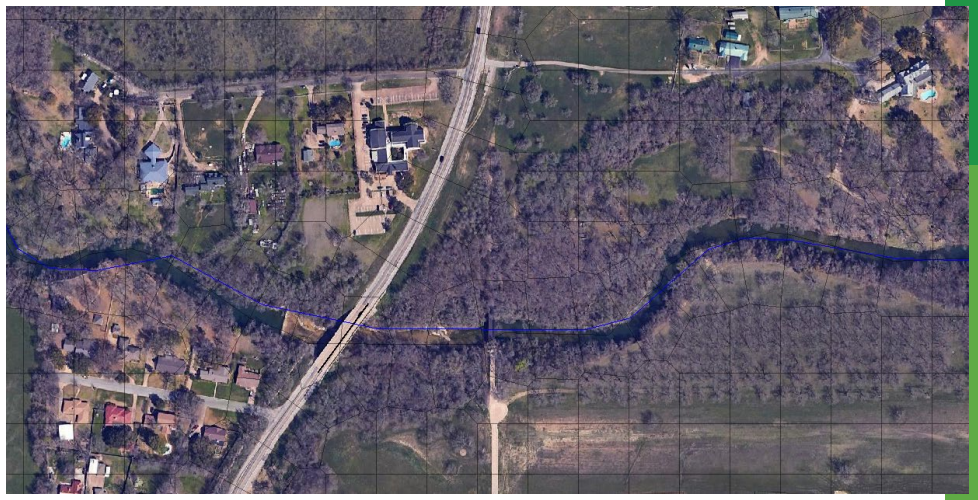
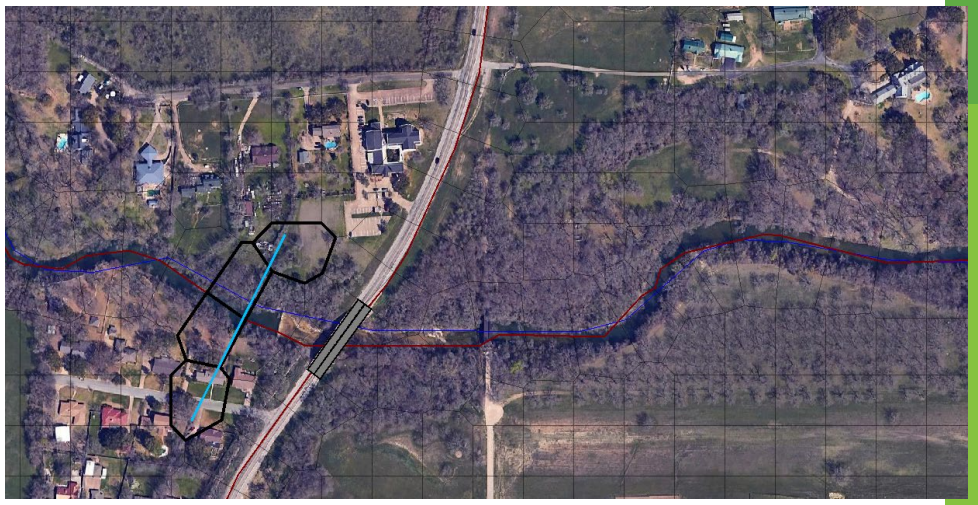
Base Level Engineering Enhancements







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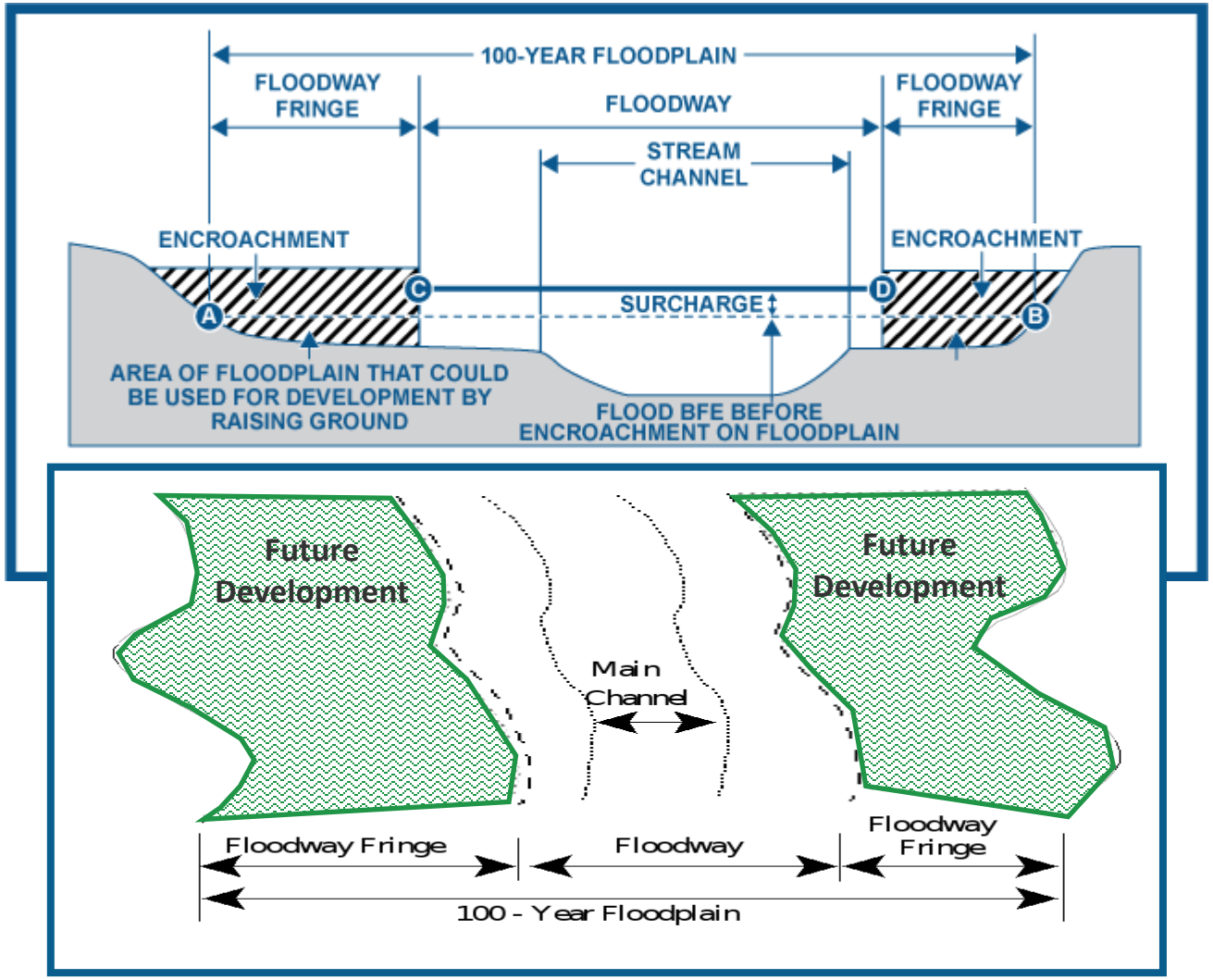
Estimating the Potential Loss of Valley Storage for Future Conditions without TSI



- Obtain existing FEMA HEC-RAS models with floodways
- Assume that FEMA's floodway encroachments represent the lost valley storage due to future development
- Use Floodplain volume for TSI existing conditions
- Use Floodway volume for TSI future conditions
- Calculate Storage-Discharge curves for HEC-HMS by running a range of discharges through these two conditions
- For reaches without a floodway, first calculate the Percent Difference in storage for multiple streams with floodways, then apply that percent difference to stream reaches without a floodway

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Technical Advisory Group Discussion Items

North Study Area H&H Study

integrating Transportation & Stormwater Infrastructure

January 2025 TSI Technical Advisory Group Meeting

TSI North Study Area

H&H Modeling Update

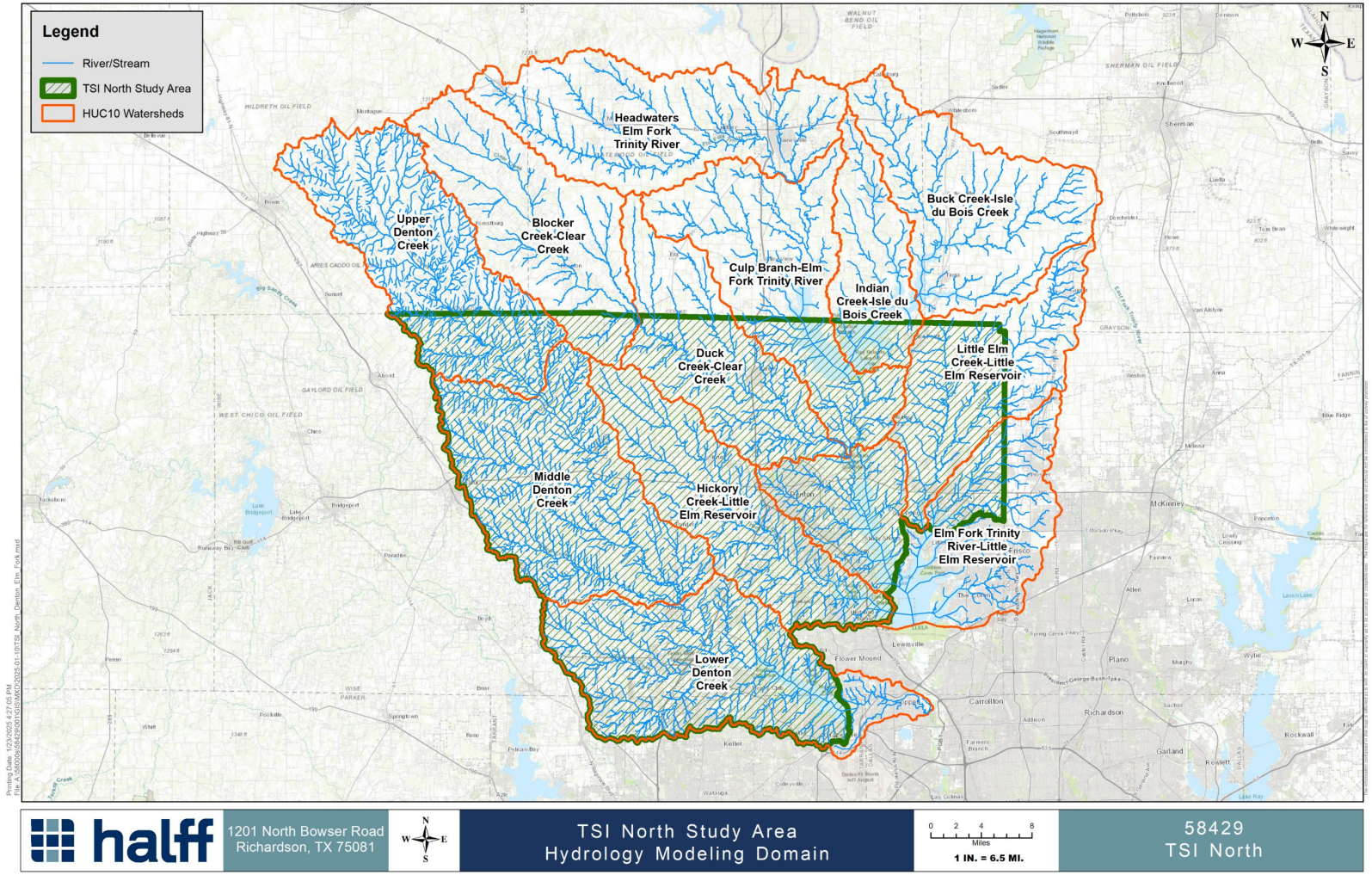
January 24, 2025

MODELING METHODS

Modeling will follow Standard Operating Procedure (SOP) developed for the TSI West Study Area.

Work completed to date -

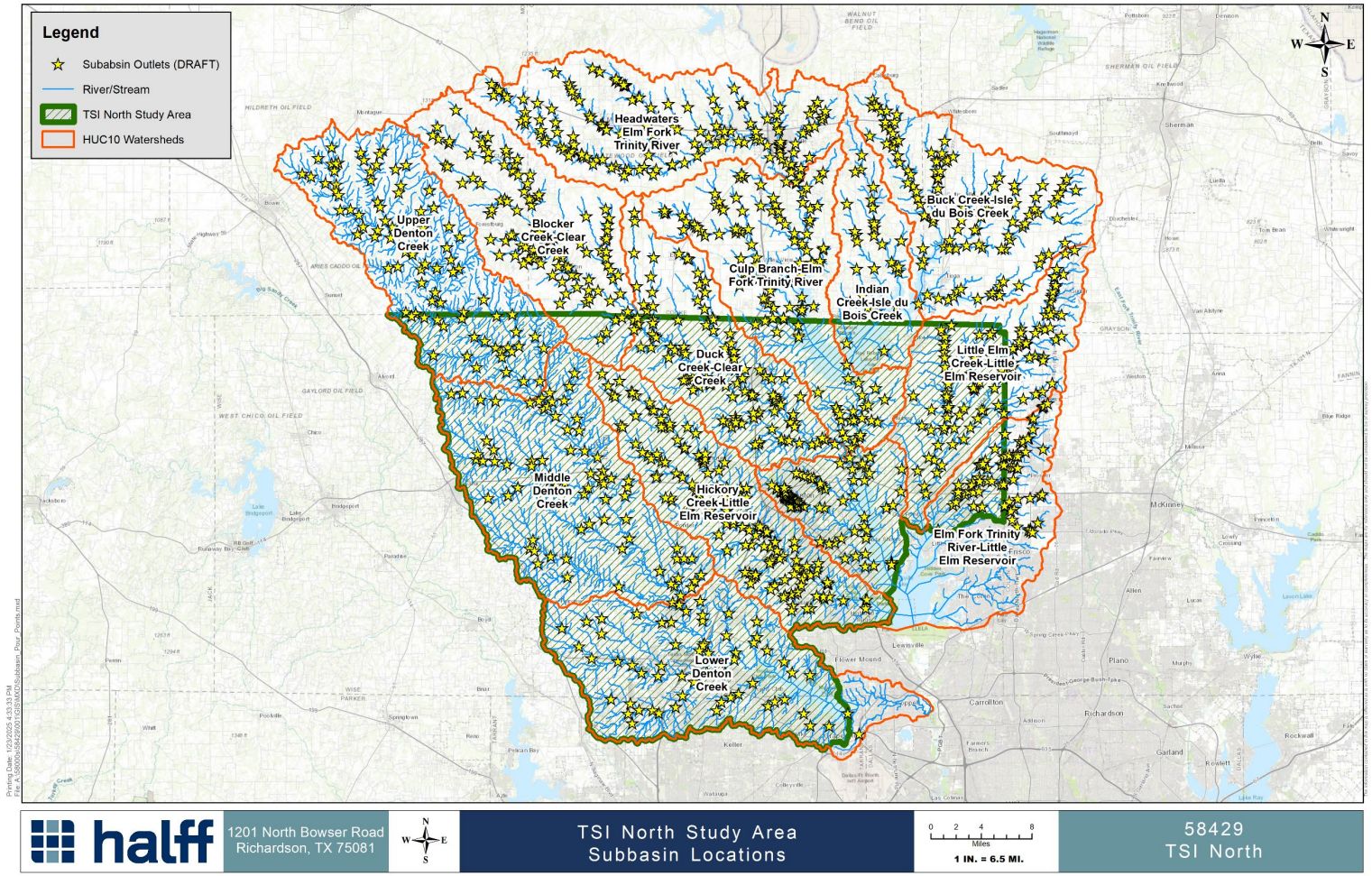
- Reviewed Hydrology SOP
- Reviewing Hydraulics SOP
- Data Collection
- Draft subbasin breaks



SUBBASIN BREAKS (DRAFT)

The following datasets were used to identify subbasin pour point locations based on the SOP recommended methodology. The number of breaks in the contributing drainage area may be reduced.

- Tx DOT Bridges
- NID Dams
- USGS Streamflow Gages
- FFRD Stream Centerlines
- Future Roads 2045
- InFRM WHA Model subbasins



NEXT STEPS

- Initiate development of HEC-HMS models for the TSI North Study Area and the contributing drainage areas
- Perform subbasin delineations within HEC-HMS following the SOP
- Review Denton County's Pecan Creek Study (when it becomes available)

Technical Advisory Group Discussion Items

Optimization Study Update

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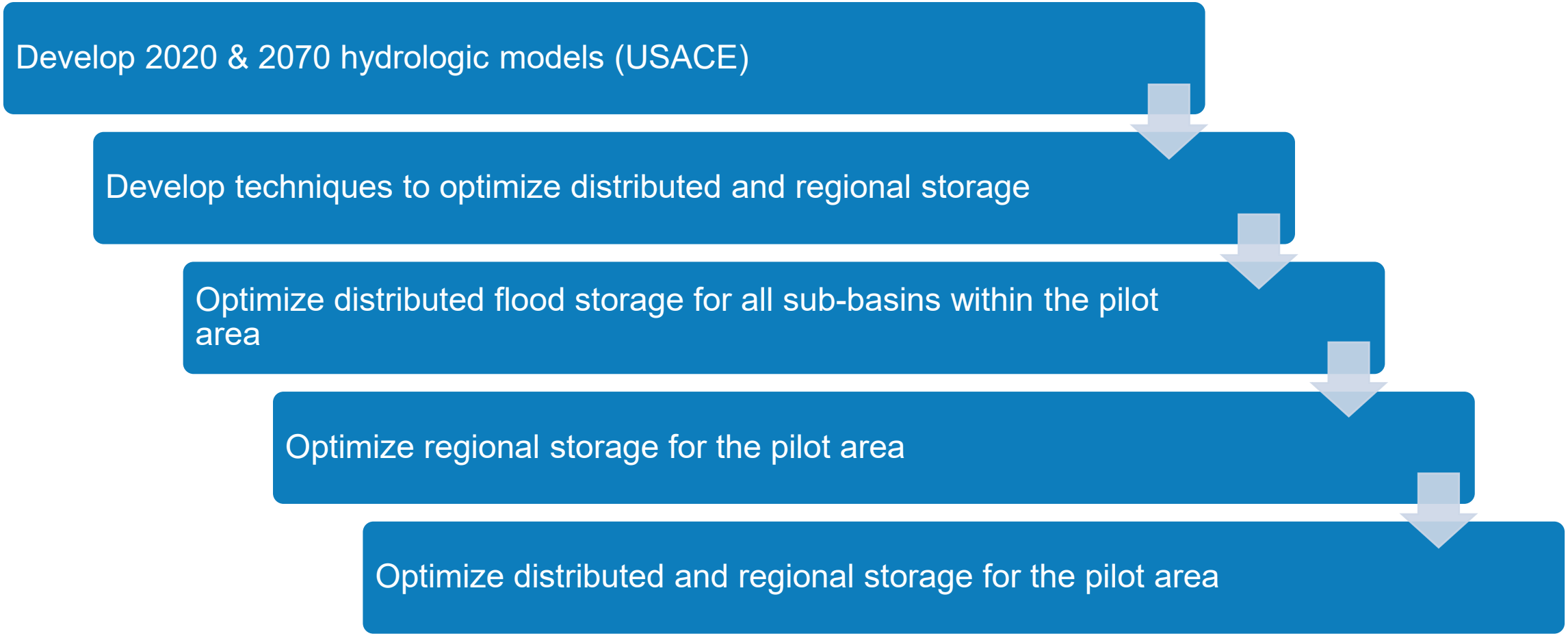
TSI Optimization Overview

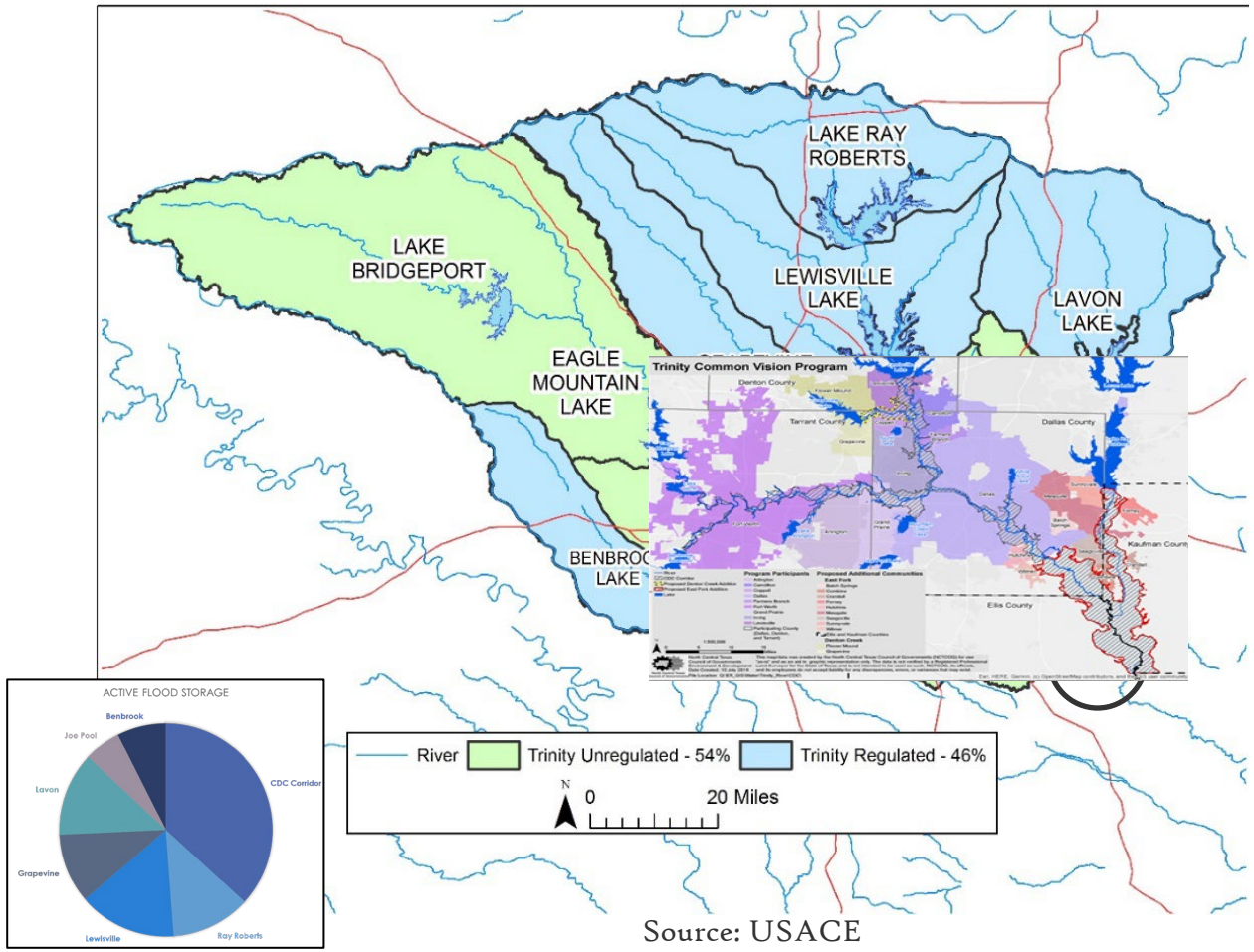
- The optimization study will
  - ***Identify locations and sizing for detention ponds to prevent increases in flooding due to growth and development***
    - Optimizes distributed detention storage
    - Optimizes regional detention storage
    - Optimizes a combination of distributed and regional detention storage
    - Develop techniques to demonstrate the effectiveness of G&GSI and NBS
- The study focuses on critical locations identified by transportation
- Considers the mitigation impacts of G&GSI and NBS in conjunction with the detention ponds
  - Specifically, the G&GSI and NBS suitability index helps to provide a foundation for where GSI/NBS can be proposed

TSI Optimization: Pilot Study Workflow



Why Is Storage So Important?

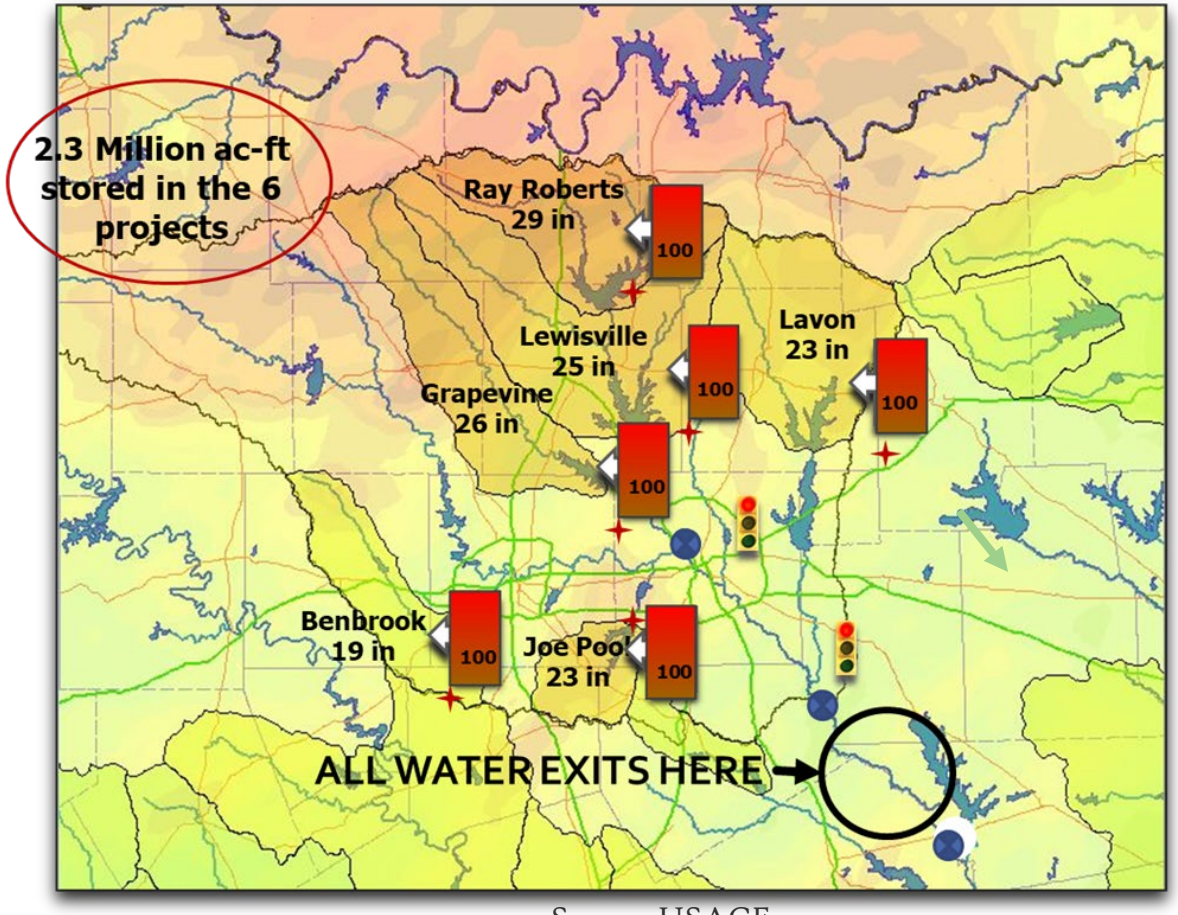
- Drainage area 6278 sq mi (below Dallas)
- Single discharge point for entire system
- Light green area is unregulated (no mitigation)
- Maximum historical flow ~90,000 cfs
- USACE maximum release 24,000 cfs
- Maximum flow rates suggest long periods to empty system



Source: USACE

Why Storage: 2015 Extreme Flooding Event, DFW

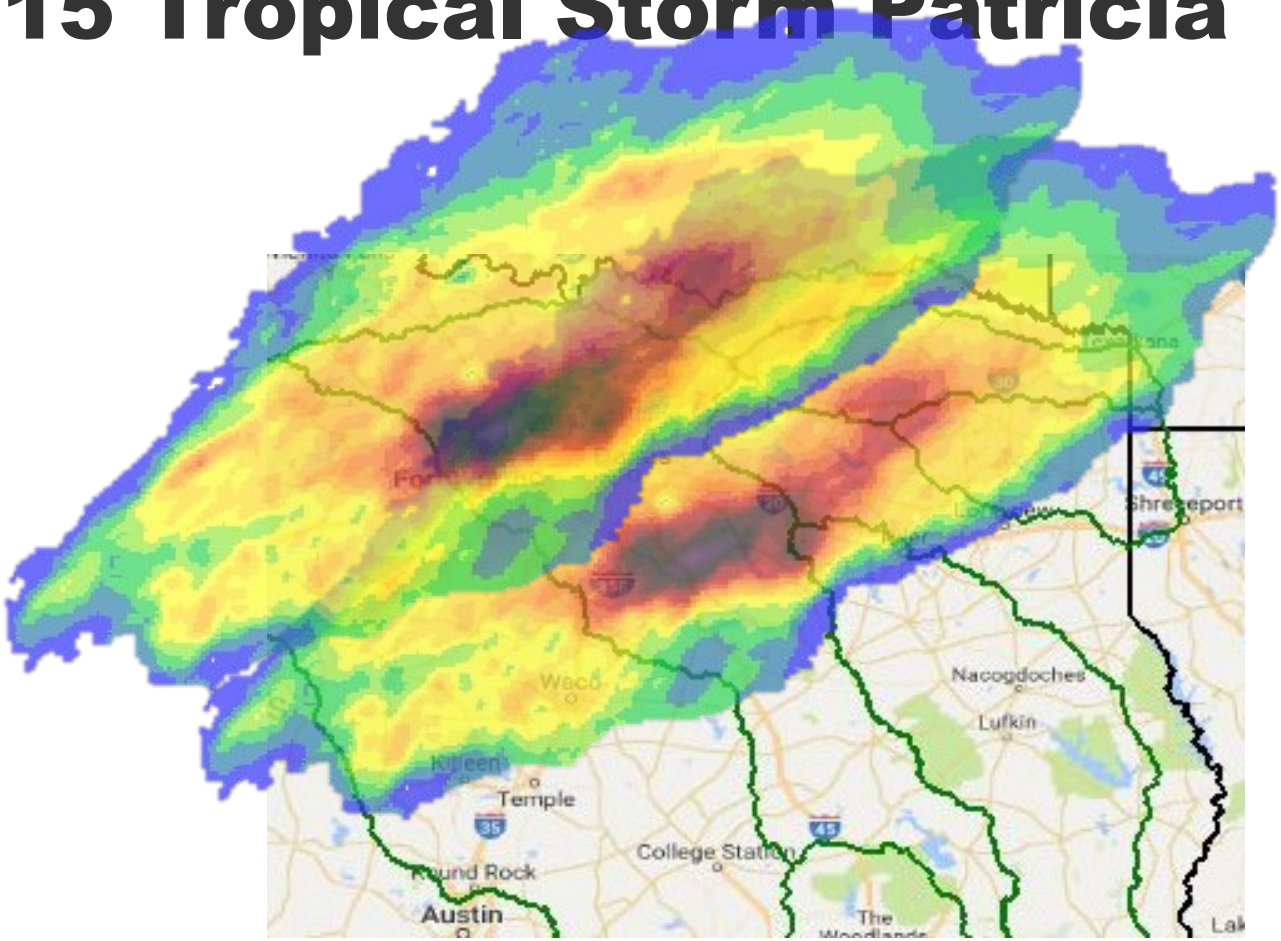
- 1 May – 15 June 2015 flooding event
- 20”-30” basin average precipitation
- Ended with Tropical Storm Bill
- USACE reservoirs completely filled and in surcharge operations
- Lakes closed to recreation
- **4-5 months to empty**



Source: USACE

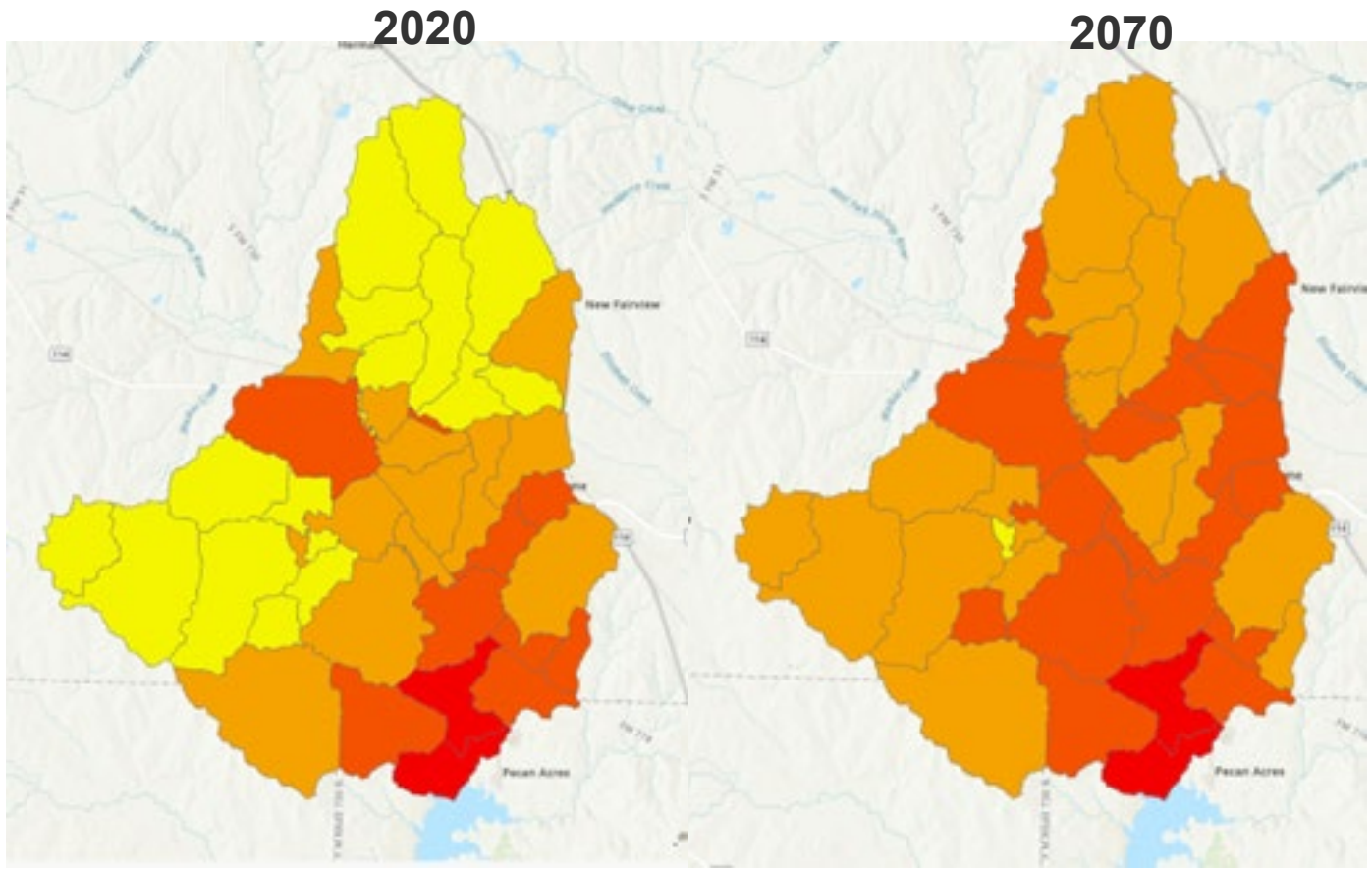
Why Storage: Sept. 2015 Tropical Storm Patricia

- N. Texas is subject to extreme storm events
- Both tropical and convective
- Maximum N. TX precipitation ~36”/24 hr
- Tropical storm Patricia ~25”/24 hr



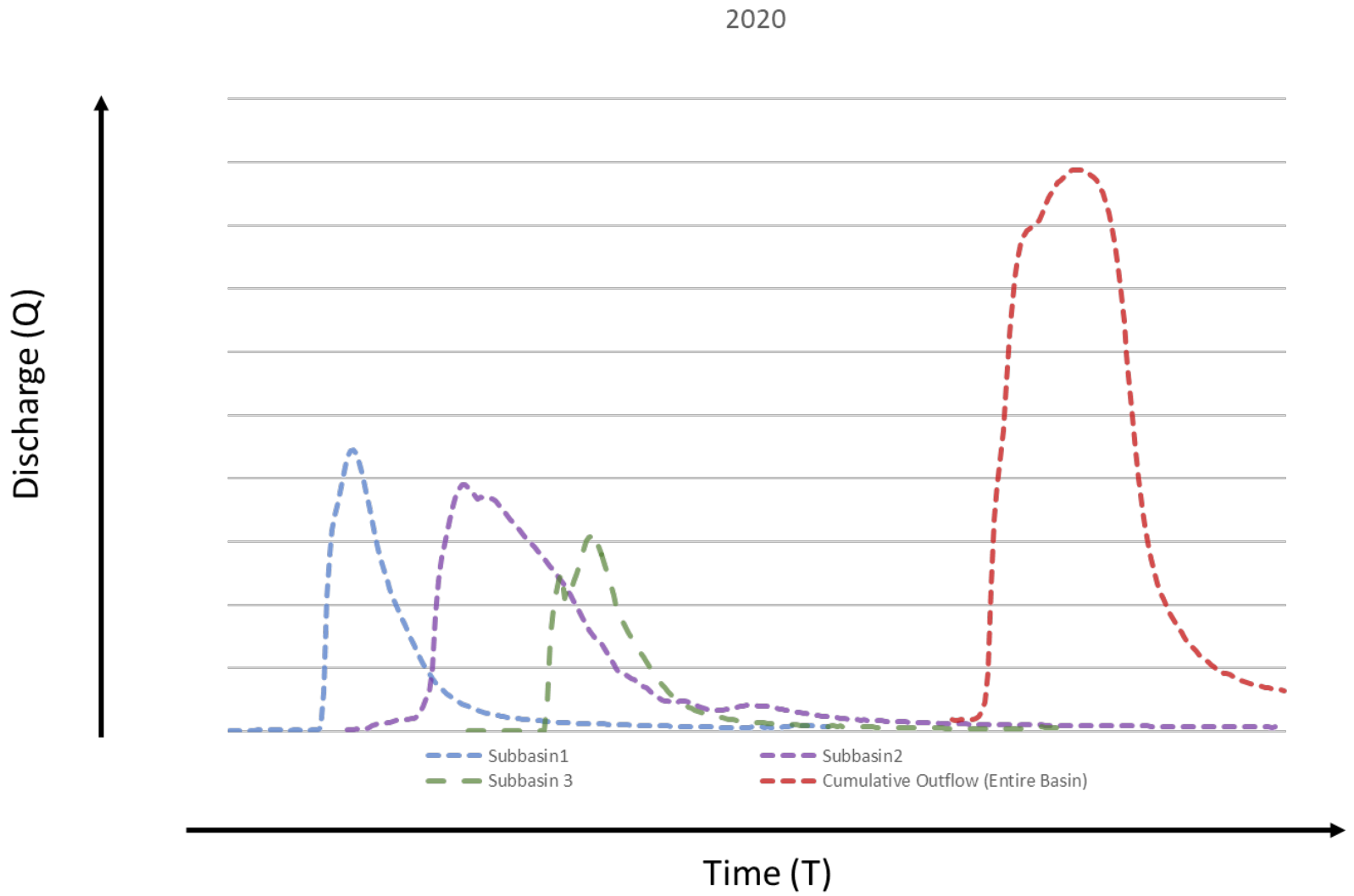
Land Use Changes

- DFW is one of the fastest growing metropolitan areas
- Population growth
  - 2000 – 5 M
  - 2025 – 8.5M
  - ~ 100,000 – 150,000 /yr
  - 1 M every 7-8 yr



Changes in Runoff Resultant from Development

- 2020 Land use sub-basins and entire catchment



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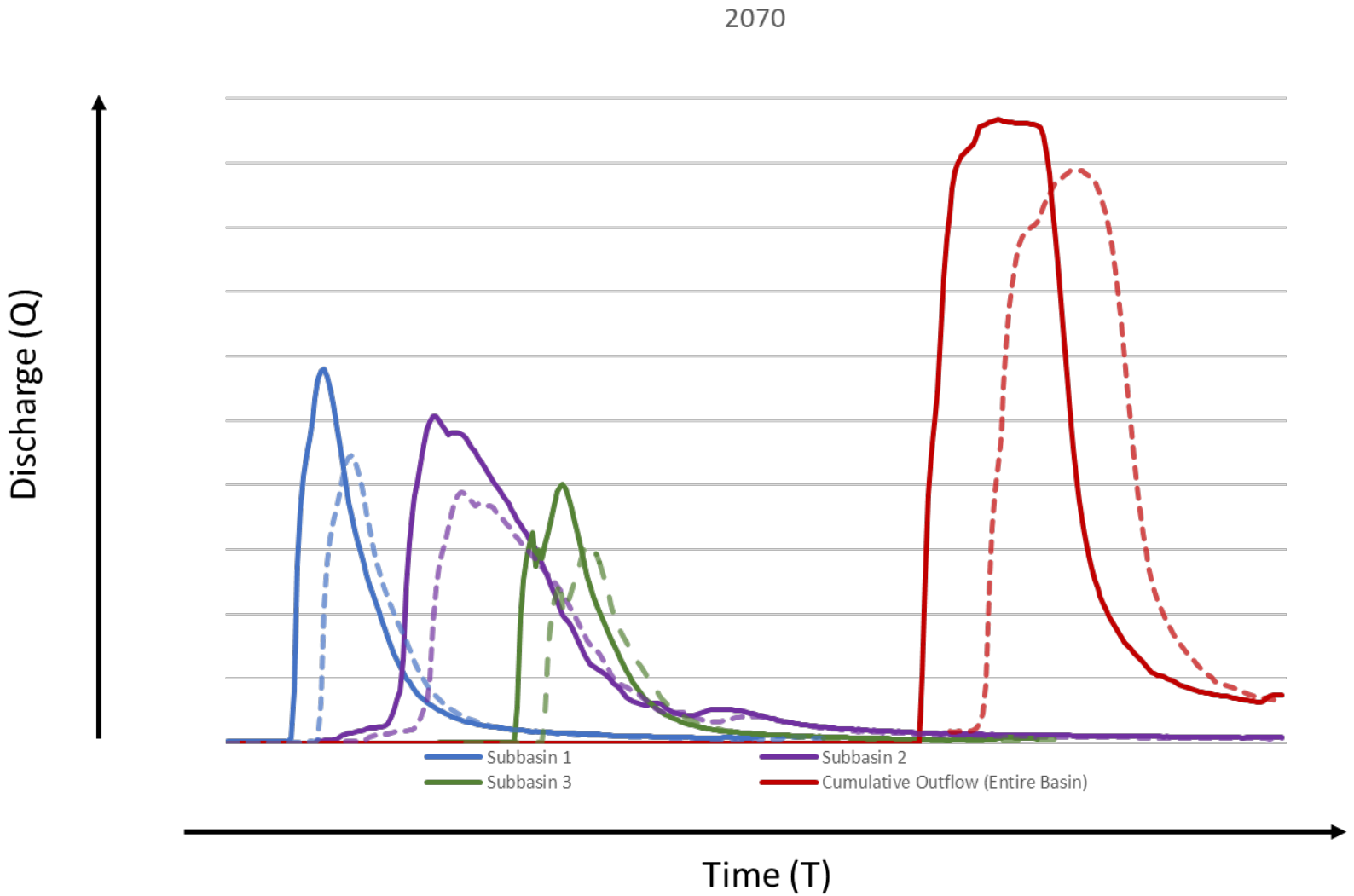
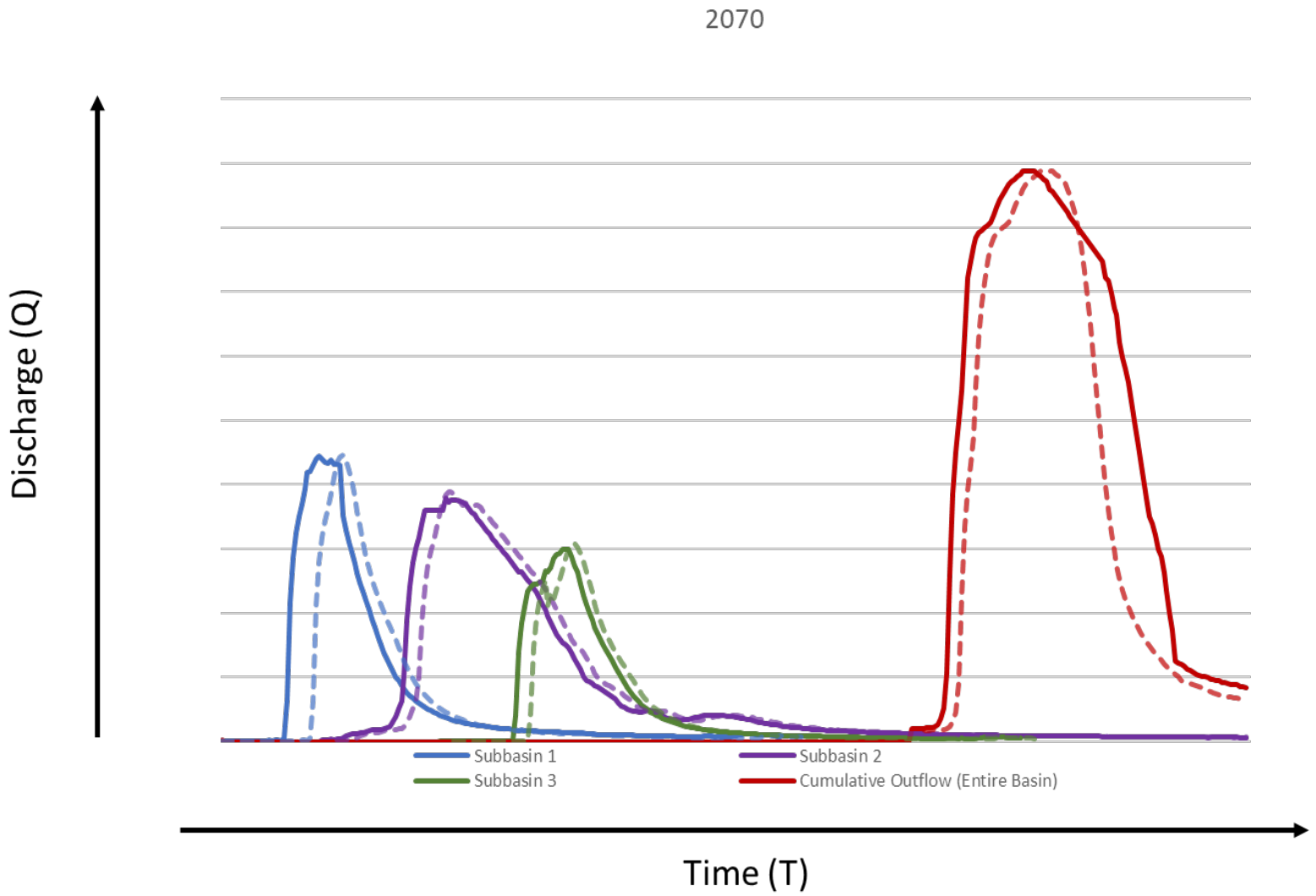


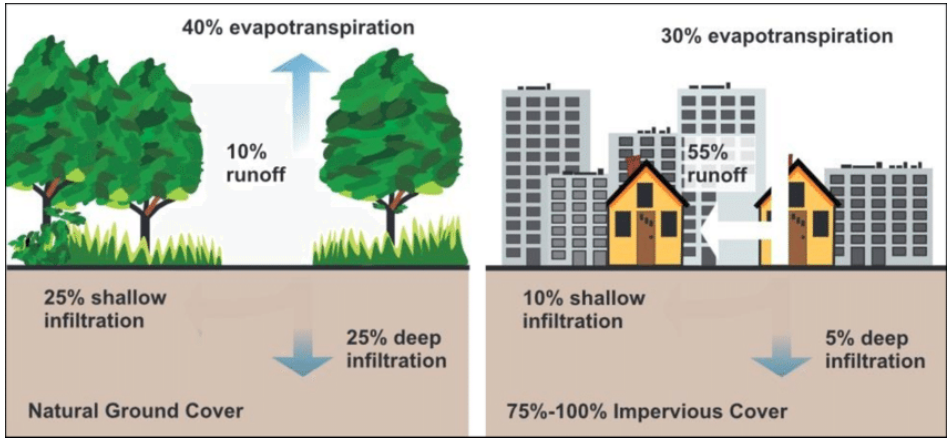
Changes in Runoff Resultant from Development

- Effects of detention on 2070 flows

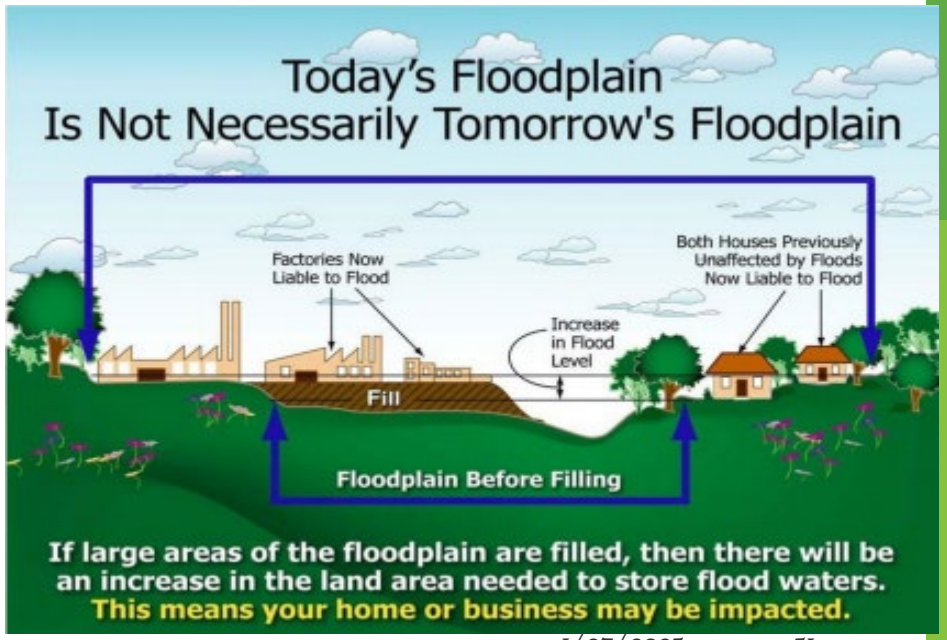


Why TSI - Growth and Development Increases Flooding

- Floodplains are among the most valuable ecosystems on earth, they are also one of the most threatened
- Growth and development increases runoff
  - Decreased evapotranspiration
  - Less infiltration
  - Depletes storage
- Flooding is increased with negative societal impacts

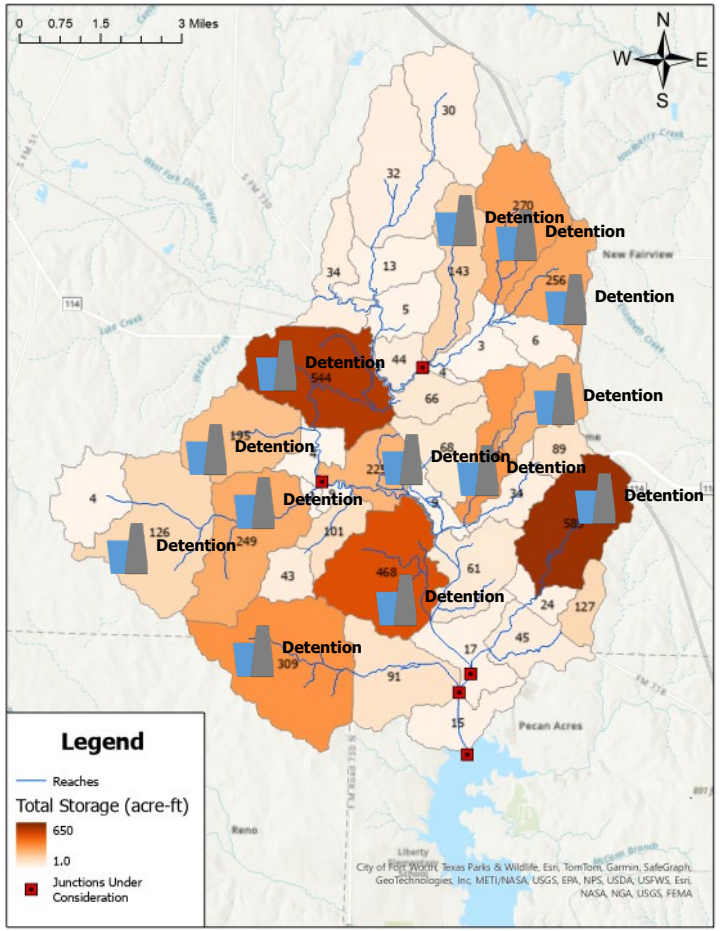


Kazemi, Hamidreza (Kasra. (2014). Evaluating the effectiveness and hydrological performance of green infrastructure stormwater control measures. 10.18297/etd/1744



Distributed Detention Storage Study

- Distributed optimization completed
- The darker the sub-basin color the more storage is needed
- Results of distributed storage only suggests 13 detention reservoirs
- Study for regional detention is nearing completion
- Distributed and regional will be jointly optimized



Peak Discharge at outfall: 39,721 cfs
Total Storage: 4,881 Acre ft

Technical Advisory Group Discussion Items

Stacking Model Update

Stacking model (GIS-based multi-criteria decision-making approach)

Flood susceptibility mapping

Environmental

Topographical
Elevation, Slope, Plan Curvature, topographic wetness index (TWI),

Meteorological
Extreme rainfall depth

Landscape
Curve number, NDVI

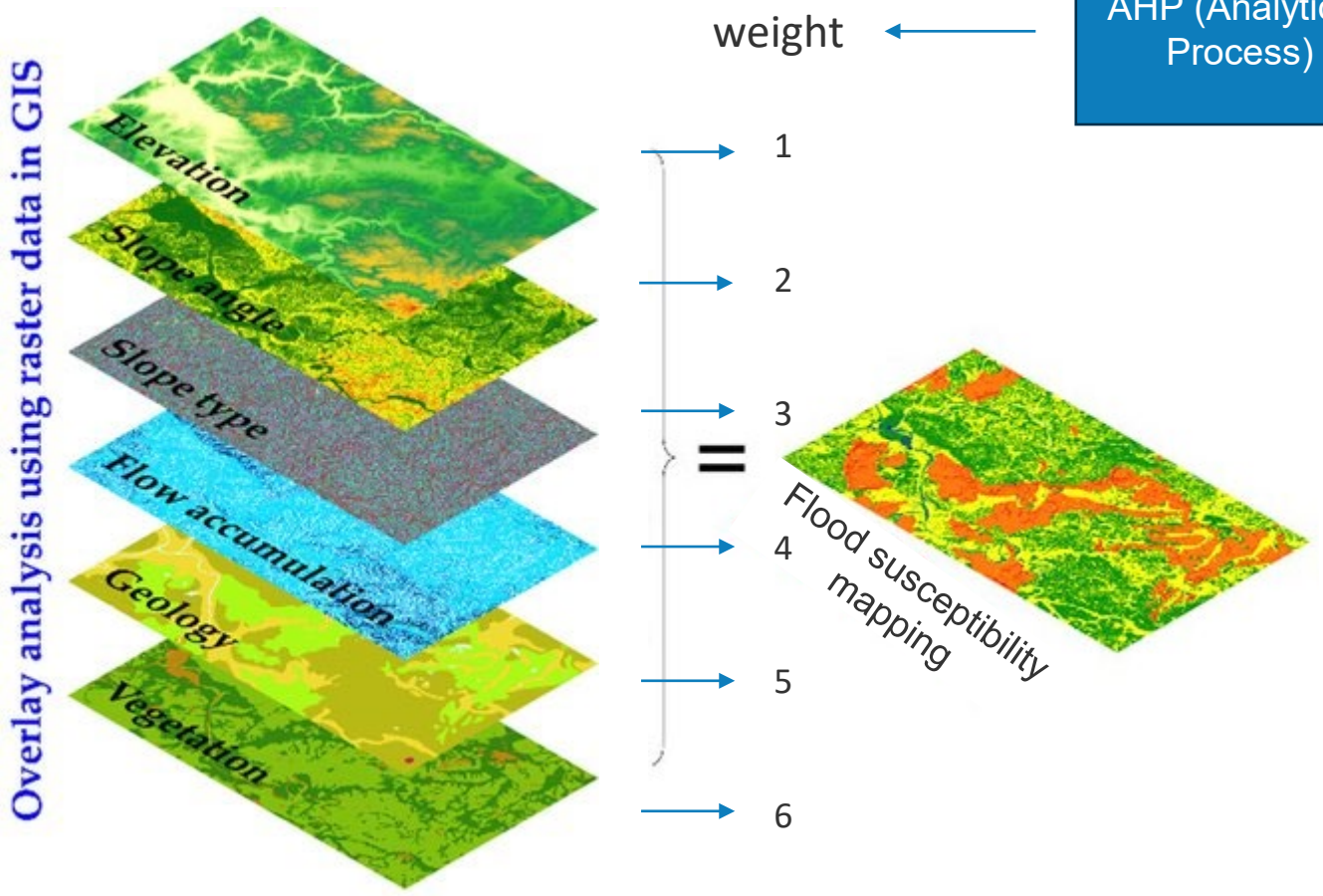
Hydrological
Stream density

Infrastructural

Road density, Dam density

Negative related

Positive related



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Stacking model (GIS-based multi-criteria decision-making approach)

Flood vulnerability mapping, flood control prioritization mapping

Infrastructural

Road traffic density, Bridge traffic density , Bridge vulnerability

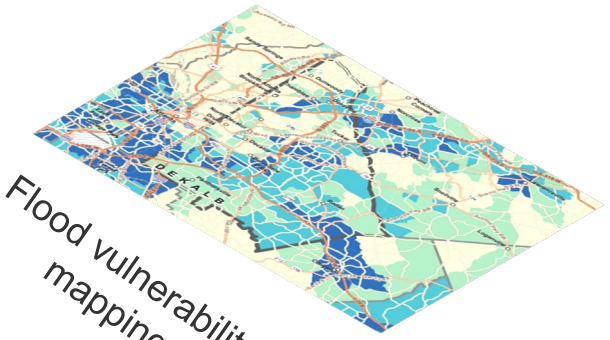
Socio-economical

Social vulnerability index

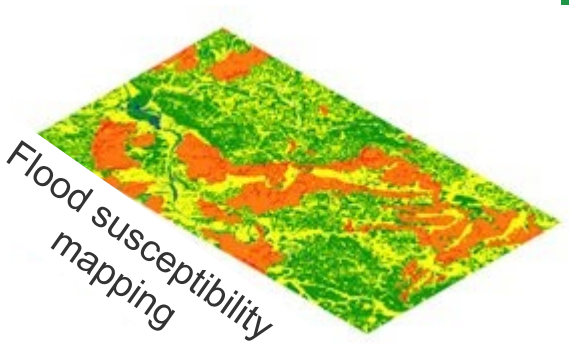
Negative related

Positive related

Same approach as flood susceptibility mapping (overlay, AHP)



Flood vulnerability mapping



Flood susceptibility mapping

- High FSI & high FVI
- High FSI & moderate FVI
- High FSI & low FVI
- Moderate FSI & high FVI
- Moderate FSI & moderate FVI
- Moderate FSI & low FVI
- Low FSI & high FVI
- Low FSI & moderate FVI
- Low FSI & low FVI

FSI: flood susceptibility index
FVI: flood vulnerability index

Flood control prioritization mapping

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Stacking model (GIS-based multi-criteria decision-making approach)

AHP (Analytic Hierarchy Process) method

- **AHP** is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology
- Individual experts' experiences are utilized to estimate the relative importance of factors through pair-wise comparisons using a specially designed questionnaire. A comparison matrix can be developed based on experts' ratings. Finally, the weight of each criteria can be determined based on the comparison matrix.

Fundamental scale for pairwise comparison in AHP.

The scale of relative importance	Definition
1	Equal importance
3	Moderate importance
5	Strong importance
7	Very strong importance
9	Extreme importance
2,4,6,8	Intermediate values

Comparison matrix

	A	B	C	D	E	F	G
1	factors	TP	MT	LS	HD	SE	IF
2	TP	1	1.78125	3.270833	4.041667	4.770833	2.895833
3	MT	0.561404	1	3	4.392857	5.145833	2.41369
4	LS	0.305732	0.333333	1	2.892857	5.020833	0.440367
5	HD	0.247423	0.227642	0.345679	1	2.4375	0.488017
6	SE	0.209607	0.194332	0.19917	0.410256	1	0.340426
7	IF	0.345324	0.414303	2.270833	2.049107	2.9375	1
8	SUM	2.669489	3.950861	10.08652	14.78674	21.3125	7.578334

All the values are synthesized based on the ratings from 8 experts

TP: topographical, MT: meteorological, LS: landscape,
HD: hydrological, SE: socio-economical, IF: infrastructural

	factors	TP	MT	LS	HD	SE	IF	factor weight	
11	TP	0.374603	0.450851	0.324278	0.27333	0.223851	0.38212	0.338172377	3.4
12	MT	0.210304	0.253109	0.297427	0.297081	0.241447	0.318499	0.269644366	2.7
13	LS	0.114528	0.08437	0.099142	0.195639	0.235582	0.058109	0.131228226	1.3
14	HD	0.092685	0.057618	0.034271	0.067628	0.11437	0.064396	0.071828206	0.7
15	SE	0.07852	0.049187	0.019746	0.027745	0.046921	0.044921	0.044506587	0.45
16	IF	0.129359	0.104864	0.225136	0.138577	0.13783	0.131955	0.144620239	1.45
17	SUM	1	1	1	1	1	1	1	10

Matrix operation

Weight for each conditioning factor

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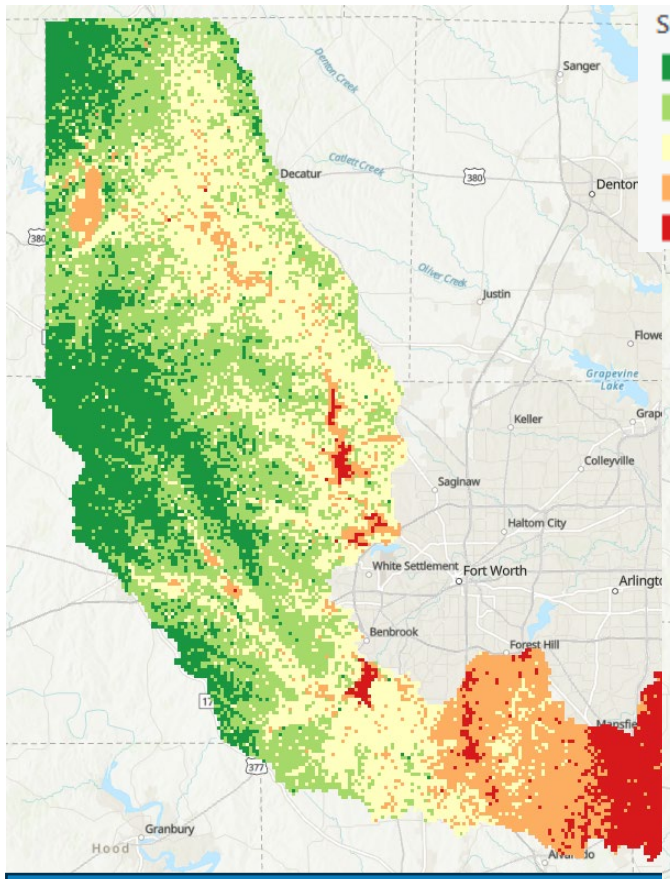
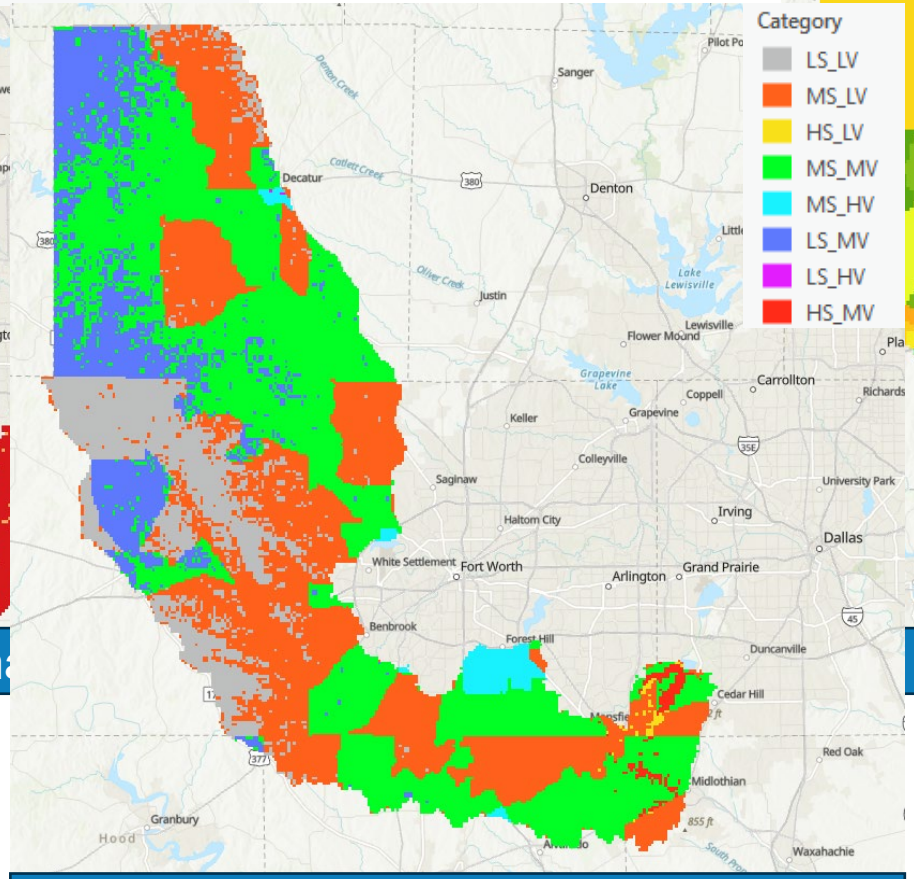
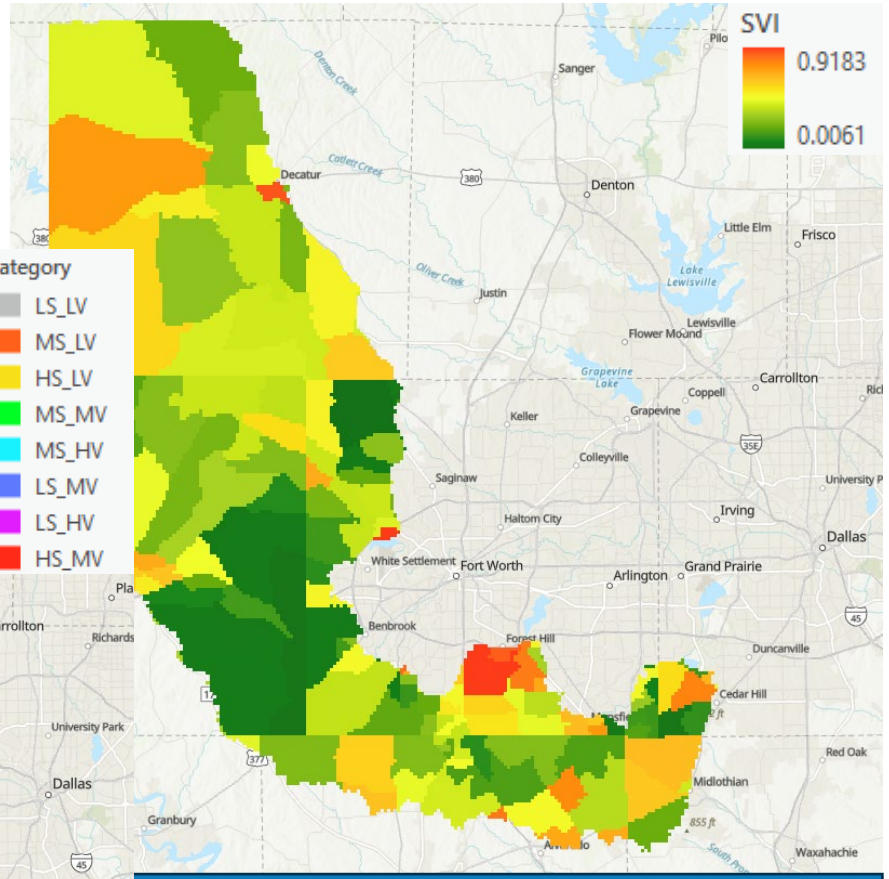
Stacking model (GIS-based multi-criteria decision-making approach)



Flood susceptibility ma



Flood control prioritization map



Flood vulnerability map

*Note: Values here are only for demonstration, which have not been finalized until the model has been calibrated and validated

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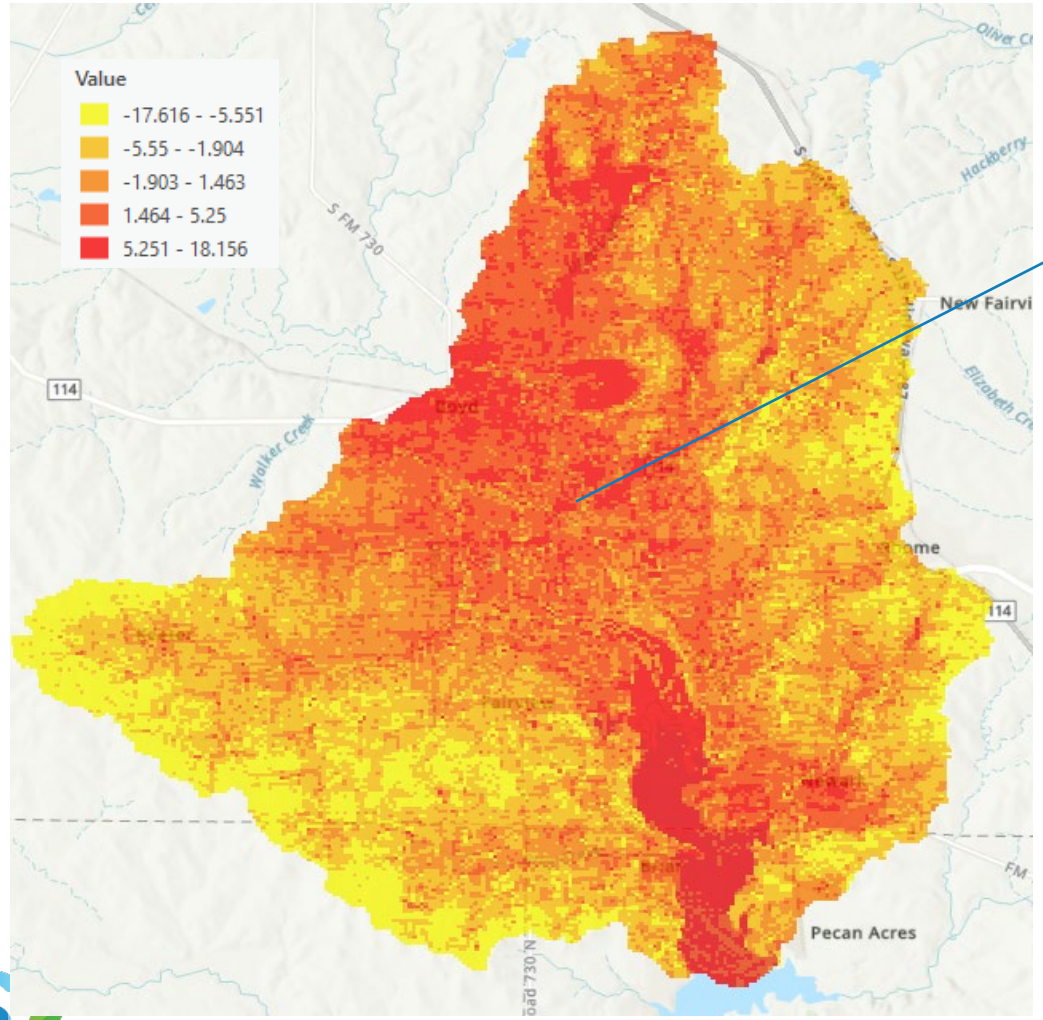
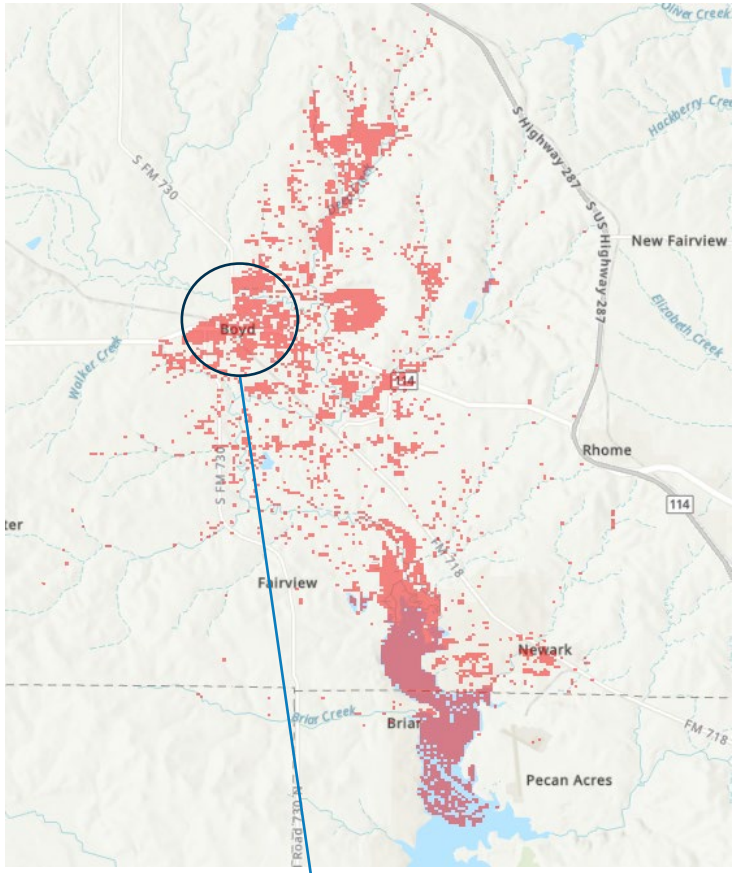
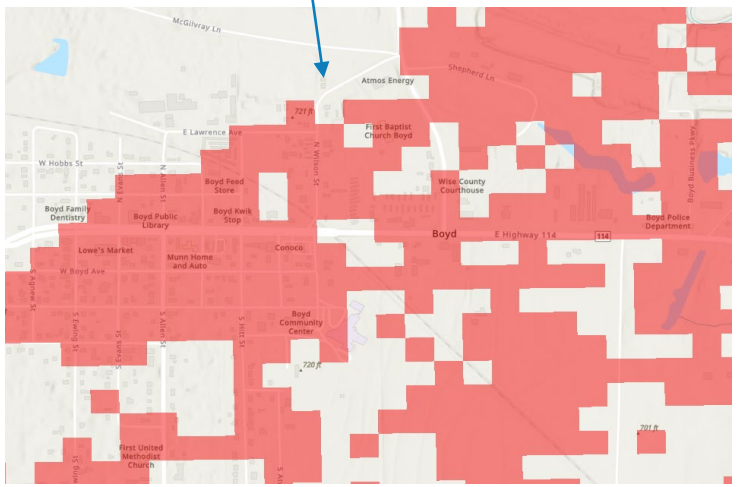
Stacking model (GIS-based multi-criteria decision-making approach)

Dig into a certain watershed (e.g. eagle mountain) and a specific flood-prone community (e.g. city of Boyd) to see if there are any opportunities to implement detention ponds or green stormwater infrastructure in those high prioritization area







& Stormwater Infrastructure

Future work

Conditioning factors (environmental, socio-economical, infrastructural)

AHP

weights

Dimensionless value

Overlayed sum

Flood inventory map

Model validation (ROC curve, AUROC)

Prioritization map for flood control

high priority areas

Future proposed measures (drainage network, land use changes, future traffic, future transportation network, etc.)

Apply GSI in these areas

GSI specifications

Proposed reduced amount of runoff, cost analysis

Constrains: available space, cost etc.

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Next Steps & Upcoming Events

Upcoming Events

Webinar- "From the Ground Up: The Whys and Hows of Groundwater Protection“

February 12, 10:00-11:30 AM

Register Here.

Participants will have an opportunity to ask questions and engage with presenters to gain insight on the tips and tools available to protect groundwater resources. Participants will hear from three speakers, representing regional Groundwater Conservation Districts:

- Jill Nicole Garcia, PG, Assistant General Manager, Upper Trinity Groundwater Conservation District.
- Corey Jones, General Manager, Northern Trinity Groundwater Conservation District
- Kaylin Garcia, Public Relations & Education Director, Prairielands Groundwater Conservation District

Upcoming Events

FEMA Webinar – Enhancing BLE Through Integrated Transportation and Stormwater Infrastructure (TSI) Planning

Tuesday, January 28, 12 – 1 PM CT

Register Here.

FEMA Region 6 has developed a suite of monthly trainings to help communities become more flood-resilient by using flood risk data for future development, emergency planning, and risk communications. Our "Virtual Brown Bag" sessions include:

- Using Base Level Engineering (BLE) at the Local Level - Trainings available for Local Officials, Local Planners, Engineering Practitioners, Floodplain Administrators and Insurance Stakeholders
- Live tutorials on pairing local data with FEMA data to develop flood risk assessments;
- Letters of Map Change (LOMCs) for Local Officials
- Base Leve Engineering (BLE) and the Community Rating System (CRS)
- Using the Estimated Base Flood Elevation (BFE) Viewer

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