North Central Texas
Council of Governments

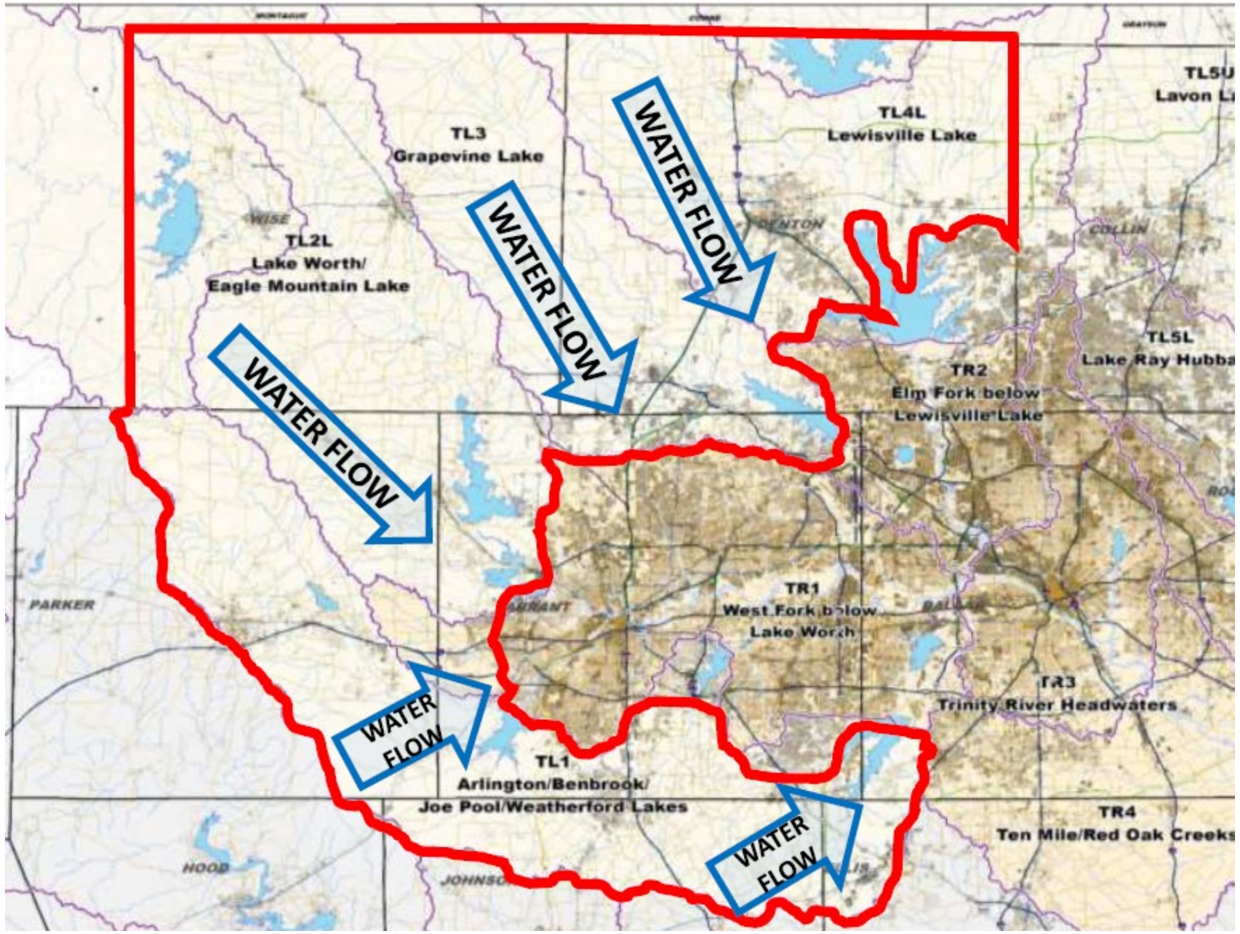
Project Update Meetings
Optimization Breakout

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.

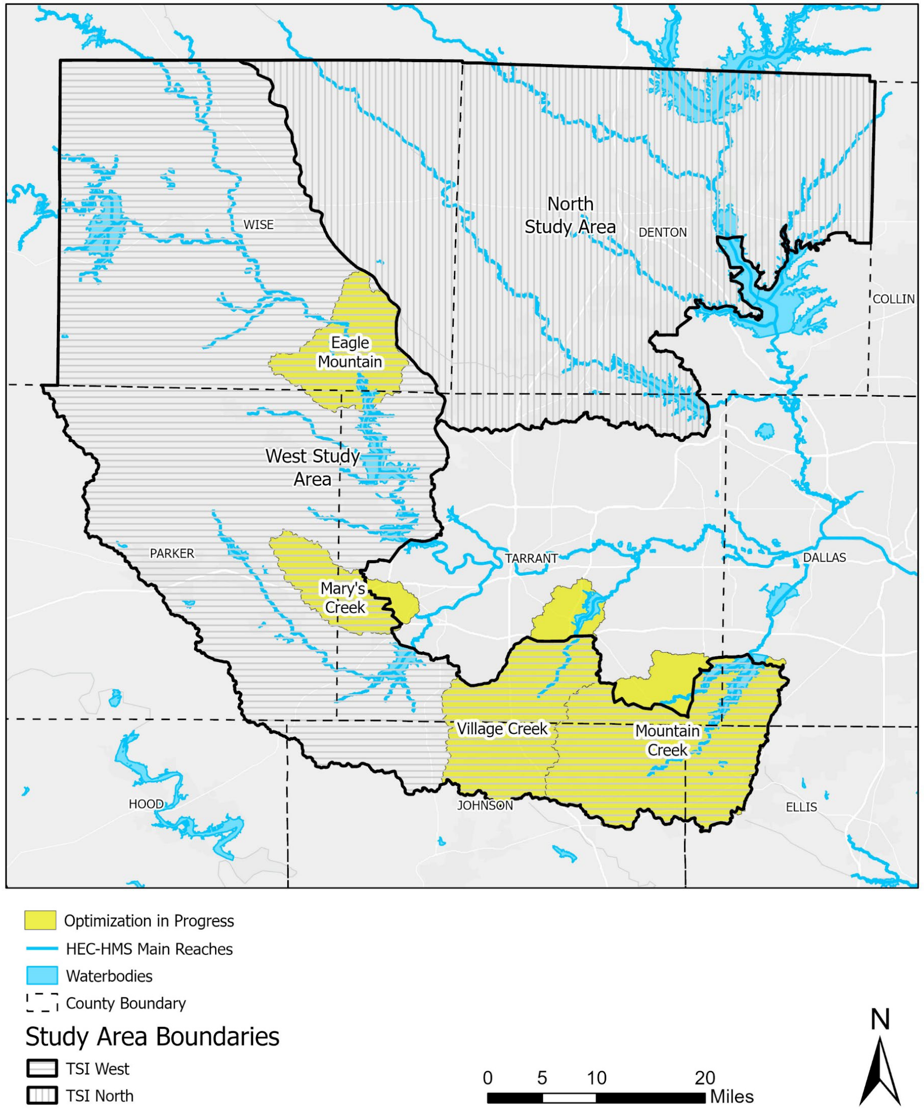
Optimization Motivation

- 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

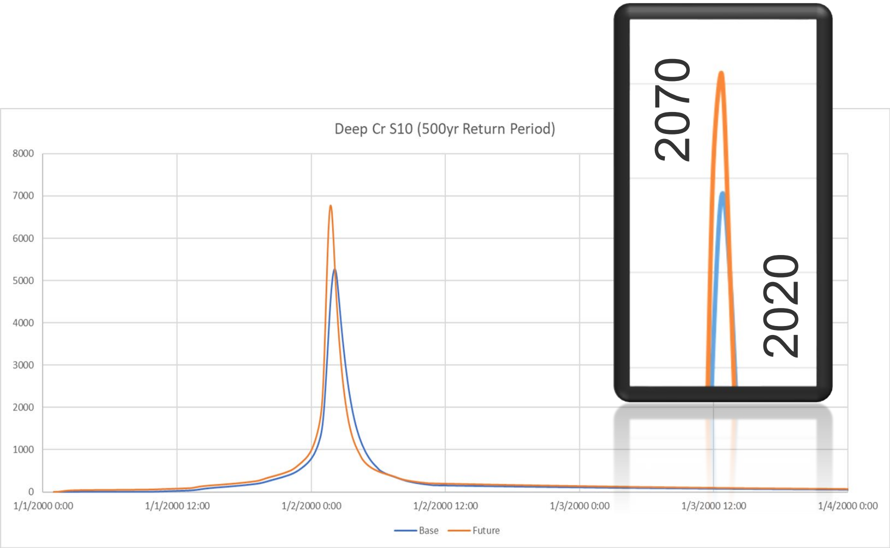


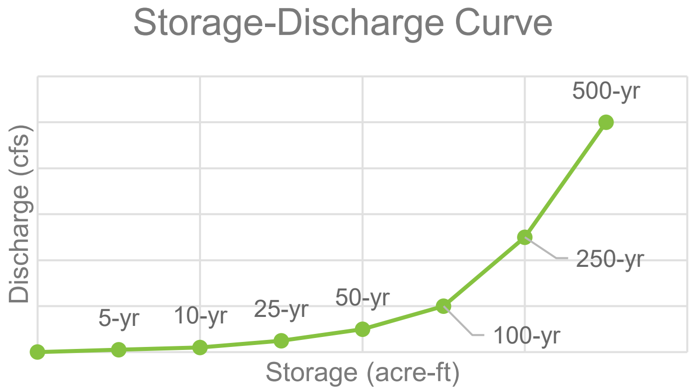
Optimization Methodology

Determine Future Storage Requirements → Optimize to Allocate Future Storage → Analyze Storage Alternatives

Determine Future Storage Requirements

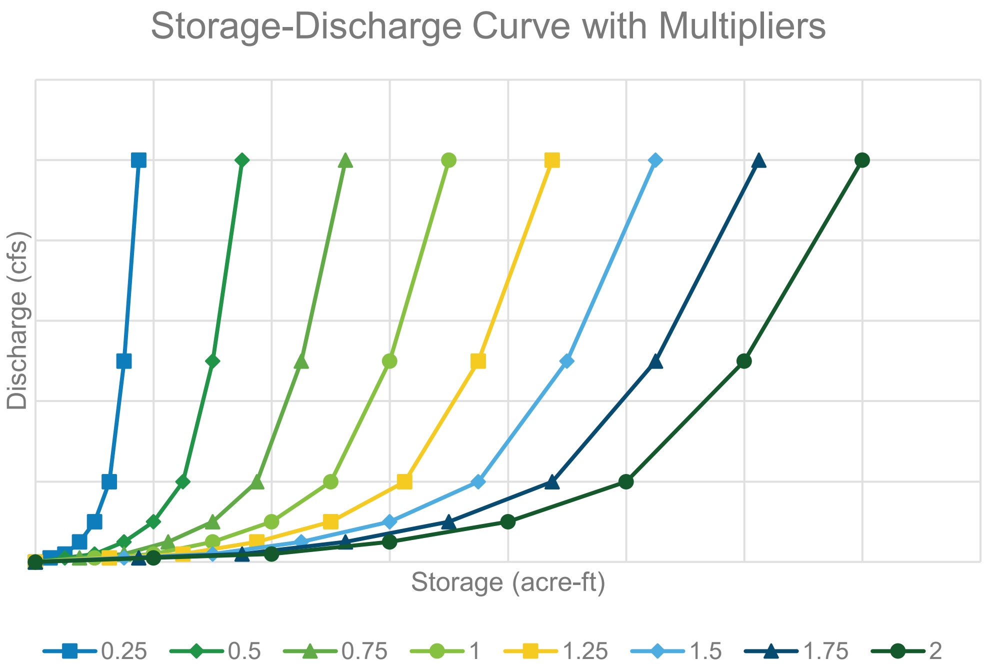
- Obtain HEC-HMS models containing **current and future flows** considering valley storage encroachments and compare for various frequency storms.
- Calculate **difference in volumes** to determine theoretical future storage required.
- Construct **storage-discharge curves** using current flow values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

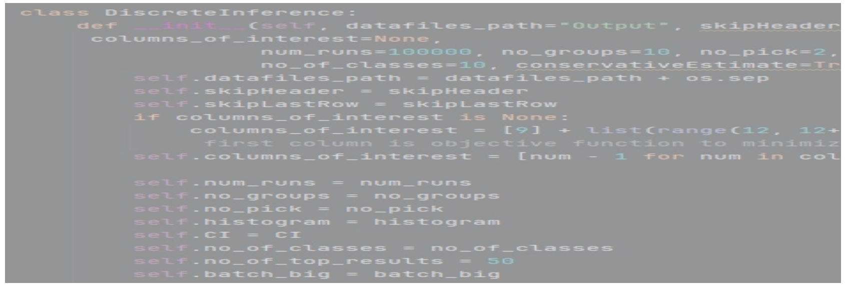




Optimize to Allocate Future Storage

- 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.





Analyze Storage Alternatives

- Determine resulting allocated future storage and create **storage allocation maps.**
- Analyze how the required storage can be achieved with:
  - Detention Ponds
  - GSI/NBS (Environmental Input)
  - Combination
- Compare alternatives.

Newly Constructed Bioretention Area **Newly Planted Bioretention Area After Storm**

Figure 2.1 Bioretention Area Examples

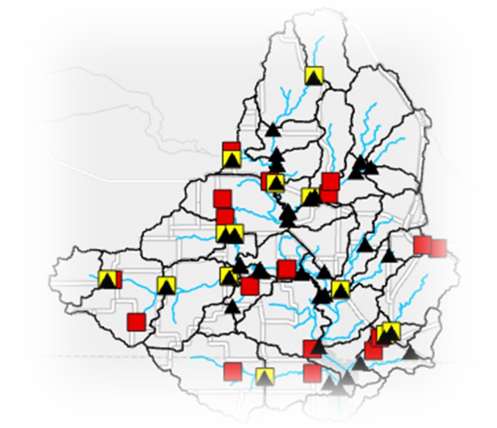
Source: NCTCOG iSWM Site Development (2014)

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.

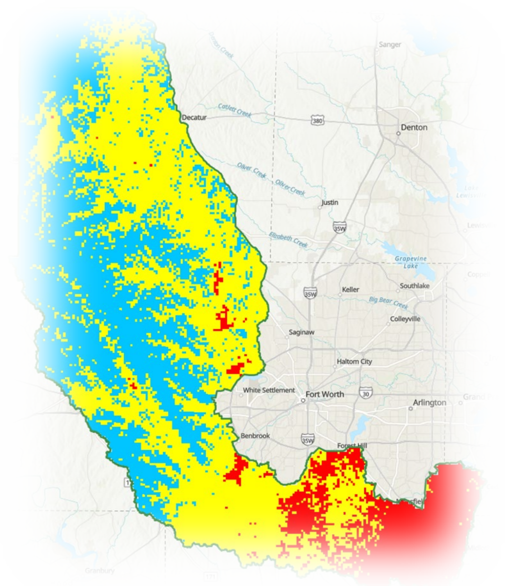
Source: NCTCOG Green Infrastructure Guide (2017)

Input from Other TSI Partners



Transportation

- Gather input from NCTCOG Transportation to inform **locations** to limit future flows to current levels.
  - Prioritize bridges based on transportation features (average daily traffic, detour length, etc.)

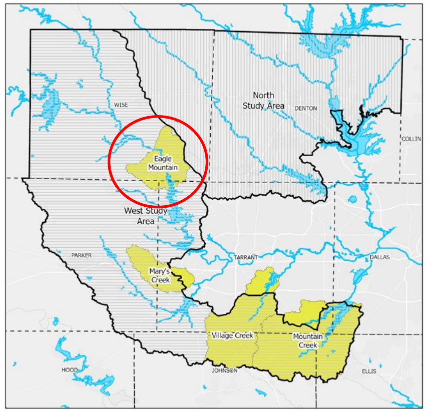


Environmental

- Gather input and models from Texas A&M AgriLife to inform **storage options**.
  - Create a menu of alternatives that includes green stormwater infrastructure (GSI) and/or nature-based solutions (NBS).

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)

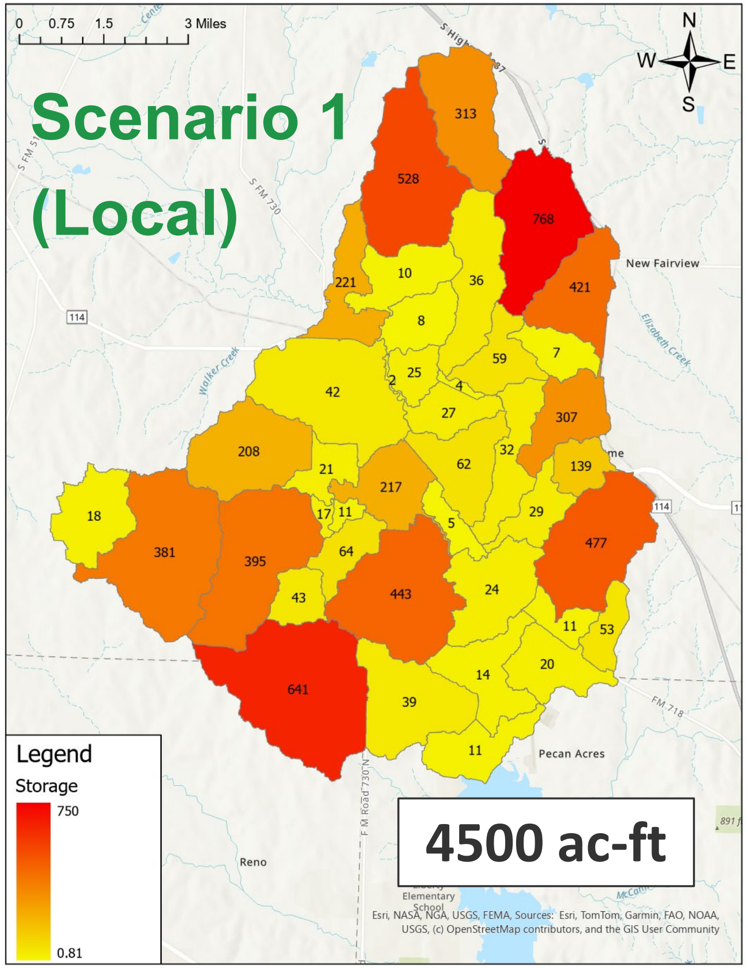
- Reservoir elements placed downstream of *subbasin* elements
- Captures water from individual subbasins

Scenario 2 (Regional)

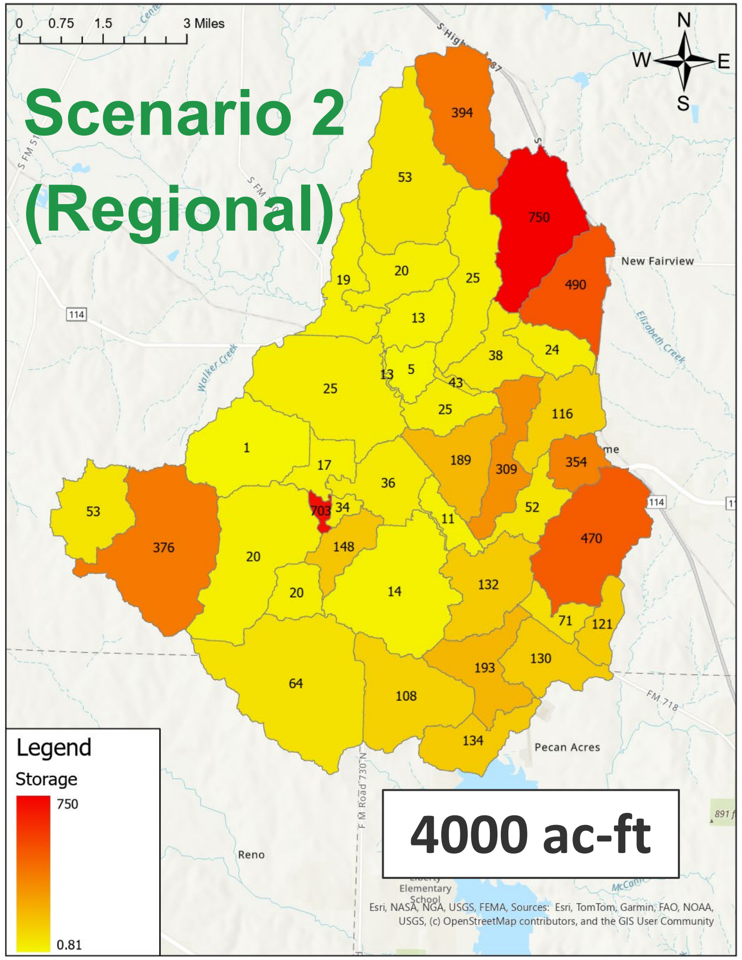
- Reservoir elements placed downstream of *junction* elements
- Captures water from all upstream subbasins

integrating **Transportation**
& Stormwater Infrastructure

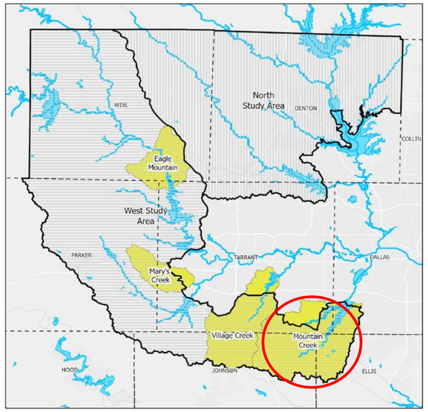
Eagle Mountain Results



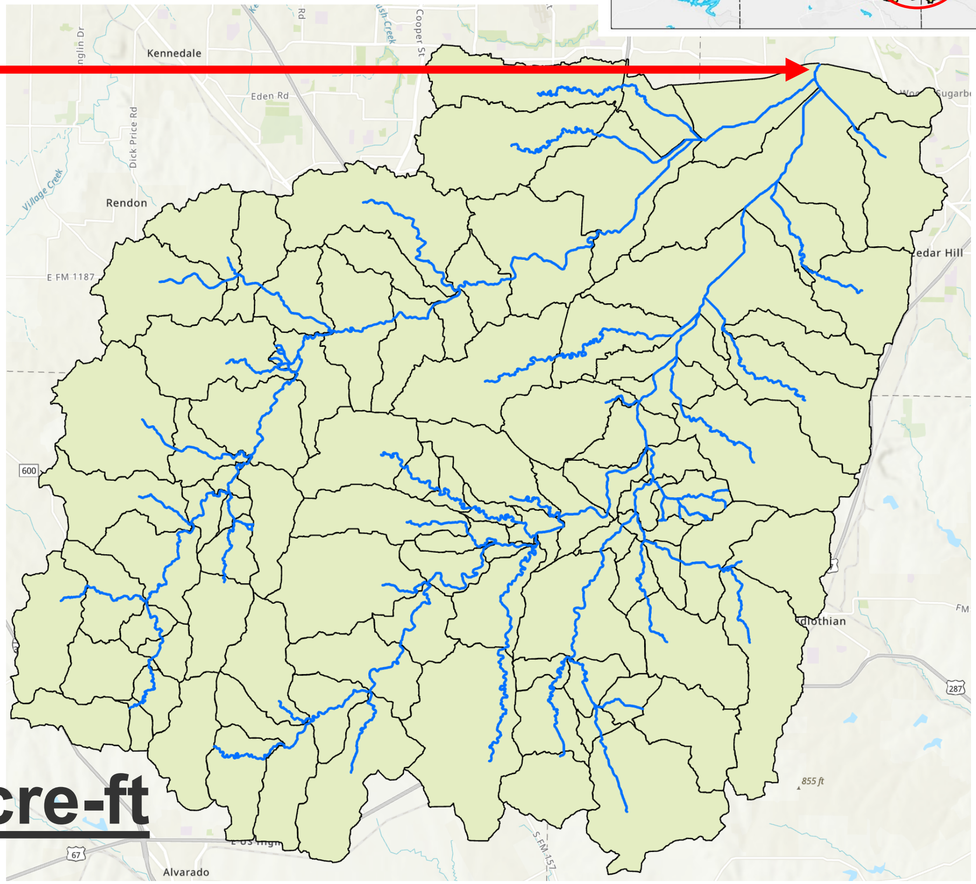
- Flows limited at 10 points (including most downstream) to current levels
- **~11%** reduction in required storage for regional implementation



Mountain Creek Study Area



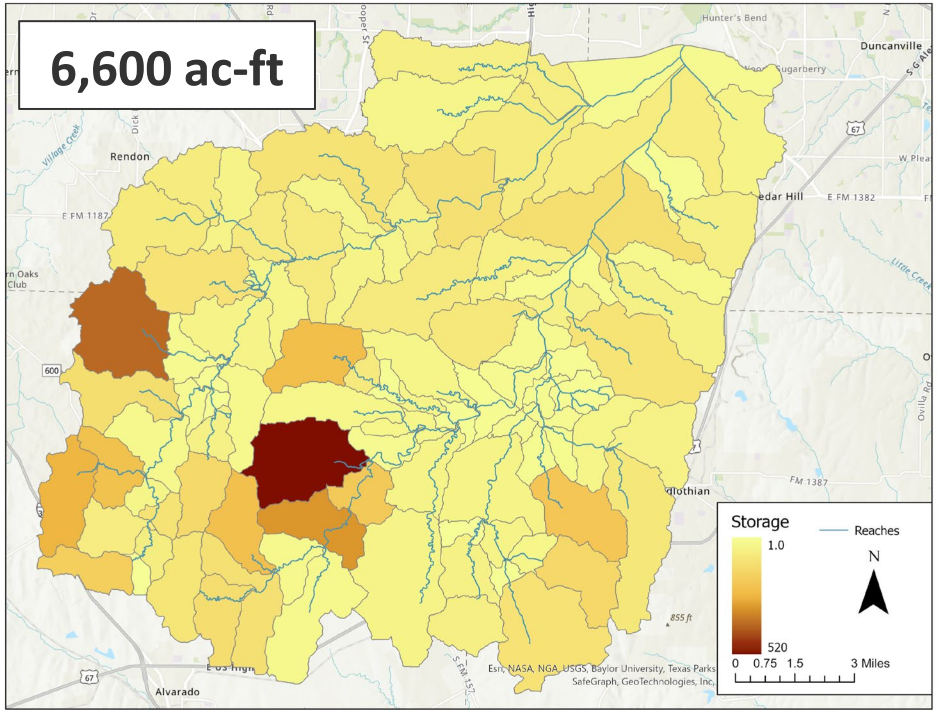
- Basin Model Information
  - ~224 square miles
  - 92 Subbasins
- Anticipated Imperviousness Increase
  - Avg: **27%**
  - Max: **52%**
- Downstream Peak Discharge
  - 2020: **50,300** cfs
  - 2070: **55,100** cfs
- Theoretical Storage Required: ~**20,600 acre-ft**



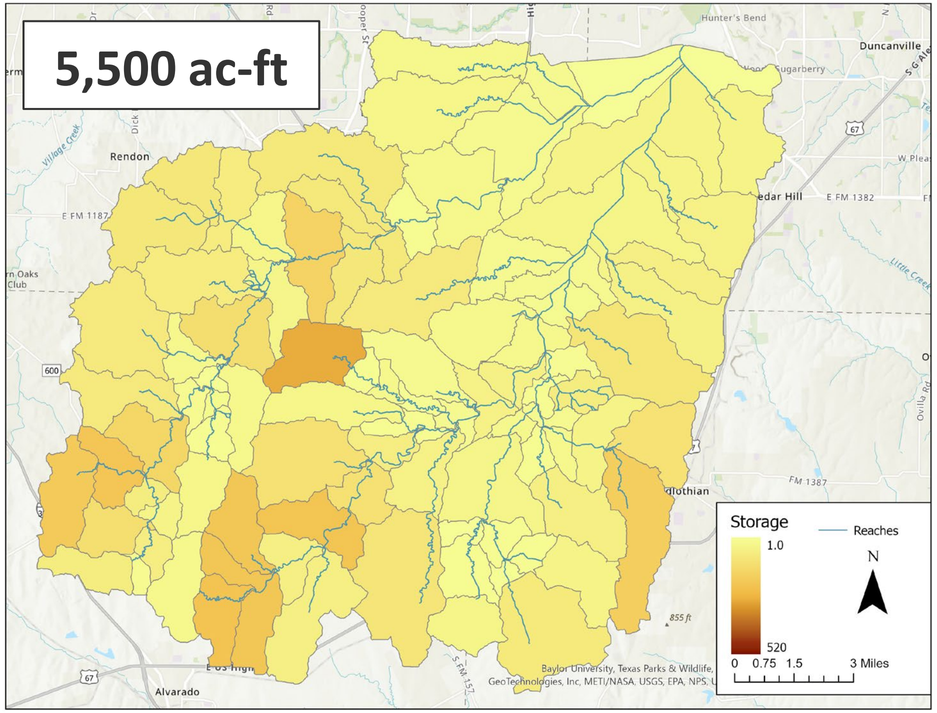
integrating **Transportation**
& Stormwater Infrastructure

Mountain Creek Results

Scenario 1 (Local)



Scenario 2 (Regional)

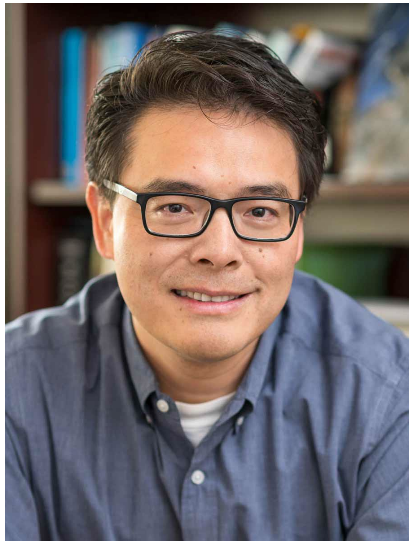


- Flows limited at selected points (including most downstream) to current levels
- **~17%** reduction in required storage for regional implementation

integrating **Transportation & Stormwater Infrastructure**

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

Contact



Nick Z. Fang, Ph.D. P.E.

Robert S. Gooch Endowed Professor,
Director of the Water Engineering Research Center (WERC)
The University of Texas at Arlington
817-272-5334
nickfang@uta.edu

WERC
Water Engineering Research Center

integrating Transportation & Stormwater Infrastructure