2022 TFMA TECHNICAL SUMMIT

ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM

LESSONS LEARNED FROM OUR JOURNEY

October 24, 2022

Kim Dewailly, P.E., CFM – City of Dallas

Jack Young, P.E., CFM – Halff Associates

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ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM | SPEAKERS

KIM DEWAILLY, P.E., CFM,

Senior Engineer Floodplain Management

City of Dallas

JACK YOUNG, P.E., CFM, PMP

Water Resources Program Manager

Halff Associates

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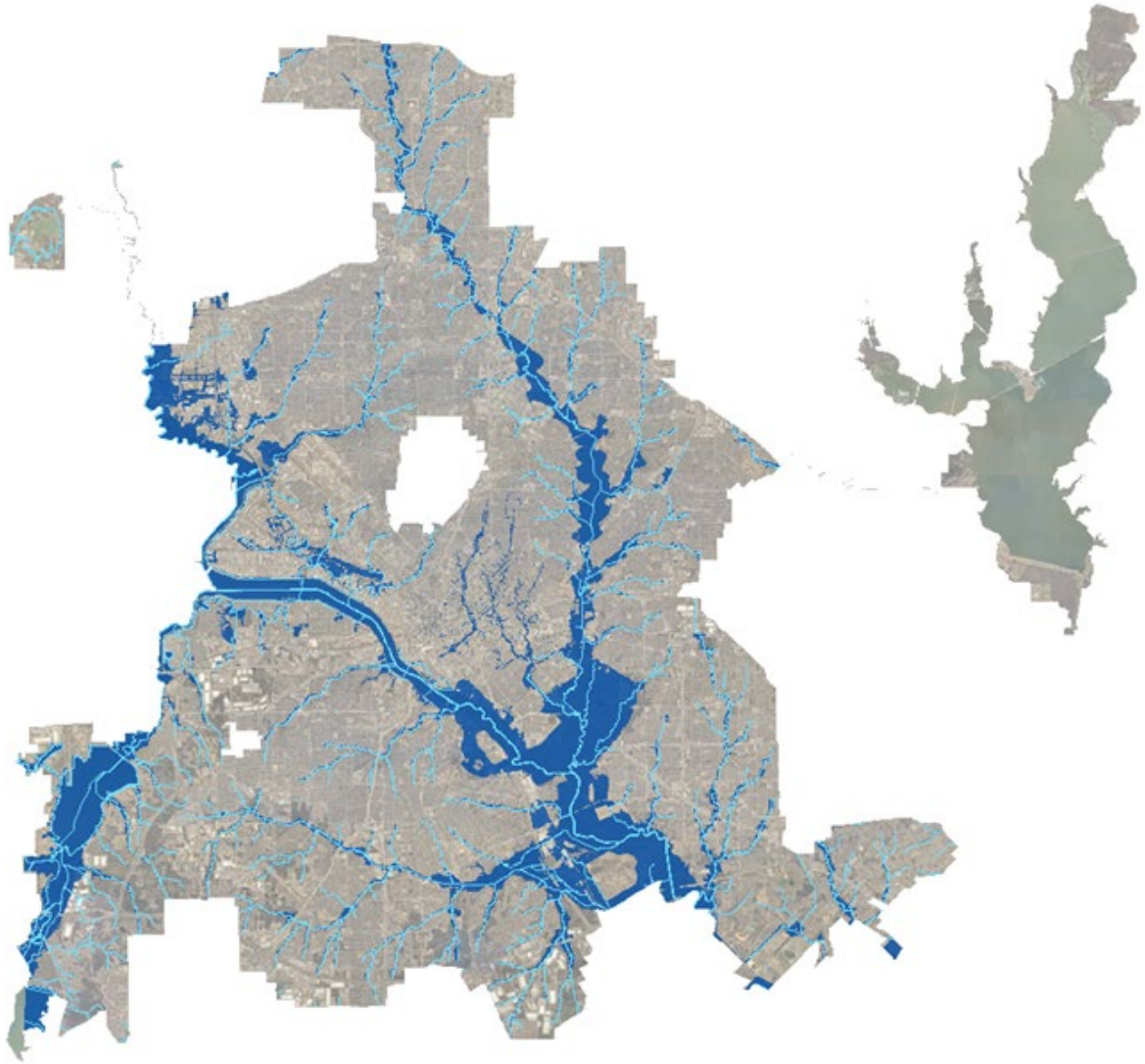
ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM | AGENDA

- City of Dallas Overview
- History of Dallas Floodplain Management
- Summary of Dallas Class 4 Activities
- Lessons Learned

ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM | DALLAS VULNERABILITY TO FLOODING

- Location
- Demographics
- Major Flooding Source



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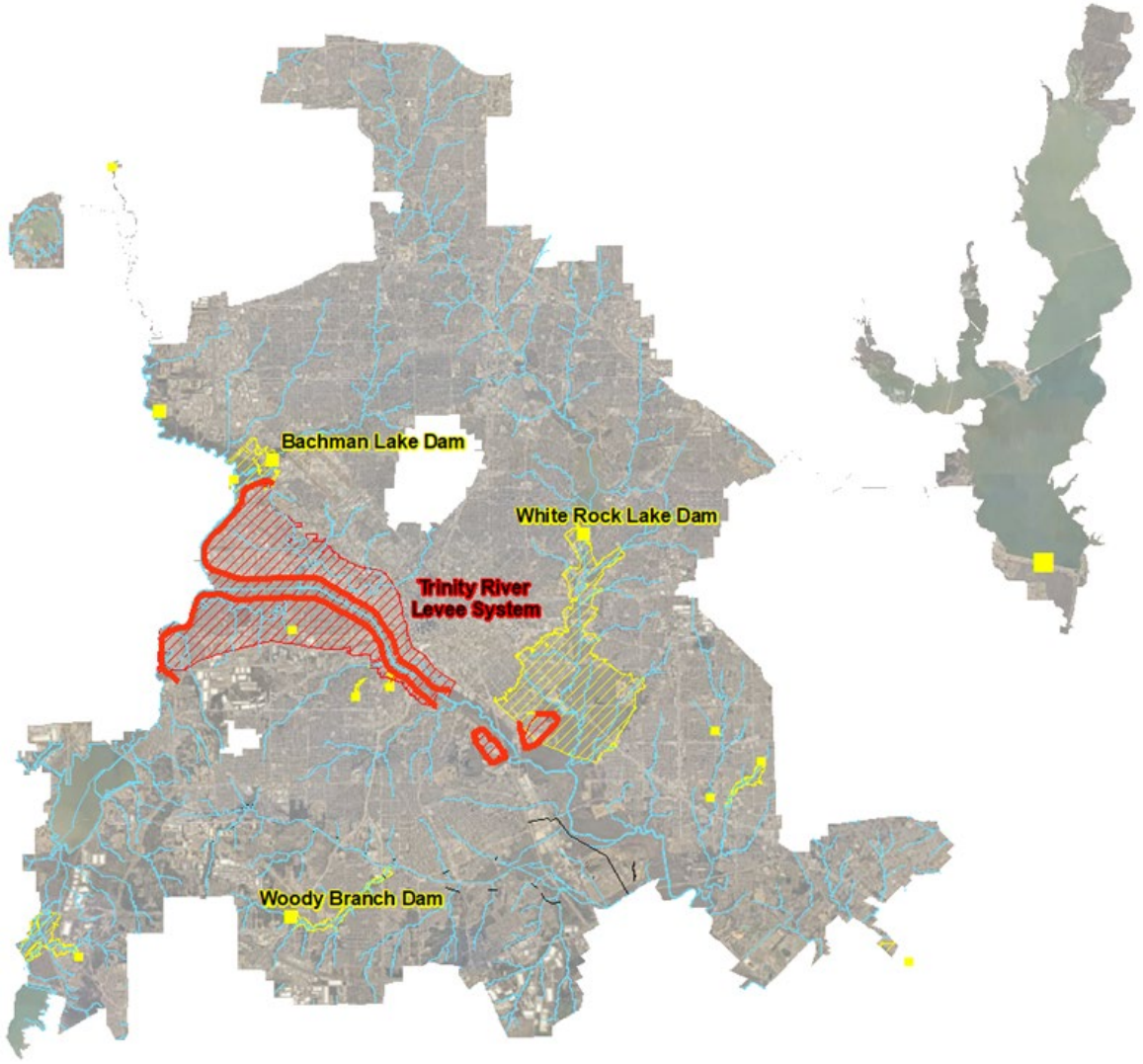
ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM | DALLAS VULNERABILITY TO FLOODING

- Stormsewer System
- High and Significant hazard dams
- Levee



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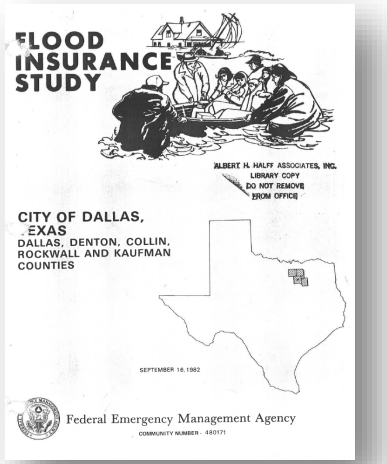
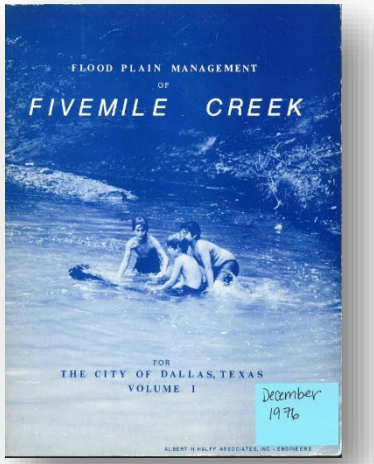
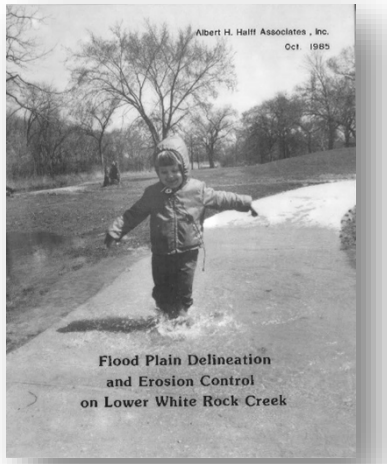
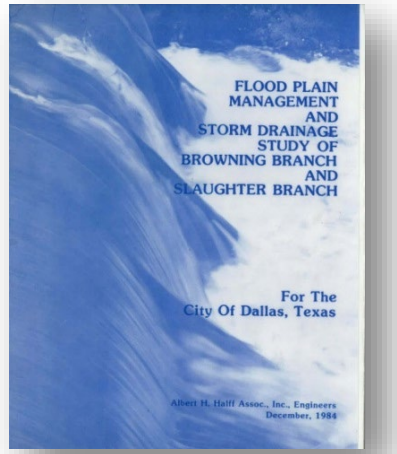
ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM | HISTORY OF DALLAS FLOODPLAIN MANAGEMENT

- 1965 – City adopts Stormwater Management Ordinance
- 1968 – Bachman Branch Stormwater Management Plan
- 1972 – Stricter Floodplain Management Ordinance
- 1972 – Joes Creek and Upper White Rock Creek Floodplain Plan
- 1978 – FEMA FIS - Dallas County
- 1983 – FEMA NFIP - City of Dallas









ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM |
HISTORY OF DALLAS FLOODPLAIN MANAGEMENT

- 1991 – Joined CRS Program
- 1999 – CRS Verification Class 8
- 2004 – CRS Verification Class 7
- 2009 – CRS Verification Class 5
- 2021 – CRS Verification Class 4
- 2023 (est) – CRS Modification Class 3

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ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM |
CRS OVERVIEW

- Program Goals
- Activities
  - Public Information Activities (300 Series)
  - Mapping and Regulations (400 Series)
  - Flood Damage Reduction Activities (500 Series)
  - Warning and Response (600 Series)
- Points
- Classes
- Prerequisites

CRS Class	Credit Points	Premium Reduction (%)
10	0-499	0%
9	500-999	5%
8	1000-1499	10%
7	1500-1999	15%
6	2000-2499	20%
5	2500-2999	25%
4	3000-3499	30%
3	3500-3999	35%
2	4000-4499	40%
1	4500+	45%

ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM
DALLAS CRS CLASS 4 ACTIVITIES

Activity	Points		Dallas % of Max Points
	Max Possible	Dallas Earned	
300 Public Information Activities	981	530	54%
400 Mapping and Regulations	5841	1892	32%
500 Flood Damage Reduction	5042	635	13%
600 Warning and Response	790	369	47%
TOTAL	**12654**	**3426**	27%

ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM
DALLAS CRS CLASS 4 ACTIVITIES

300 Series – Public information

Activity	Points			% Communities Credited*
	Max Possible	Dallas Earned	Average Points Earned	
300 Public Information Activities	981	530	344	
310 Elevation Certificates	116	86	38	96%
320 Map Information Service	90	90	73	85%
330 Outreach Projects	350	200	87	93%
340 Hazard Disclosure	80	15	14	84%
350 Flood Protection Information	125	69	38	87%
360 Flood Protection Assistance	110	55	55	41%
370 Flood Insurance Promotion	110	15	39	4%

ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM
DALLAS CRS CLASS 4 ACTIVITIES

320 MAP INFORMATION SERVICES – 90 POINTS

OBJECT: PROVIDE CITIZENS WITH FLOOD HAZARD INFORMATION

Lo
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TRINITY WATERSHED MANAGEMENT / FLOODPLAIN MANAGEMENT
LOG SHEET FOR FEMA & CRS INFORMATION

DATE	TYPE	ADDRESS	NAME, PHONE #, COMPANY NAME	MAP,PANEL #	ZONE	BFE, EL	INFO GIVEN	ASST. BY
10/1/2012	W	1802 Highland Rd (LOMR -2007)	Tom Juhn w/JBI Partners 972-738-0226	47-C, 0365J, 365K	AE,X	430	V	Tam, Stev
10/1/2012	T	PRP forms for 8220 Coolgreen	Cindy w/ State Farm Insurance 214-327-9315	48-A, 0365J	AE,X	483, 490	V,E	Tam
10/1/2012	T	8707 Wingate (Bachman Branch)	Kelly Vanboven 214-683-2025	24-W, Bachman	AE,X		V	Tam
10/1/2012	W	Mill Creek floodplain	Dale		AE,X		V	Tam
10/2/2012	T	PRP forms for 8220 Coolgreen	Cindy w/ State Farm Insurance 214-327-9315	48-A, 0365J	AE,X	483, 490	V,E	Tam
10/2/2012	T	1445 Ross Ave (flood maps)	Andrew John, 214-855-7766	Mill Creek	AE,X		V	Tam
10/2/2012	T	4835 Pachuca (Need flood maps) Insurance infor	Karl Insurance Inc. 214-497-5545	62-L, 470J Five Mile creek	X		V	Tam
10/2/2012	W	9671 Broken Bow (McCree CTP-FY10	Chad Senn Nobilityhomes@sbcglobal.net	27-Q McCree plate 12, 13	X,AE	486.3	V,E	Tam
10/3/2012	W	information about fill permit					V	Tam
10/3/2012	T	Flood insurance infor	Maria McWilliam 214-662-3588				V	Tam
10/3/2012	T	Outreach letter	Theresa Green 214-375-7722				V	Tam
10/3/2012	T	1630 Kessler	Raph Tilman 214-941-2636	44-T	AE, X		V	Tam
10/3/2012	W	9910 Inwood (Browning branch) Bachman branch plate 2	Andrea Pittman andrea@daystapp.com 214-498-1411	24-R	AE, X		V	Tam
10/4/2012	W	2223 Elderoaks (Woody Branch) Send LOMR to FEMA 2005	Kay Rodger 214-794-0159	63-V, 0490J	AE, X	557	V	Tam
10/4/2012	T	Outreach letter	Mary 469-688-1011				V	Tam
10/4/2012	W	329 Saint Augustine	Code Complian				V	Tam
10/4/2012	W	306 Centenial					V	Tam
10/4/2012	W	9910 Inwood (Browning branch) Bachman branch plate 2	Andrea Pittman andrea@daystapp.com 214-498-1411	24-R	AE, X		V, E	Tam
10/4/2012	W	13925 Hillcrest (WRC)	Mark 214-505-8888	15-M	AE, X	538	V, E	Tam

Codes: W = walk in, H = Gave handout, T = Telephone request, E = Email, V = Told Verbally, L = written request, N/A=Not Applicable, M=Mail

Notificati
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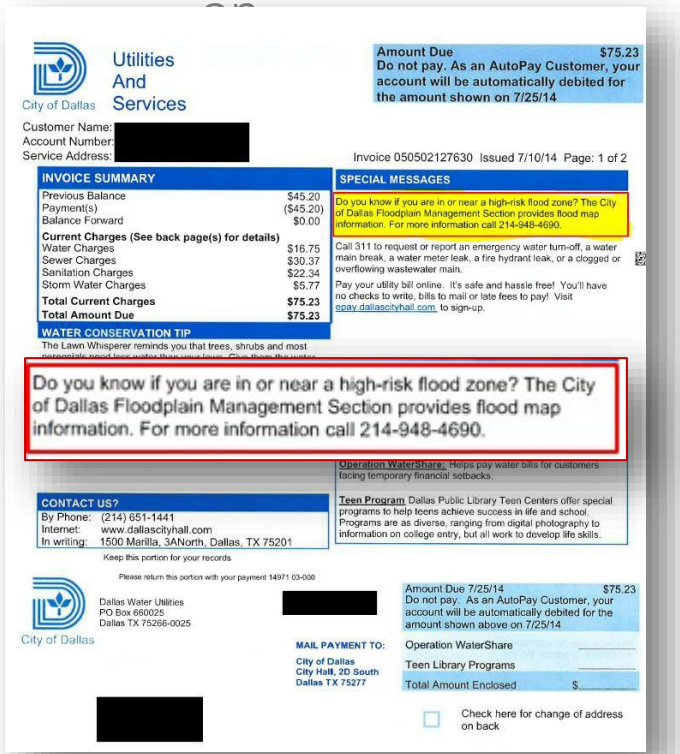


City of Dallas Utilities And Services

Amount Due $75.23
Do not pay. As an AutoPay Customer, your account will be automatically debited for the amount shown on 7/25/14

Customer Name: [redacted]
Account Number:
Service Address:

Invoice 050502127630 Issued 7/10/14 Page: 1 of 2

INVOICE SUMMARY

Previous Balance	$45.20
Payment(s)	($45.20)
Balance Forward	$0.00
Current Charges (See back page(s) for details)	
Water Charges	$16.75
Sewer Charges	$30.37
Sanitation Charges	$22.34
Storm Water Charges	$5.77
Total Current Charges	**$75.23**
Total Amount Due	**$75.23**

SPECIAL MESSAGES

Do you know if you are in or near a high-risk flood zone? The City of Dallas Floodplain Management Section provides flood map information. For more information call 214-948-4690.

Call 311 to request or report an emergency water turn-off, a water main break, a water meter leak, a fire hydrant leak, or a clogged or overflowing wastewater main.

Pay your utility bill online. It's safe and hassle free! You'll have no checks to write, bills to mail or late fees to pay! Visit epay.dallascityhall.com to sign-up.

WATER CONSERVATION TIP

The Lawn Whisperer reminds you that trees, shrubs and most

Do you know if you are in or near a high-risk flood zone? The City of Dallas Floodplain Management Section provides flood map information. For more information call 214-948-4690.

Operation WaterShare: Helps pay water bills for customers facing temporary financial setbacks.

CONTACT US?
By Phone: (214) 651-1441
Internet: www.dallascityhall.com
In writing: 1500 Marilla, 3ANorth, Dallas, TX 75201

Teen Program Dallas Public Library Teen Centers offer special programs to help teens achieve success in life and school. Programs are as diverse, ranging from digital photography to information on college entry, but all work to develop life skills.

Keep this portion for your records

Please return this portion with your payment 14971 03-000

City of Dallas

Dallas Water Utilities
PO Box 660025
Dallas TX 75266-0025

[redacted]

Amount Due 7/25/14 $75.23
Do not pay. As an AutoPay Customer, your account will be automatically debited for the amount shown above on 7/25/14

MAIL PAYMENT TO:
City of Dallas
City Hall, 2D South
Dallas TX 75277

Operation WaterShare _____
Teen Library Programs _____
Total Amount Enclosed $_____

[redacted]

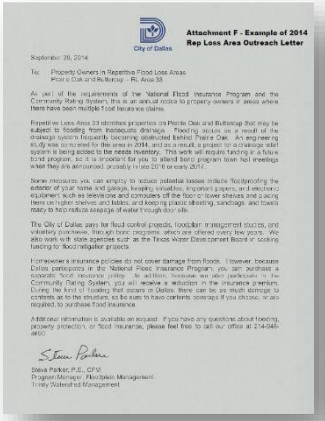
☐ Check here for change of address on back

ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM
DALLAS CRS CLASS 4 ACTIVITIES

330 OUTREACH PROJECTS – 200 POINTS

OBJECT: PROVIDE CITIZENS WITH FLOOD HAZARD INFORMATION

- Targeted Letters
- Information Materials
- Public Meetings
- Targeted Training Events
- Social Media


Attachment F - Example of 2014 Rep Loss Area Outreach Letter

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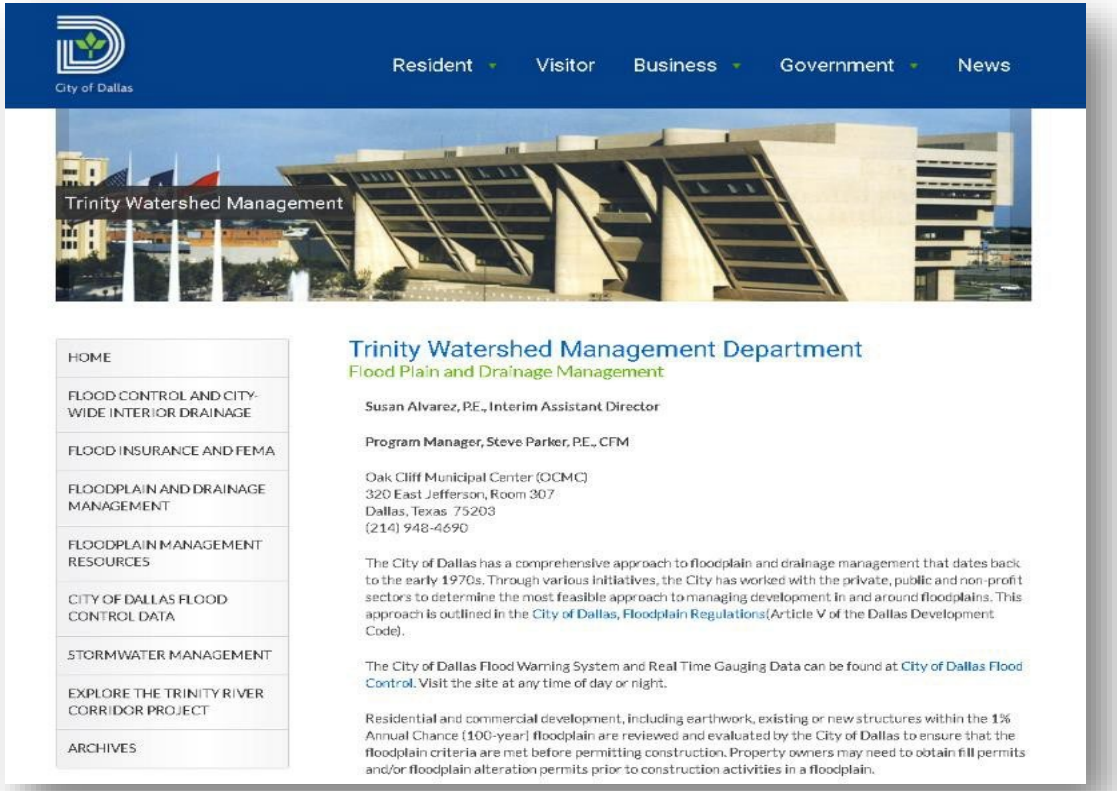
350 FLOOD PROTECTION INFORMATION – 58 POINTS

PROVIDE PUBLIC WITH INFORMATION ABOUT FLOOD PROTECTION

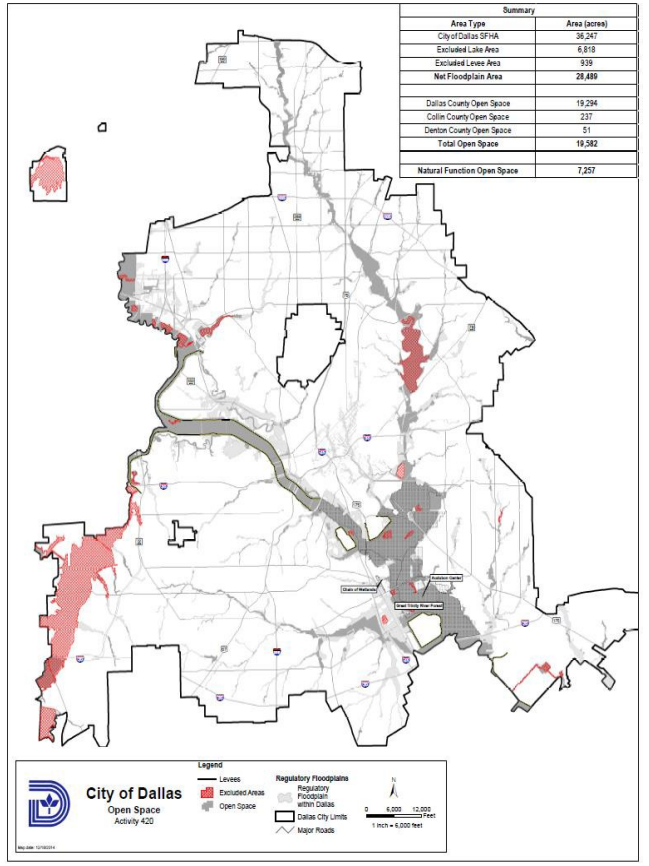
- Flood Protection Library (LIB)
- Locally Pertinent Documents (LPD)
- Flood Protection Website (WEB)



ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM
DALLAS CRS CLASS 4 ACTIVITIES

400 SERIES – MAPPING AND REGULATION

Activity	Points			% Communities Credited*
	Max Possible	Dallas Earned	Average Points Earned	
400 Mapping and Regulations	5841	1892	**1086**	
410 Flood Hazard Mapping	802	110	60	55%
420 Open Space Preservation	2020	1207	509	89%
430 Higher Regulatory Standards	2042	235	270	100%
440 Flood Data Maintenance	222	196	115	95%
450 Stormwater Management	755	144	132	87%



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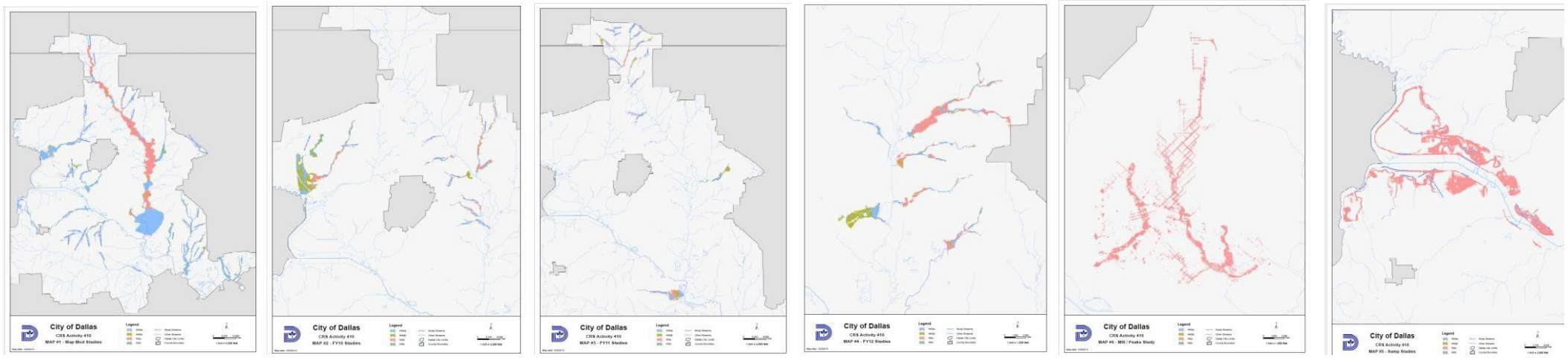
DALLAS CRS CLASS 4 ACTIVITIES

410 FLOODPLAIN MAPPING – 71 POINTS

OBJECT: IMPROVE QUALITY OF MAPPING USED TO IDENTIFY AND REGULATE DEVELOPMENT

- New Study (NS)
- Leverage (LEV)
- Higher Study Standards (HSS)
- Cooperating Technical Partner (CTP)



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DALLAS CRS CLASS 4 ACTIVITIES

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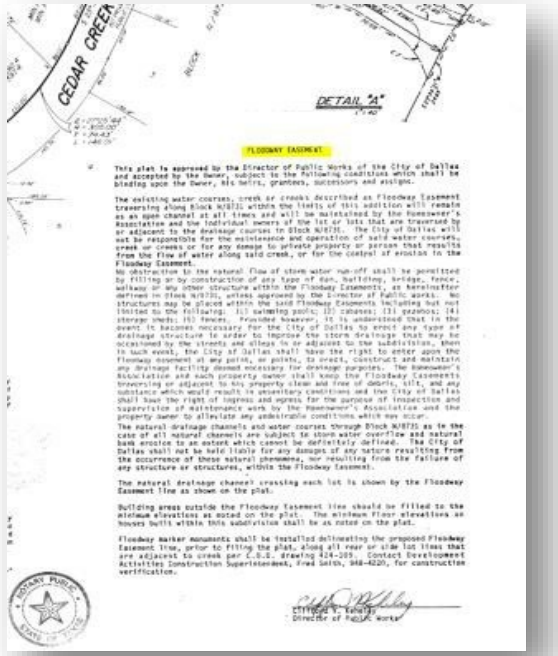
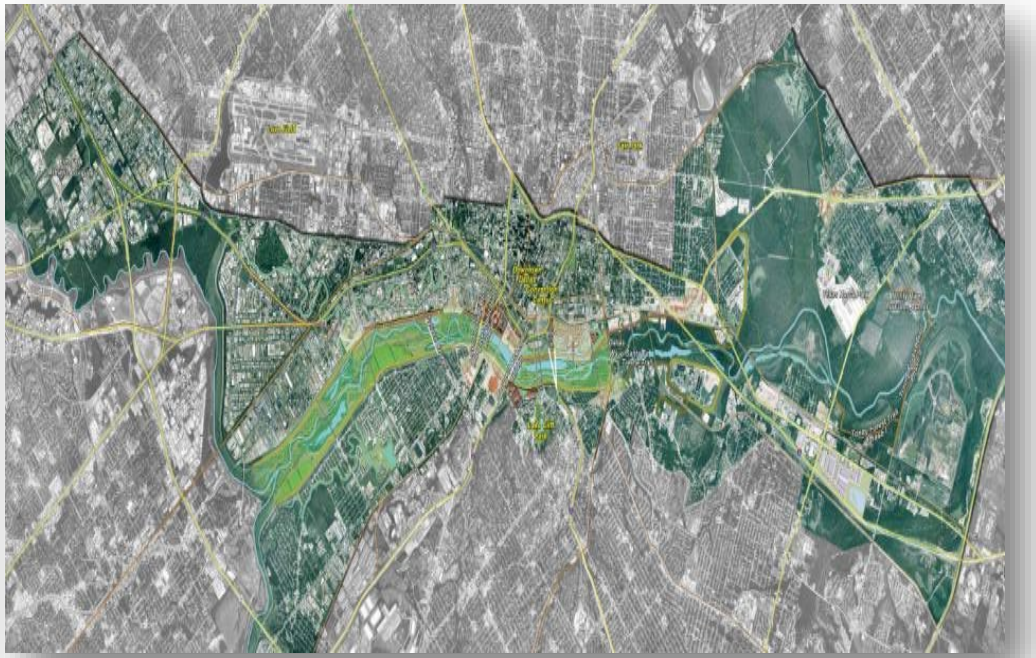
ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM
DALLAS CRS CLASS 4 ACTIVITIES

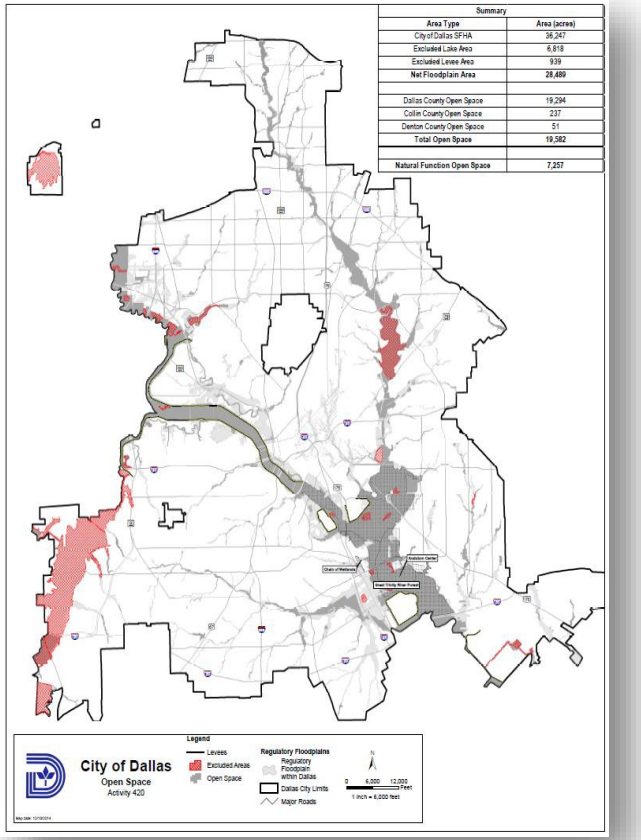
420 OPEN SPACE PRESERVATION – 1,199 POINTS

OBJECT: PREVENT FLOOD DAMAGE BY KEEPING LANDS OPEN, PROTECT NATURAL FUNCTIONS

- Open Space Preservation (OSP)
- Natural Functions Open Space (NFOS)





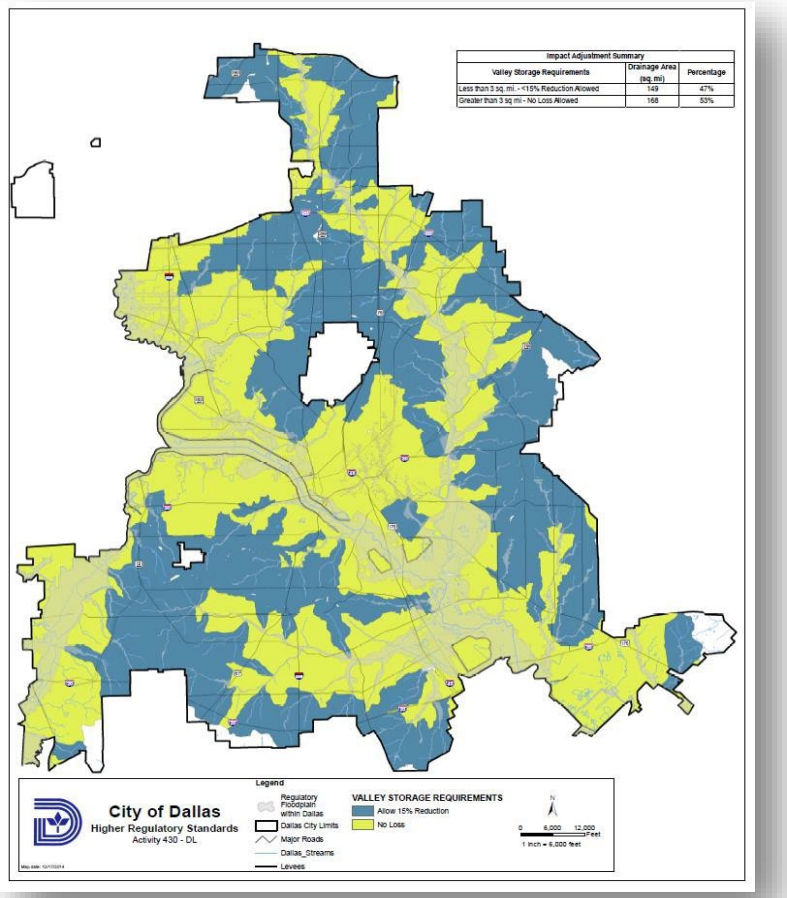


ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM
DALLAS CRS CLASS 4 ACTIVITIES

430 HIGHER REGULATORY STANDARDS – 253 POINTS

OBJECT: PROTECT EXISTING AND FUTURE DEVELOPMENT

- Development Limitations (DL)
- Freeboard (FRB)
- Cumulative Substantial Improvements (CSI)
- Building Code (BC)
- Local Drainage Protection (LDP)
- Regulations Administration (RA)

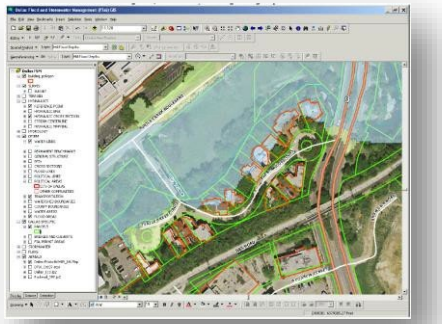


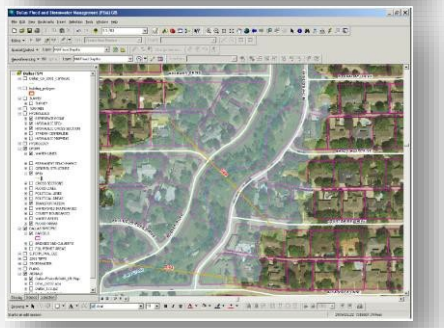
ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM | DALLAS CRS CLASS 4 ACTIVITIES

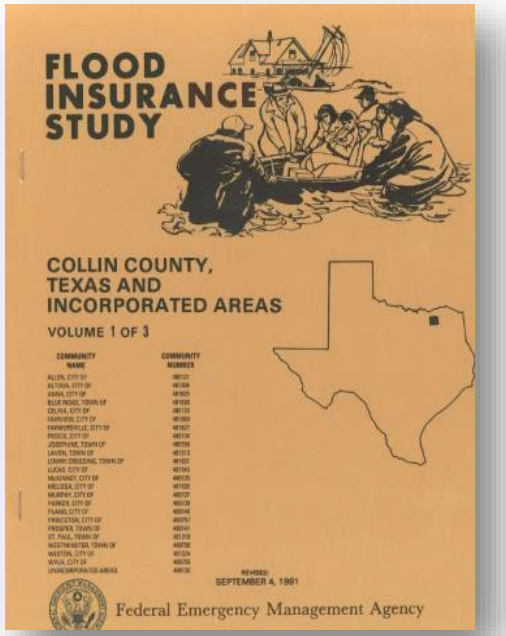
440 FLOOD DATA MAINTENANCE – 179 POINTS

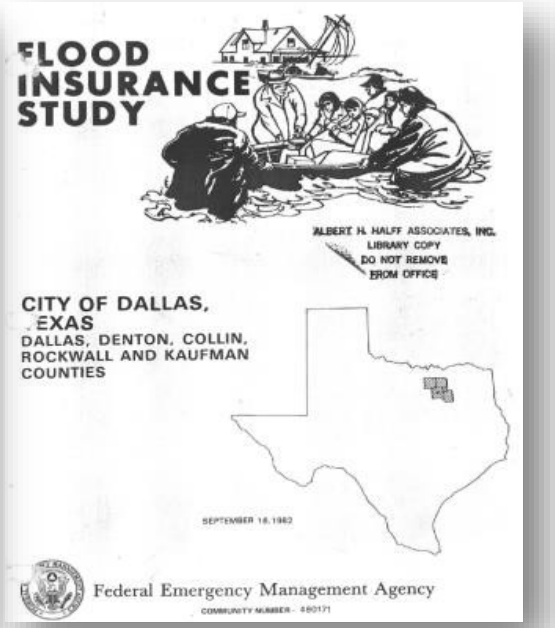
OBJECT: MAKE COMMUNITY FLOODPLAIN DATA MORE ACCESSIBLE, CURRENT, ACCURATE

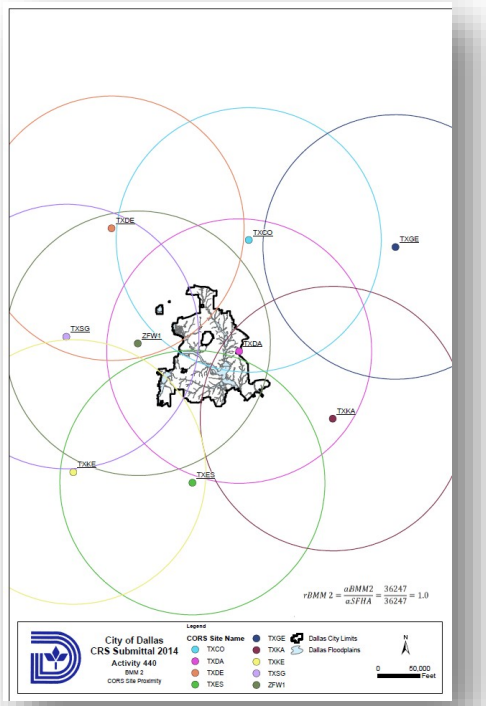
- Additional Map Data (AMD)
- FIRM Maintenance (FM)
- Benchmark Maintenance (BMM)









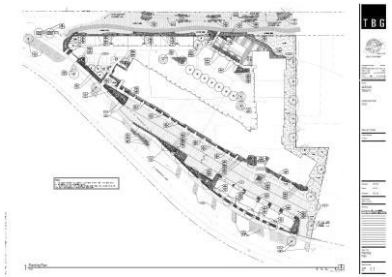


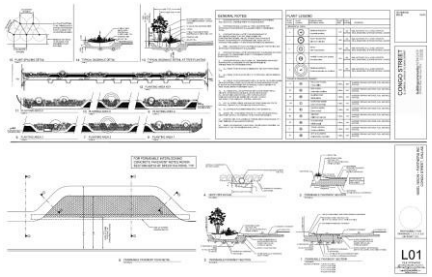
ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM | DALLAS CRS CLASS 4 ACTIVITIES

450 STORMWATER MANAGEMENT – 112 POINTS

OBJECT: PREVENT FUTURE DEVELOPMENT FROM INCREASING HAZARDS

- Stormwater Management Regulations (SMR)
- Erosion and Sedimentation Control Regulations (ESC)
- Water Quality Regulations (WQ)





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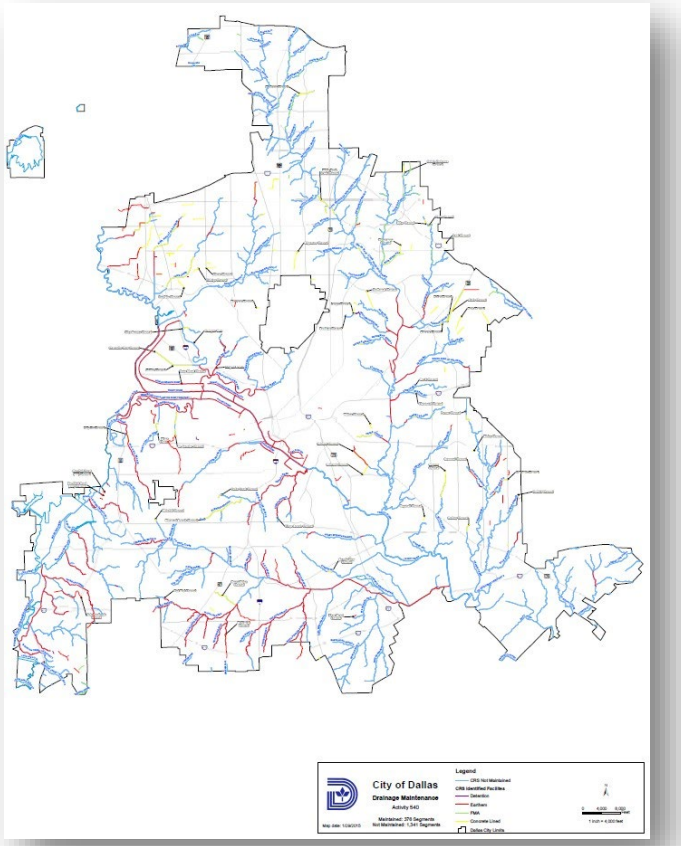
ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM |
DALLAS CRS CLASS 4 ACTIVITIES

500 SERIES – FLOOD DAMAGE REDUCTION

Activity	Points			% Communities Credited*
	Max Possible	Dallas Earned	Average Points Earned	
500 Flood Damage Reduction	5042	635	661	
510 Floodplain Management Planning	622	295	175	64%
520 Acquistion and Relocation	2250	153	195	28%
530 Flood Protection	1600	0	73	13%
540 Drainage System Maintenance	570	187	218	43%



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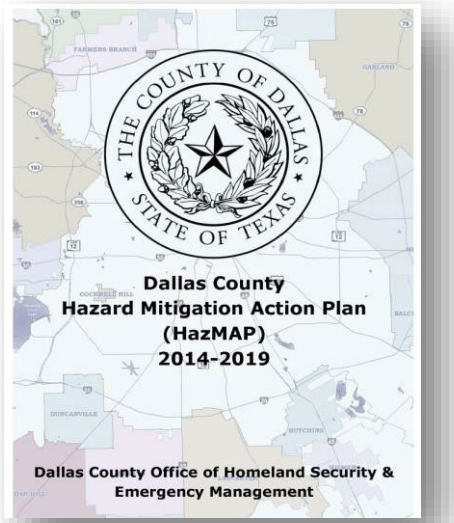
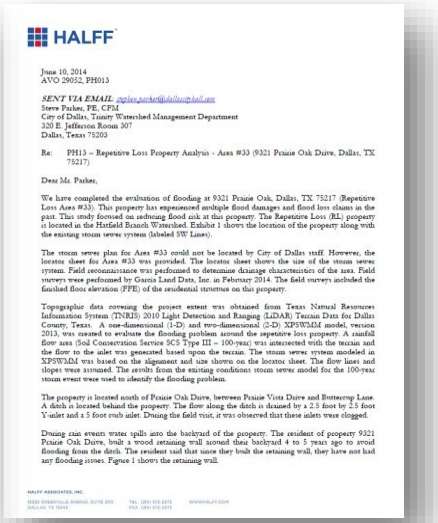
ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM | DALLAS CRS CLASS 4 ACTIVITIES

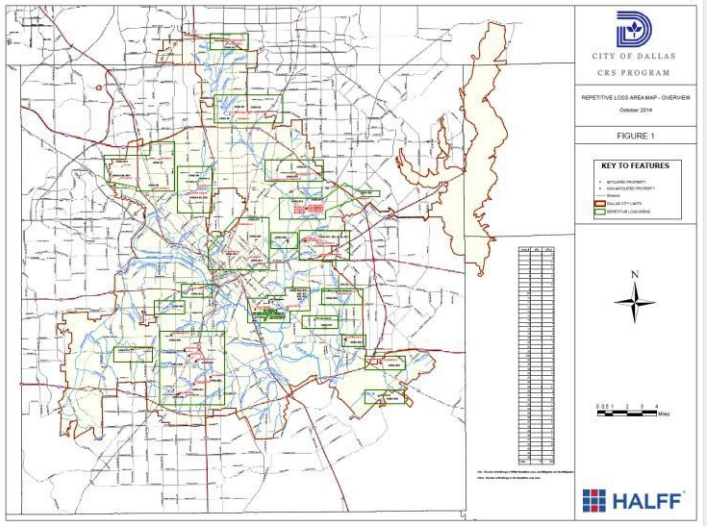
510 FLOODPLAIN MANAGEMENT PLANNING – 295 POINTS

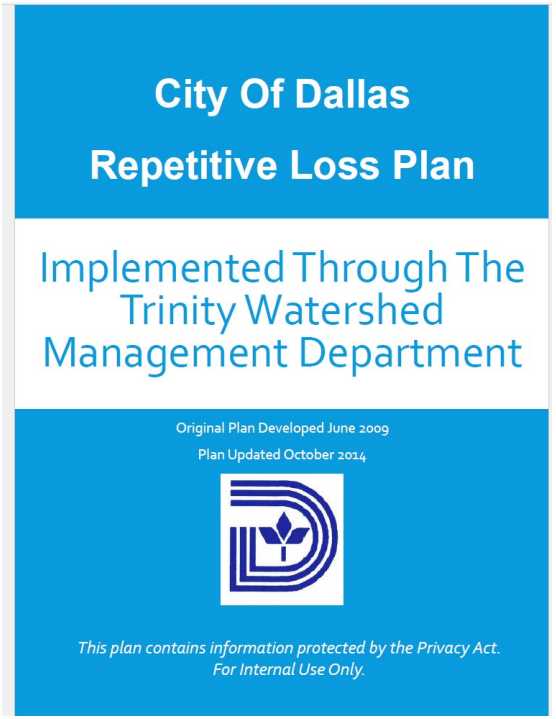
OBJECT: CREDIT OVERALL STRATEGY TO REDUCE ADVERSE IMPACT OF THE HAZARD

- Floodplain Management Planning (FMP)
- Repetitive Loss Area Analysis (RLAA)
- Natural Floodplain Functions Plan (NFP)









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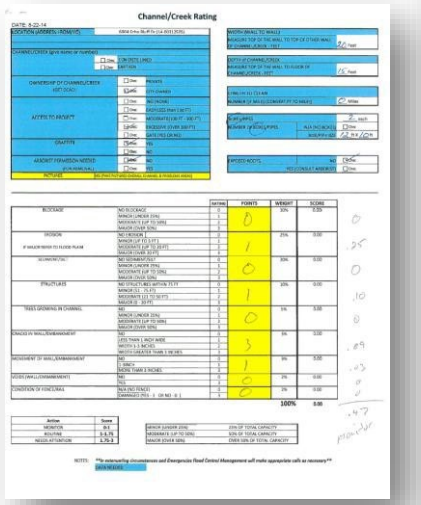
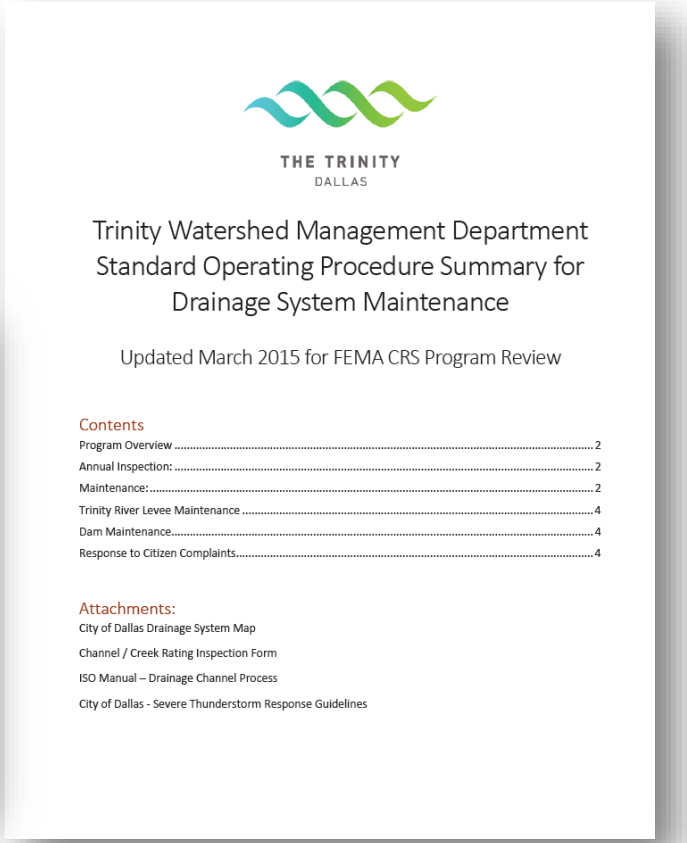
ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM
DALLAS CRS CLASS 4 ACTIVITIES

540 DRAINAGE SYSTEM MAINTENANCE – 265 POINTS

OBJECT: KEEP CHANNELS AND STORAGE BASIN CLEAR OF DEBRIS

- Chanel Debris Removal (CDR)
- Problem Site Maintenance (PSM)
- Capital Improvement Program (CIP)
- Stream Dumping Regulations (SDR)





THE TRINITY
DALLAS

Trinity Watershed Management Department
Standard Operating Procedure Summary for
Drainage System Maintenance

Updated March 2015 for FEMA CRS Program Review

Contents

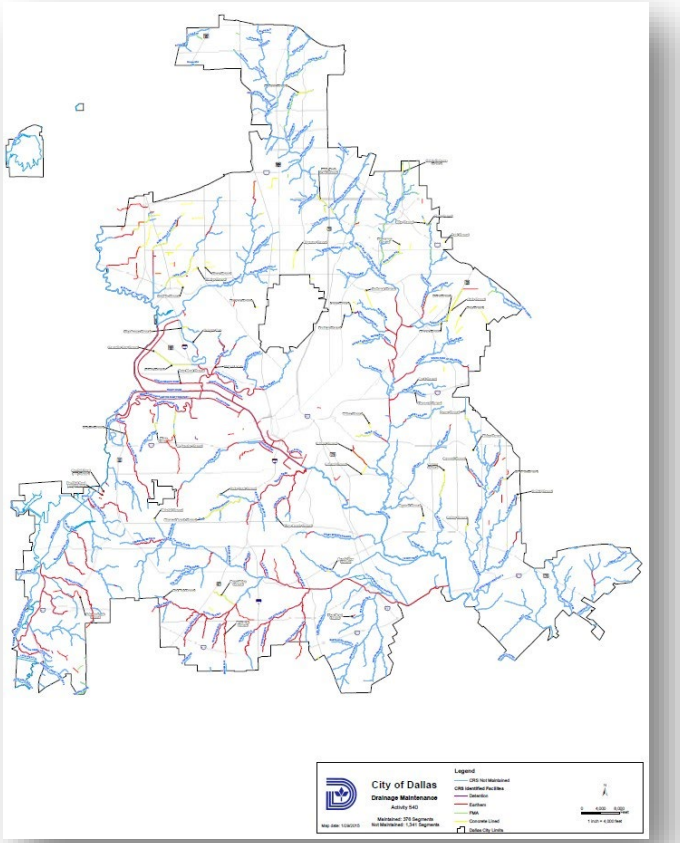
Attachments:

City of Dallas Drainage System Map

Channel / Creek Rating Inspection Form

ISO Manual – Drainage Channel Process

City of Dallas - Severe Thunderstorm Response Guidelines



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ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM
DALLAS CRS CLASS 4 ACTIVITIES

600 SERIES – WARNING AND RESPONSE

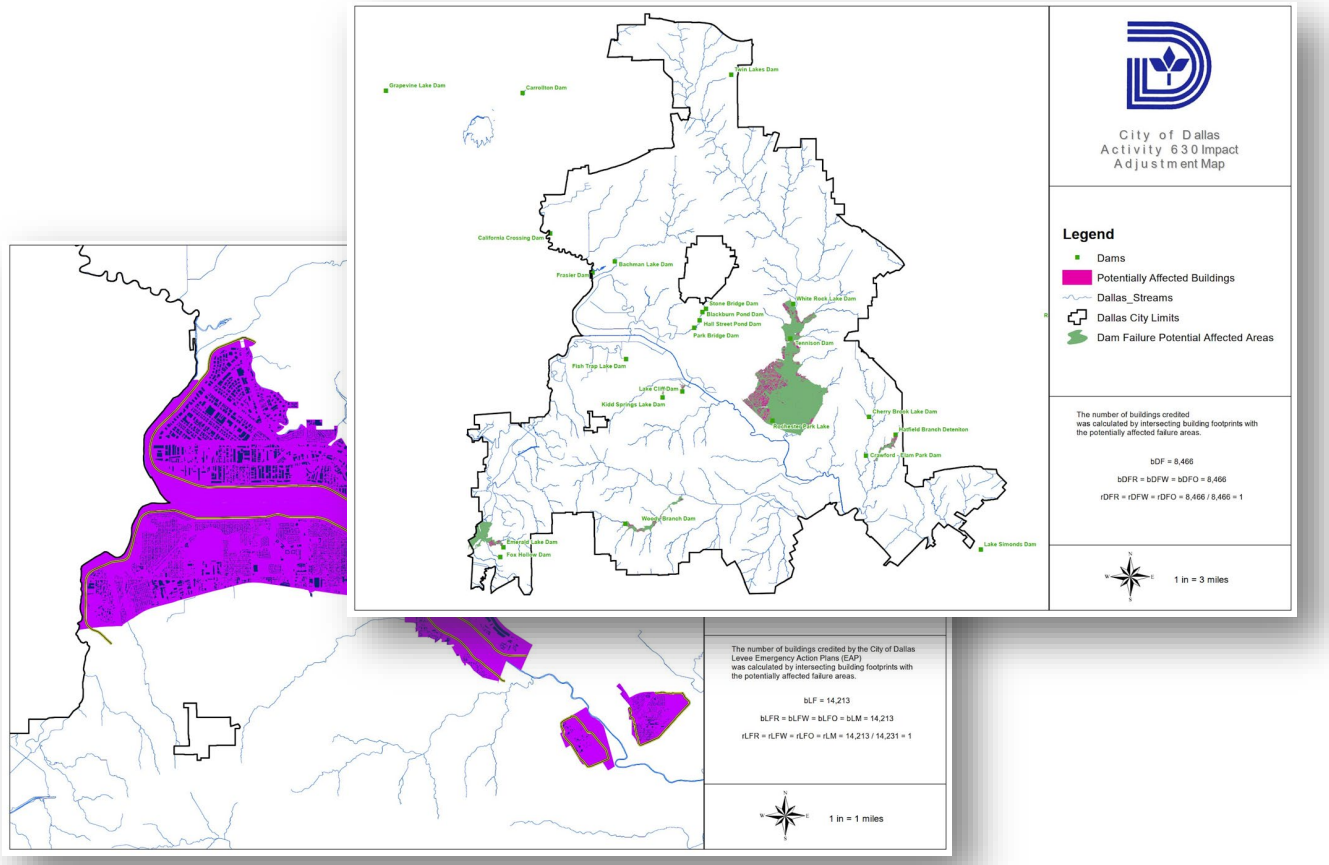
Activity	Points			% Communities Credited*
	Max Possible	Dallas Earned	Average Points Earned	
600 Warning and Response	790	369	446	
610 Flood Warning and Response	395	225	254	20%
620 Levees	235	115	157	1%
630 Dams	160	29	35	25%

ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM
DALLAS CRS CLASS 4 ACTIVITIES

600 WARNING AND RESPONSE

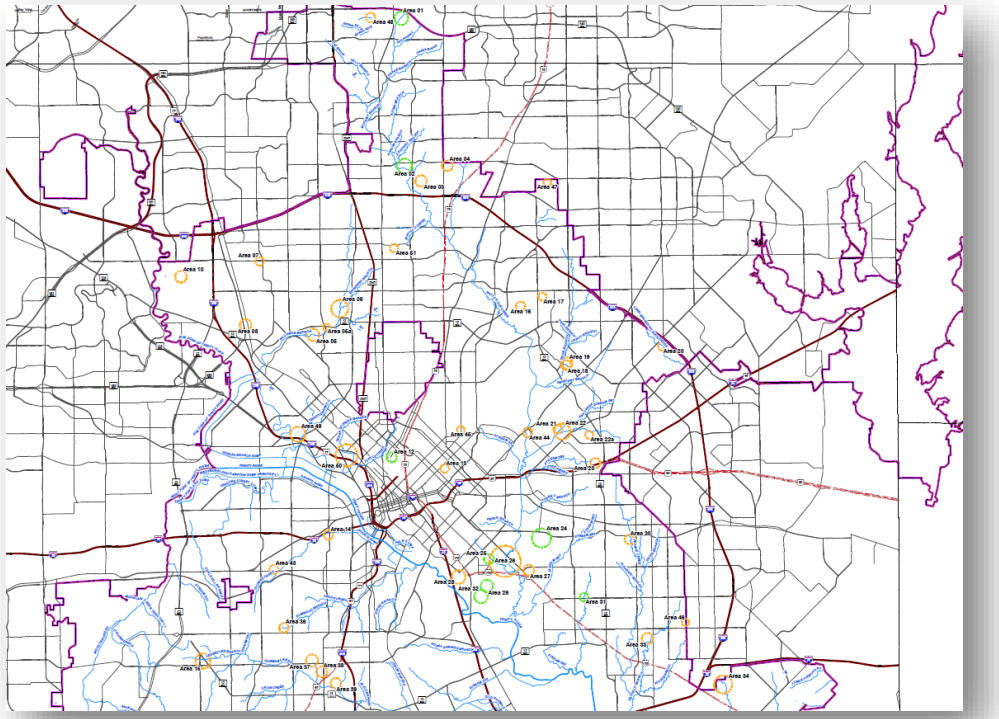
OBJECT: IDENTIFY FLOOD THREAT, DISSEMINATE WARNINGS, FLOOD RESPONSE ACTIVITIES

- 610: FLOOD WARNING AND RESPONSE
  - Flood threat recognition system (FTR)
  - Emergency warning dissemination (EWD)
  - Flood response operations (FRO)
- 620: LEVEES
  - Levee failure threat recognition system (LFR)
  - Levee failure warning (LFW)
  - Levee failure response operations (LFO)
- 630: DAMS
  - State Dam Safety Program (SDS)
  - Dam Failure Response Operations (DFO)



ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM |
WHY DO WE DO THIS

- Repetitive Loss Properties
- Insurance Premiums and Impacts
- Risk Rating 2.0
- Political Impact



ACHIEVING TEXAS' TOP RATING FROM FEMA'S CRS PROGRAM | LESSONS LEARNED

- Low Hanging Fruit
- Investment vs Return
- Staff Burden
- Organization
- Use Your Neighbors

HALFF

CITY OF DALLAS JOURNEY TOWARDS BECOMING A CRS CLASS 4 | CLOSING

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REGION 3 TRINITY
REGIONAL FLOOD PLANNING GROUP

Combined CRS Users Group/Elected Officials Seminar

Regional Flood Planning Effort Update

Glenn Clingenpeel, Chair

Stephanie Griffin, Project Manager

Agenda

- Regional flood planning overview
- Summary of Draft Plan
- Upcoming opportunities

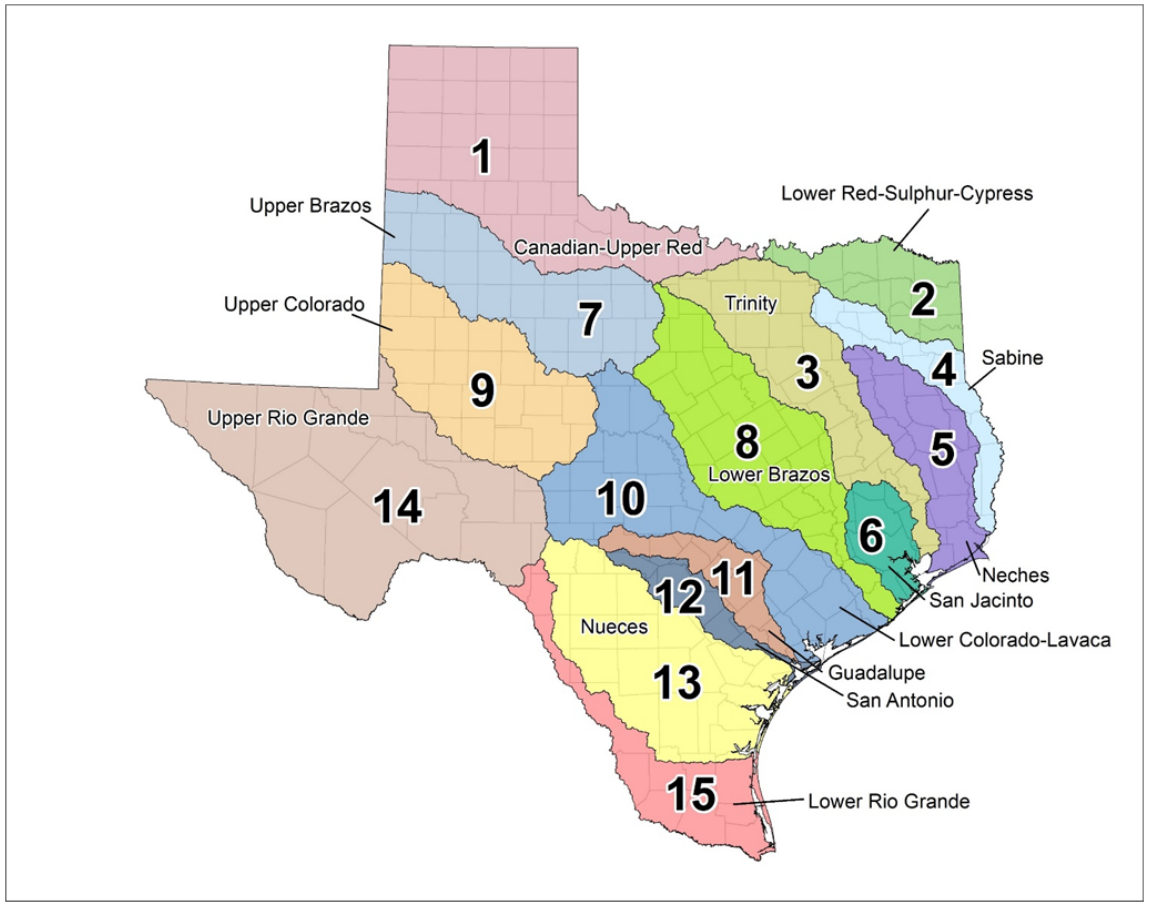
Notorious Holiday Floods

- 2015 – Memorial Day
- 2015 – Halloween
- 2015 – Christmas
- 2016 – Tax Day
- 2016 – Memorial Day
- 2017 – Hurricane Harvey
- 2018 – Independence Day
- 2018 – Labor Day
- 2019 – Halloween

Since 2015, Texas has experienced 14 flood-related events that have resulted in a Federal Emergency or Major Disaster Declaration, which totals to more than $5 billion in FEMA obligations.

RFPG Basics

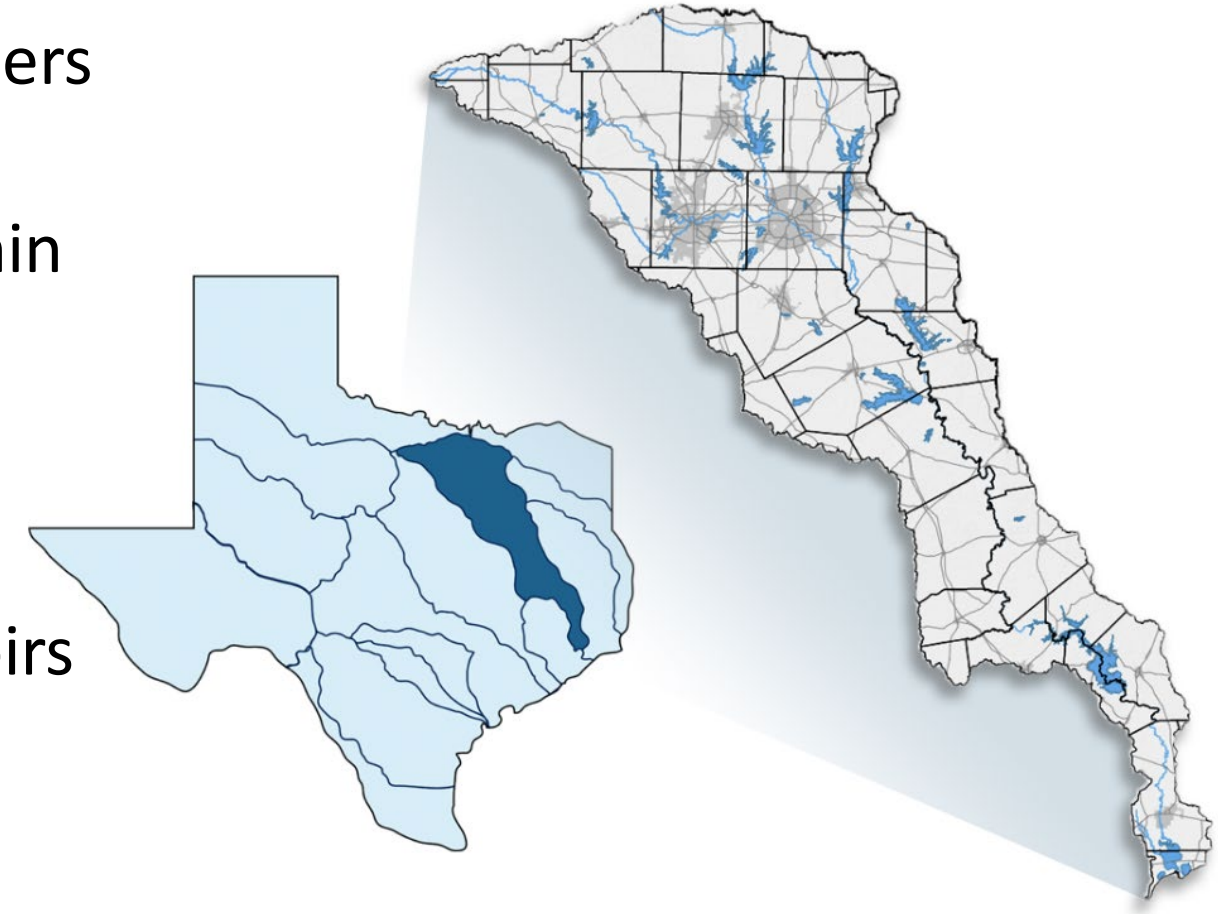
- 2019: 86th Texas Legislature passed Senate Bill 8, providing process for statewide flood planning
- Texas Water Development Board (TWDB) responsible agency
  - 15 regions
  - 12 interest categories
- Fall 2020: TWDB established RFPGs
- Spring 2021: RFPGs selected technical consultants



REGION 3 TRINITY
REGIONAL FLOOD PLANNING GROUP

Region 3 Trinity River Basin

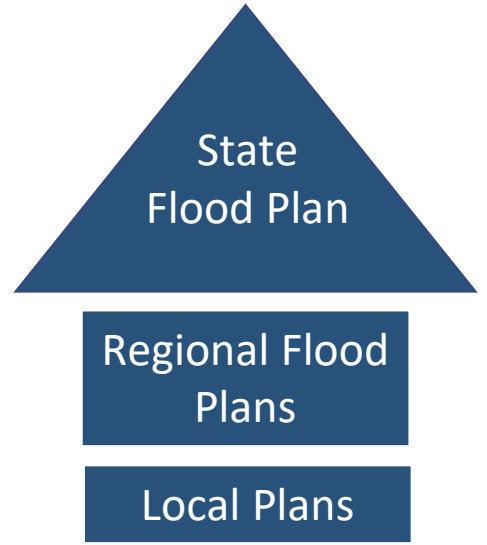
- Spans from Cooke County to Chambers County
- 38 counties entirely or partially within the region
- 17,920 square miles
- 15,855 stream miles
- More than 30 major lakes & reservoirs



REGION 3 TRINITY
REGIONAL FLOOD PLANNING GROUP

Regional Flood Planning Process

- Approach modeled after regional water planning
- Grassroots (“Bottom up”) approach
- Same scope of work for each RFPG
- Regional flood plans will roll up to become State Flood Plan
- Public process



The Trinity Regional Flood Planning Group

Voting members:	Interest group represented:
• Chad Ballard	Small business
• Sano Blocker	Electric generating utilities
• Melissa Bookhout	Agricultural interests
• Glenn Clingenpeel	River authorities
• Scott Harris	Water utilities
• Rachel Ickert	Flood districts
• Andrew Isbell	Public
• Jordan Macha	Environmental interests
• Galen Roberts	Water districts
• Matt Robinson	Industries
• Lissa Shepard	Counties
• Sarah Standifer	Municipalities

REGION 3 TRINITY REGIONAL FLOOD PLANNING GROUP

The Trinity Regional Flood Planning Group

Non-voting members:	Organization represented:
• Richard Bagans	Texas Water Development Board
• Rob Barthen	Texas Department of Agriculture
• Steve Bednarz	Texas State Soil and Water Conservation Board
• Bert Galvan	Texas Commission on Environmental Quality
• Kris Robles	General Land Office
• Andrea Sanders	Texas Division of Emergency Management
• Adam Whisenant	Texas Parks and Wildlife Department
• Ellen Buchanan	Neches Flood Planning Group (liaison)
• Todd Burrer	Region 6 San Jacinto Flood Planning Group (liaison)
• Jerry Cotter	USACE, Fort Worth
• Lisa McCracken	USACE, Galveston
• Justin Bower	Houston-Galveston Area Council
• Diane Howe	Federal Emergency Management Agency
• Lonnie Hunt	Deep East Texas Council of Governments
• Edith Marvin	North Central Texas Council of Governments
• Greg Waller	Natl Weather Service / West Gulf River Forecast Center

REGION 3 TRINITY
REGIONAL FLOOD PLANNING GROUP

Expectations of First Flood Plan

What to Expect

- Significant increase in knowledge about flooding in the Trinity basin
- Consolidation of information and resources
- Make funding sources available to local and regional entities
- Understand what we don't know
  - Where are our data gaps?
  - What studies and evaluations are needed?

What **NOT** to Expect

- An end to flooding
- A list of "silver bullet" projects that will fix specific flooding issues
- Understand all facets of flooding the basin
- Flood control projects that will significantly benefit water supply

Regional Flood Plan Components

Existing & Future Conditions

- Task 1: Introduce region
- Task 2: Determine current and future flood risk
- Task 3: Establish planning goals
- Task 4: Identify potential solutions

Recommended Solutions

- Task 5: Select recommended solutions
- Task 6: Identify potential impacts
- Task 7: Summarize flood response info
- Task 8: Recommend improvements
- Task 9: Identify funding sources
- Task 10: Encourage public participation

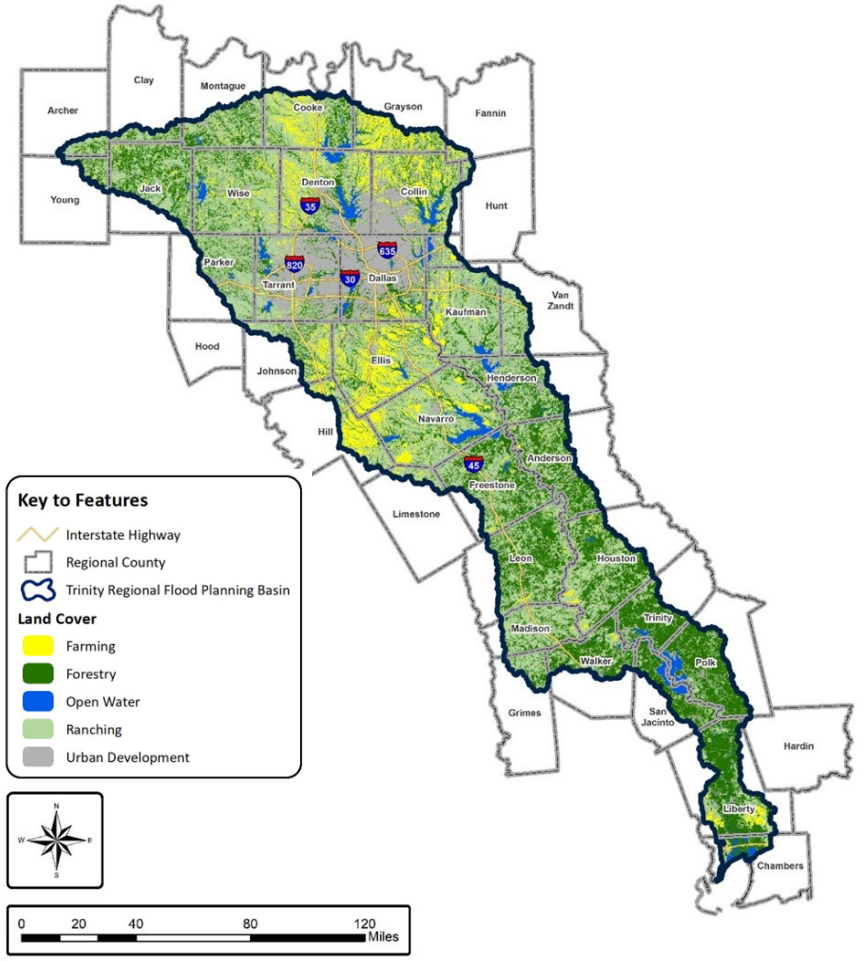
Amended to Include

- Task 11: Perform additional outreach
- Task 12: Advance FMEs to FMPs
- Task 13: Adopt amended plan

REGION 3 TRINITY
REGIONAL FLOOD PLANNING GROUP

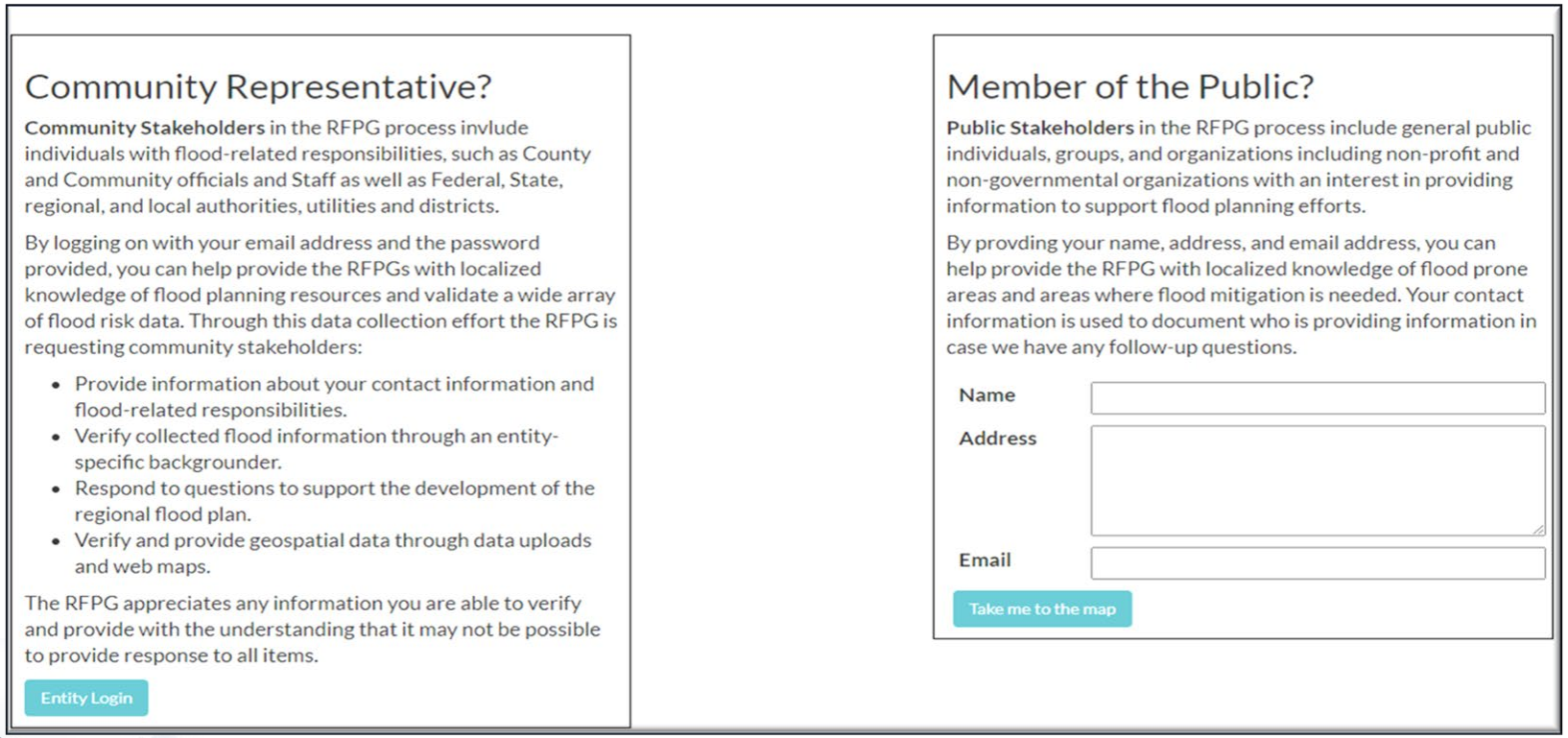
Chapter 1: Overview of Region

- Working lands
  - Farming/Crop Production
    - Predominant in Upper and Mid Basin areas
    - Concentrations of farming in Liberty County
  - Forestry
    - Predominant working land type in Lower Basin
    - Relationship to national forests and preserves
  - Ranching
    - Prominent land use throughout region
    - Largest concentrations located NW of Metroplex and in Mid Basin area



Chapter 2: Current and Future Flood Risk

- Data collection website and outreach



Community Representative?

Community Stakeholders in the RFPG process invlude individuals with flood-related responsibilities, such as County and Community officials and Staff as well as Federal, State, regional, and local authorities, utilities and districts.

By logging on with your email address and the password provided, you can help provide the RFPGs with localized knowledge of flood planning resources and validate a wide array of flood risk data. Through this data collection effort the RFPG is requesting community stakeholders:

- Provide information about your contact information and flood-related responsibilities.
- Verify collected flood information through an entity-specific backgrounder.
- Respond to questions to support the development of the regional flood plan.
- Verify and provide geospatial data through data uploads and web maps.

The RFPG appreciates any information you are able to verify and provide with the understanding that it may not be possible to provide response to all items.

Entity Login

Member of the Public?

Public Stakeholders in the RFPG process include general public individuals, groups, and organizations including non-profit and non-governmental organizations with an interest in providing information to support flood planning efforts.

By provding your name, address, and email address, you can help provide the RFPG with localized knowledge of flood prone areas and areas where flood mitigation is needed. Your contact information is used to document who is providing information in case we have any follow-up questions.

Name

Address

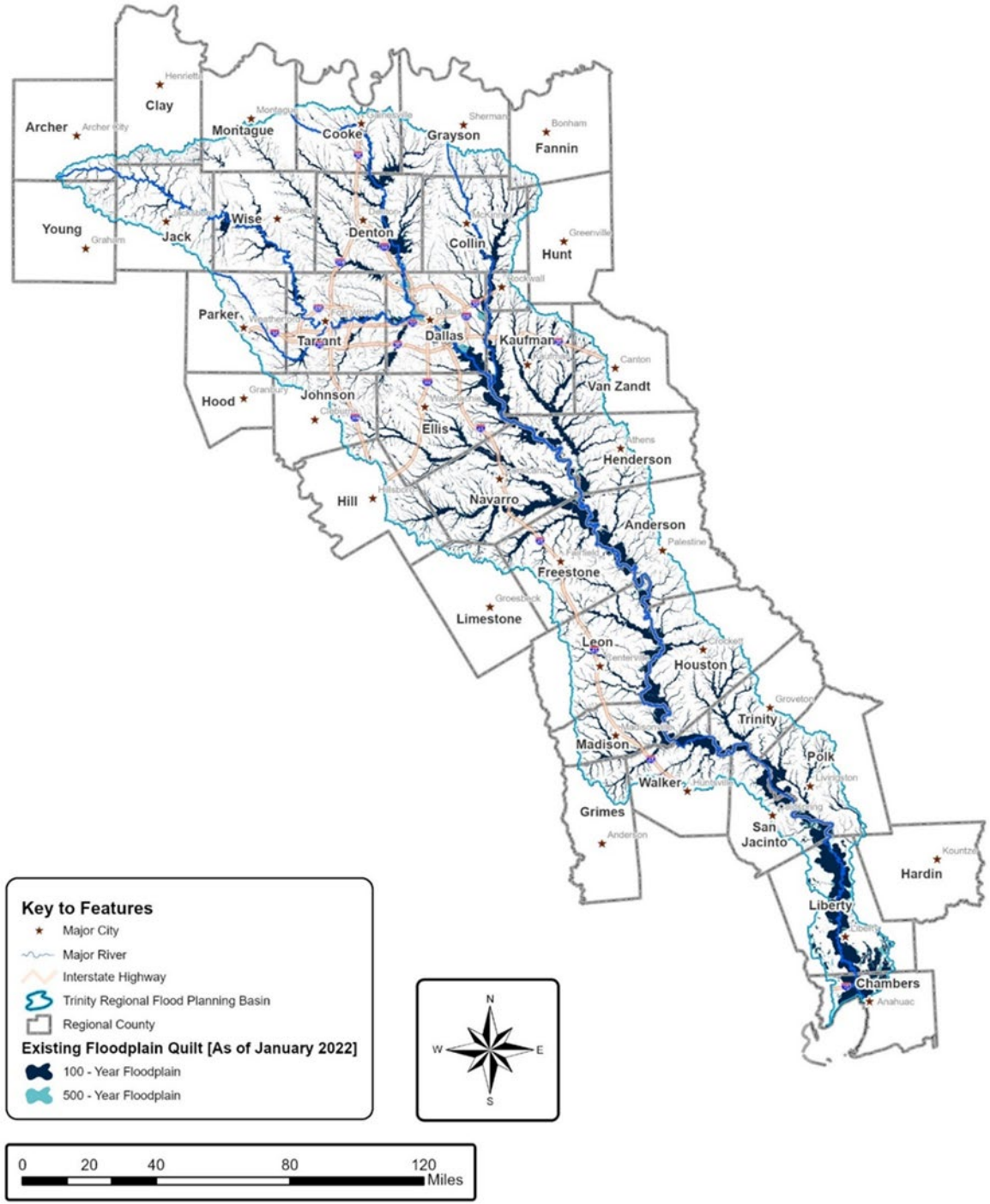
Email

Take me to the map

REGION 3 TRINITY
REGIONAL FLOOD PLANNING GROUP

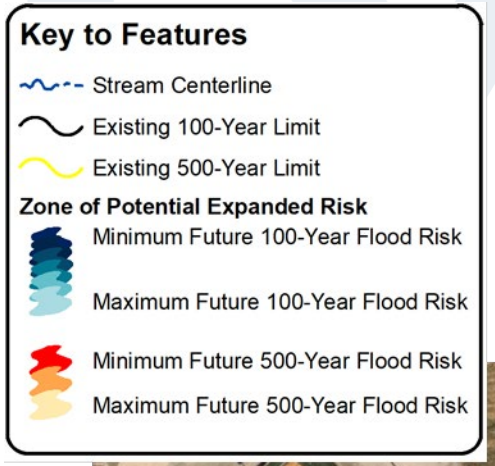
Chapter 2: Current and Future Flood Risk

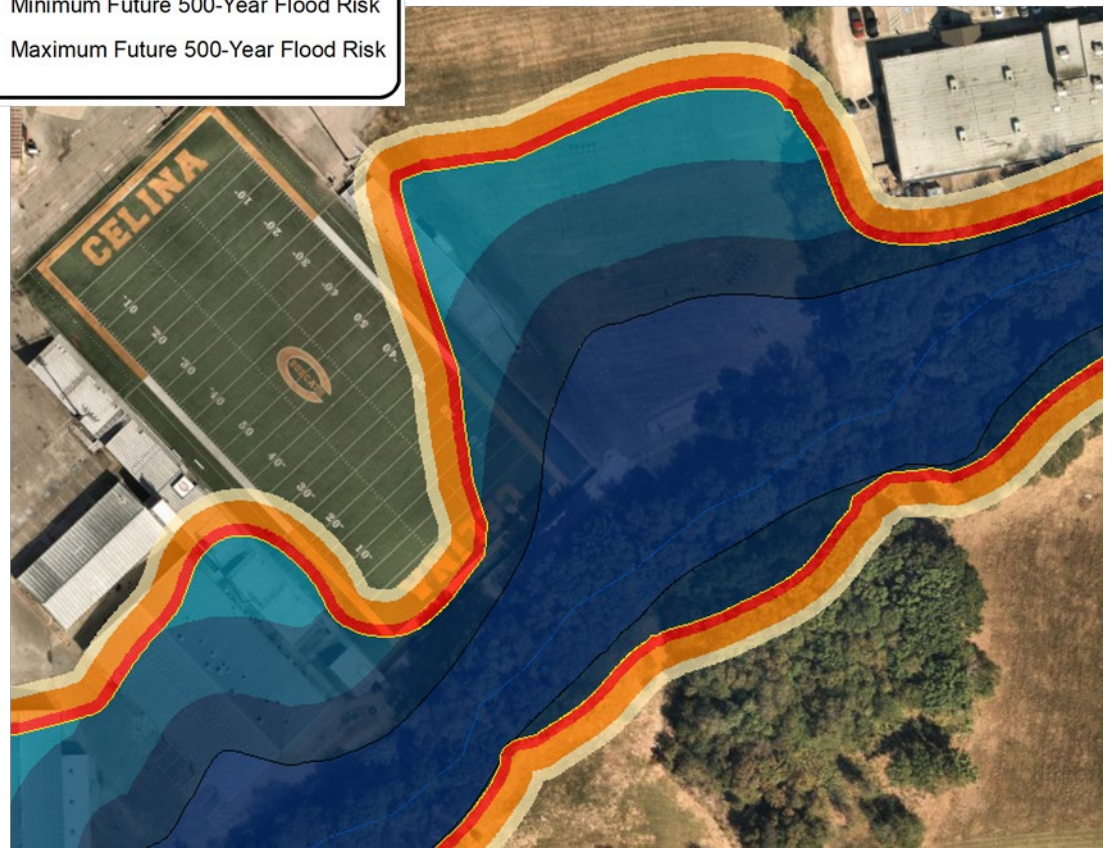
- Key findings: Existing conditions
  - Region-wide 1.32 million people displaced by 1% Annual Chance Event (ACE)
  - Total value of exposed buildings > $636 billion
  - More significant impact for 0.2% ACE
  - Assessed impacts of flooding on socially vulnerable populations and community's ability to recover



Chapter 2: Current and Future Flood Risk

- Key findings: Future conditions
  - Difficult to assess because few communities map or model
  - RFPG recommended future
    - 1% ACE floodplains as a range between current 1% and 0.2% ACE
    - 40-foot max buffer for future 0.2% ACE
  - Result: 29% more structures and 25% more people would be potentially impacted by future flood risk conditions





REGION 3 TRINITY REGIONAL FLOOD PLANNING GROUP

Chapter 3: Planning Goals

(1) Improve flood warning and public safety

(2) Improve flood analyses

(3) Reduce property damage and loss

(4) Preserve the floodplain

(5) Improve flood infrastructure

(6) Expand flood education and outreach

(7) Expand funding

Chapter 4: Potentially Feasible Actions
Chapter 5: Recommended Actions

Flood Management Evaluations = FME = studies

Flood Mitigation Projects = FMP = projects

Flood Management Strategies = FMS = other actions

The Draft Plan includes a variety of recommendations for each category, totaling over $1 billion in recommended solutions.

REGION 3 TRINITY REGIONAL FLOOD PLANNING GROUP

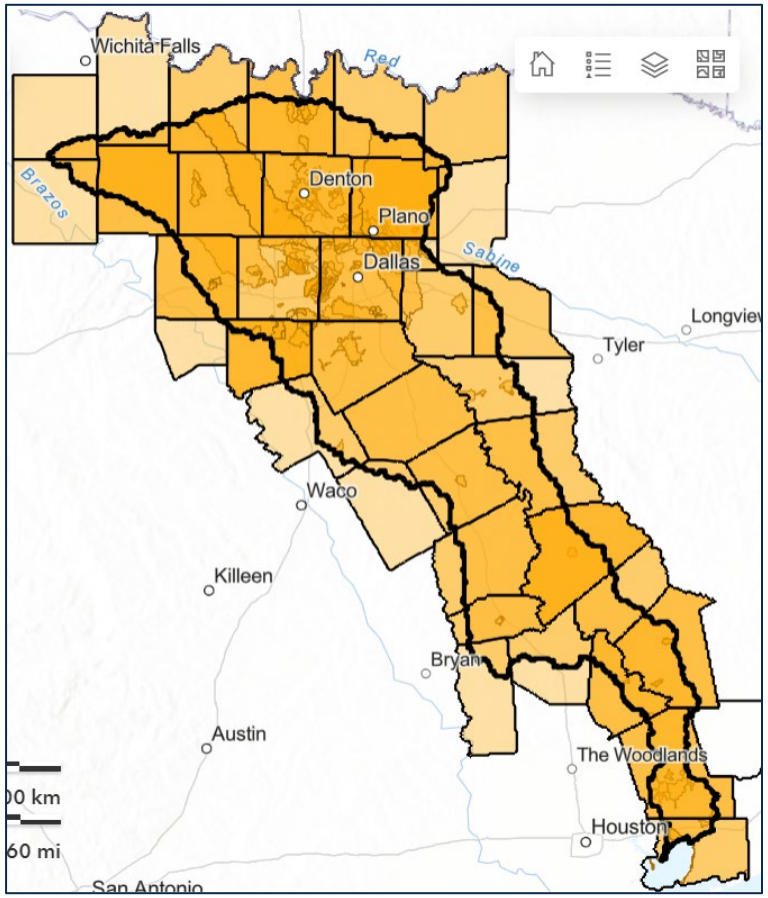
FME: Region-wide

- 342 out of 356 recommended and included in Draft Plan

Regional Flood Planning Goals

(1) Improve flood warning and public safety
(2) Improve flood analyses
(3) Reduce property damage and loss
(4) Preserve the floodplain
(5) Improve flood infrastructure
(6) Expand flood education and outreach
(7) Expand funding

FME Type	FME Description	# of FMEs Recommended	Total Cost
Preparedness	Studies on Flood Preparedness	5	$3,150,000
Project Planning	Previously Identified Drainage Projects and Flood Studies	228	$60,937,000
Watershed Planning	Flood Mapping Updates, Drainage Master Plans, H&H Modeling, Dam and Levee Failure	108	$79,879,000
Other	Dam Studies	1	$2,000,000
	Total	**342**	**$145,966,000**



FME: Upper Basin

- 293 out of 306 recommended and included in Draft Plan

FME Type	FME Description	# of FMEs Recommended	Total Cost
Preparedness	Studies on Flood Preparedness	4	$2,150,000
Project Planning	Previously Identified Drainage Projects and Flood Studies	208	$55,357,000
Watershed Planning	Flood Mapping Updates, Drainage Master Plans, H&H Modeling, Dam and Levee Failure	80	$57,068,000
Other	Dam Studies	1	$2,000,000
	Local Area Total	**293**	**$116,575,000**

FMP: Region-wide

- 7 FMP fully evaluated
- All recommended and included in Draft Plan

FMP Name	Sponsor	Total Cost
Spring Meadows Estates Detention Pond Design	Sachse	$1,868,000
West Irving Creek Phases 2, 3, and 4	Irving	$98,746,000
Arlington VC(A)-1 Drainage and Erosion Improvements	Arlington	$2,601,000
Lancaster/Foch Area Mitigation	Fort Worth	$11,771,000
Linwood Park Flood Mitigation (Western Arlington Heights)	Fort Worth	$50,523,000
Sunnyvale Urban Flooding Reduction Improvements - Area 1	Sunnyvale	$4,560,000
Sunnyvale Urban Flooding Reduction Improvements - Area 2	Sunnyvale	$5,701,000
		$175,770,000

Regional Flood Planning Goals

(1) Improve flood warning and public safety
(2) Improve flood analyses
(3) Reduce property damage and loss
(4) Preserve the floodplain
(5) Improve flood infrastructure
(6) Expand flood education and outreach
(7) Expand funding

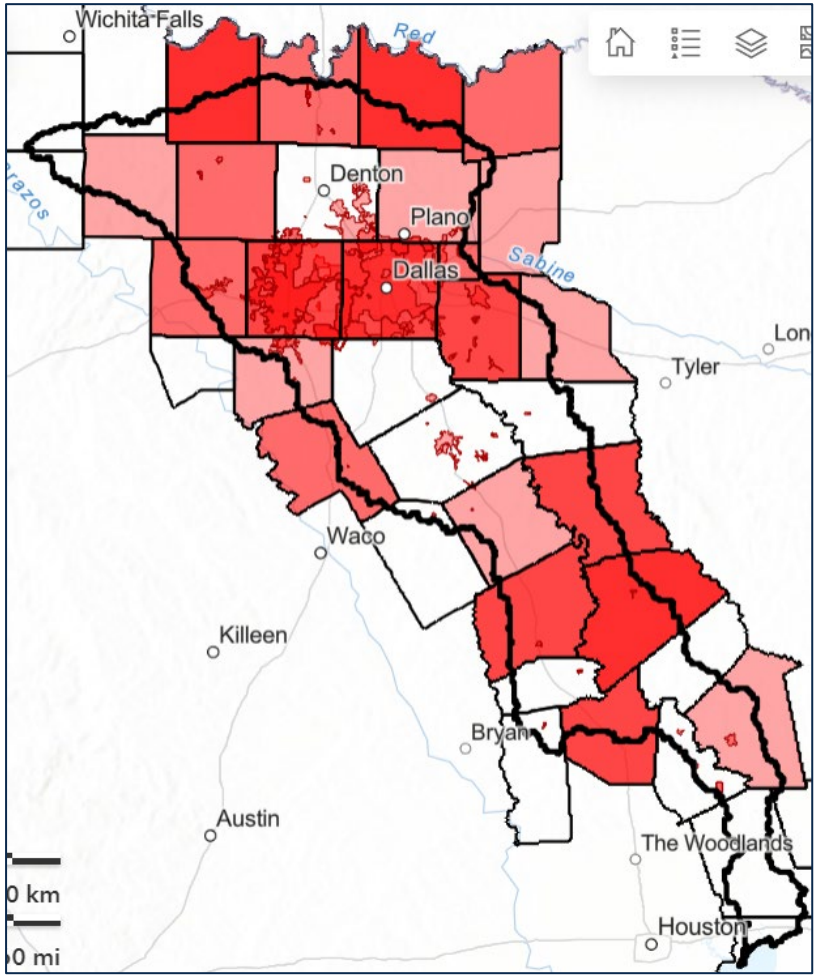
FMS: Region-wide

- 136 out of 143 recommended and included in Draft Plan

FMS Type	FMS Description	# of FMSs Recommended	Total Cost
Education and Outreach	Turn Around, Don't Drown Campaigns; NFIP Education; Flood Education; Dam Safety Education	19	$975,000
Flood Warning	Flood Warning Systems; Rain/Stream Gauges and Weather Stations; Low Water Crossings (LWCs)	20	$5,300,000
Infrastructure Projects	Hazardous Roadway Overtopping Mitigation Program; Citywide Drainage Improvements; Flood-Proofing	5	$430,000,000
Other	Debris Clearing/Channel Maintenance; Erosion Control; Dam & Levee Inspections; Green Infrastructure; Open Space Programs	12	$8,525,000
Property Acquisition and Flood-proofing	Acquire Repetitive Loss Properties; Acquire and Preserve Open Spaces; Flood-Proofing	28	$295,500,000
Regulatory and Guidance	City Floodplain Ordinance Creation/Updates; Zoning Regs; Land Use Programs; Open Space Regs	52	$6,600,000
	Total	**136**	**$746,900,000**

Regional Flood Planning Goals

(1) Improve flood warning and public safety
(2) Improve flood analyses
(3) Reduce property damage and loss
(4) Preserve the floodplain
(5) Improve flood infrastructure
(6) Expand flood education and outreach
(7) Expand funding



FMS: Upper Basin

- 110 out of 116 recommended and included in Draft Plan

FMS Type	FMS Description	# of FMSs Recommended	Total Cost
Education and Outreach	Turn Around, Don't Drown Campaigns; NFIP Education; Flood Education; Dam Safety Education; Floodplain Regulatory Awareness	15	$765,000
Flood Measurement and Warning	Flood Warning Systems; Rain/Stream Gauges and Weather Stations; Low Water Crossings (LWCs)	18	$4,800,000
Infrastructure Projects	Hazardous Roadway Overtopping Mitigation Program; Citywide Drainage Improvements; Flood-Proofing facilities	5	$430,000,000
Other	Debris Clearing Maintenance; Channel Maintenance and Erosion Control; Dam Inspections; Levee Inspections; City Parks; Green Infrastructure; Open Space Programs	11	$8,425,000
Property Acquisition and Structural Elevation	Acquire High Risk and Repetitive Loss Properties; Acquire and Preserve Open Spaces; Flood-Proofing Facilities	21	$235,500,000
Regulatory and Guidance	City Floodplain Ordinance Creation/Updates; Zoning Regulations; Land Use Programs; Open Space Regulations	40	$5,400,000
	Local Area Total	**110**	**$684,890,000**

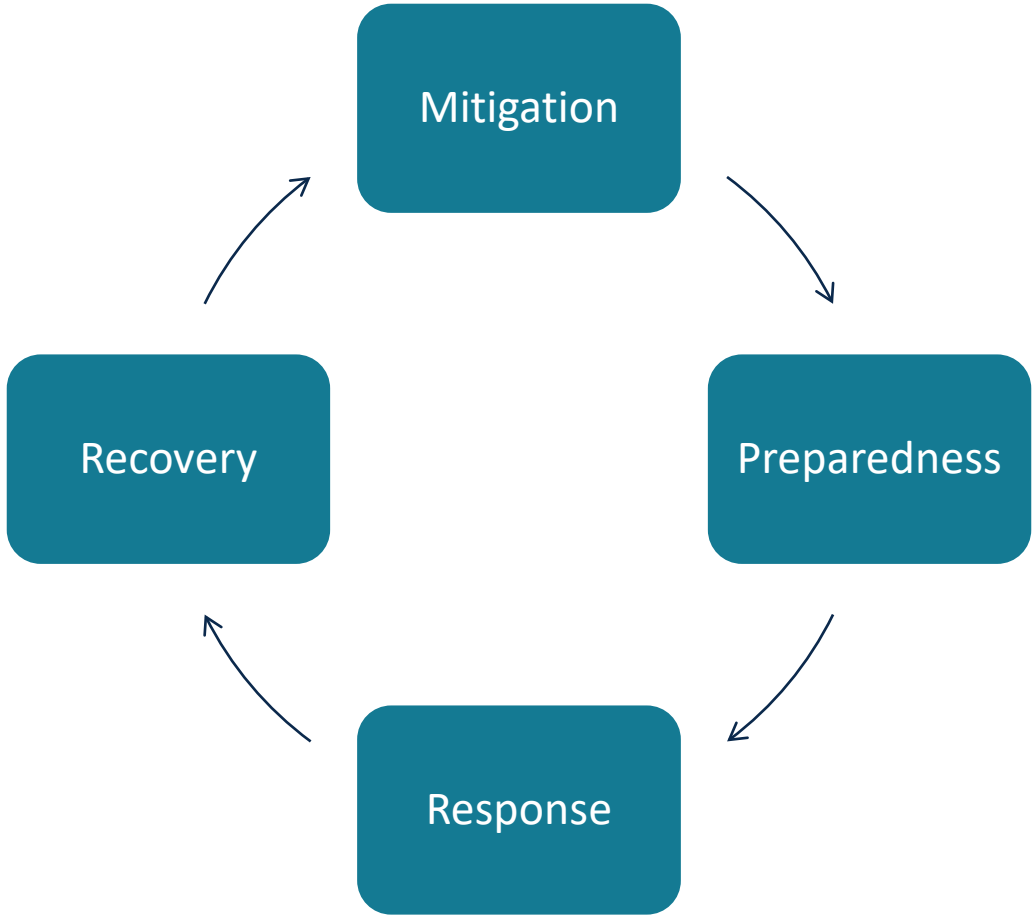
Chapter 6: Potential Impacts of Actions

- Upstream and downstream neighbors
- Adjacent regions
- State Water Plan

Flood Exposure	Existing Conditions	After FMP Implementation	Exposure Reduction from FMPs
	1% ACE	1% ACE	1% ACE
Exposed Structures	1,500	1,108	392
Exposed Population	37,593	33,421	4,172
Exposed Low Water Crossings	9	2	7
Number of Road Closure Occurrences	253	192	61
Road Length (Mi.)	31	23	8

REGION 3 TRINITY REGIONAL FLOOD PLANNING GROUP

Chapter 7: Flood Response Summary



REGION 3 TRINITY REGIONAL FLOOD PLANNING GROUP

Chapter 8: Recommended Planning Process Improvements

- Legislative
- Regulatory or administrative
- Flood planning process
- Funding recommendations

Chapter 9: Potential Funding

- Financing analysis – Who will pay?

Funding surveys sent to Sponsors on 6/7/2022 and 6/14/2022

14% Sponsor response rate (22 of 158) (as of 7/5/2022)

Overall, total cost of **$1,076,686,000** needed to implement recommended FMEs, FMSs, and FMPs

From total cost, projected **$961,274,000** of state and federal funding is needed

REGION 3 TRINITY REGIONAL FLOOD PLANNING GROUP

Chapter 10: Public Participation

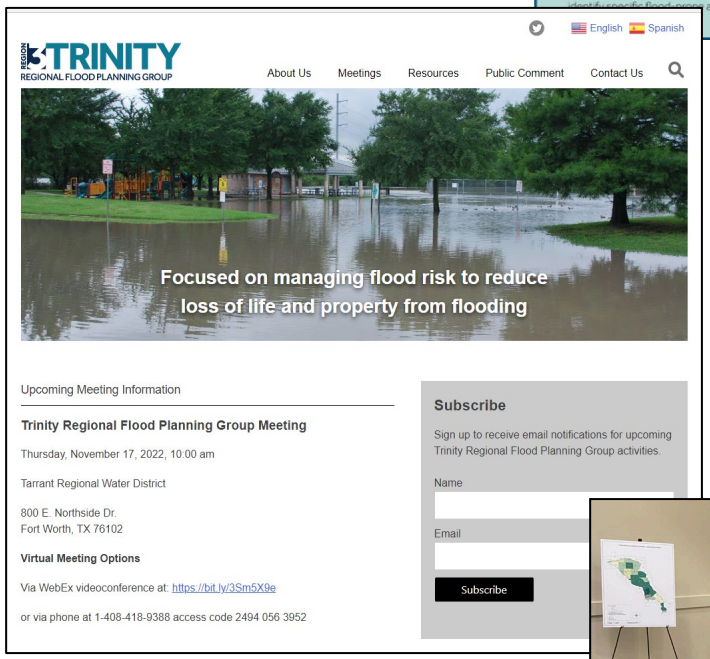
Numerous public meetings and open houses (many included a hybrid option)

Meeting notices and materials posted to website and Texas Secretary of State. Notification emails sent to interested parties

Maintenance of stakeholders / interested parties database with nearly 850 unique email addresses and nearly 1,100 individual contacts

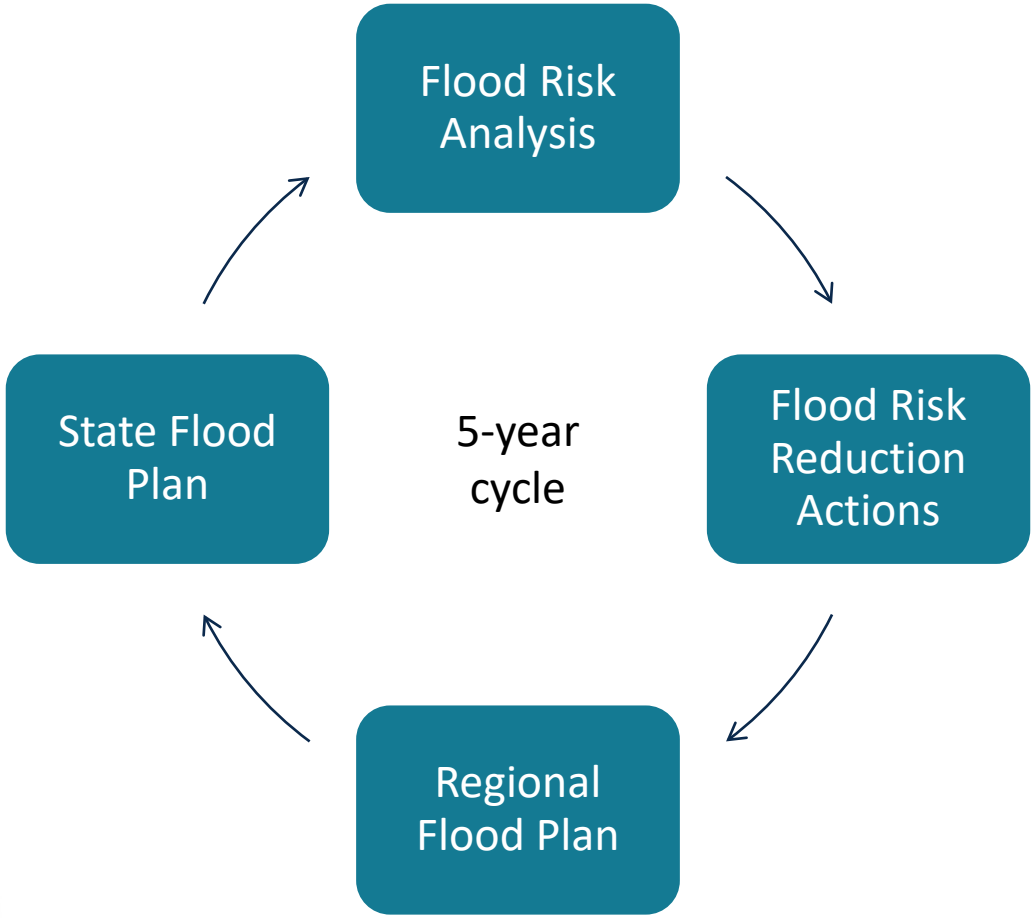
- City and county officials
- State, federal and other entities with flood planning responsibilities
- Public / interested party sign-ups from website

Development and use of award-winning website

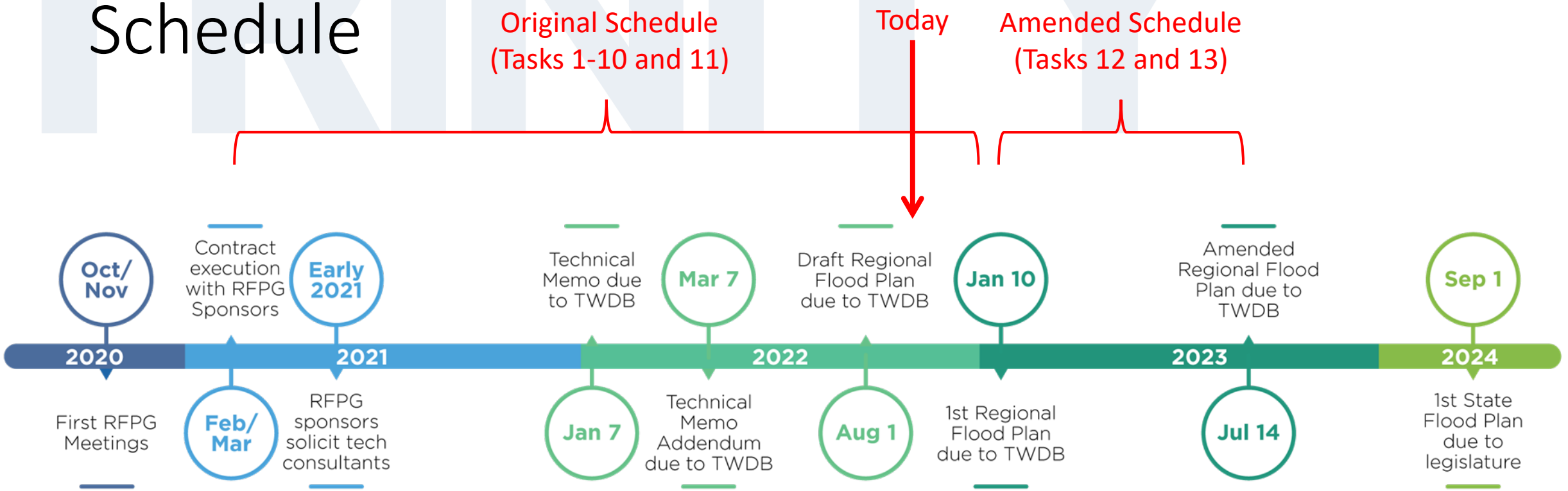


REGION TRINITY REGIONAL FLOOD PLANNING GROUP

Regional Flood Plan Cycle



Schedule



REGION 3 TRINITY
REGIONAL FLOOD PLANNING GROUP

Trinity RFPG Activities - 2022

- January 7: Submitted Tech Memo to TWDB
- March 7: Submitted Tech Memo Addendum to TWDB
- August 1: Submitted Draft Regional Flood Plan to TWDB
- August 29, 30 & 31: Open Houses in Dayton, Crockett & Arlington
- September 8: Public Meeting to Receive Public Input on Draft Plan
- October 10: Close of public comment period on Draft Plan
- October 18: Received TWDB comments on Draft Plan

REGION 3 TRINITY
REGIONAL FLOOD PLANNING GROUP

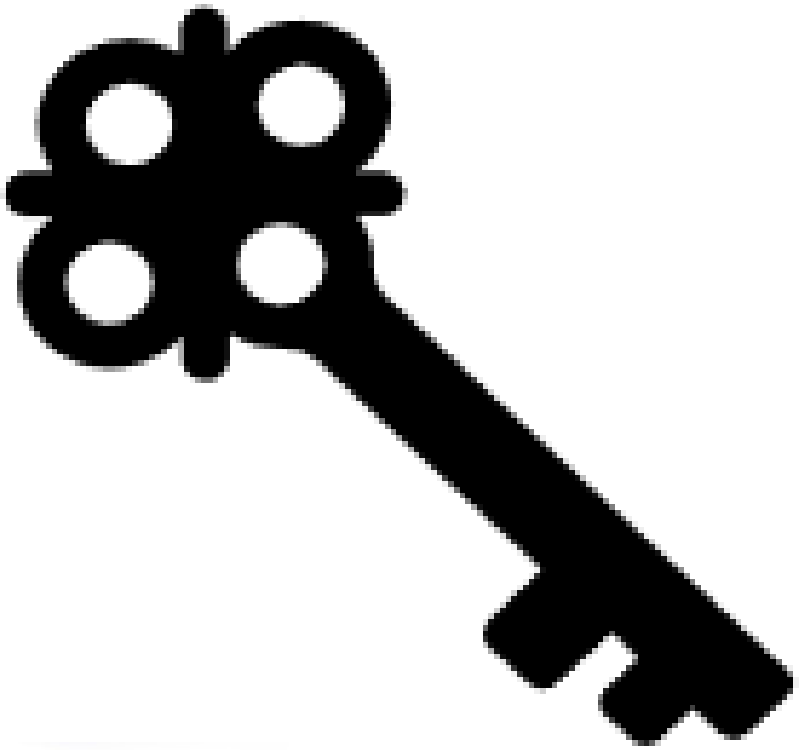
Upcoming Trinity RFPG Activities

- By January 10, 2023
  - Develop responses to all comments received
  - Revise plan, as appropriate
  - Approve Final Regional Flood Plan for submittal to TWDB

- By July 14, 2023
  - Advance FMEs to FMPs
  - Prepare and submit Amended Regional Flood Plan to TWDB

REGION 3 TRINITY REGIONAL FLOOD PLANNING GROUP

Public Input



- Target audiences
  - Cities/towns
  - Counties
  - Entities with flood-related responsibilities
  - General public

REGION 3 TRINITY REGIONAL FLOOD PLANNING GROUP

Input Opportunities

- Attend Trinity RFPG Meetings (next meeting is Nov 17)
- Submit new or updated flood mitigation actions for consideration in the Amended Plan
- Sign up for email alerts at https://trinityrfpg.org
- Follow us on Twitter: @TrinityTRFPG
- Email questions to info@trinityrfpg.org

REGION 3 TRINITY REGIONAL FLOOD PLANNING GROUP

REGION 3 TRINITY
REGIONAL FLOOD PLANNING GROUP

Questions?

Stephanie Griffin

Project Manager

sgriffin@halff.com

PREVENTION VS. RESPONSE:

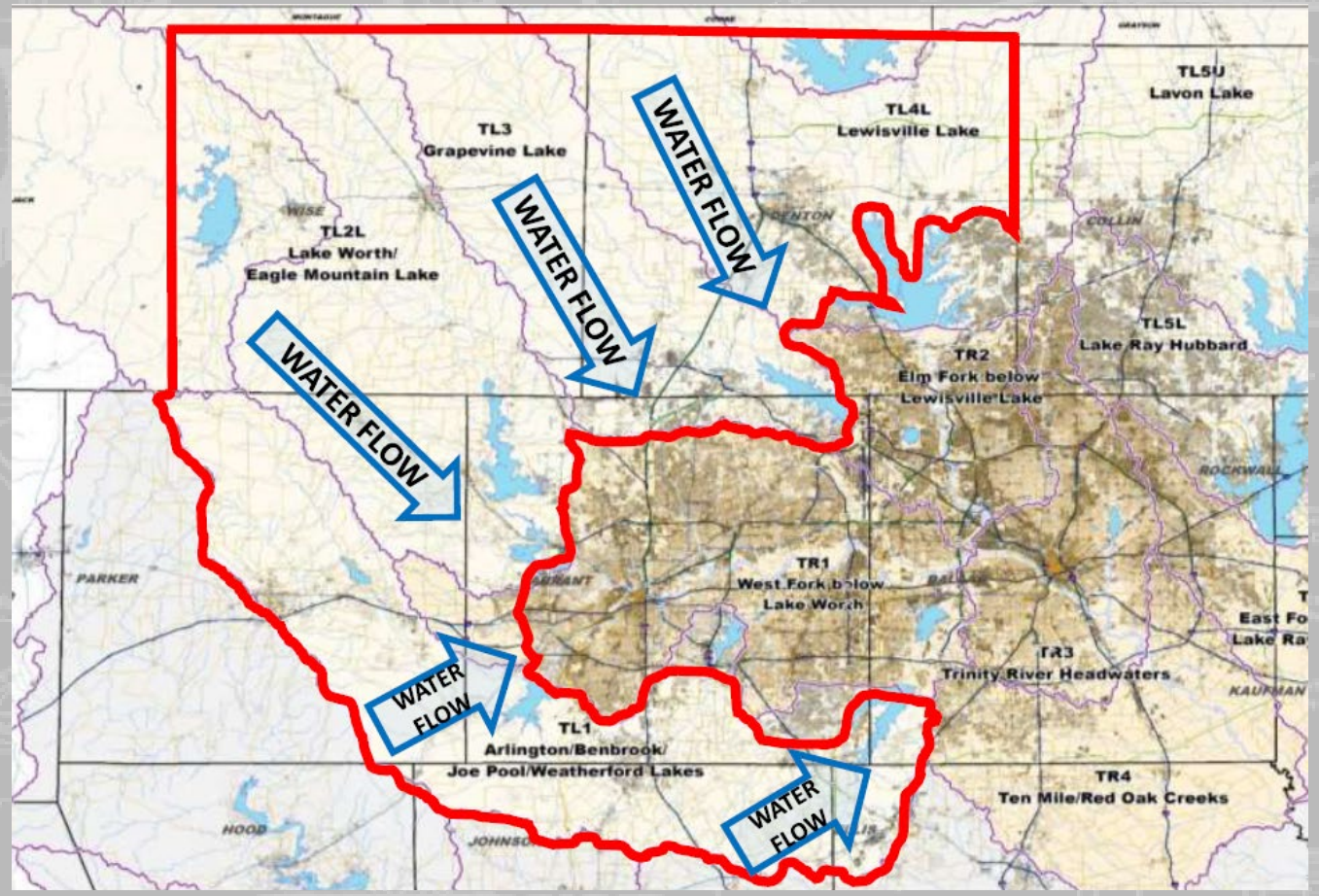
INTEGRATED TRANSPORTATION AND STORMWATER INFRASTRUCTURE (TSI) PLANNING INITIATIVE IN NORTH TEXAS

Integrated Transportation and Stormwater Management Initiative

Edith Marvin, P.E.
North Central Texas Council of Governments

Matt Lepinski, P.E.
USACE Fort Worth District

25 October 2022



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PREVENTION VS. RESPONSE:

INTEGRATED TRANSPORTATION AND STORMWATER INFRASTRUCTURE (TSI) PLANNING INITIATIVE IN NORTH TEXAS

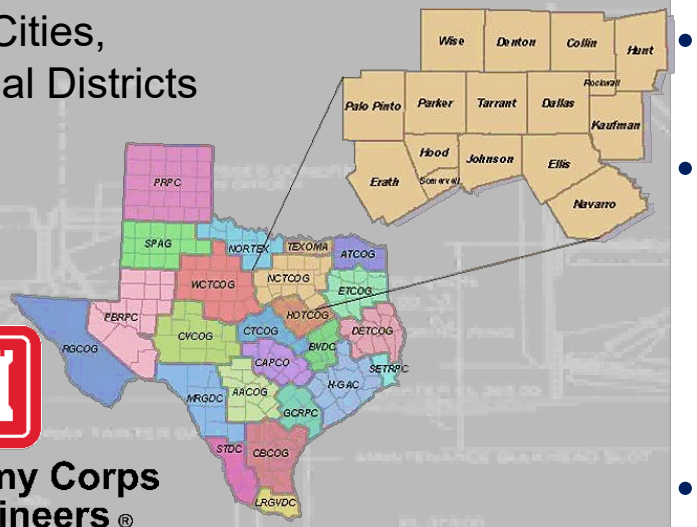
Integrated Transportation and Stormwater Management Initiative

NCTCOG:
Voluntary association of member governments
A political subdivision of the state – non taxing entity
Established in 1966 to assist member governments in:

- Planning for common needs
- Cooperating for mutual benefit
- Strengthen their individual and collective power
- Coordinating for sound regional development

16 Counties, 169 Cities,
53 School & Special Districts

North Central Texas Council of Governments



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- NCTCOG and the USACE have a long history of collaborative efforts in our region towards assisting our communities with flood risk reduction.
- Programs such as Trinity River Common Vision, iSWM, FEMA CTP Discovery and Flood Studies, Recommended strategies for counties, Public Works Construction Standard Specifications, and others have helped to bring our communities together to build the development standards that can be adopted to reduce flood risks.
- Despite those regional efforts, reports of flooding continue to emerge with any notable storm event.
- Despite being the 4th (soon to be 3rd) largest metropolitan area in the U.S., with a population of over 8 million, growing by 150,000 residents each year, North Central Texas does not have a flood control district to fund and oversee progress.
- Flooding is managed by local governments on a voluntary basis.

PREVENTION VS. RESPONSE:

INTEGRATED PLANNING OF REGIONAL TRANSPORTATION AND STORMWATER MANAGEMENT TOGETHER AS A SYSTEM OF INFRASTRUCTURE IMPROVEMENTS (TSI)

Integrated Transportation and Stormwater Management Initiative

NCTCOG is charged with regional planning for our 16-county area.

So, can we do better?

Would the transportation industry be an ideal partner?

ClipArtBest.com

Should we just keep repeating mistakes that lead to flooding?

Can we enhance prospects for quality of life here?

What would be a highly cost-effective strategy?

Like many other infrastructure aspects of growth and development, can we get in front of watershed growth and plan ahead to avoid problems?

Through progressive development practices, can we prevent flooding to begin with, rather than address the challenges and costs after it has been created?

North Central Texas Council of Governments

U.S.ARMY

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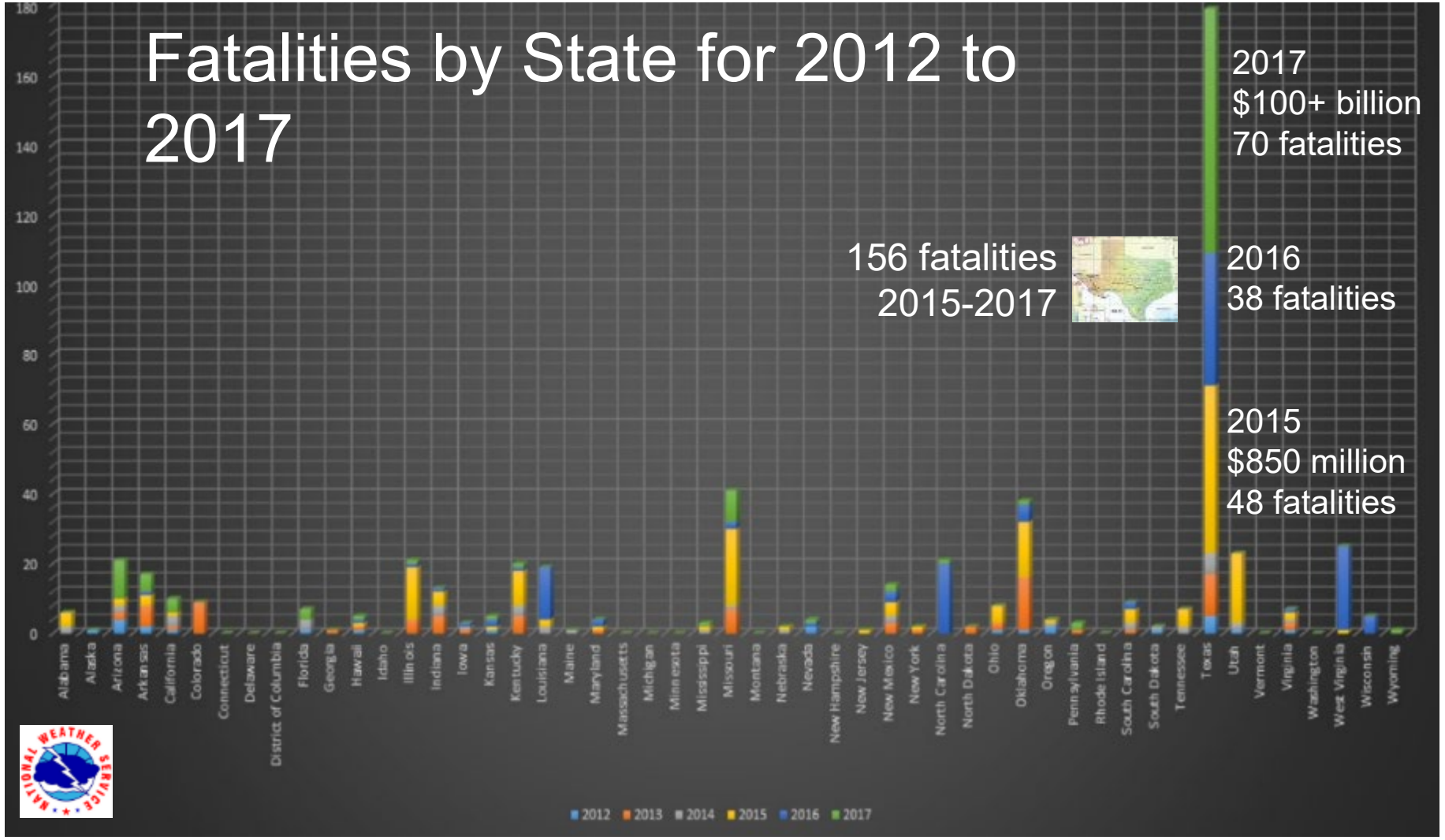
Matt Lepinski, USACE, is going to describe for you now a project that we've brainstormed and funded that we believe will become a new national standard as an approach to prevent flooding, rather than just respond to it.

Flooding Fatalities and Damages

Texas far outpaces other states in flood related fatalities & flood related damages

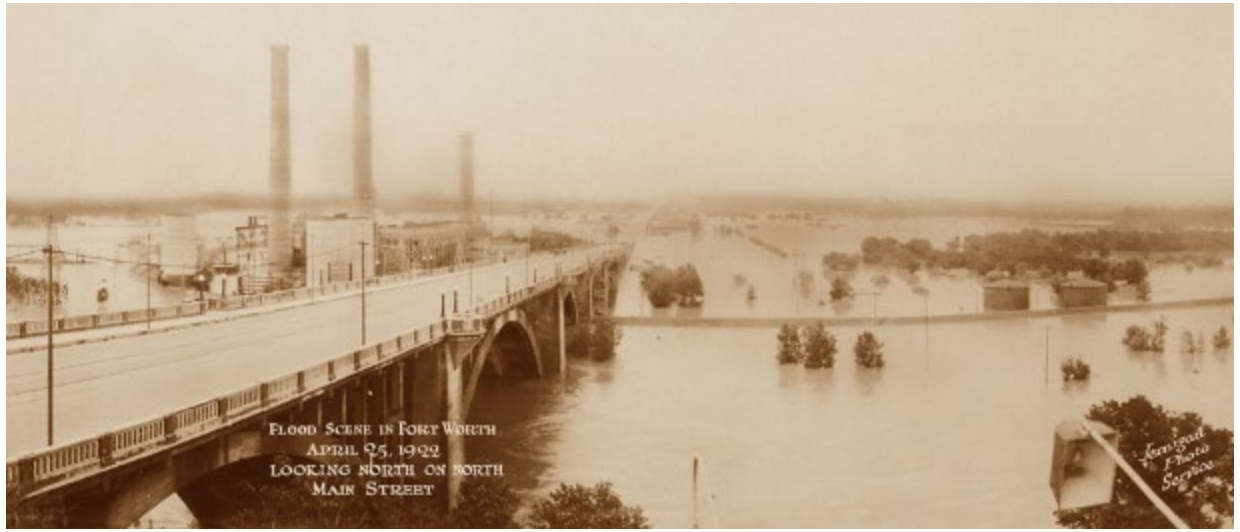


5 Year Tally of Flood Fatalities

(Source: Gregory Waller, Service Coordination Hydrologist, NWS – West Gulf River Forecast Center, http://www.nws.noaa.gov/om/hazstats.shtml, 11/18 TFMA)

PLAY STATEWIDE FLOOD VIDEO

RESPONSE VS PREVENTION?



Fort Worth - April 1922 (11 inches of rain in 2 days):

- 17 breaches in the Trinity River levees
- Killed at least 10 people and $1M+ in damages
- Motivated countywide effort to prevent further flooding of the Trinity and provide adequate water supply.
- Resulted in an election held by Tarrant County commissioners in 1924 to create the Tarrant County Water Improvement District No. 1, which would later change to Tarrant Regional Water District in 1996.

Sources:

https://ms-my.facebook.com/photo/?fbid=10157516869922955&set=in-april-1922-a-devastating-flood-occurred-in-fort-worth-the-massive-flood-cause

https://www.trwd.com/100-years-since-the-big-flood-in-fort-worth/

RESPONSE VS PREVENTION?

Fort Worth – May 1949 (approximately 11 inches of rain overnight):

- Clear Fork Trinity levees breached
- Killed 10 people and $11M+ in damages
- Resulted in extensive improvements/maintenance of levee system by Water District and USACE Fort Worth District, established in 1950 after disastrous floods in the area
  - USACE Fort Worth District has constructed 25 lakes, 2 floodways, and other local projects ($2.6B to build but prevented $68B+ in damages)
  - Operates/maintains reservoirs/lakes and 35% of Texas's water supply

Sources:

https://www.onlyinyourstate.com/texas/dallas-fort-worth/deadly-flooding-struck-fort-worth-in-1949/

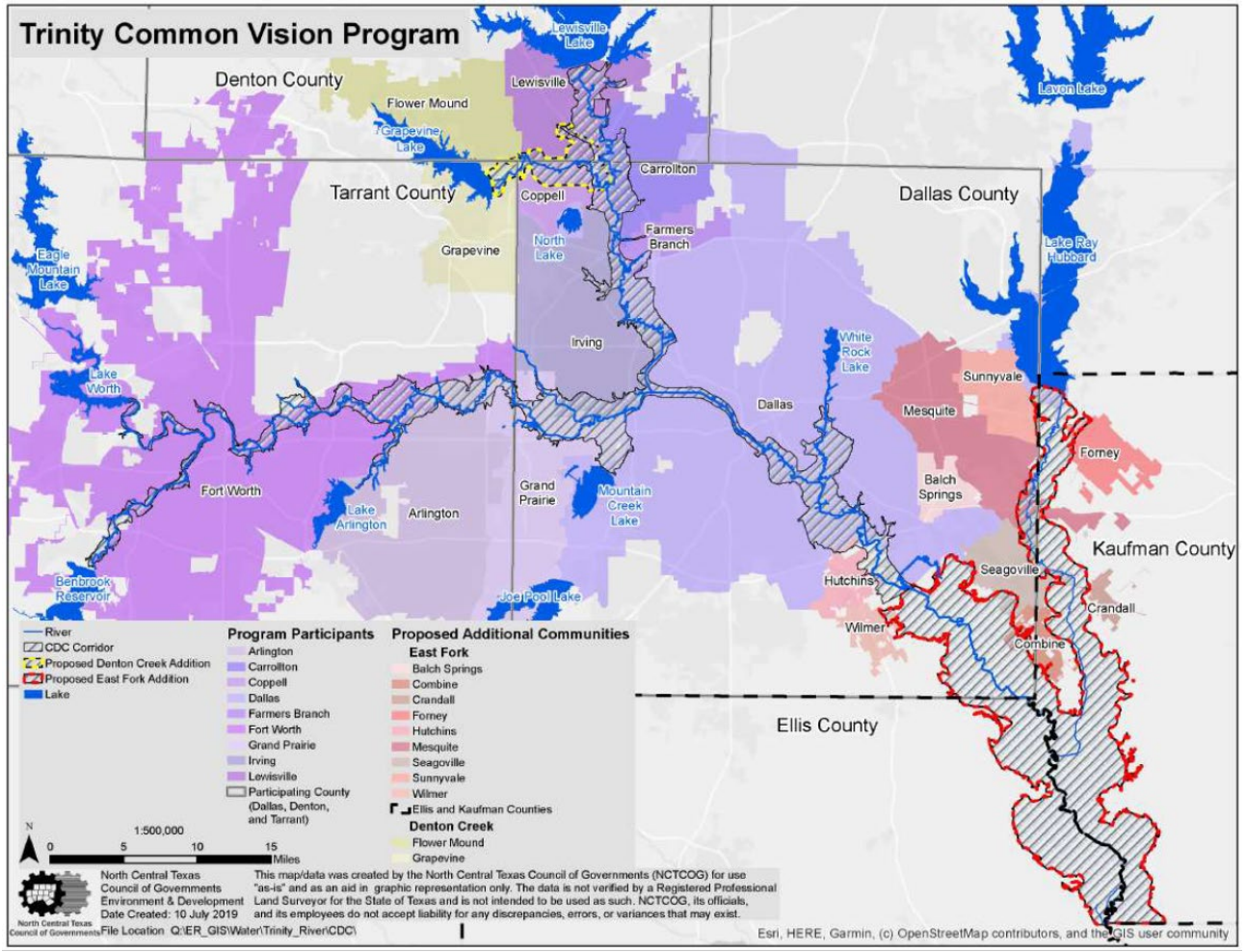
https://www.swf.usace.army.mil/About/History/#:~:text=The%20Fort%20Worth%20District%2C%20established%20in%201950%20after,parts%20of%20Louisiana%20and%20New%20Mexico.%20The%20District%3A

PREVENTION VS RESPONSE: TRINITY RIVER CDC PROGRAM

Upper Trinity Corridor Development Certificate (CDC) Program

Goal: Stabilization of flood risk along Trinity River

- CDC program originated in 1991
- Understood that commercial/residential development could compromise existing flood control "protections" and may impact wetlands/natural resources
- CDC model (USACE) and FEMA model developed in the 1990's
  - CDC hydrologic modeling is based on future anticipated watershed development (year 2055). Any proposed private or public project within the Regulatory Zone, the FEMA 100-year regulatory floodplain of the Trinity River Corridor, must obtain a CDC prior to start of construction
- CDC does not prohibit floodplain development, but ensures that any development that does occur in the floodplain will not adversely raise flood water levels or significantly reduce flood storage capacity
- As the Metroplex economy continues to grow and develop, the CDC process is helping prevent increased flood risks.



Source:
http://trinityrivercdc.com/

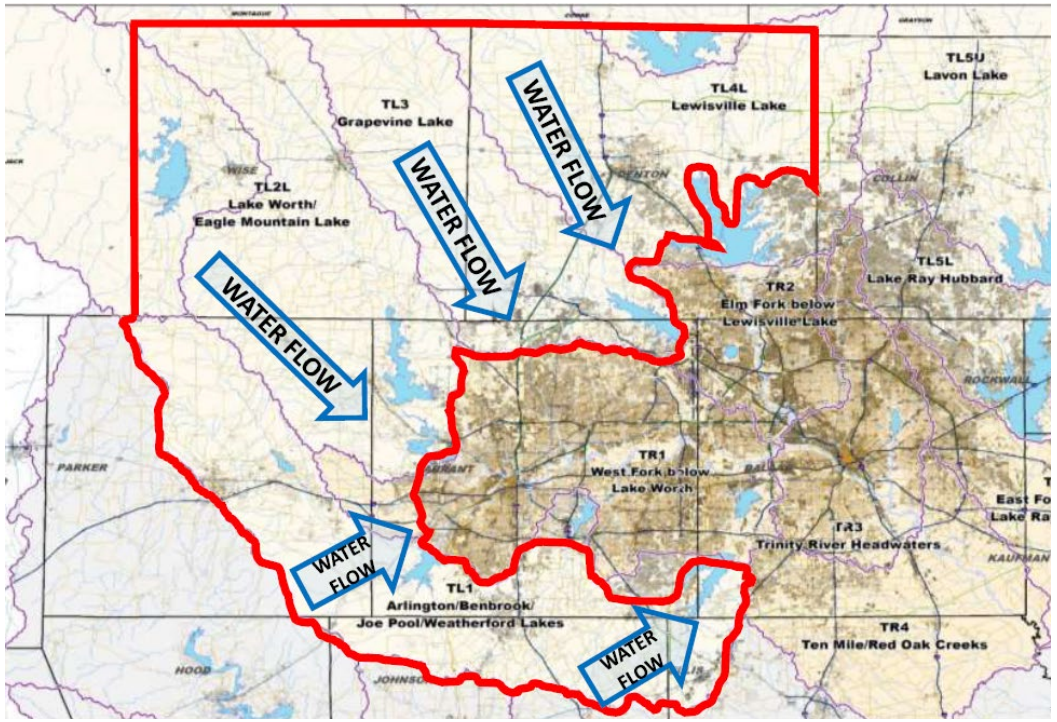
PROBLEM SOLVED OR A WORK IN PROGRESS?

- **Recent flood events in Texas have highlighted the need for more comprehensive stormwater planning**
  - Development of Texas's first-ever state flood plan is underway through the efforts of 15 Regional Flood Planning Groups
  - The regional flood plans will be due in January 2023, and state flood plan is due September 1, 2024

- **Lack of regulation outside floodplains (i.e., outside CDC footprint and FEMA 100-year boundary) leads to a "in or out" mindset about flooding**
  - Flooding doesn't stop at lines on a map.
  - FEMA Future of Flood Risk Data (FFRD) and other initiatives are helping provide a more comprehensive picture of the country's flood hazards and risk by leveraging new technologies

- **Rapidly developing study area drains into densely populated DFW-metroplex and there is currently no comprehensive regional plan to address this**
  - 85 Cities and portions of 8 counties within study area
  - Population expected to increase 126% by 2045
  - 60% undeveloped as of 2015

- **Questionable historic records & lack of safety factors**



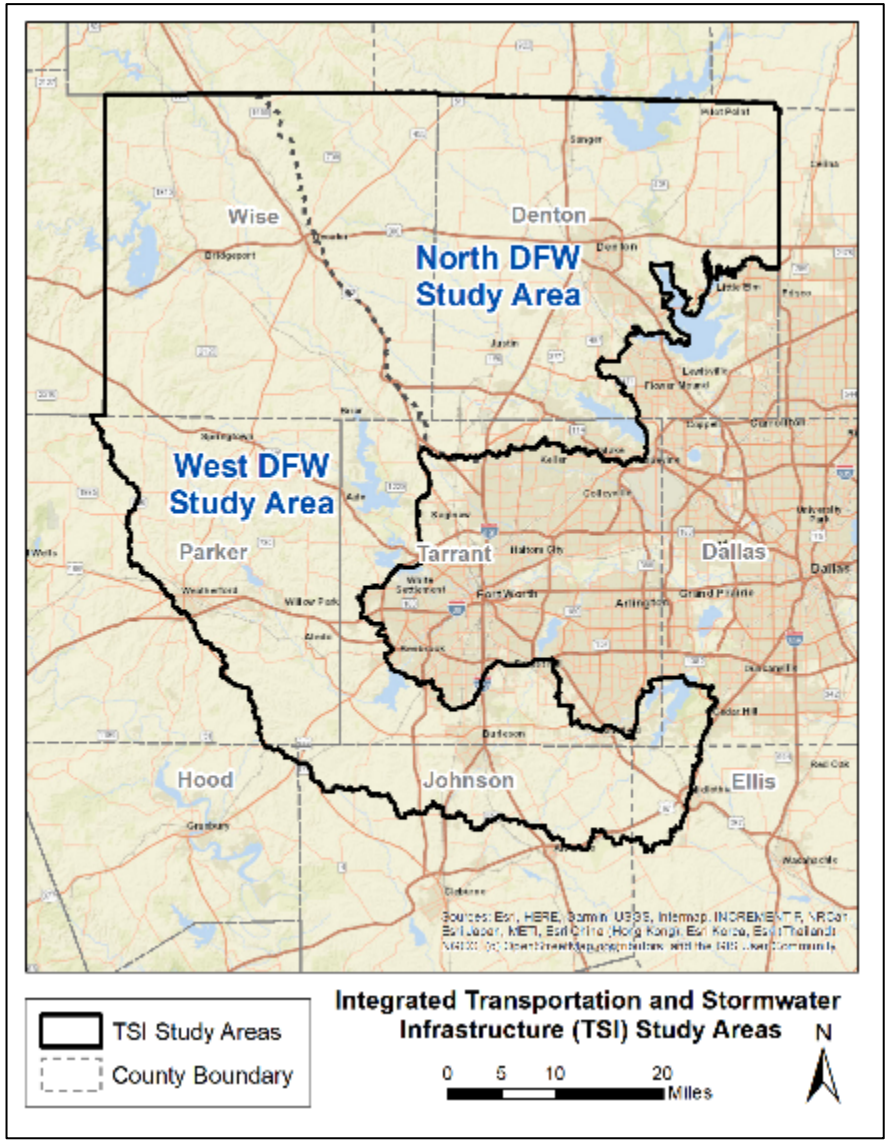
The TSI initiative intends to learn from mistaken approaches that have resulted in flooded roadways, neighborhoods, and critical infrastructure, and can assist communities with an improved approach to efficiently minimize these impacts before they occur.

INTEGRATED TRANSPORTATION AND STORMWATER INFRASTRUCTURE (TSI) INITIATIVE

What is the TSI project?

- **Purpose:** Integration of regional planning for transportation, stormwater management, urban development, and environmental features in order to decrease flood risk, minimize overall life cycle costs of infrastructure, and reduce impacts to the natural environment in the rapidly developing study area.
- **Timeline & Budget:** 3+ years and $10
- **Benefits:** Study area as well as downstream
  - Promotes sound flood risk management decisions
  - Enables actionable local flood risk awareness and resiliency opportunities

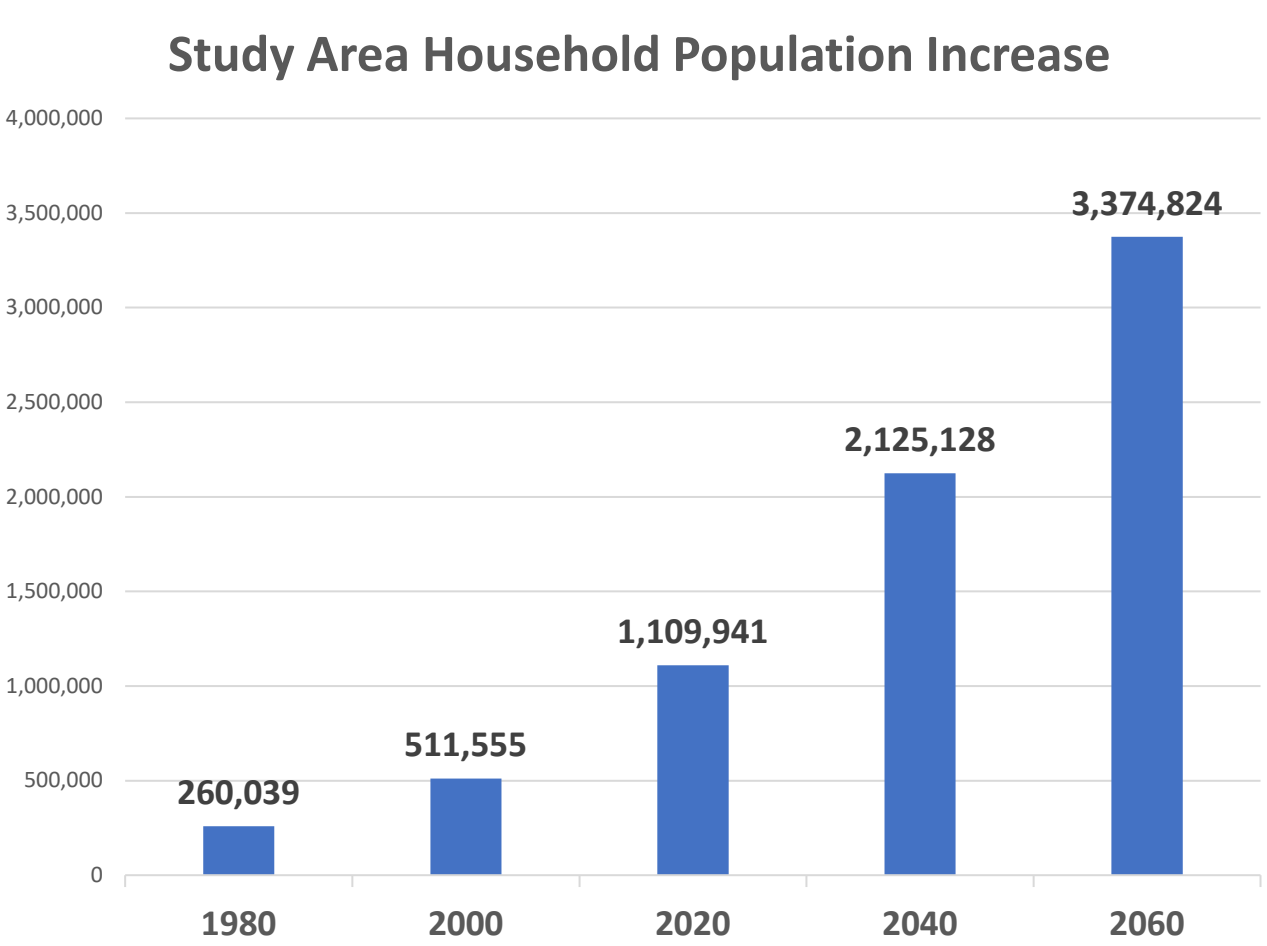
Objective: a ‘roadmap’ for communities



Integrated Transportation and Stormwater Management Initiative

WHERE: Focus on Vulnerable Areas

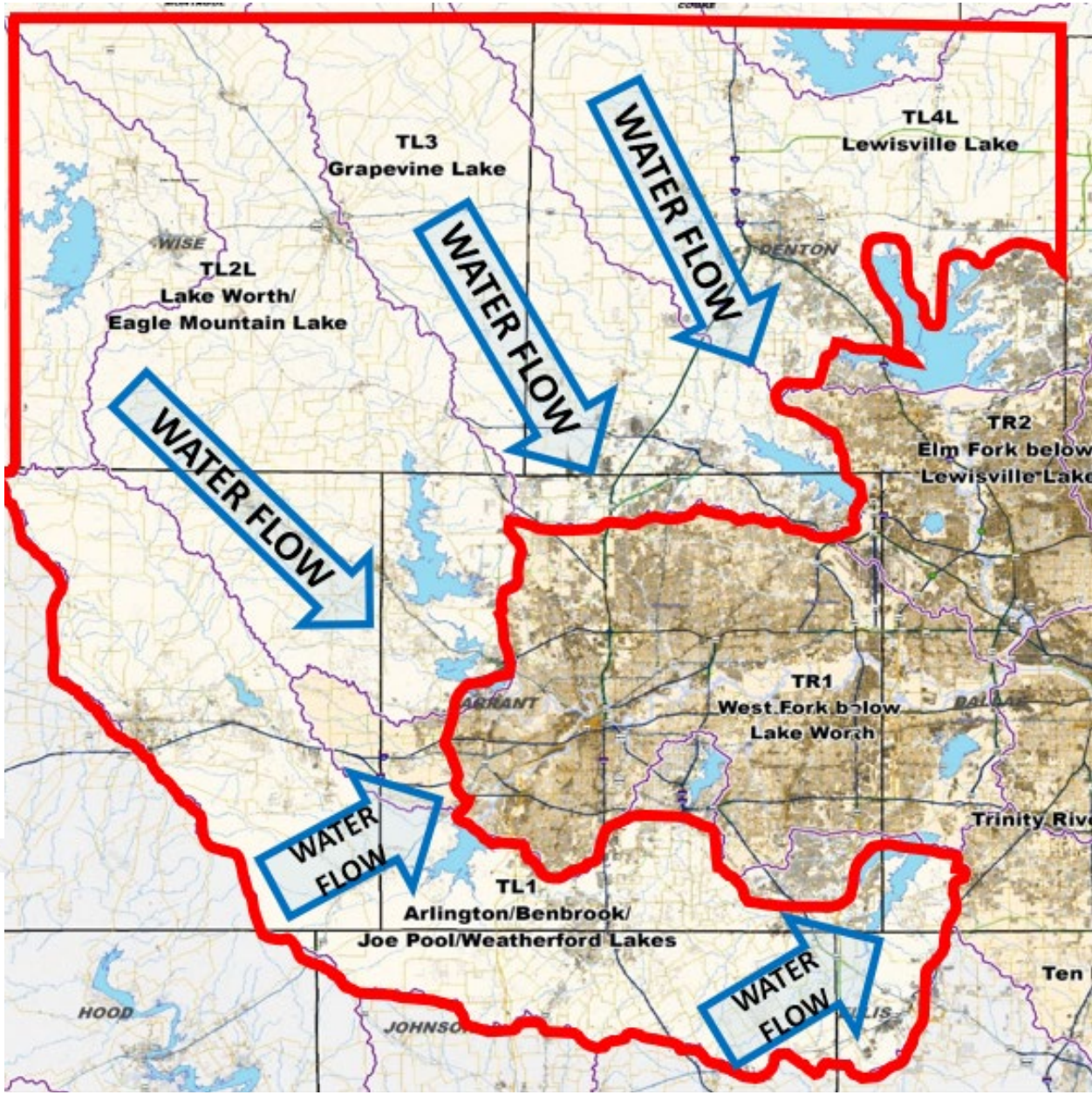
North Central Texas Council of Governments



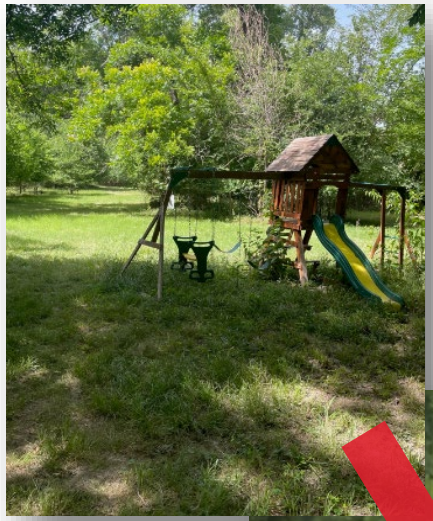
Sources:

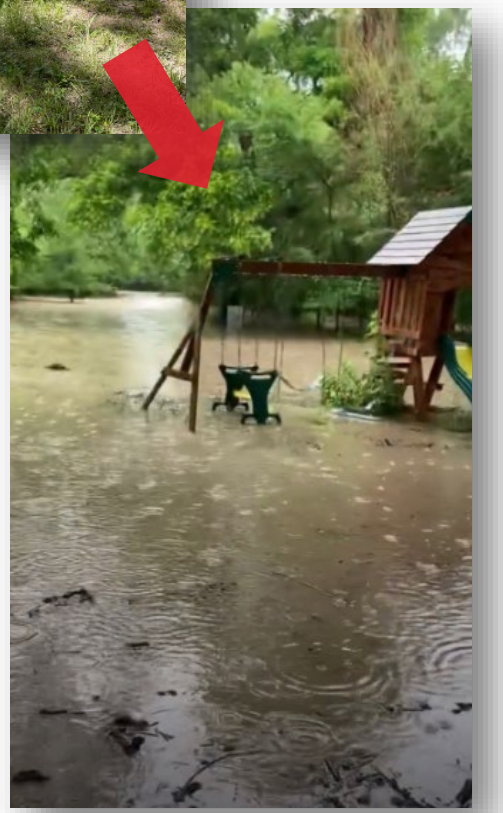
- 2000 & 2020 - NCTCOG using US Census data normalized to 2010 geographies
- 2040 & 2060 - NCTCOG with 2040 controlled to Perryman county control totals and 2060 using a regional control total without feedback loops

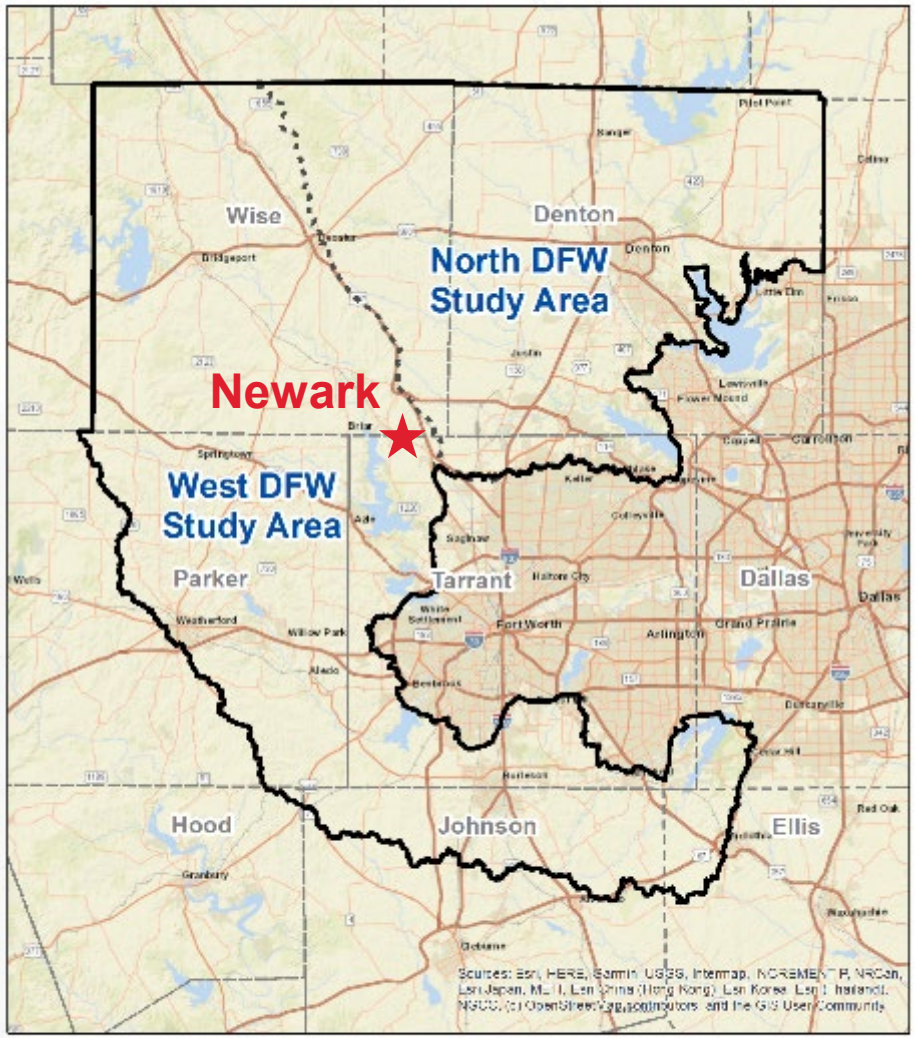
*Excludes group quarters (dormitories, senior living facilities, prisons, and other non-household institutional living facilities)

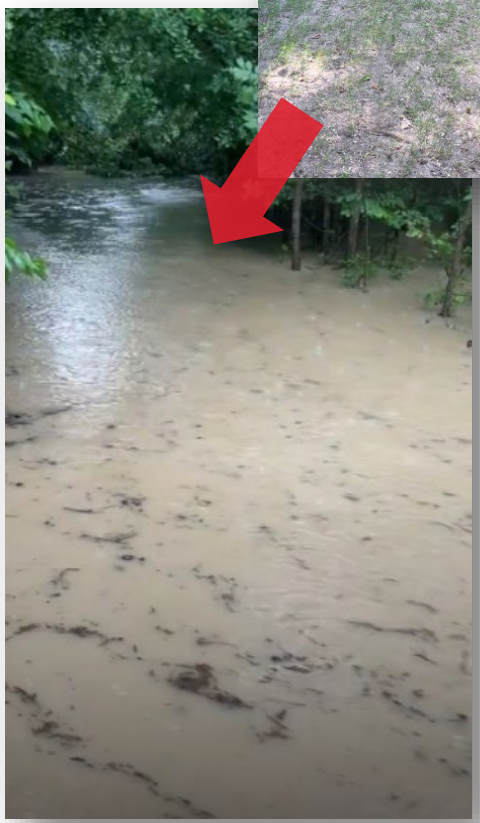


IMPACT OF DEVELOPMENT… A LOCAL PERSPECTIVE

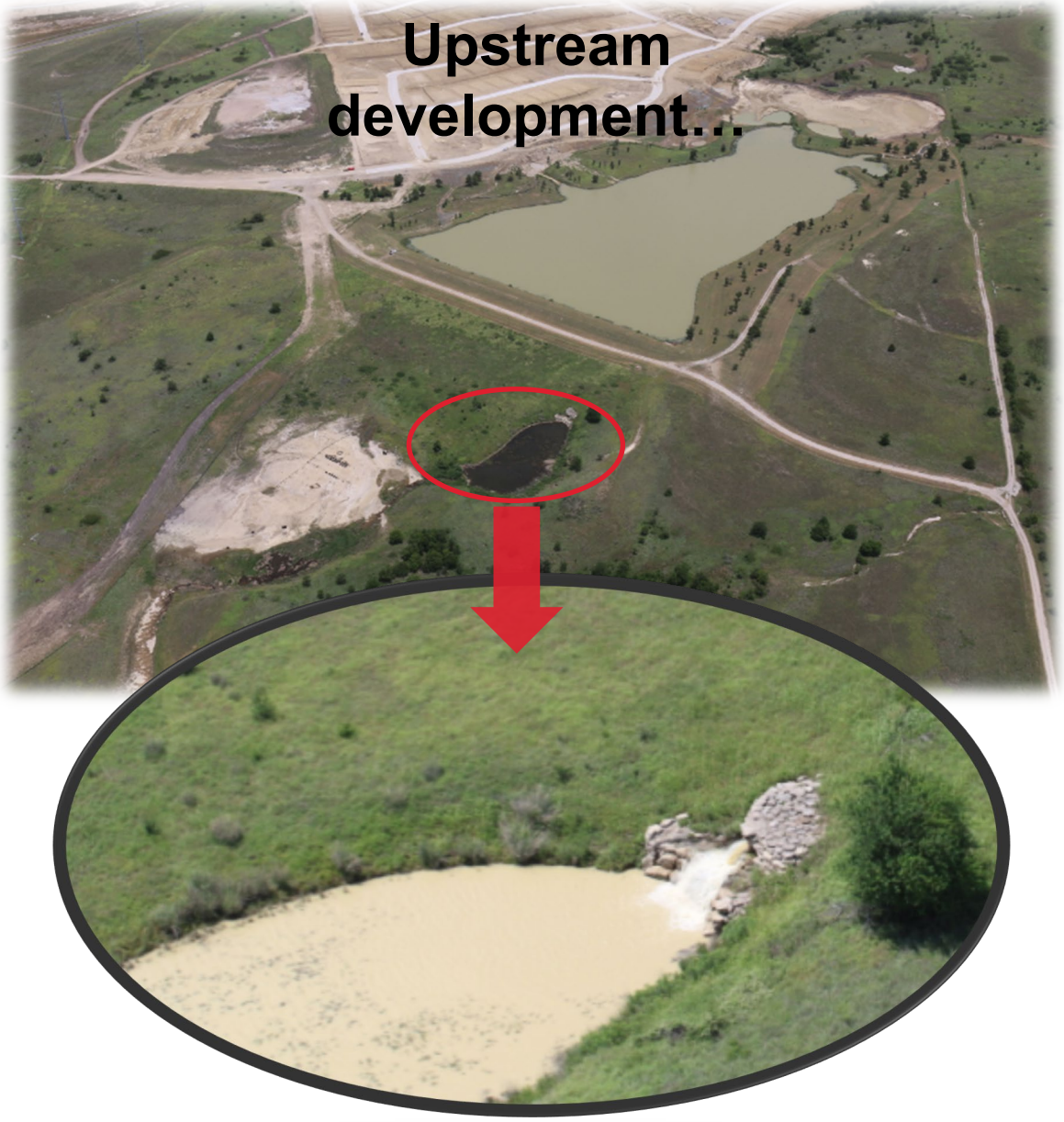






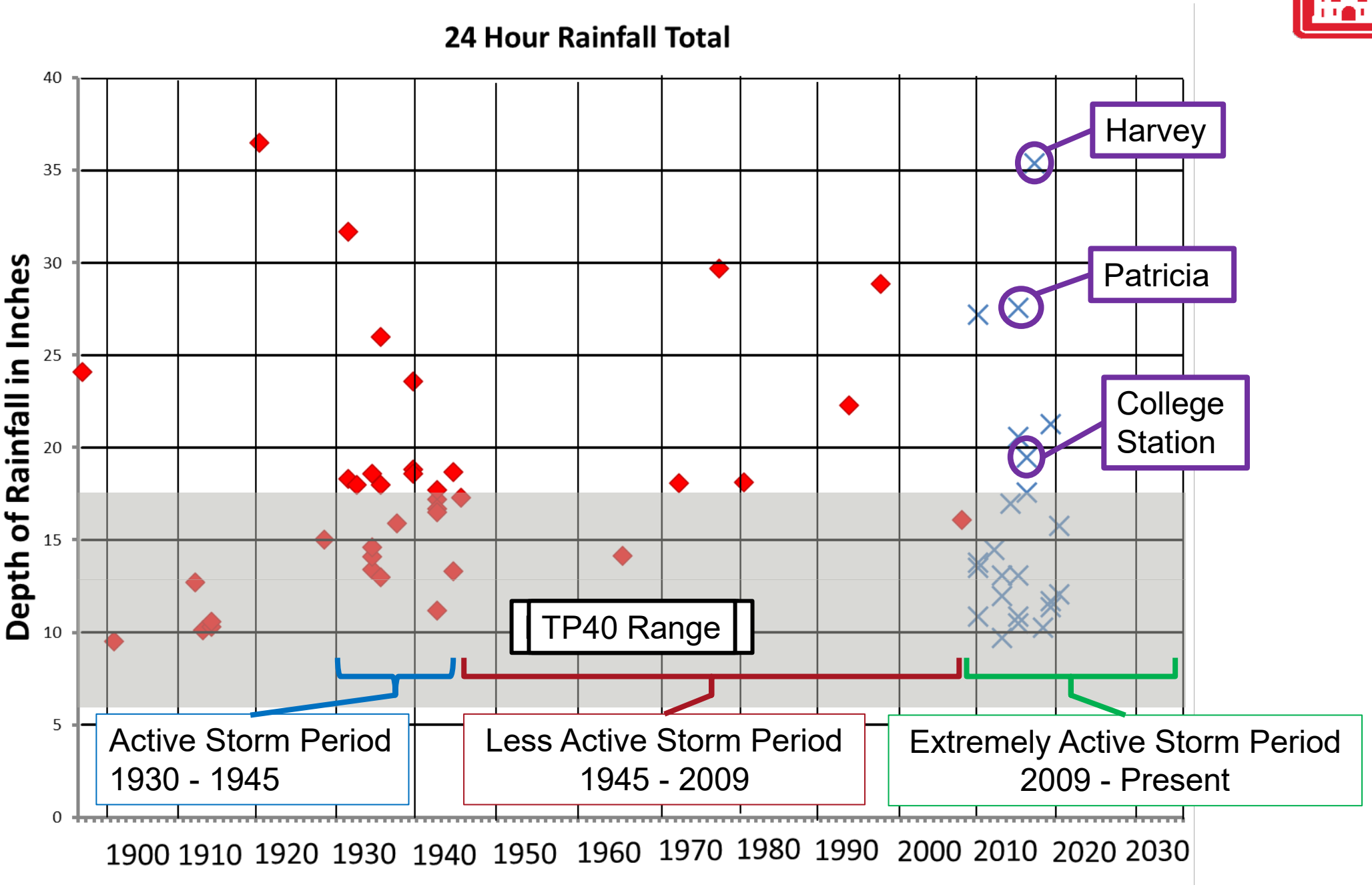


IMPACT OF DEVELOPMENT… A LOCAL PERSPECTIVE



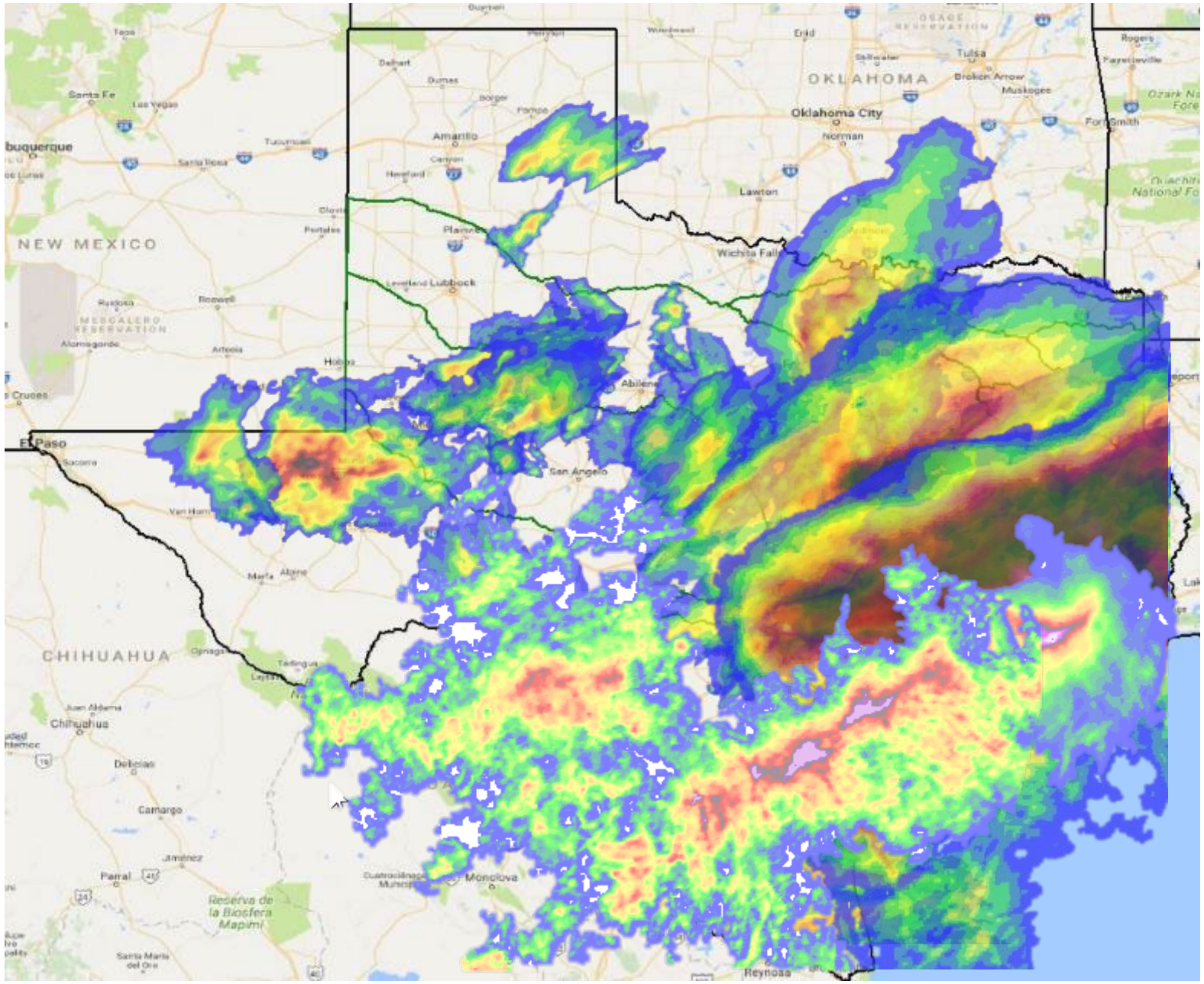
… may lead to downstream flooding and water quality concerns

EXTREME STORMS… A HISTORY LESSON



EXTREME STORMS (2010-2019)

- The DFW area can experience extreme precipitation events
- The region transitions from periods of drought to wet periods
- These events exceed infrastructure and neighborhood design levels



GOALS AND OUTCOMES

North Central Texas Council of Governments

Proactive Planning

- Reimagine transportation design to integrate stormwater, environmental, and flood reduction benefits
- Protect current and future infrastructure
- Develop model for replication

Reduce Flooding

- Reduce flooding downstream of rapidly growing upstream communities
- Increase resiliency to flooding disasters
- Inform decision-making
- Implement stormwater infrastructure with transportation infrastructure

Tools/ Resources

- Empower communities to adopt higher floodplain management standards
- Develop GIS based tools and resources

Integrated Transportation and Stormwater Management Initiative

Local-Scale Innovation

- Enhance Trinity River Watershed Hydrology Assessment
- Enhance existing hydraulic models such as BLE
- Emergency management modeling tool
- Optimization study for drainage/flood control structures

Community Roadmap

- Produce planning-level designs for transportation, stormwater detention, and environmental
- Integrate these layers to identify what needs to be built and achieved benefits
- Establish ways to fund planned infrastructure

TSI SCOPED TASKS

1.0 Data Collection and Analysis

2.0 Stakeholder Engagement

3.0 Integrated Transportation, Stormwater, and Environmental Planning

- 3.1 Project Area H&H Assessment and Scenarios
- 3.2 Assess Transportation Infrastructure Impacts and Develop Decision-Making Tools
- 3.3 Environmental Planning
- 3.4 Project Area Real-Time Flood Warning System
- 3.5 Managing Land through Strategic Planning and Development Regulations

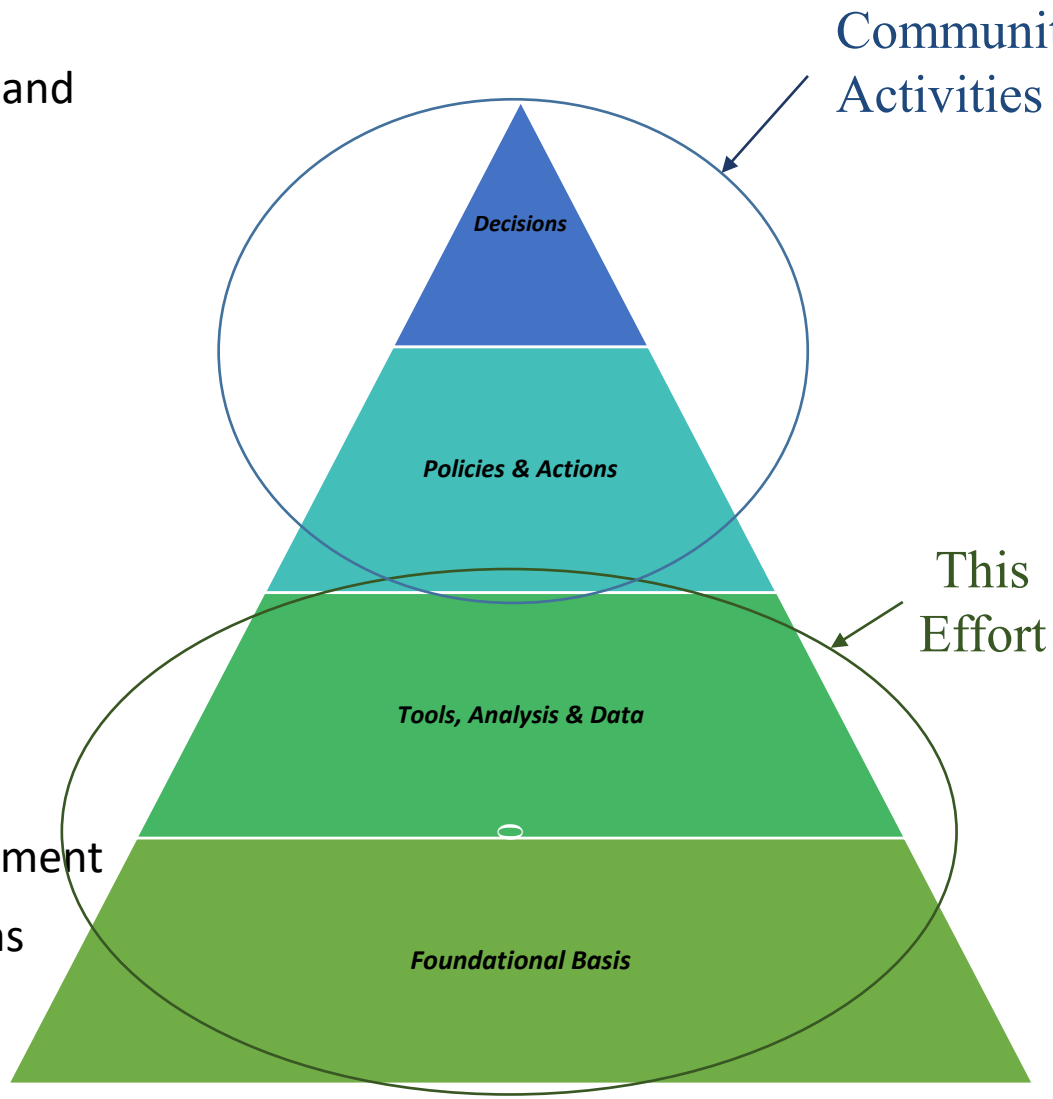
4.0 Project Management and Project Replication

- 4.1 Project Management
- 4.2 Replicate and Amplify Outcomes

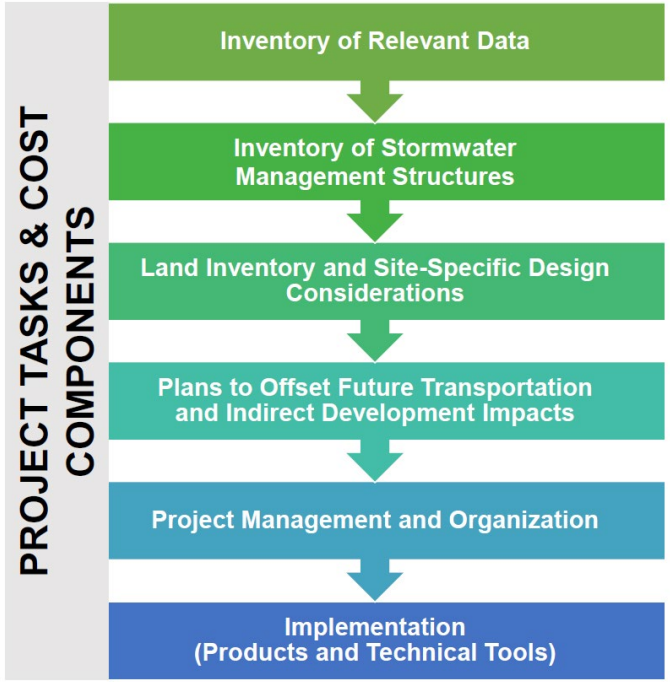
North Central Texas Council of Governments

HOW:

- Inventory of existing data, information and structures
- Develop state-of-the-art data, tools & analysis for:
  - Modeling
  - Emergency response
  - Emergency preparedness
  - Planning for infrastructure and neighborhoods
  - Regulating the flood prone areas
- Develop planning level storm water infrastructure options
- Develop environmental areas for enjoyment
- Develop environmental mitigation areas
- Groundwater recharge
- Open space connectivity opportunities
- Roadmap or documentation to allow duplication of this effort elsewhere



Integrated Transportation and Stormwater Management Initiative



PREVENTION VS. RESPONSE: BRAINSTORMING

North Central Texas Council of Governments

Transportation Infrastructure
- Structure Elevation / Culverts / Model Growth
- Mechanical Culverts?
- Transportation “LEED” Certified (Ray Roberts / Lewisville)
- Green Parkway Widths / Detention

Safety
- Technology / Routing
- Prioritization / Low Lying Facilities

Stormwater
- Minimize / Reduce Downstream Detention
- Tools, Data, Experts

Environmental Features
- Tree Farms / Intentional Saturation
- Filtration / Recharge

Wetland and Stream Bed Mitigation Banking

Environmental Stewardship as a Revenue Element
- Mitigation Banking
- Horse Farms
- Eco-Tourism

To provide a menu of options and the location(s) where they make sense

NEW ROADWAY / MECHANICAL CULVERT / TEMPORARY STORAGE BEHIND BRIDGE

GETTY

E.G. FILTER AND RECHARGE AQUIFER

EMERGENCY MANAGEMENT

GOVERNMENT INITIATED

TRANSPORTATION SOLUTION

NCTCOG

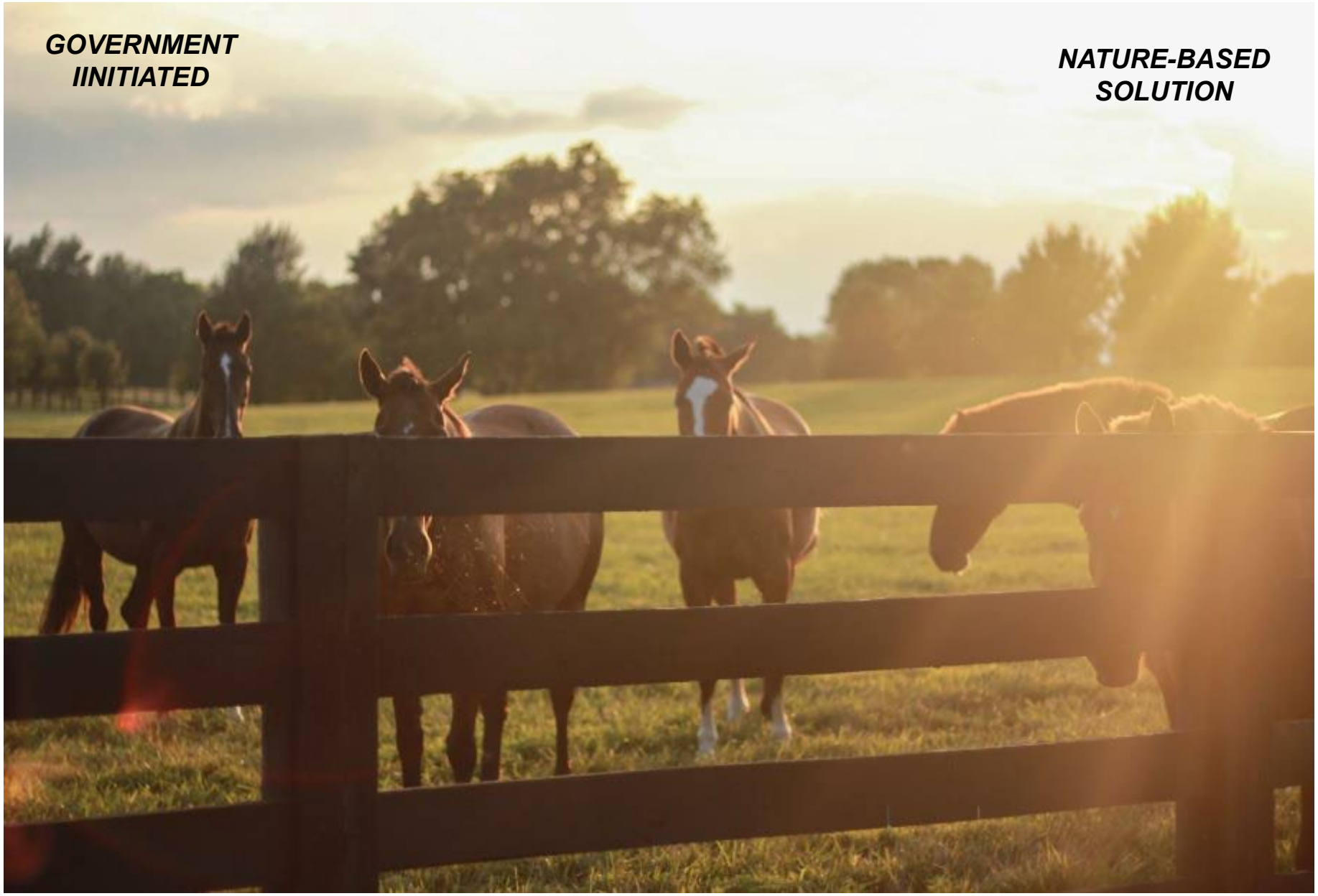
E.G. NAVIGATIONAL SYSTEM PREDICITION

FLOOD MANAGEMENT WITHIN STREAM BED

GETTY

E.G. DEVELOPMENT SETBACKS AT ROBERTS-LEWISVILLE

GREENSPACE / VALLEY STORAGE



GETTY

E.G. WATER STORAGE IN ABANDONED QUARRIES

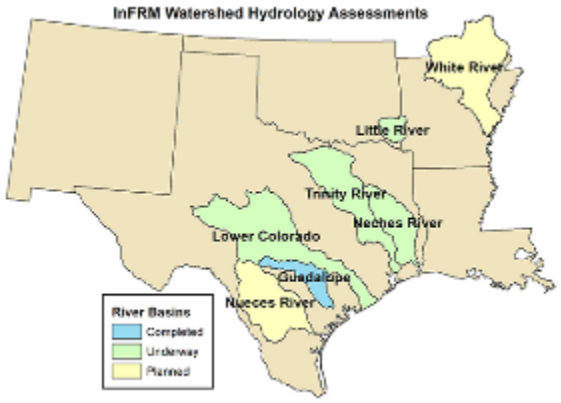
WATER RETENTION ON PROPERTY

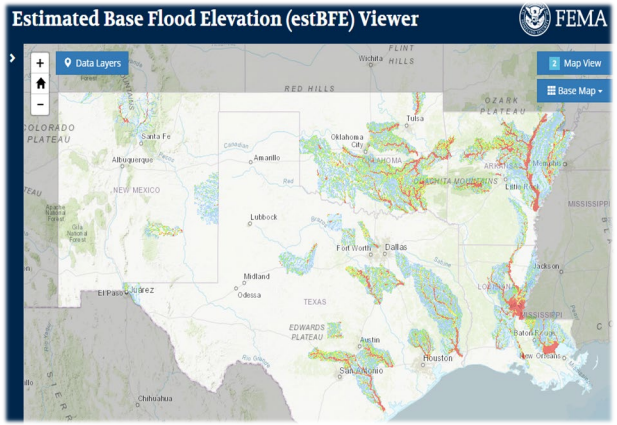
GETTY

E.G. POCKET PARK ALONG STREAM BED IN HOUSING DEVELOPMENT

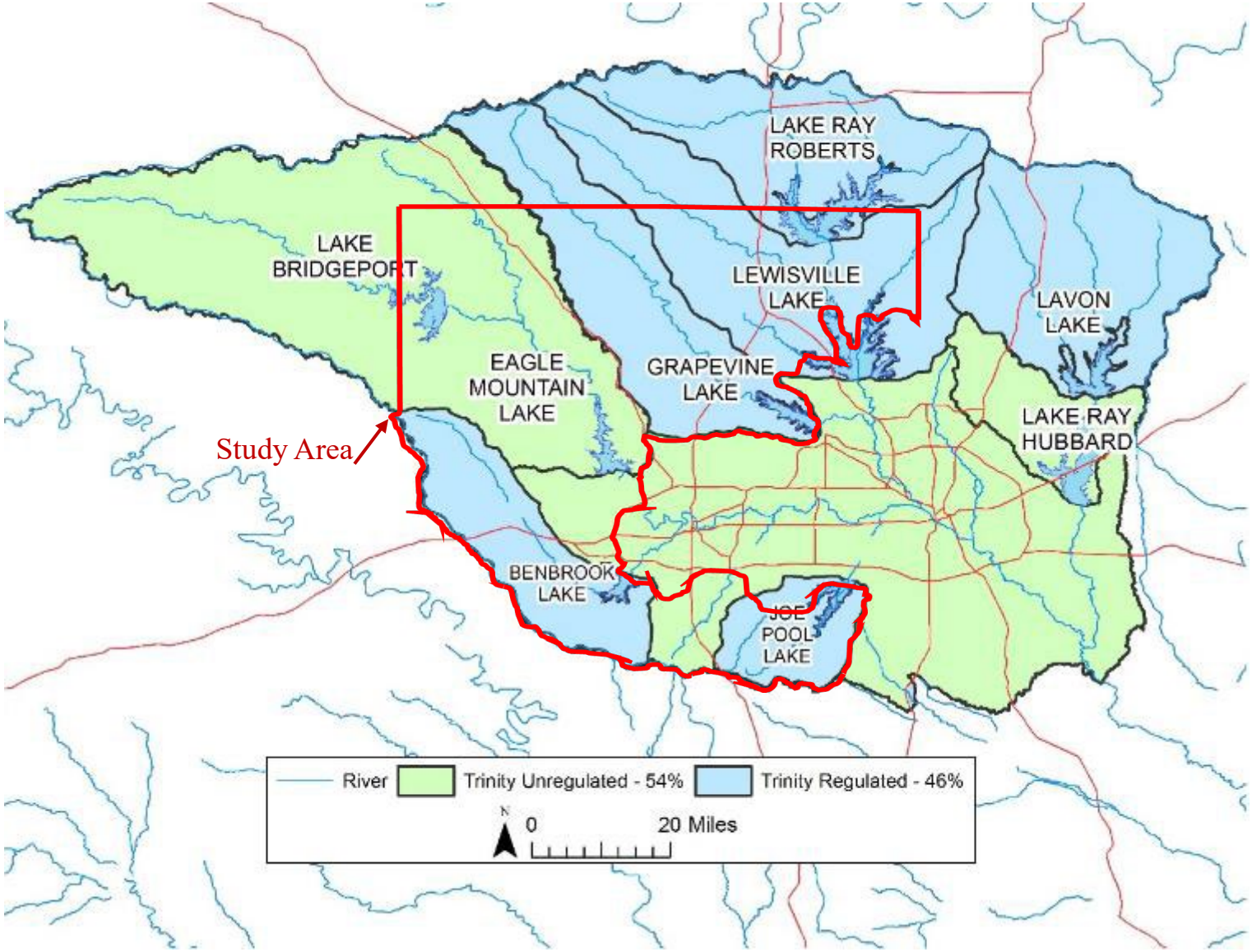
HYDROLOGIC AND HYDRAULIC SUPPORT TO TSI

Leverage existing Flood Risk Management initiatives…



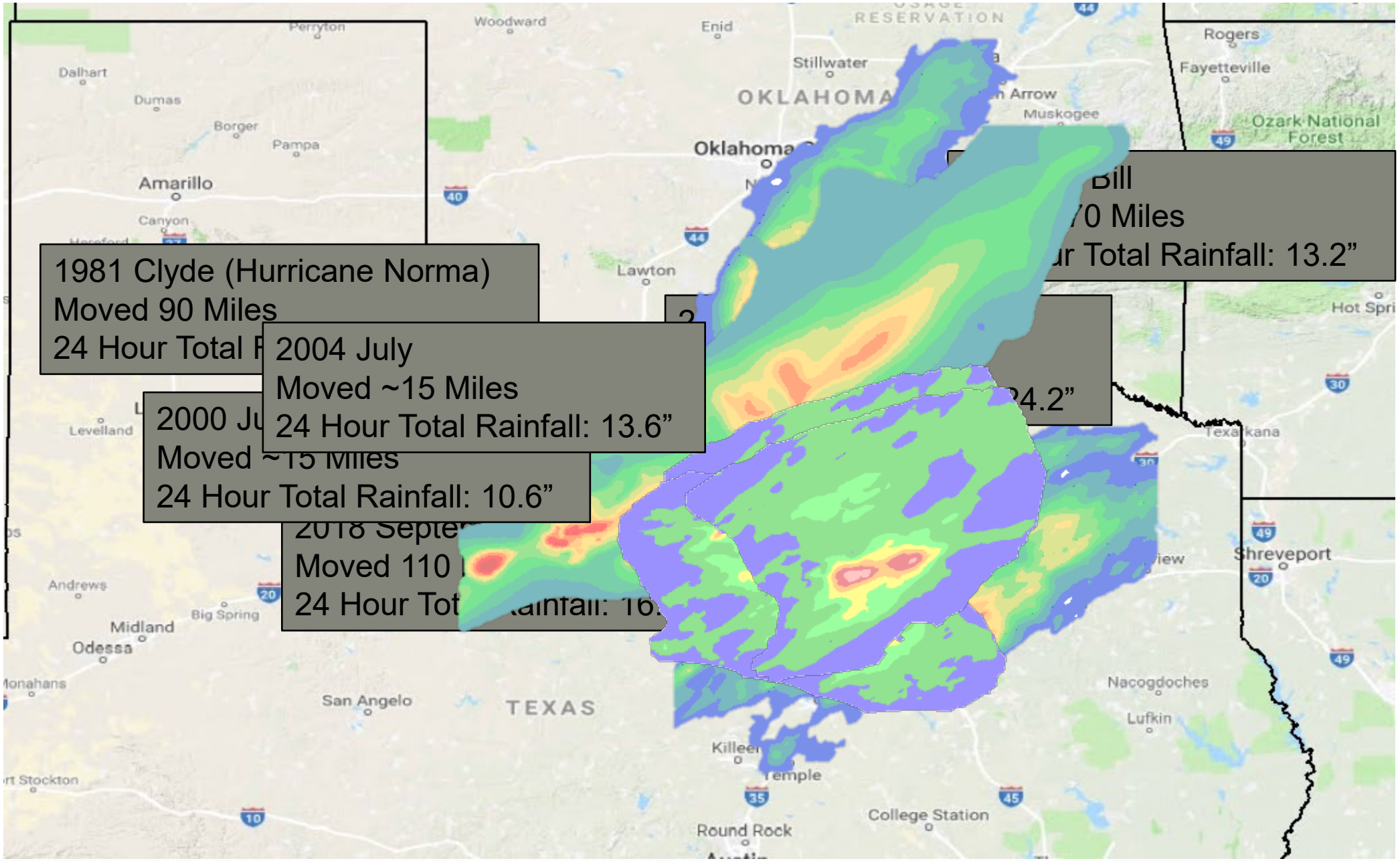


- **… to innovate at a regional scale**
  - Provide a roadmap for communities in the study area through integration of key layers such as infrastructure, transportation, stormwater, planning, and environmental
  - Investigate and enhance Trinity River Watershed Hydrology Assessment (WHA)
  - Review & enhance existing hydraulic models such as Base Level Engineering (BLE)
  - Storm shifting to simulate the impact of larger regional storms
  - Response and emergency management modeling tool
  - Optimization study for ideal locations and sizing for smaller/regional ponds and other drainage/flood control structures, considering more than just the 100-year event



- Devastating floods, 1908, 1942, 1949
- 6 multi-purpose reservoirs
- 2 federal levee systems
- DFW Flood Control System
  - ► 7.4 million people
  - ► $100 billion in damages prevented
  - ► $2 - $3 billion annually
- Water supply system
- Total cost $2.5 billion
- ***Must be operated as a system***

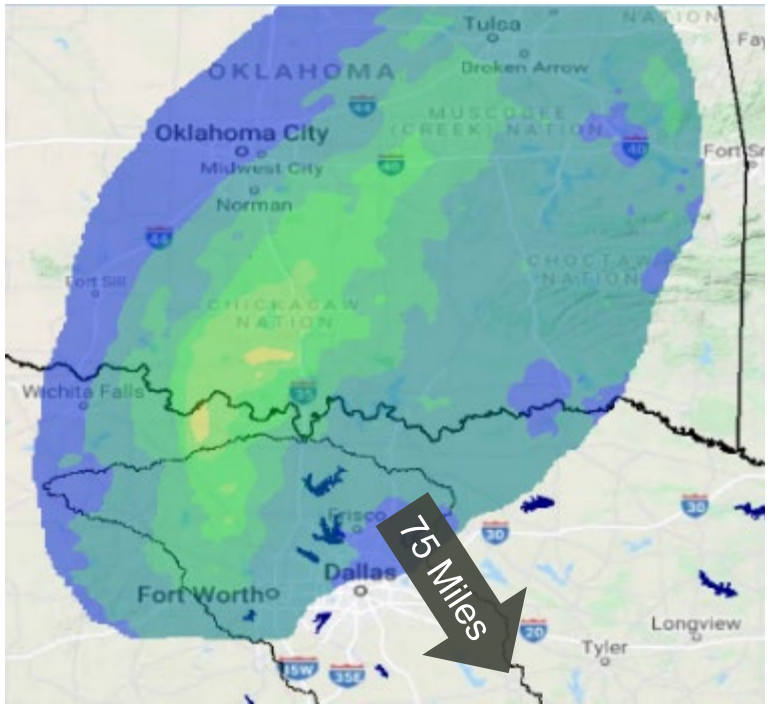
CASE STUDY: STORM SHIFTING

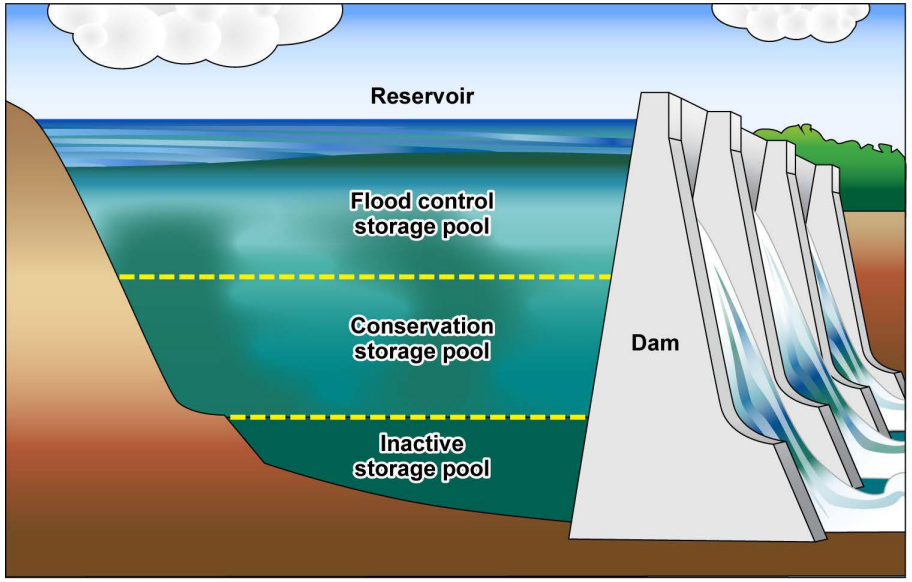


UPPER TRINITY STORM SHIFT STUDY SCENARIOS

Example: Tropical Storm Bill (13.6” in 48 hours):

- **Dry Scenario:** Reservoirs at 85% of conservation pool (uses driest loss and baseflow parameters from Trinity Watershed Hydrology Assessment (WHA) study).
- **Best Estimate Scenario:** Reservoirs at top of conservation pool (uses final 100-year Trinity WHA parameters).
- **Wet Scenario:** Reservoirs at 85% of flood pool (uses wettest loss and baseflow parameters from Trinity WHA study).





Source: GAO. | GAO-16-685

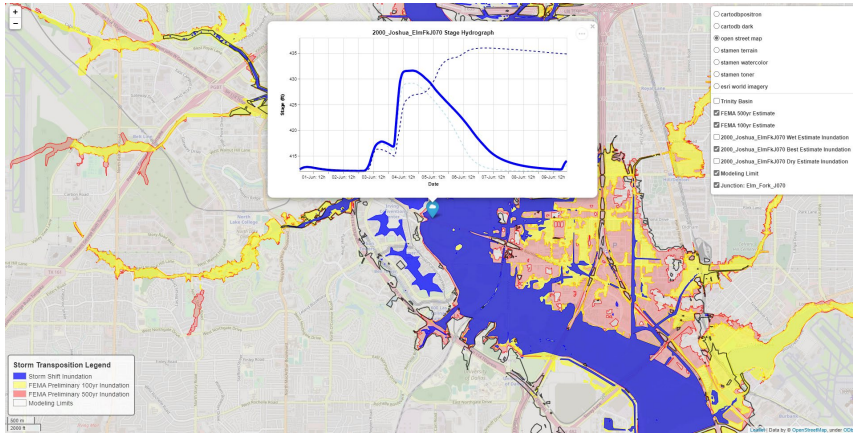
UPPER TRINITY STORM SHIFT RESULTS

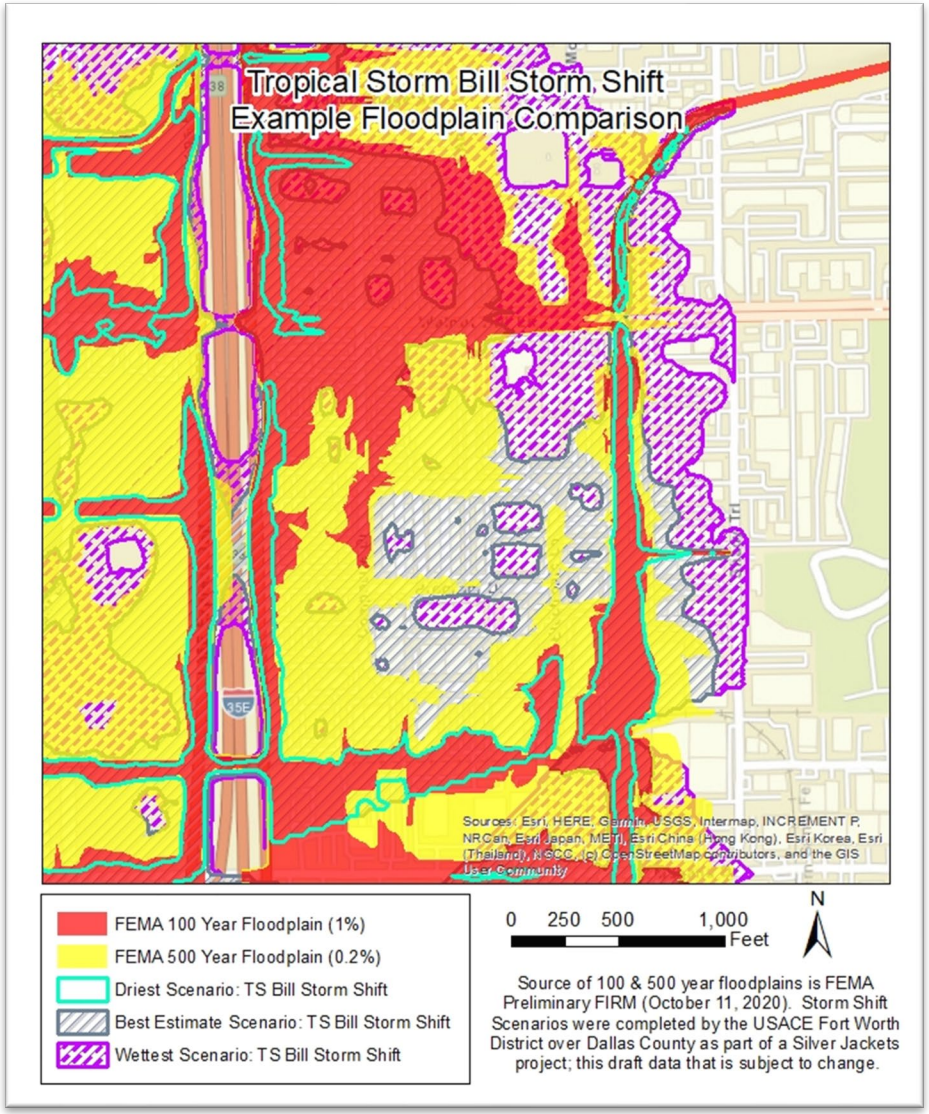
Tropical Storm Bill (13.6” in 48 hours):

- Flows for Dry, Best Estimate, and Wet scenarios shown below (includes comparison to Trinity WHA)
- Map to right shows example comparison of these scenarios against FEMA 100 and 500-year floodplains

TS BILL STORM SHIFTS	Upper Trinity Silver Jackets Study			Trinity InFRM WHA Study		
	Dry	Best Estimate	Wet	100-yr	200-yr	500-yr
Junction	PeakFlow (cfs)	PeakFlow (cfs)	PeakFlow (cfs)	PeakFlow (cfs)	PeakFlow (cfs)	PeakFlow (cfs)
Elm Fork Junction 070	30,404	51,911	105,369	45,100	52,800	62,400

- Report, Factsheet, and interactive results/data are available at the link below.





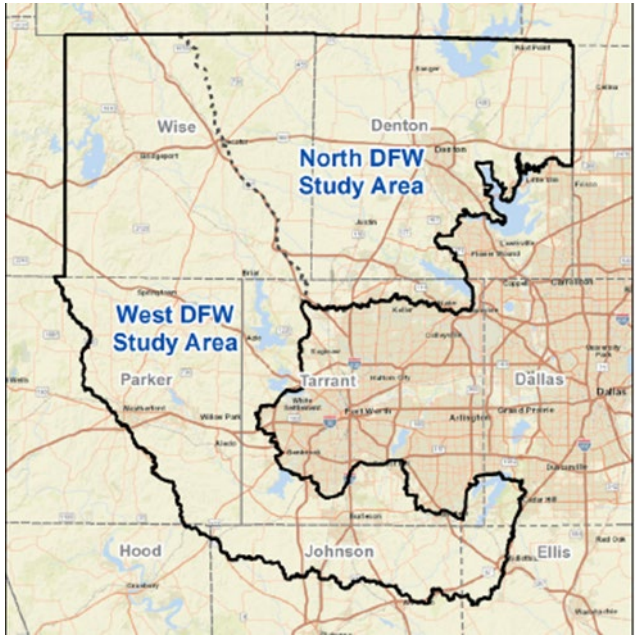
https://www.nctcog.org/envir/watershed-management/storm-shifting

$10 Million

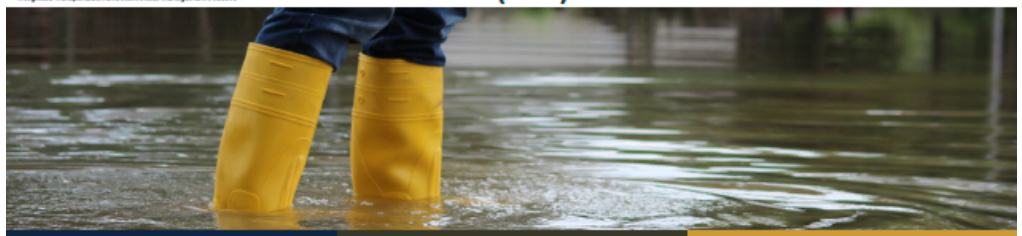
No funding is being requested of our local governments; only your engagement, participation, and follow-through with the tools and resources that we develop for your use.

Thank you to our Funding Partners:

- Federal Emergency Management Agency
- Texas Water Development Board
- Texas Department of Transportation / Federal Highway Administration
- Texas General Land Office



Upper Trinity River Basin Integrated Transportation and Stormwater Infrastructure (TSI) Plan



CONTEXT

Recent flood events in Texas have highlighted the need for more comprehensive stormwater planning. This is important in the upstream portions of the Trinity watershed, where the population is expected to grow significantly.

PROJECT PURPOSE

Proactively integrate regional stormwater management, urban development, transportation, and environmental planning in the face of rapid development, resulting in ***a transferable 'roadmap' for risk awareness and resiliency.***

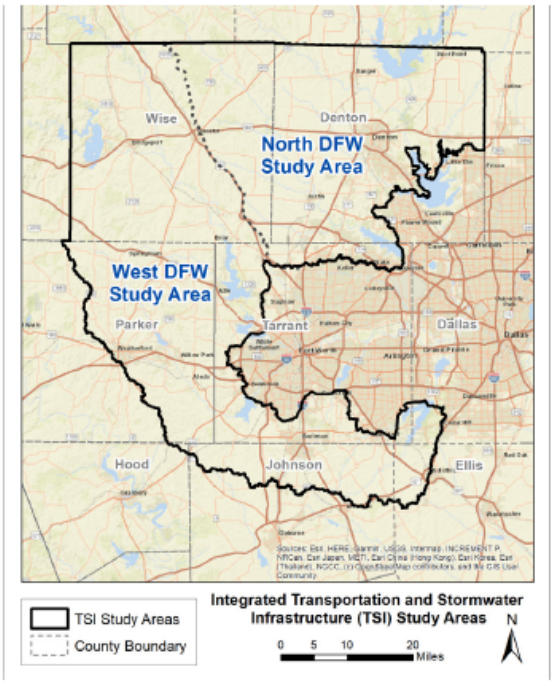
IMPORTANCE

To learn from past mistakes that have resulted in flooded roadways, neighborhoods, and critical infrastructure, and to assist communities with an improved approach to efficiently minimize these impacts before they occur.

About the Project

The North Central Texas Council of Governments (NCTCOG) and the United States Army Corps of Engineers (USACE), along with several other key partners, are collaborating on the Upper Trinity River Basin Integrated Transportation and Stormwater Infrastructure (TSI) project to address the long-term planning needs of communities in North Central Texas. This multi-year effort in these North and West DFW study areas will include transferable TSI plans to aid communities in identifying projects and policies that:

- address vulnerable and critical infrastructure assets;
- reduce flood risk;
- minimize overall lifecycle costs;
- provide environmental and ecosystem benefits to accommodate future population growth; and
- respond to changing storm frequency, duration, and intensity.



Project Area Facts

- 85 cities and portions of 8 counties
- Expected to grow to 2,000,000 residents by 2045 (126% increase from 2020)
- 19% growth in impervious surface from 2006 – 2016
- 60% undeveloped (2015)

Project Goals and Outcomes

REDUCE FLOODING

- Reduce flooding in growing communities.
- Reduce or prevent downstream flood impacts from rapidly growing upstream communities.
- Increase resiliency to flooding disasters in communities by encouraging a proactive approach to stormwater management.
- Provide flood-related data to community officials to inform decision making in incorporated and unincorporated areas

PROVIDE TOOLS / RESOURCES

- Empower communities to adopt higher floodplain management standards and current building codes.
- Encourage communities to collaborate and strategize on common flooding issues through regional initiatives.
- Develop GIS based tools and resources that identify opportunities for green stormwater infrastructure.

PROACTIVE PLANNING

- Comprehensively plan stormwater, transportation, and environmental infrastructure/features.
- Protect current and future transportation and stormwater infrastructure investments by planning for future conditions.
- Develop a planning model that can be replicated in other areas across the United States.

Partner Organizations

North Central Texas Council of Governments

trwd Tarrant Regional Water District

University of Texas Arlington

Texas A&M Institute for a Disaster Resilient Texas

US Army Corps of Engineers

Texas A&M AgriLife

Funding Partners

- Texas Water Development Board
- Texas Department of Transportation – Federal Highway Administration
- Texas General Land Office
- Federal Emergency Management Agency

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QUESTIONS & DISCUSSION