Region 2 Lower Red-Sulphur-Cypress Regional Flood Planning Group
March 3, 2022
2:00 pm
at
Small Business Development Center
The Community Room – (2nd Floor),
105 N. Riddle Avenue,
Mt. Pleasant, TX 74555
or
Via teleconference/webinar
Use the following information to register for the meeting:
https://us06web.zoom.us/meeting/register/tZAsce2gpzkjHdVuhz4I6kEhqH4GG11veLVF
After registering, you will receive a confirmation email containing information about joining the meeting.

If you experience issues while registering or do not have access to a computer, please contact Paul Prange no less than two (2) workdays prior to the meeting at 903.255.3519 or pprange@atcog.org.

Agenda:

1. Call to Order
2. Welcome
3. Confirmation of attendees / determination of quorum
4. Public comments – limit 3 minutes per person

Action Items

5. Consider approval of minutes for the meeting held February 10, 2022.
6. *Additional Action Items Below

Presentations

7. Texas Water Development Board Update
8. Region 1 Canadian-Upper Red Regional Flood Planning Group Updates

Technical Consultant Update

9. Technical Presentation by Halff Associates, Inc.
    1. Chapter 1
        a. Update on Ag Crop and Loss Data
    2. Chapter 2
        a. Future Conditions Flood Quilt and Exposure Analysis
        b. Submittal of Chapter 2 is being delayed until March to allow for incorporation of the new agricultural data
    3. Chapter 3
        a. Chapter 3 Review
        b. Discuss Comments
    4. Chapter 5
        a. Update Status of Data Processing
        b. Schedule first review committee meeting

5. Tech Memo Addendum
    a. The Tech Memo Addendum is due to TWDB on March 7, 2022
    b. Tech Memo Addendum Review
    c. Discuss Comments
    d. *Consider Approval of Tech Memo Addendum for submittal to TWDB
6. Schedule

Other Business

10. Update from Planning Group Sponsor
11. Consider date and agenda items for next meeting
12. Adjourn

If you wish to provide written comments prior to or after the meeting, please email your comments to pprange@atcog.org and include "Region 2 RFPG Meeting" in the subject line of the email – OR – you may mail your comments to Region 2 RFPG, c/o ATCOG – Paul Prange, 4808 Elizabeth St, Texarkana, TX 75503.

If you wish to provide oral public comments at the meeting, please submit a request via email to pprange@atcog.org , include "Region 2 RFPG Meeting Public Comment Request" at least 2 hours prior to the meeting, and follow the registration instructions at top of page 1 of the Agenda.

Additional information may be obtained from: www.texasfloodregion2.org, or by contacting Paul Prange at pprange@atcog.org, 903-832-8636, -or- Region 2 RFPG, c/o ATCOG, 4808 Elizabeth St, Texarkana, TX 75503

All meeting agendas and notices will be posted on our website at www.texasfloodregion2.org. If you wish to be notified electronically of RFPG activities, please submit a request to pprange@atcog.org, include "Request for notification of Region 2 RFPG activities". This request will be honored via email only unless reasonable accommodations are needed.

Meeting Minutes
Region 2 Lower Red-Sulphur-Cypress Flood Planning Group Meeting
February 10, 2022
2:00 p.m.
Ark-Tex Council of Governments Office Building, 4808 Elizabeth Street, Texarkana, TX 75503 and Via Zoom Webinar/Teleconference

Roll Call:

Voting Member	Interest Category	Present (x) /Absent ( ) / Alternate Present (*)
Preston Ingram (William)	Agricultural interests	X
Andy Endsley	Counties	X
W. Greg Carter	Electric generating utilities	X
Laura-Ashley Overdyke	Environmental interests	X
Casey Johnson	Industries	
Dustin Henslee	Municipalities	X
Kirby Hollingsworth	Public	
R. Reeves Hayter	River authorities	X
Kelly Mitchell	Small business	
Joseph W. Weir III	Water districts	X
Susan Whitfield	Water utilities	X

Non-voting Member	Agency	Present(x)/Absent( )/ Alternate Present (*)
James (Clay) Shipes	Texas Parks and Wildlife Department	X
Andrea Sanders	Texas Division of Emergency Management	X
Darrell Dean	Texas Department of Agriculture	
Tony Resendez	Texas State Soil and Water Conservation Board	
Trey Bahm	General Land Office	
Anita Machiavello (Morgan White - Alternate)	Texas Water Development Board (TWDB)	X
Michelle Havelka	Texas Commission on Environmental Quality	X
Darlene Prochaska	USACE, Fort Worth District	
Travis Wilsey	USACE, Tulsa District	
Randy Whiteman	RFPG 1 Liaison	
Richard Brontoli	Red River Valley Association	
Jason Dupree	TxDOT – Atlanta District	X
Dan Perry	TxDOT – Paris District	X

Quorum:
Quorum: **Yes**
Number of voting members or alternates representing voting members present: **8**
Number required for quorum per current voting membership of **11**: **6**

Other Meeting Attendees: **
Kathy McCollum - ATCOG
Paul Prange – ATCOG
Joshua McClure – Halff Associates Team
Jim Keith – Halff Associates Team
Parker Moore – Halff Associates Team
Kimberly Miller- Halff Associates Team
Sophia Kiec-Halff Associates Team
Ginny Connolly-Halff Associates Team
Tyler Ogle-Freese & Nichols
Chris Hartung - SRBA
Walt Sears – NETMWD
Paul Hensel – City of Hooks, TX
Lisa Mairs – USACE
James Bronikowski – TWDB
Reem Zoun-TWDB
Sanjay Negi-Texas A&M

**Meeting attendee names were gathered from those who entered information for joining the Zoom meeting.

All meeting materials are available for the public at:
http://www.twdb.texas.gov/flood/planning/regions/schedule.asp.

AGENDA ITEM NO. 1: Call to Order
Reeves Hayter called the meeting to order at 2:04p.m.

AGENDA ITEM NO. 2: Welcome
Reeves Hayter welcomed members and attendees to the Region 2 Lower Red-Sulphur-Cypress Flood Planning Group meeting.

AGENDA ITEM NO. 3: Confirmation of attendees / determination of a quorum
Reeves Hayter asked ATCOG staff member, Paul Prange, to conduct a roll call of attendees. Each present voting and non-voting member of the Region 2 Lower Red-Sulphur-Cypress RFPG introduced themselves, establishing that a quorum had been met. Eight voting members were present and seven non-voting members were absent.

AGENDA ITEM NO. 4: Public comments – limit 3 minutes per person
Reeves Hayter opened the floor for public comments. No comments were given.

ACTION ITEMS

AGENDA ITEM NO. 5: Consider approval of minutes for the meeting held Thursday, November 4, 2021. *Additional Action Items Below
Reeves Hayter opened the floor for discussion and approval of the minutes from the previous meeting. Paul Prange announced that one error was listed in the minutes initially provided to the Region 2 board members, but had been revised prior to the meeting for review and approval. A motion was made by Greg Carter and was seconded by Reeves Hayter to approve the minutes as amended. The motion carried unanimously.

AGENDA ITEM NO. 6: Discuss and Consider establishing a subcommittee to review Task 5 FMS/E/Ps and select for recommendation:
Reeves Hayter opened the floor for discussion and stated that the tables listing FMS/E/Ps appeared to consist of approximately 7 or 8 pages. Mr. Hayter asked Josh McClure about the recommendation proposed at the January meeting, to appoint a subcommittee to review the information listed in the tables. Mr. McClure stated that the review of Task 5 by a subcommittee would be the best path forward. Jim Keith concurred and stated that several other regions are utilizing this method of review, as well. Mr. Hayter announced that he had considered several options for conducting the review and concluded that a 5 member technical advisory committee would be the best choice. Mr. Hayter asked the board for comments and Laura-Ashley Overdyke stated that this makes sense. Mr. Hayter then proposed that the technical advisory committee be comprised of Greg Carter, Dustin Henslee, Laura-Ashley Overdyke, Andy Endsley and Reeves Hayter. A motion was made by Joseph Weir and seconded by Susan Whitfield. The motion carried unanimously.

PRESENTATIONS

AGENDA ITEM NO. 7: Texas Water Development Board Update:
Reeves Hayter turned the floor over to Anita Machiavello who announced that the technical memorandum submitted to TWDB in January is undergoing a second technical review by TWDB staff and informal comments will be provide to the Region 2 Flood Planning Group in late spring of 2022. Ms. Machiavello reminded the group that the final tech memo is still due on March 7, 2022 and an item is required on the March agenda for consideration and approval of Halff Associates to submit the tech memo to TWDB for review. Ms. Machiavello announced that Chris Brown is working with TWDB on a contract amendment and the TWDB will host another Chairs' conference call in March.

AGENDA ITEM NO. 8: Region 1 Canadian-Upper Red Regional Flood Planning Group Updates:
Reeves Hayter asked for any updates relating to Region 1 flood planning activities. Randy Whiteman was not in attendance, so Mr. Hayter asked Josh McClure if he had any information and Josh stated that he did not have any updates to provide, at this time. Jim Keith also stated that he did not have any updates to provide to the Region 2 Flood Planning Group. Mr. McClure stated that he would try to gather some information and provide it to the Region 2 board members via email.

TECHNICAL CONSULTANT UPDATE

AGENDA ITEM NO. 9: Technical Presentation by Halff Associates, Inc.

- **a. Chapter 1 Summary and Discussion**
- **b. Task 2**
  - **1. Requirements**
  - **2. Existing Conditions Flood Quilt Review**
  - **3. Take public comments on existing conditions flood quilt**
  - **4. Future Conditions Methodology**
- **c. Task 5 Process**
  - **1. Establish Task 5 subcommittee to review FMS/E/Ps and select for recommendation**
- **d. Tech Memo Addendum**
  - **1. Present Outline**
  - **2. Present Future Conditions Methodology**
- **e. Schedule through August 1, 2022**

Reeves Hayter turned the floor over to Joshua McClure who provided a Status Update focusing on the Tech Memo Addendum, Chapter 1, Chapter 2, Chapter 5, and the Schedule of Upcoming Deliverables. Mr. McClure stated that the Tech Memo was submitted to TWDB on January 7, 2022 and that it has been administratively approved. The Final Tech Memo is due to TWDB on March 7, 2022 and the TWDB provided a submittal checklist requiring two additional tables to be included. Mr. McClure asked Anita Machiavello if the checklist would likely be revised before March 7, 2022 and Ms. Machiavello stated that it would.

Joshua McClure conducted a presentation focusing on Chapter 1 and the comments provided by the Region 2 Flood Planning Group. Mr. McClure thanked everyone who submitted comments and stated that some were related to typographical errors and other comments indicated that the text in Chapter 1

did not seem to realistically describe Northeast Texas, as the board members see it. Rural areas appeared to be underemphasized and urban areas appeared to be overemphasized, along with a lack of data relating to certain agricultural losses. Mr. McClure stated that he concurred with the comments and asked if further discussion was necessary. Reeves Hayter asked if Halff Associates would incorporate the comments into Chapter 1 and provide a revised version to the Region 2 Board of Directors for review. Mr. McClure answered yes, that revisions would be made and resubmitted for review around April, 2022. Mr. McClure also stated that he is working with Preston Ingram to gather additional data relating to crop losses and mentioned that he located some FEMA data which may be used to predict future crop losses. Reeves Hayter stated that data related to crop losses due to flooding, is well hidden and difficult to obtain. Kimberly Miller stated that agriculture is a huge part of the economy in Region 2 and research has been ongoing to locates additional data. Ms. Miller asked if Hay production was the dominant crop within the region and Greg Carter stated that timber production is a very large crop, as well. Mr. Ingram mentioned that the primary row crops are corn, soybeans, wheat, milo, and cotton. He then explained the process that farmers use to report claims of crop losses, which doesn't differentiate between drought or flood conditions, and directed the technical consultants to FSA and USDA websites for additional information. Mr. McClure stated that the primary data set that is missing is the level of impact on crops caused by past flooding. Discussion took place between the Region 2 board members and the technical consultants. Mr. Hayter thanked everyone for participating in the discussion and stated that the flood planning group will have an opportunity to make additional recommendations later in the development of the plan.

Joshua McClure then presented information on Chapter 2 - Existing Conditions Flood Risk Analysis. Mr. McClure began discussing the Floodplain Quilt and Exposure Analysis by demonstrating how to access and navigate an interactive map to enter data. Chapter 2 focuses on merging all floodplain data together from FEMA NFHL (Approximate and Detailed), FEMA BLE, FAFDS and FATHOM data sources (Pluvial and Fluvial) to compile the Floodplain Quilt for Region 2. Mr. McClure pointed out that Delta, Camp, Franklin, Marion and Red River Counites had no existing floodplain data available, so the FATHOM data has been utilized to designate the approximate floodplains in these five counties. Reeves Hayter stated that the Zone A flood maps are not detailed enough to predict flood damage, but the Fathom data has been added to increase the level of accuracy. However, in doing so a tremendous amount of floodplain has been designated on the flood map, which may cause a great deal of public concern and confusion about whether or not certain properties are located within the floodplain. Mr. Hayter then asked Mr. McClure if the Fathom Pluvial data should even be included on the flood map. Mr. McClure stated that the map depicts flood data which is advisory in nature and not regulatory. Additionally, this data will indicate increased potential risk of flood damage within the region.

Joshua McClure then turned the presentation over to Parker Moore to present the Exposure Analysis. Mr. Moore began a slide presentation depicting the Floodplain Quilt which contains various data sources indicating the 100 Year and 500 Year flood risk area. The slides contained information focusing on Potentially Affected Populations, Structures, Critical Facilities, Agriculture, Roads, the Social Vulnerability Index, and Future Conditions. Discussion took place regarding Critical Facilities, Agricultural data, the Social Vulnerability Index, and Future Conditions. The SVI shows Region 2 at (.4) on average, and (.75) is typically where the TWDB considers an area to be more vulnerable. Mr. McClure defined the Future

Conditions as 30 years in advance, so the 500 Year floodplain will be utilized as the basis and a 22' increase in area will be added to the 500 Year floodplain boundary.

Parker Moore turned the meeting over to Jim Keith to present Chapter 5 – Recommendation of FMEs/FMPs/ and FMSs. Mr. Keith began discussing Tasks 4B and 5 to provide detailed information to the Technical Advisory Committee for their selection process. Mr. Keith stated that identifying flood problems in conjunction with a high SVI, will help determine the number of potential projects within Region 2. Mr. Keith then described the process for recommending FMEs and FMPs to the flood planning group, with the ultimate goal of reducing flood risk while demonstrating quantifiable flood risk reduction benefits. Currently, only 3 FMPs have been identified within Region 2, but the Technical Advisory Committee may be able to identify additional projects during two meetings scheduled for March 2022.

Joshua McClure then presented the Look-Ahead portion of his presentation and stated that Chapters 2 and 3, along with the Tech Memo will be completed in February. Final Tech Memo approval by the Region 2 Board of Directors and submittal of the Tech Memo to TWDB will occur in March, along with the submittal of Chapters 4 and 5. Discussion of Chapters 4 and 5 and submittal of Chapters 6 and 7 will occur in April. Discussion of Chapters 6 and 7 and submittal of Chapters 8 and 9 will occur in May. Discussion of Chapters 8 and 9 and submittal of Chapter 10 will occur in June. Discussion of Chapter 10 and approval of the Draft Regional Flood Plan will occur in July, with the Draft Plan due to TWDB on August 1, 2022.

OTHER BUSINESS

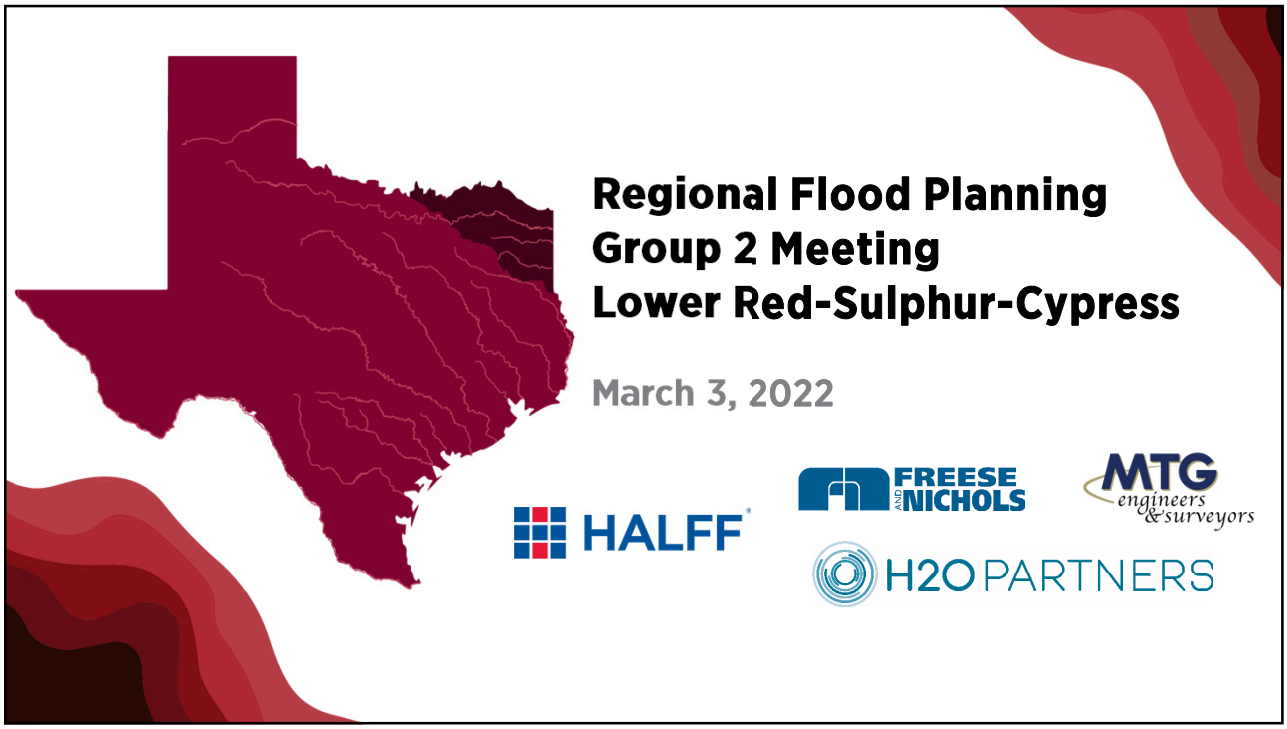
AGENDA ITEM NO. 10: Update from Planning Group Sponsor
Reeves Hayter turned the floor over to Paul Prange who announced that ATCOG has hired a new Hazard Mitigation Planner who will assist in conducting flood planning outreach within Region 2 to increase public participation.

AGENDA ITEM NO. 11: Consider date and agenda items for next meeting
Reeves Hayter opened the floor for discussion. The Region 2 RFPG board members agreed to conduct the next meeting on Thursday, March 3, 2022 at 2:00p.m. at a location to be determined in the central part of the region and via webinar/teleconference.

AGENDA ITEM NO. 12: Adjourn
Reeves Hayter opened the floor to adjourn the meeting.
The vote to adjourn was passed by unanimous consent.
The meeting was adjourned at 4:14p.m. by Reeves Hayter.
Approved by the Region 2 Lower Red-Sulphur-Cypress RFPG at a meeting held on 03/03/2022.

_____

Reeves Hayter, CHAIR



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Outline/Agenda

- Tech Memo Addendum Status Update
- Chapter 1 – Planning Area Description
  - Update on Ag Crop and Loss Data
- Chapter 2 - Future Conditions Flood Risk Analysis
  - Update
- Chapter 3- Review and discuss comments
- Chapter 5 - Recommendation of FMEs, FMPs and FMSs
  - Update
  - Subcommittee meetings
- Schedule

2

2

Status Update

3

Tech Memo Addendum Submittal

- Initial Tech Memo was submitted January 7
  - January 7 Tech Memo has been administratively approved
- Final Tech Memo due to TWDB Monday, March 7.
  - Required data that was not included in the January 7 tech memo
- TWDB provided submittal checklist
- Geodatabases and maps

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Chapter 1 – Planning Area Description

5

Ag Crop and Loss Data Update

- Reeves Hayter provided link to Ag Census Fact Sheets
- Good summary of ag stats for the county
- Not perfect, especially for timber

2017 CENSUS OF AGRICULTURE *County Profile*

Lamar County
Texas

Total and Per Farm Overview, 2017 and change since 2012

	2017	% change since 2012
Number of farms	1,946	+6
Land in farms (acres)	463,905	-7
Average size of farm (acres)	238	-12
Total	($)	
Market value of products sold	73,439,000	-13
Government payments	8,480,000	+65
Farm-related income	4,390,000	+39
Total farm production expenses	74,383,000	-4
Net cash farm income	11,926,000	-25
Per farm average	($)	
Market value of products sold	37,739	-18
Government payments (average per farm receiving)	12,733	+17
Farm-related income	9,461	+30
Total farm production expenses	38,224	-9
Net cash farm income	6,128	-29

(Z) Percent of state agriculture sales

Share of Sales by Type (%)

Crops
Livestock, poultry, and products

Land in Farms by Use (%) [a]

Cropland
Pastureland
Woodland
Other

Acres irrigated: 4,988
1% of land in farm

Land Use Practices (% of farms)

No till
Reduced till
Intensive till
Cover crop

6

Ag Crop Loss Data Update

- Preston Ingram connected us with Bart Fischer, PhD at TAMU
- Risk Management Agency - Summary of Business
- Cause of Loss - Data on specific, insured damages
  - Does not include non-insured damages (deductible)
  - Does not include non-insured land
  - Timber not included
  - Flooding is one cause, but damages may fall under other categories (excess precipitation)
- FCIC Yearly Stats – Includes all insured acres and value
  - Have to correlate with Cause of Loss to determine total damage

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Chapter 2 - Future Conditions Flood Risk Analysis

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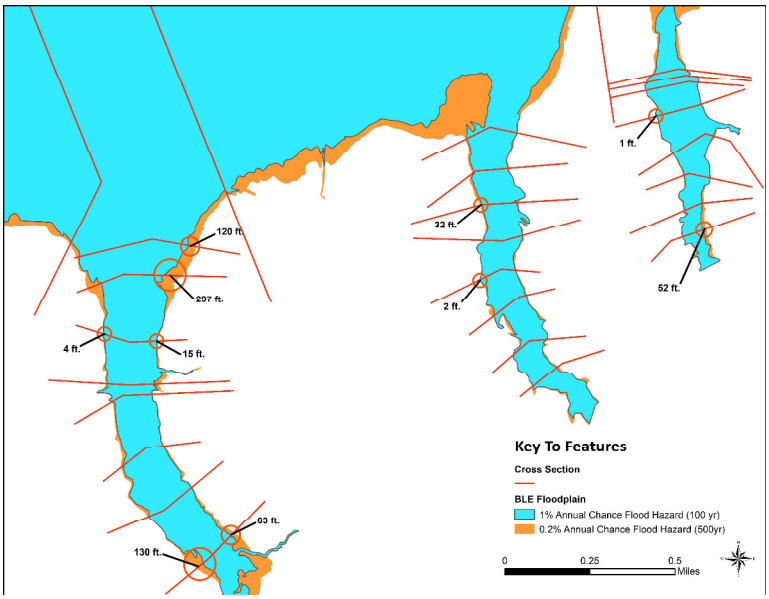
Future Conditions



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Floodquilt Hierarchy & Approach

	Best Available		→		→		→		Most Approximate	
	Local Floodplain (if determined		NFHL AE		BLE		NFHL A		FAFDS, or No FEMA	
	100YR	500YR	100YR	500YR	100YR	500YR	100YR	500YR	100YR	500YR
Existing	Local Study, if provided	Local Study, if provided	Zone AE + Pluvial Fathom*	Zone AE + Pluvial Fathom*	BLE + Pluvial Fathom	BLE + Pluvial Fathom	Zone A + Pluvial Fathom	Zone A + Pluvial Fathom	Combined Pluvial & Fluvial (Replaced FAFDS with Fathom)	Combined Pluvial & Fluvial (Replaced FAFDS with Fathom)
Future	Local Study, if provided	Local Study, if provided	Existing 500-Year	22' Buffer of Existing 500' Year	Existing 500-Year	22' Buffer of Existing 500' Year	Existing 500-Year	22' Buffer of Existing 500' Year	Fathom Existing 500-Year	22' Buffer of Existing 500' Year

*Area of dated NFHL AE in Red River area was replaced with updated BLE.

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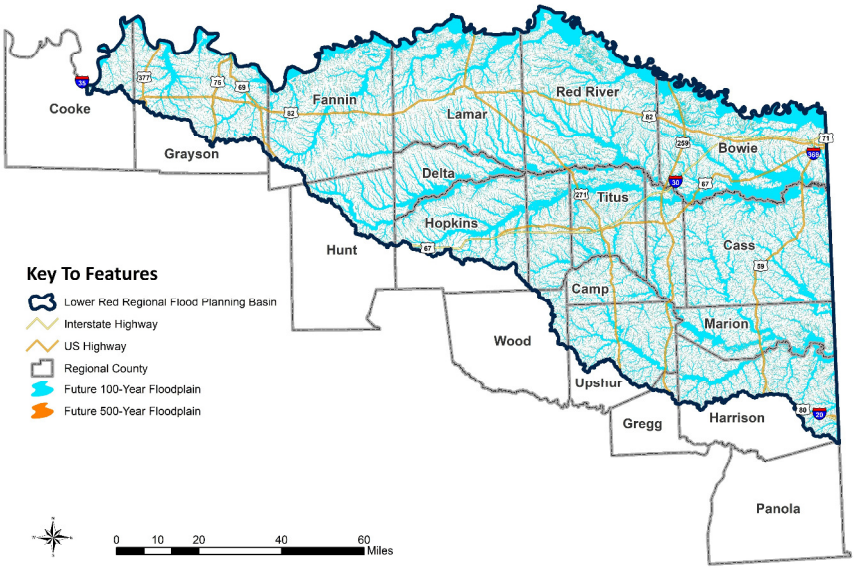
Future 1% & 0.2% Flood Risk Area



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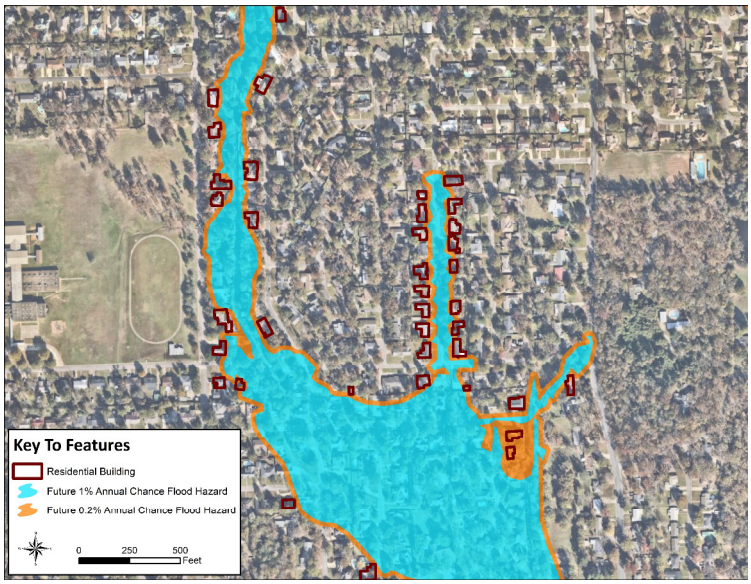
Future Flood Risk Area – Paris, Lamar County



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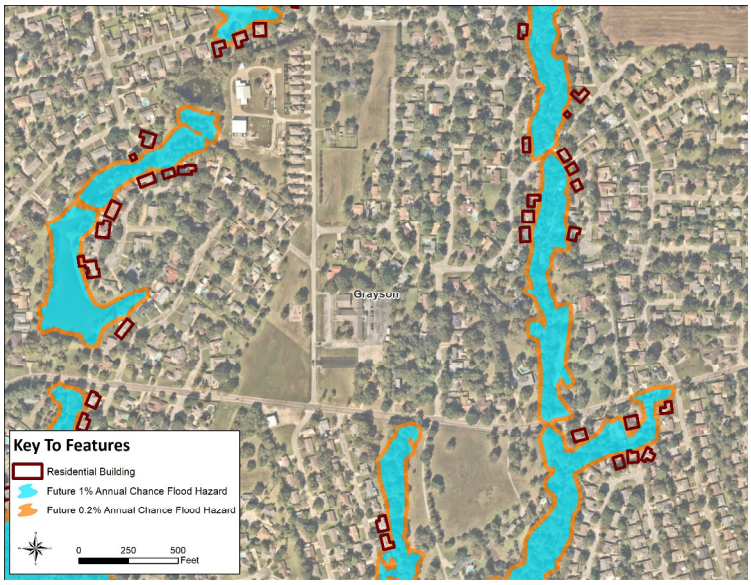
Future Flood Risk Area – Sherman, Grayson County



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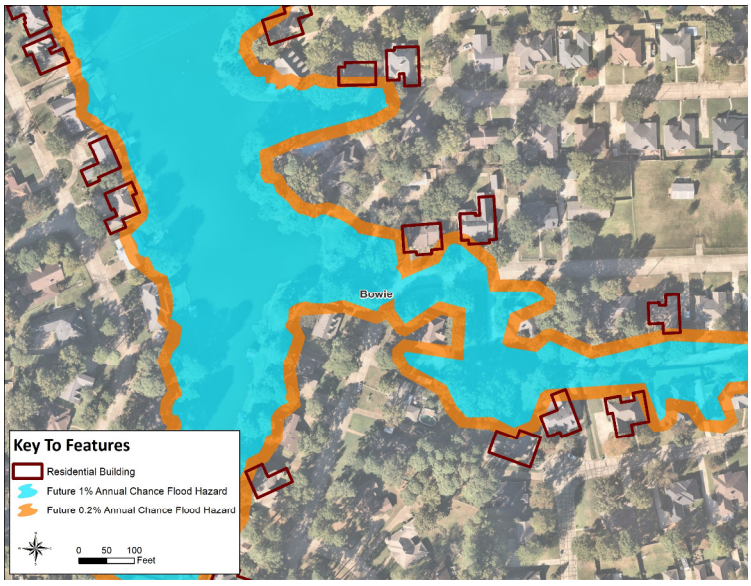
Future Flood Risk Area – Texarkana, Bowie County



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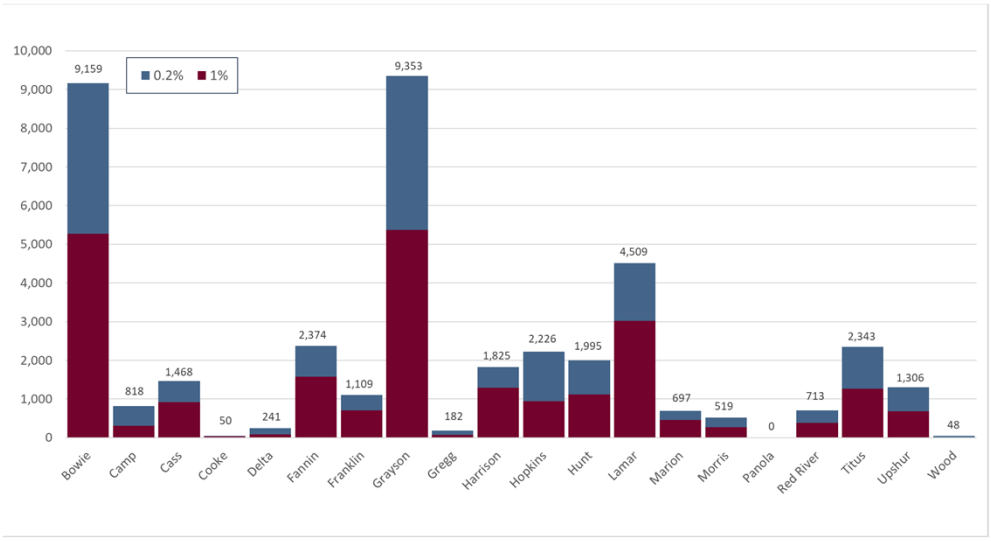
Population in Future 1% & 0.2% Flood Risk Area



Nighttime populations included.

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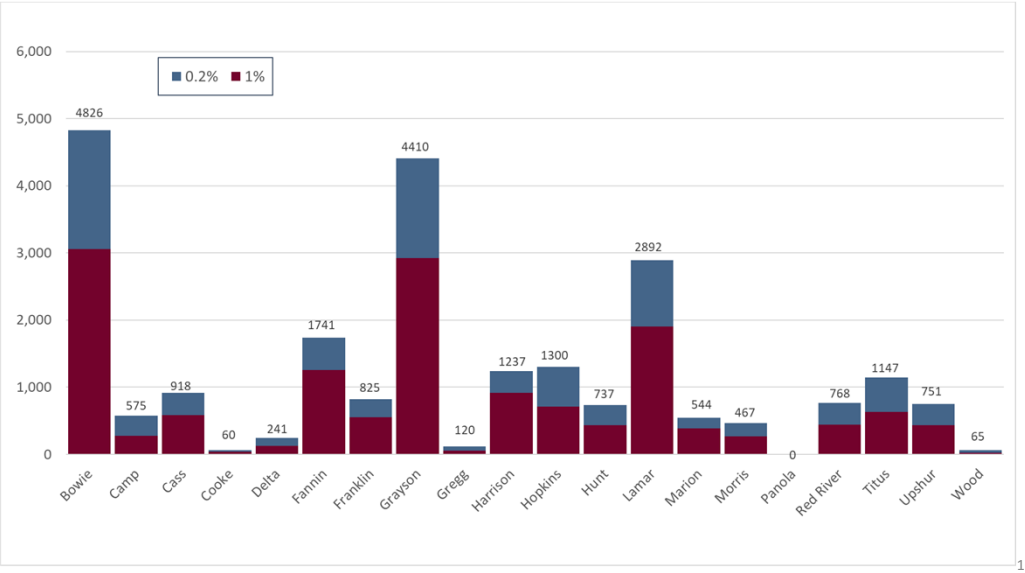
Structures in Future 1% & 0.2% Flood Risk Area



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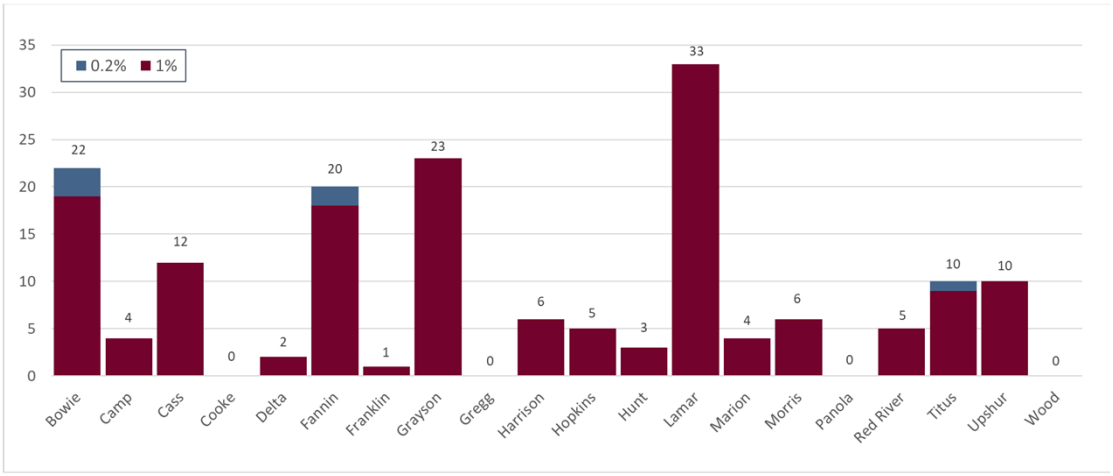
Critical Facilities in Future 1% & 0.2% Flood Risk Area



Critical Facilities Include: Airports, Power Plants, Super Fire Stations, Police Stations, Nursing Homes, Schools, Shelters, Super Fund Sites, W/WW Treatment Facilities

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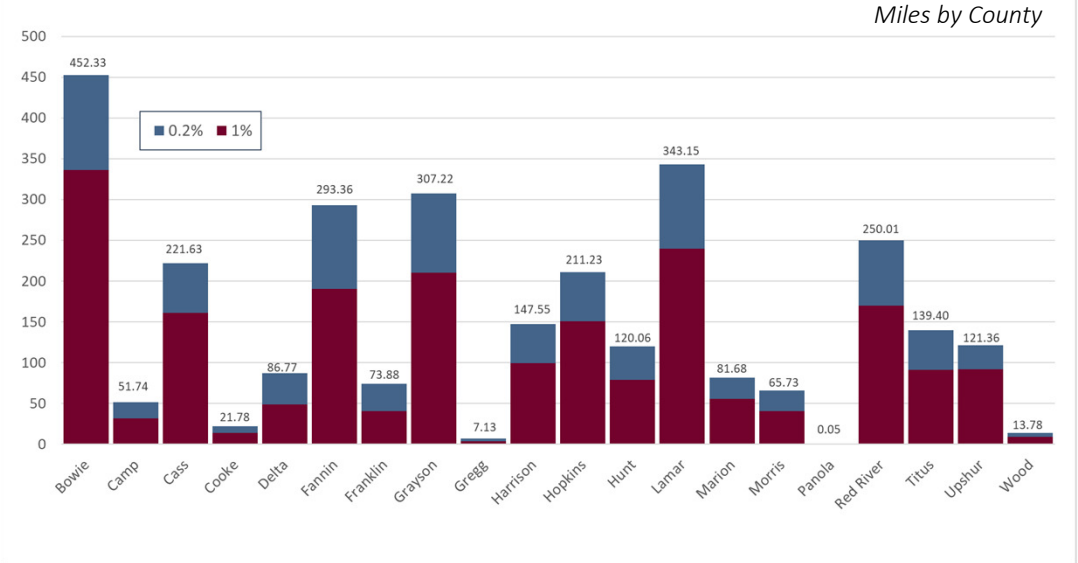
Roads in Future 1% & 0.2% Flood Risk Area

Miles by County



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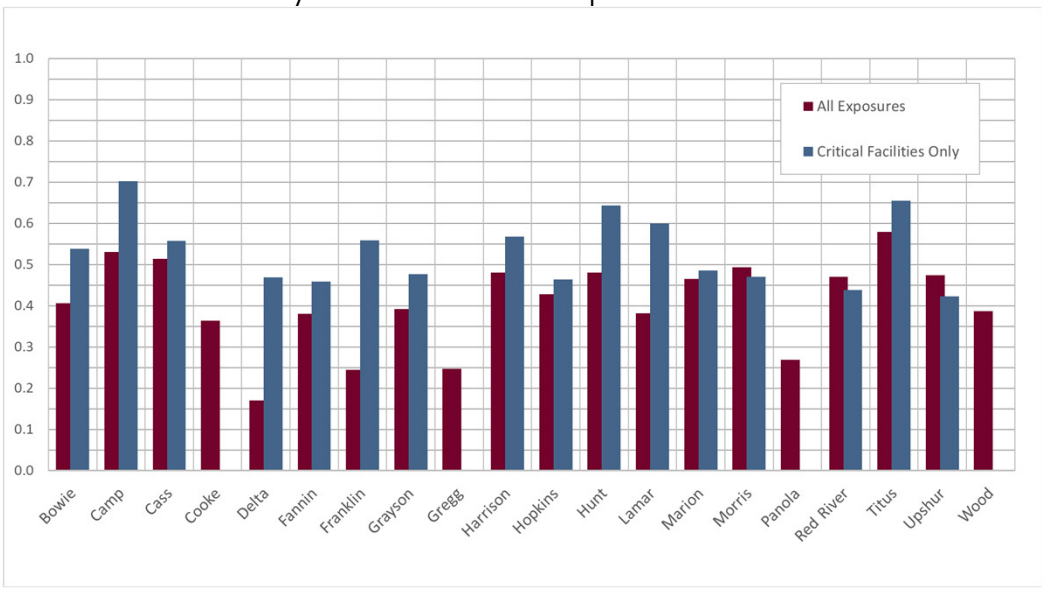
Social Vulnerability of Future Flood Exposures & Critical Facilities



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Chapter 3 - Floodplain Management Practices & Flood Protection Goals

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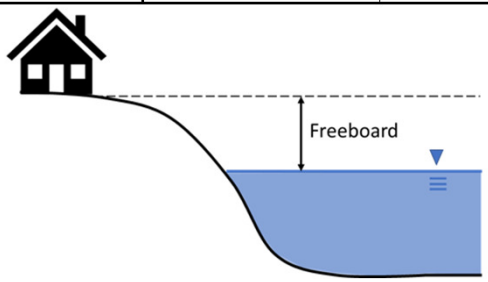
Recommended Floodplain Management Standards

Type/Condition	Infrastructure	Recommended Standard
New Construction Pre-Existing (Retrofit)	Residential Properties	Finished floor elevation (FFE) 1-ft above BFE (BFE = Base Flood Elevation, 100-yr flood)
	Commercial Properties	
	Critical Facilities	FFE above 500-yr or 2-ft above 100-yr whichever comes first



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Recommended Floodplain Management Standards

Type/Condition	Infrastructure	Recommended Standard
New Construction Pre-Existing (Retrofit)	Roadways	2-yr capture Depth not to exceed curb in 10-yr storm
	Culverts/Bridges	Minor Roadways: Pass the 25-yr Major Roadways: Pass the 100-yr
	Storm Drainage Systems	25-yr flow underground 100-yr within right of way
	Detention Facilities	Multi-stage Detention - detain to existing conditions peak discharge for 2-, 25- and 100-year Storms
	Mapping Coverage	Developers building in a Zone A or unmapped areas must provide a hydrologic and hydraulic study establishing BFE

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Goals Summary

Goal Category	Goal	Short Term Goal (2033)	Long Term Goal (2053)
Education and Outreach	For each planning cycle, hold public outreach and education activities (in multiple locations within the region) to improve awareness of flood hazards and benefits of flood planning.	3	3
Flood Warning and Readiness	Support the development of a community coordinated warning and emergency response program (including flood gauges) that can detect the flood threat and provide timely warning of impending flood danger.	Identify potential areas where flood warning systems would be beneficial	Implement a minimum of 1 flood warning system
Flood Studies and Analysis	Increase the coverage of flood hazard data by completing studies to reduce areas identified as having current gaps in flood mapping by X percent.	25%	90%

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Goals Summary

Goal Category	Goal	Short Term Goal (2033)	Long Term Goal (2053)
Flood Prevention	Reduce the percentage of communities that do not have floodplain standards that meet or exceed the NFIP minimum standards by X.	25%	100%
	Support the development of minimum stormwater infrastructure design standards applicable across the FPR.	Creation of an integrated stormwater management manual to serve as a guide/foundation for local governments	Help local governments to adopt and implement the stormwater management manual
Non-Structural Flood Infrastructure	Reduce the number of NFIP repetitive-loss properties by X percent.	10%	50%
Structural Flood Infrastructure	Improve the level of service of vulnerable roadway segments and low water crossing located within the existing and future 1% annual chance floodplain by X percent.	25%	90%
	Repair, rehabilitate, or replace X percent of aged stormwater infrastructure that is at high risk of failure would increase flood risks.	10%	50%

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Discuss Chapter 3 Comments

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Chapter 4B & 5 – Identification and Recommendation of FMEs, FMPs and FMSs

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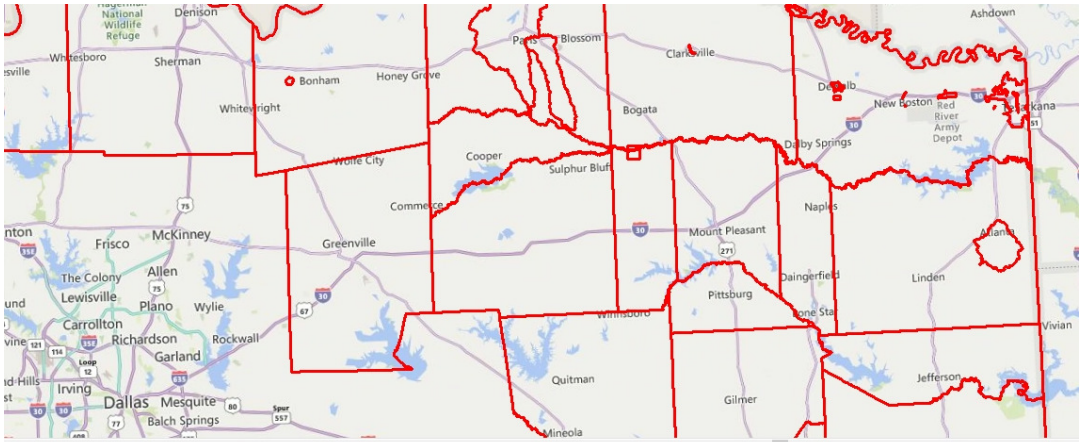
Task 4B Review



FME_ID	FME_NAME	DESCR	RF	RFPG_NAME	COUNTY	HUC8	HUC10	HUC12	WS_ID	GOAL_ID
021000041	City of Atlanta Park View St and Jefferson	Install culvert crossing	2	Lower Red-Sulphur-Cypress	Cass	11140304	1114030402	1114030	<Null>	6001. 6002. 6003. 6004
021000042	City of Paris Big Sandy Cr Tribs 4 and 6 Imp	Re-grade channel downstream of Clarksville Ave. and establi	2	Lower Red-Sulphur-Cypress	Lamar	11140301	1114030104	1114030	<Null>	6003. 6004
021000043	City of Paris Big Sandy Cr Tribs 4 and 6 Imp	Channel improvements in the upper portion of Tributary 4	2	Lower Red-Sulphur-Cypress	Lamar	11140301	1114030104	1114030	<Null>	6001. 6002. 6003. 6004
021000044	City of Paris Big Sandy Cr Tribs 4 and 6 Imp	Tributaty 6 channel improvements and culvert replacement	2	Lower Red-Sulphur-Cypress	Lamar	11140301	1114030104	1114030	<Null>	6001. 6002. 6003. 6004
021000054	City of Ector Property Buyout	Acquire flood prone properties for use as park areas.	2	Lower Red-Sulphur-Cypress	Fannin	11140101	<Null>	1114010	Bois D'a	5001. 5002

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Planning Level Cost Estimates

Table 22: Potential costs generally associated with FMSs, FMPs, and FMEs [A]

			FMS	FMP	FME
Non-recurring	Study costs and other (non-capital costs)	Non-engineering studies: (e.g., floodplain regulation development; flood authority or revenue raising studies; public awareness program)	x	x	x
		Engineering/technical/feasibility studies: (e.g. Hydrologic & hydraulic modeling/mapping; identification of potential flood risk reduction solutions; BCA and alternative analyses; project design; construction engineering)		x	x
		Surveying; geotechnical; testing		x	x
	Total study costs		x	x	x
	Construction-related (capital costs)	Design and Permitting		x	
	Construction-related (capital costs)	Environmental; archaeological & historical resources		x	
		Temporary and/or permanent easements; land acquisition		x	

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Planning Level Cost Estimates - Continued

Table 22: Potential costs generally associated with FMSs, FMPs, and FMEs [A]

			FMS	FMP	FME
Non-recurring		Mitigation; utility relocation		x	
		Legal assistance; fiscal services & costs (bond counsel); outreach		x	
		Direct construction costs of components/facilities		x	
		Buyouts; property elevations		x	
		Interest during construction		x	
		Project management (by engineer)		x	
		Inspection; pilot testing; warranty; manuals		x	
		(other special services or relevant costs)		x	
		Contingency(s)		x	
	Total construction costs			x	
TOTAL PROJECT COSTS [B]			x	x	x
Recurring		Debt service [interest rate & term (years)]		x	
		Operation & Maintenance		x	
		Other (i.e., public awareness campaign)	x		
TOTAL ANNUAL RECURRING COSTS			x	x	

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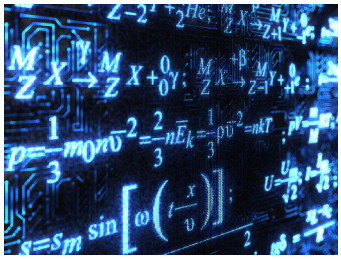
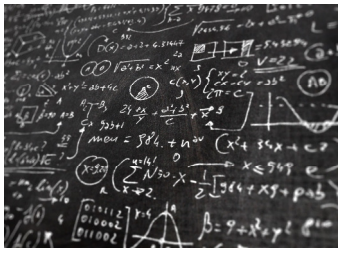
Planning Level Cost Estimate Templates





OPINION OF PROBABLE CONSTRUCTION COST - DEVELOP FEMA FIS

PROJECT NAME	Lower Red-Sulphur-Cypress Regional Flood Plan	DATE	2/14/2022

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
MANAGEMENT					
1	Project Management and Meetings	1	LS	$ -	$ -
DISCOVERY DATA CAPTURE					
2	Data Collection	1	HUC 8	$ 15,000	$ 15,000
4	Event Data Capture	1	LS	$ 750	$ 750
SURVEY DATA CAPTURE					
5	Survey Data Collection	1	LS	$ -	$ -
TOPOGRAPHIC: EXISTING TOPOGRAPHIC DATA CAPTURE					
7	Processing Existing LiDAR	278	SQ MI	$ 27	$ 7,503
HYDROLOGIC DATA CAPTURE					
15	Rainfall-Runoff Analyses (high)	0	RV MI	$ 2,800	$ -
16	Rainfall-Runoff Analyses QA/QC	1	LS	$ -	$ -
HYDRAULICS DATA CAPTURE					
19	Detailed Study (high)	0	RV MI	$ 4,750	$ -
23	Riverine Workmaps	0	PANEL	$ 200	$ -
24	QA/QC	1	LS	$ -	$ -
COASTAL DATA CAPTURE					
25	Floodplain Mapping of Coastal	0	CO MI	$ 3,000	$ -
26	QA/QC	1	LS	$ -	$ -
FLOODPLAIN MAPPING DATA CAPTURE					
29	Redelineation (high)	0	RV MI	$ 550	$ -
30	Redelineation QA/QC	0	RV MI	$ 80	$ -
FINAL DELIVERABLES					
31	Technical Report	1	LS	$ -	$ -

SUBTOTAL			$ 27,253
CONTINGENCY	30%		$ 9,000
SUBTOTAL			$ 37,000
MOBILIZATION	10%		$ 4,000
SUBTOTAL			$ 41,000
ENGINEERING & PERMITTING			$ 9,000
PROJECT TOTAL (2021 COSTS)			**$ 50,000**

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FMP: No Negative Impact

- Supporting Engineering Report should include:
  - Description of the Analysis
  - Description of the Proposed Improvements
  - Impacts of the Proposed Improvements
  - Description of Mitigation Measures
  - **No Negative Impact Certification**
- Evaluating reports and models submitted for existing Impact Analyses already completed

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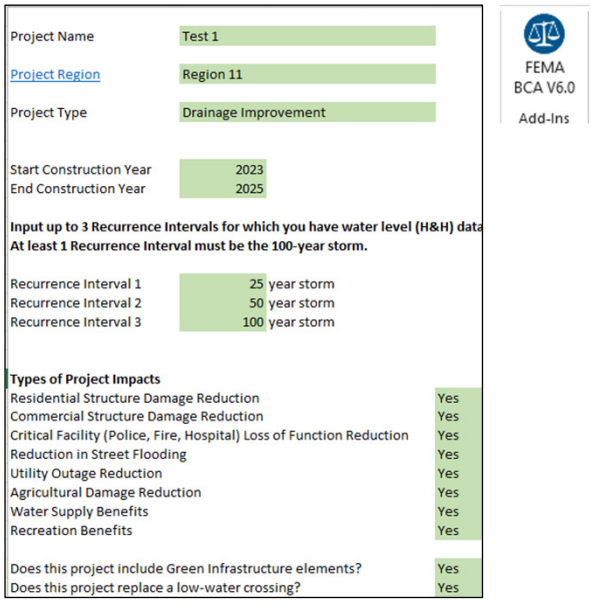
FMP: Benefit-Cost Analysis

- TWDB benefit BCR input interface and analysis tool works alongside FEMA's BCA Toolkit 6.0
- Uses the data calculated in Table 13 and formats it for the FEMA BCA Toolkit 6.0



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Process for Recommending FMEs

Screening

"Not every conceivable FME will be recommended. The RFPG and technical consultant must decide which identified potential FME will be recommended."

1. Goals
- Remove FMEs that do not support a goal. ☑

2. Contact Sponsors
- Verify if study has been completed.
- Verify interest in potential FME.
- Request additional data to refine FME Areas.
- Remove FMEs that have been completed or Sponsor is not interested.

In Progress

Complete Analysis for Remaining Actions

3. Analysis
- Refine FME areas as needed.
- Populate Flood Risk Indicators.
- Calculate cost for FME.

In Progress

Flood Risk Indicators
- Structures in 100-yr floodplain
- Population at 100-yr flood risk
- Critical facilities at 100-yr flood risk
- # of low water crossings
- Farm and ranch land at 100-yr flood risk
- Roads at 100-yr flood risk

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Process for Recommending FMEs

Sub-Committee meeting #1 Steps 4 and 5.

Sub-Committee meeting #2 Step 6

Evaluate Feasible Actions

"Recommend FMEs that the RFPG determines are most likely to result in identification of potentially feasible FMSs and FMPs"

4. Evaluate
- Quantifiable results to ID FMEs with the most complete information and/or could result in the greatest benefits.
- Identify FMEs that have real potential to develop into FMP for the next cycle.
- Identify FMEs that could be promoted to FMP *(RFPG to decide whether FMEs will be performed during this planning cycle as part of Task 12).*
- Identify FMEs located in areas of greatest need (Use Task 4A results).

5. Goals
- Review selected FMEs to verify if they cover all short-term goals.
- Develop additional FMEs as needed to cover missing short-term goal.
- Identify Sponsors for additional FMEs and obtain their commitment.

Recommend

6. Recommend
- Final FME Recommendations.

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Process for Recommending FMPs

Screening

"The RFPGs will recommend specific FMPs in the regional flood plan. The primary function of each recommended FMP must be flood risk reduction and they must include quantifiable flood risk reduction benefits."

1. Goals

- Remove FMPs that do not support a goal. ☑

2. Unfeasible

- Focuses on addressing response and recovery rather than mitigation.
- Does not provide flood mitigation for the 100-yr flood event *(may still be recommended if RFPG desires)*
- FMP is dependent on another action that was classified as unfeasible.

In Progress

3. Contact Sponsors

- Verify if project has been completed.
- Verify interest in potential FMP and request commitment to sponsor it.
- Request additional data to refine FMP Areas.
- Remove FMPs that have been completed or Sponsor is not interested.

In Progress

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Process for Recommending FMPs

Screening

"The RFPGs will recommend specific FMPs in the regional flood plan. The primary function of each recommended FMP must be flood risk reduction and they must include quantifiable flood risk reduction benefits."

4. Initial Analysis

- Refine FMP areas as needed.
- Populate Flood Risk Indicators.

In Progress

5. Evaluate

- RFPG Sub-committee determines which FMPs to perform full analysis.

In Progress

Complete Analysis for Remaining Actions

6. Full Analysis

- Reduction in Flood Risk
- Negative Impacts Determination
- Calculate costs
- Benefit-Cost Analysis

In Progress

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Process for Recommending FMPs

Sub-Committee meeting #1
Step 9

Sub-Committee meeting #2
Step 10

"The RFPGs will recommend specific FMPs in the regional flood plan. The primary function of each recommended FMP must be flood risk reduction and they must include quantifiable flood risk reduction benefits."

Evaluate Feasible Actions

Recommend

7. Unfeasible

- Causes adverse impacts
- Duplicates benefits
- Overallocation of water supply source
- FMP is dependent on another action that was classified as unfeasible.

Does not result in quantifiable flood risk reduction benefits.
Implementation issues
Known opposition.

In Progress

8. Demote

- Determine if there are any FMPs that need to be demoted to FME.

In Progress

9. Evaluate

- Quantifiable results to ID FMPs with the most complete information and/or could result in the greatest benefits.
- Identify FMPs located in areas of greatest need (Use Task 4A results).

10. Recommend

- Final FMP Recommendations.

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Potential Task 5 and Sub-Committee Meeting Schedule

Feb/25/2022
- TC completes Screening and Initial Analysis

Mar/4/2022
- TC completes Full Analysis

Mar/16-18/2022
- 1st Sub Committee Meeting
- Evaluate feasible actions

Mar/22/2022
- TC completes development of additional FMEs (if needed)

Mar/23-25/2022
- 2nd Sub Committee Meeting
- Final Recommendations

Mar/30/2022
- TC submits Chapter 5 Draft to RFPG for review

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Tech Memo Addendum Comments

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Consider Approval of Tech Memo Addendum

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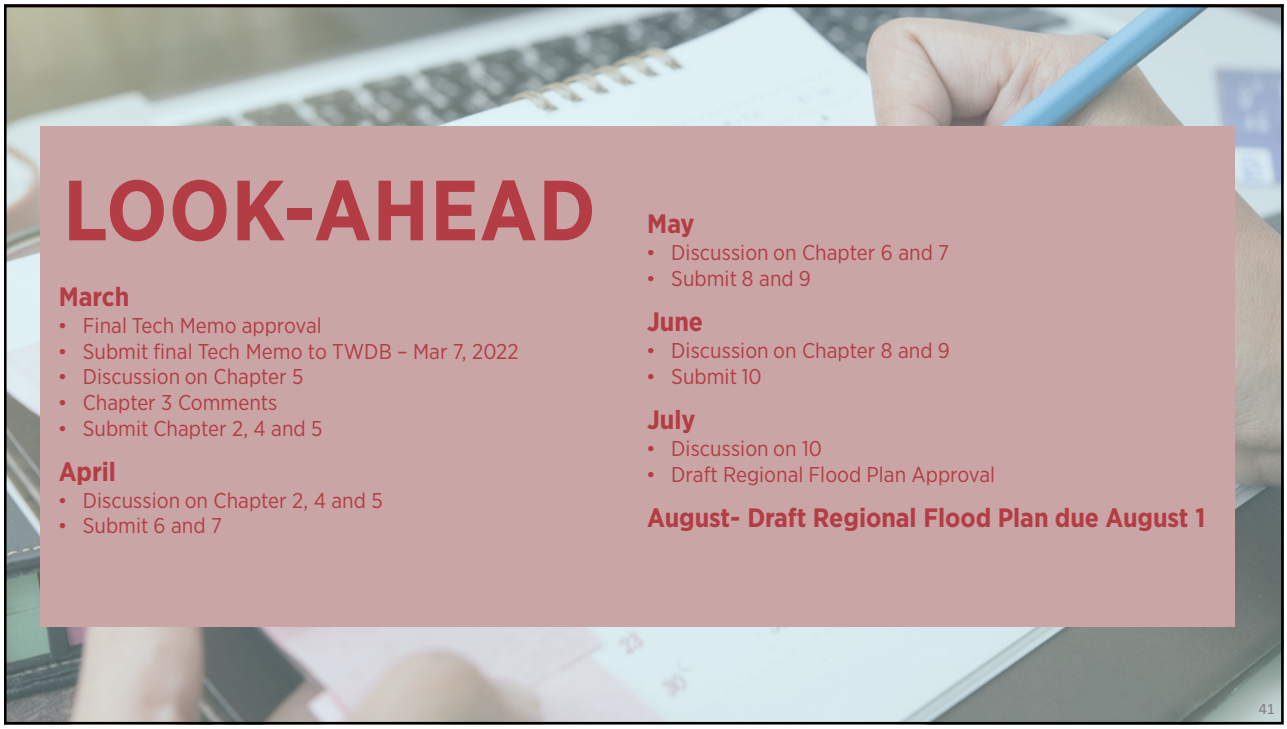
LOOK-AHEAD
March
• Final Tech Memo approval
• Submit final Tech Memo to TWDB – Mar 7, 2022
• Discussion on Chapter 5
• Chapter 3 Comments
• Submit Chapter 2, 4 and 5
April
• Discussion on Chapter 2, 4 and 5
• Submit 6 and 7
May
• Discussion on Chapter 6 and 7
• Submit 8 and 9
June
• Discussion on Chapter 8 and 9
• Submit 10
July
• Discussion on 10
• Draft Regional Flood Plan Approval
August- Draft Regional Flood Plan due August 1
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DRAFT Technical Memorandum Addendum

TO:	Mr. Jeff Walker, Executive Administrator Texas Water Development Board Stephen F. Austin Building 1700 N. Congress Avenue, 6th Floor Austin, Texas 78701	DATE:	Draft: February 16, 2022 To be submitted to TWDB on March 7, 2022
THROUGH	Chris Brown Executive Director Ark-Tex Council of Government 4808 Elizabeth Street Texarkana, TX 75503	AVO:	TWDB Contract No. 2101792501 Halff AVO 43790.001
FROM:	Joshua McClure, PhD, PE, CFM, PMP 3803 Parkwood Blvd. Suite 800 Frisco, Texas 75034-8641	SUBJECT:	Lower Red-Sulphur-Cypress Regional Flood Plan Task 4C – Technical Memorandum Addendum

Addendum Overview

In August 2021, TWDB extended the deadline for completion and submittal of three subtasks associated with the Technical Memorandum to be submitted as an addendum by March 7, 2022. The purpose of this extension was to accommodate the delayed release of the Fathom data associated with the TWDB's floodplain quilt (TWDB Data Hub, 2021). Results presented in this memorandum are considered interim due to ongoing incorporation of best available data into the floodplain quilt. The Technical Memorandum Addendum includes:

- Existing and potential future conditions flood risk (Task 4C.1.c);
- Flood hazard data gaps and additional flood-prone areas (Task 4C.1.d); and
- Available hydrologic and hydraulic models needed to evaluate FMS's and FMP's (Task 4C.1.e)

Task 4C – Technical Memorandum Addendum Deliverables

The following sections introduce the technical memorandum addendum deliverables associated with the March 7th extension. Several additional attachments are included at the end of this document. **Table 1** indicates which subtasks and information are contained in each one.

Table 1: Technical Memorandum Addendum Attachments

Attachment	TWDB Task	Description
2,3,4	4C.1.c	A geodatabase and associated maps for: region-wide 1.0% annual chance flood event and 0.2% annual chance flood event inundation boundaries, and the source of flooding for each area, for use in its risk analysis, including indications of locations where such boundaries remain undefined. Includes TWDB-required Tables 3 and 5.
2,3	4C.1.d	A geodatabase and associated maps that identifies additional flood-prone areas not included in the floodplain quilt based on hydrologic features, historic flooding, and or local knowledge.
2,3	4C.1.e	A geodatabase and associated maps in accordance with TWDB Flood Planning guidance documents that identifies areas where existing hydrologic and hydraulic models needed to evaluate FMSs and FMPs are available

4C.1.c – Existing and potential future conditions flood risk

Existing Conditions Flood Quilt

As of May 20, 2021, TWDB provided regional planning groups with an official version of the existing conditions floodplain quilt. The quilt was provided to establish a starting point in identifying flood risk within the region. The floodplain quilt compiled flood risk boundaries from several sources.

- National Flood Hazard Layer (NFHL) Pending Data
- National Flood Hazard Layer (NFHL) Preliminary Data
- National Flood Hazard Layer Effective Data (Detailed Study Areas only)
- Estimated Base Flood Elevation Data
- National Flood Hazard Layer (NFHL) Effective Data (Approximate Study Areas only)
- First American Flood Data Services (FAFDS)

On October 29, 2021, TWDB provided the planning group with Fathom floodplain data to estimate flood risk in locations where floodplain information was unavailable. Five counties within Region 2 had no flood quilt data while most others relied on outdated, approximate Zone A floodplain maps. Region 2 relied on the following methodology to prioritize the best available floodplain data for incorporation into the floodplain quilt, with the first being considered the best and the last being considered the least reliable.

1. Local Detailed Studies
    a. Local detailed studies were included only if they are city/county-wide studies completed to FEMA or TWDB standards.
    b. To date, no such studies have been provided that have not already been incorporated into FEMA Zone AE studies.
2. FEMA Zone AE Detailed Studies
    a. These are generally considered to be high quality studies and are typically used for regulatory and insurance purposes.
    b. Hydrologic and hydraulic models and supporting data are typically available for Zone AE mapped areas, although this data is less available in older study areas
    c. In Region 2, these are limited to most of Grayson County and the larger municipalities in the area.
    d. Typically includes 1% and 0.2% annual chance floodplains.
    e. Some cities, such as Sherman, Paris, and Texarkana have previously incorporated their own detailed studies.

3. Base Level Engineering (BLE)
    a. BLE is an approximate study based on recent high-resolution topographic data and typically lacks detailed hydrologic modeling, bridge and culvert modeling, and other details.
    b. Hydraulic models and study documentation are available for BLE areas, although hydrologic models are not typically available because of the hydrologic estimations used in lieu of detailed modeling
    c. BLE is not considered a regulatory product, but, where available, is considered to be better quality than similarly prepared, but older Zone A floodplain maps.
    d. Includes 1% and 0.2% annual chance floodplains.
    e. Currently, BLE is only available within the Lower Red River Basin portion of Region 2.
4. FEMA Zone A Approximate Studies
    a. FEMA Zone A floodplains are typically based on approximate hydrologic and hydraulic methods without floodplain details, such as bridges.
    b. Models are not usually available for such areas.
    c. The topographic data used to develop this mapping usually lower resolution and several decades older than that used for BLE mapping.
    d. Typically only includes 1% annual chance floodplains.
    e. For these reasons, FEMA Zone A floodplain is considered of lower reliability for flood planning than BLE in Region 2
    f. Zone As are a regulatory product and hold more weight in flood insurance rates and determinations.
    g. Zone As make up most of the effective floodplain mapping that is available in the region.
5. Fathom Cursory Floodplain Dataset
    a. Data sets provided by TWDB as a cursory floodplain dataset to be used in areas lacking other floodplain mapping.
    b. Includes 1% and 0.2% annual chance floodplains.
    c. Developed using recent, but moderately detailed topography.
    d. Developed using a proprietary, third-party methodology, that has not yet been vetted against FEMA standards.
    e. No modeling is publicly available for Fathom floodplains.
    f. For these reasons, Fathom is being used only where floodplain data does not exist:
        i. Fluvial
            1. Riverine/Channel flooding, similar to areas typically mapped by FEMA.
            2. Data will be used where no other floodplain data was available (Camp, Delta, Franklin, Marion and Morris Counties)
            3. Was used to replace FAFDS data.
        ii. Pluvial
            1. More upland/urban flooding than typically mapped by FEMA
            2. Fathom Pluvial data was added to all portions of the region to extend mapping beyond the typical FEMA mapping limits in order to more fully capture flood risks in the region.

This methodology was modified slightly from that proposed in the initial January 7 Technical Memo submittal by raising the prioritization of BLE above Zone A floodplains. An existing conditions flood hazard quilt was assembled using this prioritization approach and was made available, via a web map interface, to the RFPG, public and

stakeholders between January 24 and February 24, 2022. Public comments from this and the RFPG meetings will be considered in the final flood plan.

Future Conditions Flood Quilt

The future condition methodology was based on Method 2 from the TWDB-approved Region 3 *Potential Future Conditions Flood Risk Methodology Memorandum* dated January 7, 2022, included as **Attachment 1**. Since limited hydrologic data is available in the basin, predicting future conditions is not feasible using currently available data. Therefore, the existing 0.2% annual chance floodplain was used as a proxy for the future 1.0% annual chance floodplain. This should be a conservatively high estimate of the impacts of development and climate change within Region 2, which are expected to have minimal impacts compared to other regions that are rapidly developing and experiencing more significant climate impacts.

Future 0.2% annual chance floodplain was developed using the horizontal buffer approach described in the Region 3 *Potential Future Conditions Flood Risk Methodology Memo*. The underlying assumption of this method is that if the existing 0.2% AC floodplain is a reasonable proxy for the future 1% AC floodplain, then a similar offset could be used to estimate the future 0.2% AC flood floodplain. A Region 2 specific analysis was conducted to determine this 0.2% AC buffer by comparing existing 0.1% and 0.2% AC floodplains to determine the average offset. Newly published Base Level Engineering data was analyzed, measuring cross-section distances between the existing 1.0% and 0.2% AC. The median distance between over 11,400 cross-sections was 22'. The future 0.2% annual chance area has been estimated by buffering the future 1.0% annual chance area 22 feet. Future flood condition methodology was presented to the RFPG February 10, 2022 and results were shown at the March 3, 2022 meeting.

Exposure and Vulnerability Analysis

On December 1, 2021, TWDB supplied the planning groups with the final buildings dataset to be used for the existing and future conditions flood exposure analysis. Exposure analysis was performed to determine the number of at-risk structures (buildings, roadways, critical facilities, etc.), population estimates, the length of impacted roadways and area of agricultural land contained within the previously developed existing and potential future flood hazard boundary. **Table 3** provides overall Lower Red Sulphur Cypress flood exposure results.

Table 2: Region 2 Existing and Potential Future Flood Exposure Analysis Results

Potential Flood Risk Event	Number of At-Risk Structures	Number of At-Risk Critical Facilities	Number of Roadway-Stream Crossings*	Impacted Agricultural Area (sq. mi.)
Existing 1% Annual Chance (100-year)	13,438	160	2,882	283
Future 1% Annual Chance (100-year)	15,023	166	2,927	299

**includes all locations of stream and road intersections*

Following the exposure analysis, a vulnerability analysis was performed for both existing and potential future conditions using the Social Vulnerability Index (SVI) dataset. The vulnerability analysis was performed to assess a community's resilience, with values closer to 1 denoting greater vulnerability.

The flood risk analyses (existing and potential future flood risk, exposure, and vulnerability) for this submittal are considered interim. TWDB-required **Table 3** and **Table 5** located in **Attachment 2** provide the results per county of the existing and future exposure and vulnerability analysis as outlined in the Technical Guidelines for Regional Flood Planning. A geodatabase and associated maps are provided in **Attachment 3** as digital data.

4C.1.d – Flood hazard data gaps and additional flood-prone areas

During review of the final floodplain quilt, a flood hazard data gap assessment was performed. Preliminary analysis identified gaps as areas with no prior mapping or recent detailed studies, which consists of most of the region except for the cities of Sherman, Paris, and Texarkana. An ongoing effort is being made to determine the validity of the associated hydrologic and hydraulic modeling in areas of greater risk.

In addition to incorporation of recently published BLE data and the Fathom dataset, a region-wide data collection and outreach effort was made to identify flood-prone areas. These areas were identified by the region's stakeholders along with public datasets and are based on hydrologic features, historic flooding, and local knowledge. These areas were all predominately captured by the revised flood quilt and there are no plans to modify the quilt accordingly, unless additional data is provided by stakeholders. A data gaps and additional flood-prone area feature class and associated **Maps 5 and 9** are provided in **Attachments 2 and 3** as digital data.

4C.1.e – Available hydrologic and hydraulic models needed to evaluate FMS's and FMP's.

A list of previous studies containing modeling data was submitted as part of the January 7, 2022 Technical Memorandum. The location of these studies were added to a geodatabase to provide a georeferenced representation of model- backed study areas for use when conducting FMS and FMP evaluations. It should be noted that for use in developing an FMS or FMP, these models will need some level of enhancement to provide fully detailed flood risk reduction evaluations per TWDB technical requirements. Available model locations geodatabase and associated **Map 13** are provided in **Attachment 3** as digital data.

4C.1.c,d,e – Technical Memorandum Addendum Geodatabase and Tables

As outlined in the TWDB Extension of Time to Complete Technical Memorandum dated August 17, 2021 and associated Technical Memorandum Data Deliverable Clarification dated October 29, 2021, documentation in **Attachment 3** outlines geodatabase deliverables included in this Technical Memorandum as well as spatial files and tables. Specific data deliverables align with the TWDB's Exhibit D: Data Submittal Guidelines for Regional Flood Planning. The geodatabase files require ArcGIS software to be used to view the files. The RFPG can provide these files to anyone requesting said files by emailing rfpg2@halff.com. Please keep in mind that these files will continue to be updated and enhanced throughout the development of the Regional Flood Plan and simply reflect a snapshot in time of the project as it stands today.

Attachment 1

Task 4C.1c – Potential Future Conditions Flood Risk Methodology Memorandum

Attachment 2

Task 4C.1c, 4C.1d – TWDB Required Table 3 and Table 5, Maps 4-13

- Map 4: Existing Condition Flood Hazard (2.2.A.1 Existing condition flood hazard analysis)
- Map 5: Existing Condition Flood Hazard - Gaps in Inundation Boundary Mapping and Identify Known Flood-Prone Areas (2.2.A.1 Existing condition flood hazard analysis)
- Map 6: Existing Condition Flood Exposure (2.2.A.2 Existing condition flood exposure analysis)
- Map 7: Existing Condition Vulnerability and Critical Infrastructure (2.2A.3 Existing condition vulnerability analysis)
- Map 8: Future Condition Flood Hazard (2.2.B.1 Future condition flood hazard analysis)
- Map 9: Future Condition Flood Hazard - Gaps in Inundation Boundary Mapping and Identify Known Flood-Prone Areas (2.2.B.1 Future condition flood hazard analysis)
- Map 10: Extent of Increase of Flood Hazard Compared to Existing Condition (2.2.B.1 Future condition flood hazard analysis)
- Map 11: Future Condition Flood Exposure (2.2.B.2 Future condition flood exposure analysis)
- Map 12: Future Condition Vulnerability and Critical Infrastructure (2.2.B.3 Future condition vulnerability analysis)
- Map 13- Map showing where existing hydrologic and hydraulic models needed to evaluate FMSs and FMPs are available

Due to the file sizes of the draft figures, they are available for individual download at the following link: https://halff-my.sharepoint.com/:f:/p/ah4115/EiIKqJL_5FVLoqC_bvnxeYYBccg5j1O2nBIDcQf-IlOg3A?e=SE0M3V

Because this document is intended to show progress towards the development of the draft regional flood plan, these figures will be removed from the link on March 7, 2022 when the Technical Memorandum Addendum is submitted to the Texas Water Development Board. Updated versions of these figures will be included in the draft flood plan.

Attachment 3

Task 4C – Geodatabase

This March 7, 2022 Technical Memorandum Addendum submittal for the Lower Red-Sulphur-Cypress Basin incudes the following geodatabases named:

- FPR02_GIS_Data_03072022.gdb,
- FPR02_Addl_TechMemoData03072022.gdb
- 02_RFP_ExhibitC_Table3_5.xlsx

The geodatabases are populated with the layers and tables below:

Item Name	Description	Feature Class Name	Data Format Polygon/Line/ Point/GDB Table
Existing Flood Hazard	Perform existing condition flood hazard analyses to determine the location and magnitude of both 1.0% annual chance and 0.2% annual chance flood events	ExFldHazard	Polygon
Flood Mapping Gaps	Gaps in inundation boundary mapping	Fld_Map_Gaps	Polygon
Existing Exposure	Gaps in inundation boundary mapping Develop high-level, region-wide, and largely GIS-based existing condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events	ExFldExpPol	Polygon
	Develop high-level, region-wide, and largely GIS-based existing condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events	ExFldExpLn	Polyline

Item Name	Description	Feature Class Name	Data Format Polygon/Line/ Point/GDB Table
	Develop high-level, region-wide, and largely GIS-based existing condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events	ExFldExpPt	Point
	Combines the Exposure Poly, Line, and Point data into a single master layer, also includes Vulnerability data	ExFldExpAll	Point
Future Flood Hazard	Perform future condition flood hazard analyses to determine the location and magnitude of both 1.0% annual chance and 0.2% annual chance flood events	FutFldHazard	Polygon
Future Exposure	Perform future condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events	FutFldExpPol	Polygon
	Perform future condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events	FutFldExpLn	Polyline
	Perform future condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region	FutFldExpPt	Point

Item Name	Description	Feature Class Name	Data Format Polygon/Line/ Point/GDB Table
	for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events		
	Combines the Exposure Poly, Line, and Point data into a single master layer, also includes Vulnerability data	FutFldExpAll	Point
Existing H&H Models (Addl_TechMemoData.gdb)	Shows boundaries of where existing hydrologic and hydraulic models needed to evaluate FMSs and FMPs are available	Exis_HH_Models	Polygon
Flood Prone Areas (Addl_TechMemoData.gdb)	Known, reported flood prone areas, from public input process	Reported_FloodProneAreas	Polygon

DRAFT Technical Memorandum Addendum

TO:	Mr. Jeff Walker, Executive Administrator Texas Water Development Board Stephen F. Austin Building 1700 N. Congress Avenue, 6th Floor Austin, Texas 78701	DATE:	Draft: February 16, 2022 To be submitted to TWDB on March 7, 2022
THROUGH	Chris Brown Executive Director Ark-Tex Council of Government 4808 Elizabeth Street Texarkana, TX 75503	AVO:	TWDB Contract No. 2101792501 Halff AVO 43790.001
FROM:	Joshua McClure, PhD, PE, CFM, PMP 3803 Parkwood Blvd. Suite 800 Frisco, Texas 75034-8641	SUBJECT:	Lower Red-Sulphur-Cypress Regional Flood Plan Task 4C – Technical Memorandum Addendum

Addendum Overview

In August 2021, TWDB extended the deadline for completion and submittal of three subtasks associated with the Technical Memorandum to be submitted as an addendum by March 7, 2022. The purpose of this extension was to accommodate the delayed release of the Fathom data associated with the TWDB's floodplain quilt (TWDB Data Hub, 2021). Results presented in this memorandum are considered interim due to ongoing incorporation of best available data into the floodplain quilt. The Technical Memorandum Addendum includes:

- Existing and potential future conditions flood risk (Task 4C.1.c);
- Flood hazard data gaps and additional flood-prone areas (Task 4C.1.d); and
- Available hydrologic and hydraulic models needed to evaluate FMS's and FMP's (Task 4C.1.e)

Task 4C – Technical Memorandum Addendum Deliverables

The following sections introduce the technical memorandum addendum deliverables associated with the March 7th extension. Several additional attachments are included at the end of this document. **Table 1** indicates which subtasks and information are contained in each one.

Table 1: Technical Memorandum Addendum Attachments

Attachment	TWDB Task	Description
2,3,4	4C.1.c	A geodatabase and associated maps for: region-wide 1.0% annual chance flood event and 0.2% annual chance flood event inundation boundaries, and the source of flooding for each area, for use in its risk analysis, including indications of locations where such boundaries remain undefined. Includes TWDB-required Tables 3 and 5.
2,3	4C.1.d	A geodatabase and associated maps that identifies additional flood-prone areas not included in the floodplain quilt based on hydrologic features, historic flooding, and or local knowledge.
2,3	4C.1.e	A geodatabase and associated maps in accordance with TWDB Flood Planning guidance documents that identifies areas where existing hydrologic and hydraulic models needed to evaluate FMSs and FMPs are available

4C.1.c – Existing and potential future conditions flood risk

Existing Conditions Flood Quilt

As of May 20, 2021, TWDB provided regional planning groups with an official version of the existing conditions floodplain quilt. The quilt was provided to establish a starting point in identifying flood risk within the region. The floodplain quilt compiled flood risk boundaries from several sources.

- National Flood Hazard Layer (NFHL) Pending Data
- National Flood Hazard Layer (NFHL) Preliminary Data
- National Flood Hazard Layer Effective Data (Detailed Study Areas only)
- Estimated Base Flood Elevation Data
- National Flood Hazard Layer (NFHL) Effective Data (Approximate Study Areas only)
- First American Flood Data Services (FAFDS)

On October 29, 2021, TWDB provided the planning group with Fathom floodplain data to estimate flood risk in locations where floodplain information was unavailable. Five counties within Region 2 had no flood quilt data while most others relied on outdated, approximate Zone A floodplain maps. Region 2 relied on the following methodology to prioritize the best available floodplain data for incorporation into the floodplain quilt, with the first being considered the best and the last being considered the least reliable.

1. Local Detailed Studies
    a. Local detailed studies were included only if they are city/county-wide studies completed to FEMA or TWDB standards.
    b. To date, no such studies have been provided that have not already been incorporated into FEMA Zone AE studies.
2. FEMA Zone AE Detailed Studies
    a. These are generally considered to be high quality studies and are typically used for regulatory and insurance purposes.
    b. Hydrologic and hydraulic models and supporting data are typically available for Zone AE mapped areas, although this data is less available in older study areas
    c. In Region 2, these are limited to most of Grayson County and the larger municipalities in the area.
    d. Typically includes 1% and 0.2% annual chance floodplains.
    e. Some cities, such as Sherman, Paris, and Texarkana have previously incorporated their own detailed studies.

3. Base Level Engineering (BLE)
    a. BLE is an approximate study based on recent high-resolution topographic data and typically lacks detailed hydrologic modeling, bridge and culvert modeling, and other details.
    b. Hydraulic models and study documentation are available for BLE areas, although hydrologic models are not typically available because of the hydrologic estimations used in lieu of detailed modeling
    c. BLE is not considered a regulatory product, but, where available, is considered to be better quality than similarly prepared, but older Zone A floodplain maps.
    d. Includes 1% and 0.2% annual chance floodplains.
    e. Currently, BLE is only available within the Lower Red River Basin portion of Region 2.
4. FEMA Zone A Approximate Studies
    a. FEMA Zone A floodplains are typically based on approximate hydrologic and hydraulic methods without floodplain details, such as bridges.
    b. Models are not usually available for such areas.
    c. The topographic data used to develop this mapping usually lower resolution and several decades older than that used for BLE mapping.
    d. Typically only includes 1% annual chance floodplains.
    e. For these reasons, FEMA Zone A floodplain is considered of lower reliability for flood planning than BLE in Region 2
    f. Zone As are a regulatory product and hold more weight in flood insurance rates and determinations.
    g. Zone As make up most of the effective floodplain mapping that is available in the region.
5. Fathom Cursory Floodplain Dataset
    a. Data sets provided by TWDB as a cursory floodplain dataset to be used in areas lacking other floodplain mapping.
    b. Includes 1% and 0.2% annual chance floodplains.
    c. Developed using recent, but moderately detailed topography.
    d. Developed using a proprietary, third-party methodology, that has not yet been vetted against FEMA standards.
    e. No modeling is publicly available for Fathom floodplains.
    f. For these reasons, Fathom is being used only where floodplain data does not exist:
        i. Fluvial
            1. Riverine/Channel flooding, similar to areas typically mapped by FEMA.
            2. Data will be used where no other floodplain data was available (Camp, Delta, Franklin, Marion and Morris Counties)
            3. Was used to replace FAFDS data.
        ii. Pluvial
            1. More upland/urban flooding than typically mapped by FEMA
            2. Fathom Pluvial data was added to all portions of the region to extend mapping beyond the typical FEMA mapping limits in order to more fully capture flood risks in the region.

This methodology was modified slightly from that proposed in the initial January 7 Technical Memo submittal by raising the prioritization of BLE above Zone A floodplains. An existing conditions flood hazard quilt was assembled using this prioritization approach and was made available, via a web map interface, to the RFPG, public and

stakeholders between January 24 and February 24, 2022. Public comments from this and the RFPG meetings will be considered in the final flood plan.

Future Conditions Flood Quilt

The future condition methodology was based on Method 2 from the TWDB-approved Region 3 *Potential Future Conditions Flood Risk Methodology Memorandum* dated January 7, 2022, included as **Attachment 1**. Since limited hydrologic data is available in the basin, predicting future conditions is not feasible using currently available data. Therefore, the existing 0.2% annual chance floodplain was used as a proxy for the future 1.0% annual chance floodplain. This should be a conservatively high estimate of the impacts of development and climate change within Region 2, which are expected to have minimal impacts compared to other regions that are rapidly developing and experiencing more significant climate impacts.

Future 0.2% annual chance floodplain was developed using the horizontal buffer approach described in the Region 3 *Potential Future Conditions Flood Risk Methodology Memo*. The underlying assumption of this method is that if the existing 0.2% AC floodplain is a reasonable proxy for the future 1% AC floodplain, then a similar offset could be used to estimate the future 0.2% AC flood floodplain. A Region 2 specific analysis was conducted to determine this 0.2% AC buffer by comparing existing 0.1% and 0.2% AC floodplains to determine the average offset. Newly published Base Level Engineering data was analyzed, measuring cross-section distances between the existing 1.0% and 0.2% AC. The median distance between over 11,400 cross-sections was 22'. The future 0.2% annual chance area has been estimated by buffering the future 1.0% annual chance area 22 feet. Future flood condition methodology was presented to the RFPG February 10, 2022 and results were shown at the March 3, 2022 meeting.

Exposure and Vulnerability Analysis

On December 1, 2021, TWDB supplied the planning groups with the final buildings dataset to be used for the existing and future conditions flood exposure analysis. Exposure analysis was performed to determine the number of at-risk structures (buildings, roadways, critical facilities, etc.), population estimates, the length of impacted roadways and area of agricultural land contained within the previously developed existing and potential future flood hazard boundary. **Table 3** provides overall Lower Red Sulphur Cypress flood exposure results.

Table 2: Region 2 Existing and Potential Future Flood Exposure Analysis Results

Potential Flood Risk Event	Number of At-Risk Structures	Number of At-Risk Critical Facilities	Number of Roadway-Stream Crossings*	Impacted Agricultural Area (sq. mi.)
Existing 1% Annual Chance (100-year)	13,438	160	2,882	283
Future 1% Annual Chance (100-year)	15,023	166	2,927	299

**includes all locations of stream and road intersections*

Following the exposure analysis, a vulnerability analysis was performed for both existing and potential future conditions using the Social Vulnerability Index (SVI) dataset. The vulnerability analysis was performed to assess a community's resilience, with values closer to 1 denoting greater vulnerability.

The flood risk analyses (existing and potential future flood risk, exposure, and vulnerability) for this submittal are considered interim. TWDB-required **Table 3** and **Table 5** located in **Attachment 2** provide the results per county of the existing and future exposure and vulnerability analysis as outlined in the Technical Guidelines for Regional Flood Planning. A geodatabase and associated maps are provided in **Attachment 3** as digital data.

4C.1.d – Flood hazard data gaps and additional flood-prone areas

During review of the final floodplain quilt, a flood hazard data gap assessment was performed. Preliminary analysis identified gaps as areas with no prior mapping or recent detailed studies, which consists of most of the region except for the cities of Sherman, Paris, and Texarkana. An ongoing effort is being made to determine the validity of the associated hydrologic and hydraulic modeling in areas of greater risk.

In addition to incorporation of recently published BLE data and the Fathom dataset, a region-wide data collection and outreach effort was made to identify flood-prone areas. These areas were identified by the region's stakeholders along with public datasets and are based on hydrologic features, historic flooding, and local knowledge. These areas were all predominately captured by the revised flood quilt and there are no plans to modify the quilt accordingly, unless additional data is provided by stakeholders. A data gaps and additional flood-prone area feature class and associated **Maps 5 and 9** are provided in **Attachments 2 and 3** as digital data.

4C.1.e – Available hydrologic and hydraulic models needed to evaluate FMS's and FMP's.

A list of previous studies containing modeling data was submitted as part of the January 7, 2022 Technical Memorandum. The location of these studies were added to a geodatabase to provide a georeferenced representation of model- backed study areas for use when conducting FMS and FMP evaluations. It should be noted that for use in developing an FMS or FMP, these models will need some level of enhancement to provide fully detailed flood risk reduction evaluations per TWDB technical requirements. Available model locations geodatabase and associated **Map 13** are provided in **Attachment 3** as digital data.

4C.1.c,d,e – Technical Memorandum Addendum Geodatabase and Tables

As outlined in the TWDB Extension of Time to Complete Technical Memorandum dated August 17, 2021 and associated Technical Memorandum Data Deliverable Clarification dated October 29, 2021, documentation in **Attachment 3** outlines geodatabase deliverables included in this Technical Memorandum as well as spatial files and tables. Specific data deliverables align with the TWDB's Exhibit D: Data Submittal Guidelines for Regional Flood Planning. The geodatabase files require ArcGIS software to be used to view the files. The RFPG can provide these files to anyone requesting said files by emailing rfpg2@halff.com. Please keep in mind that these files will continue to be updated and enhanced throughout the development of the Regional Flood Plan and simply reflect a snapshot in time of the project as it stands today.

Attachment 1

Task 4C.1c – Potential Future Conditions Flood Risk Methodology Memorandum

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MEMORANDUM

TO:	Texas Water Development Board Regional Flood Planning 1700 N Congress Ave Austin, TX 78701	DATE:	January 7, 2022
FROM:	Halff Associates, Inc. 4000 Fossil Creek Road Fort Worth, TX 76137	AVO:	43791
SUBJECT:	Flood Planning Data **Future Conditions Mapping**		

INTRODUCTION

For the 2020 – 2023 planning cycle, Regional Flood Planning Groups (RFPGs) are tasked with performing a future condition flood analysis to determine the potential location of both 1-percent (100-year) and 0.2 percent (500-year) annual-chance flood hazard. The estimated floodplain changes will be used solely for the purpose of estimating the general magnitude of potential future increases in flood risk under the equivalent of a "do-nothing" or "no-action" alternative and within the regional flood planning context will not, in any way, be used for developing new flood extent maps for any regulatory purposes.

In areas where future condition flood hazard data is not already available, Exhibit C of the Technical Guidelines for Regional Flood Planning outlines the following 4 methods for performing future condition flood identification.

1. Method 1: Increase water surface elevation based on projected percent population increase (as proxy for development of land areas)
2. Method 2: Utilize the existing condition 0.2 percent annual chance floodplain as a proxy for the future 1 percent level
3. Method 3: Combination of methods 1 and 2 or an RFPG-proposed method
4. Method 4: Request TWDB perform a Desktop Analysis

CONSIDERATIONS FOR DEVELOPING FUTURE CONDITIONS FLOOD RISK

When developing a predicative assessment for future conditions flood risk, Texas Water Development Board (TWDB) suggested each region consider two major factors: Unmitigated Population Increase and Projected Future Rainfall.

Population Increase

Within the Trinity River watershed region, concentrated population growth is predicted to occur within locations along the upper, mid, and lower region areas. The TWDB's Water User Group projects that within the upper portion of the region, ten (10) Dallas/Fort Worth surrounding communities could experience over 300% increase in

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population over the next 30 years. Larger communities, such as Athens and Corsicana within the mid basin area are projected to experience over 30% population growth. The lower region is expected to see overflow growth from Harris County, with significant growth occurring in Dayton and Liberty. Population growth generally correlates to an increase in urbanization. This, in turn, leads to an increase in impervious ground cover as land use changes. Unmitigated, urbanized areas will increase watershed rainfall runoff leading to higher water surface elevations in the region's rivers, creeks, and channels during extreme rainfall events.

Projected Future Rainfall

The other factor TWDB suggested the planning group consider when estimating future flood risk is future rainfall patterns. To aid the regional planning groups, the Office of the Texas State Climatologist provided TWDB with guidance on how to incorporate projected future rainfall in their April 16, 2021 report, titled *"Climate Change Recommendations for Regional Flood Planning."* The report states that 1-day 100-year rainfall amounts increased by approximately 15% between 1960 and 2020. The climatologist coupled historic rainfall data with results from climate models to develop a relationship between extreme rainfall amounts and future increases in global temperature. Percent increase in future precipitation was developed for both urbanized and rural watershed conditions. Due to the uncertainty of predicting weather patterns for extreme rainfall events, the climatologist provided a minimum and maximum range for estimating future rainfall increases. The climatologist found even more uncertainty when analyzing rural and large river catchments due to future decreases in soil moisture. This led them to providing a percent decrease as a minimum range. The climatologist recommendations for future percent rainfall increase are provided in Table 1.

Table 1: Range of Potential Future Rainfall Increase 2050-2060

Location	Range -Minimum	Range -Maximum
Urban Areas	12%	20%
Rural Areas/River	-5%	10%

CASE STUDIES - FUTURE CONDITIONS FLOOD RISK

In order to obtain a better understanding of how future conditions affect extreme rainfall flood risk within the Trinity region, preexisting available hydrologic and hydraulic models containing future flood risk data were analyzed. Results from these studies served as an estimation of how future land use and climate change impact floodplain elevations and widths when compared to existing conditions. Comparable studies were chosen based on availability, location, and similar hydrologic/hydraulic parameters. Figure 1 provides a location for the existing studies collected for this assessment.

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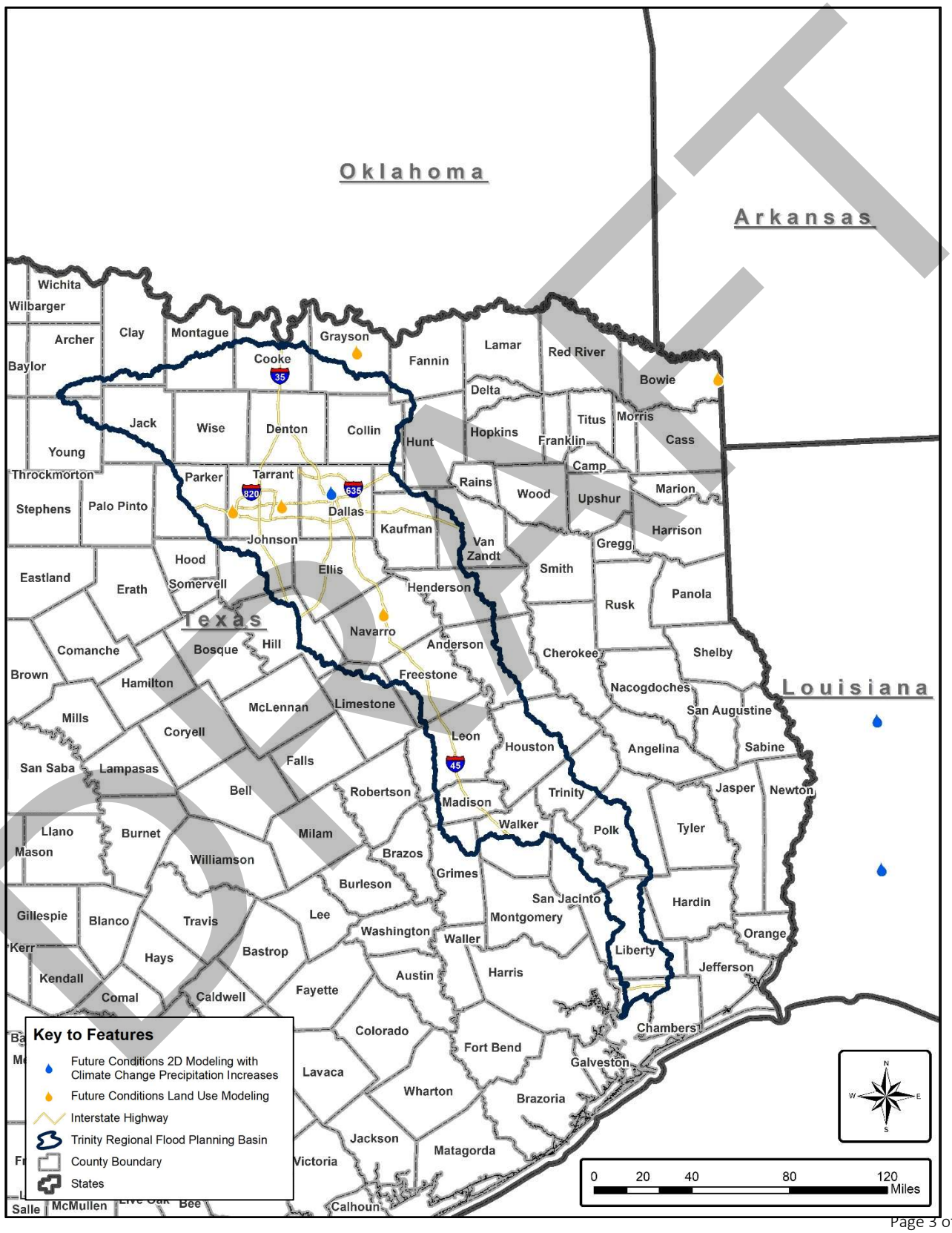

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Figure 1: Case Study Locations

Future Conditions - Land Use Studies

Five (5) drainage/floodplain master plans were utilized to assess potential flood risk increases due to future fully developed land use conditions. The future conditions analysis for these studies did not consider potential increases to rainfall data and are therefore based on land use changes only. A comparison was made between the existing and future conditions 100-year flood elevations. In addition to the future 100-year comparison, a flood elevation comparison was made between the existing 100-year and 500-year storm events to analyze the viability of utilizing Method 2 for future flood hazard data for this planning cycle. Results of the comparisons are provided in Table 2.

Table 2: Future Conditions Land Use Water Surface Elevation (WSEL) Comparison

Location	Flooding Source	Average WSEL Change Existing Vs Future 100yr (ft)	Average WSEL Change Existing 100yr vs 500yr (ft)
Parker County	Marys Creek	0.1	0.8
Grand Prairie	Fish, Kirby, Rush, Prairie Creek	0.2	1.4
Sherman	Post Oak, EF Post Oak, Sand Creek	0.7	1.0
Texarkana	Wagner, Swampoodle, Corral Creek	0.6	1.8
Corsicana	Post Oak, SF Post Oak, Mesquite Creek	0.2	1.0
Average		***0.4***	***1.2***

Future Conditions – Projected Future Rainfall

During the data collection phase, the consultant team was unable to obtain studies that analyzed future flood risk based on potential future rainfall predictions. As a substitute, two (2) large scale rain on grid studies were obtained: Dallas City-Wide Watershed Masterplan and the FEMA Louisiana Upper Calcasieu Base Level Engineering Analysis. The modeling methodology of these studies allowed for rainfall data to be quickly modified in accordance with the recommendations from the state climatologists. The 100-year storm event rainfall was increased by 15% for both studies and the flood elevation results were compared to the present-day conditions. The increase of 15% was chosen because it fell into the high range of rainfall increases and matched the historic period of record increase. The existing 100-year and 500-year flood elevations were also compared for the Method 2 consideration. Results of the comparisons are provided in Table 3.

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Table 3: Future Rainfall Increase WSEL Comparison

Location	Average WSEL Change Existing Vs Future 100yr (ft)	Average WSEL Change Existing 100yr vs 500yr (ft)
Dallas	0.2	Unavailable*
Upper Calcasieu	0.4	1.7
Average	***0.3***	***N/A***

** Dallas Watershed Master Plan only considered the 100-year storm event*

REGION 3 FUTURE CONDITIONS FLOOD HAZARD APPROACH

Potential Future 100-Year Flood Hazard Methodology

The potential future conditions 100-year flood hazard approach methodologies were discussed during the September 23, 2021 Region 3 RFPG meeting. Advantages and disadvantages of each methodology along with the results of the case studies were presented for consideration. Due to the relatively large coverage of adequate existing 500-year floodplain data within the region, Method 2 was considered the most reasonable approach. The planning group had reservations about the usage of the existing 500-year as a potential future 100-year flood risk proxy due to the case studies showing the floodplain may be too conservative of an approach.

From the future conditions land use case study results, the average change in potential future 100-year WSEL compared to existing conditions was only 0.4 feet while the comparison between the existing 100-year and existing 500-year water surface elevations yielded an average 1.2 feet change. By Increasing the average change in WSEL between existing and potential future conditions from Table 2 by the average taken from Table 3 to account for future rainfall projections, the results generally yielded a comparison less than that of the differences between the existing 100-year and existing 500-year water surface elevation.

The planning group also had concerns about the potential for Region 3 entities (communities and/or insurance companies) to mistakenly use the data for regulatory purposes. As a solution to both concerns, the planning group proposed that the potential future 100-year floodplain should be presented in this planning cycle as a range between the existing 100-year and the existing 500-year (zone of potential expanded risk). The methodology complies with the Method 2 approach and covers the uncertainty and variability resulting from the case study

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analysis. The exposure and vulnerability assessment data would be extracted from the maximum potential future 100-year floodplain limit.

Potential Future 500-Year Flood Hazard Methodology

The potential future conditions 500-year flood hazard approach methodology was discussed during the December 17, 2021 Region 3 RFPG meeting. Under Method 2 in the TWDB Technical Guidelines, an excerpt regarding the determination of the future 500-year flood hazard states*: "RFPGs will have to utilize an alternate approach to develop a proxy for the 0.2 percent annual chance future condition floodplain, such as adding freeboard (vertical) or buffer (horizontal) estimates. The decision on what specific approach or values to use, which may vary within the region (e.g., for urban vs rural areas), for these estimates will be up to the RFPGs, but technical justification should be provided to explain how the estimates were developed. This method cannot be applied to flood risk areas that do not already have a delineated existing condition 0.2 percent annual chance floodplain, (i.e., flood-prone areas)."* Based on this statement, reasonable buffer limits were researched based on the difference in existing top widths between the 100-year and 500-year floodplain quilt within the Trinity Region. It is reasonable to assume that the difference between top widths for the existing conditions, will be similar for potential future conditions. To establish a reasonable buffer zone to represent potential future 500-year flood risk, Base Level Engineering data previously collected for the plan was analyzed. Nine (9) large-scale studies were selected to form the basis for the buffering analysis. Figure 2 shows the general location and coverage of the nine (9) studies selected.

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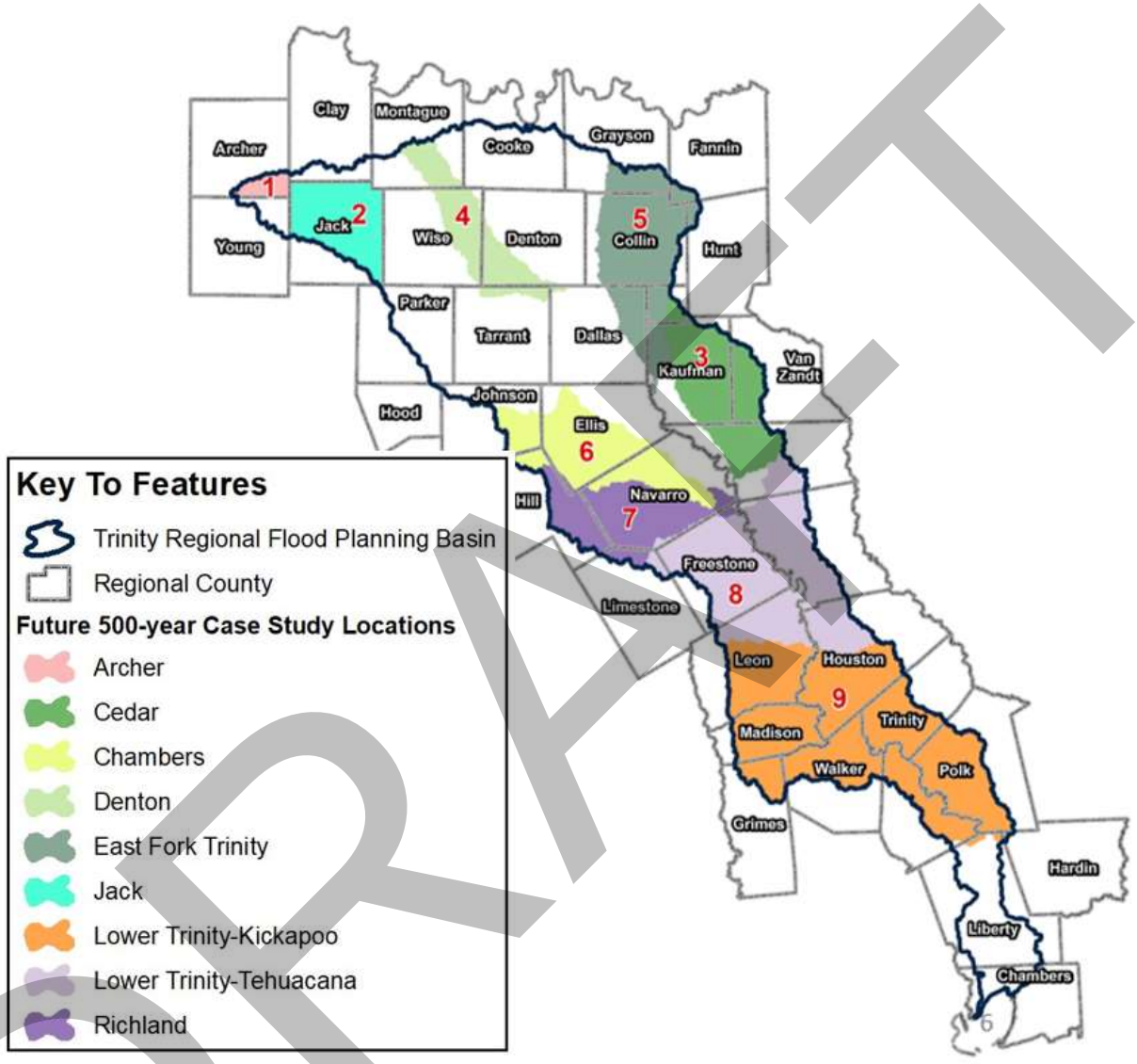

Figure 2: Future 500-year Case Study Locations

The nine (9) studies collected represent over 25,000 miles of floodplain, with over 300,000 cross-sections. Using automated means, 600,000 individual distance measurements were collected along these cross-sections between the existing 100-year and 500-year floodplains. Figure 3 shows an example of measurement locations.

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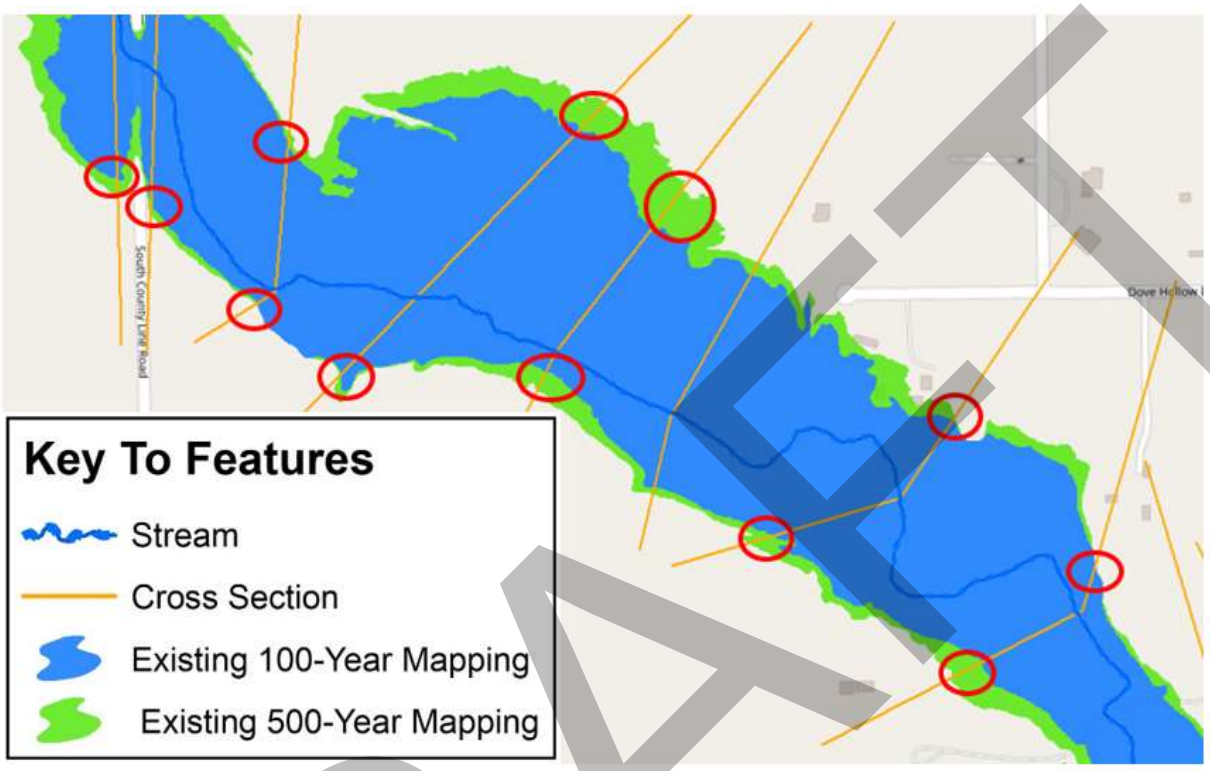

Figure 3: Measurement Locations to Develop Potential Future Condition 500-Year Flood Risk Buffer

The measurements were then averaged for each of the nine (9) study locations. The average distance measurement along the right or left overbank of the floodplain ranged from 30 feet to 50 feet. The total average overbank measurement of all nine (9) studies was determined to be approximately 40 feet, representing 80 feet total change in top width. Similar to the future 100-year flood risk boundary, the future 500-year will be presented as a range between the existing 500-year flood risk boundary and the 40-foot buffer. Table 4 provides the average measurement results of the analysis.

Table 4: Average Change in Horizontal Distance

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Location	Average Width Change (Left or Right Overbank) Existing 100yr vs 500yr (ft)
1. Archer	30.8
2. Jack	32.2
3. Denton	32.6
4. Cedar	30.8
5. East Fork Trinity	42.6
6. Chambers	37.2
7. Richland	44.5
8. Lower Trinity Tehuacana	36.3
9. Lower Trinity Kickapoo	47.6
Rounded Average	***40***

CONCLUSION

The Trinity RFPG and its consultant have developed a procedure for generating potential future 100-year and 500-year flood risk data that generally follows Method 2 of the TWDB's Technical Guidance document. The existing 500-year floodplain was selected to serve as a proxy for the potential maximum 100-year flood hazard. A 40-foot buffering of the existing 500-year flood hazard boundary was selected to serve as the potential maximum future 500-year flood hazard. Using the previously described buffering methodology for potential future 500-year conditions allows for rapid development of estimated expanded risk within the constraints of the flood plan timeline and lack of future 500-year detailed data throughout the planning area. A disadvantage of this approach is that average buffering is performed independent of topographic or water surface elevation changes. For areas with relatively flat terrain, the potential 500-year flood risk limit based on buffering may underestimate the expanded urban exposure risk. This disadvantage may be less impactful on rural floodplains whose exposure risks are large tracts of agricultural land. Table 5 shows the existing and range of potential future conditions flood risk approach summary. Figure 4 presents an example of the range of potential future flood risk.

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Table 5: Existing and Future Conditions Flood Hazard Approach

	Best Available		→		→		→		Most Approximate	
	Local Floodplain (if determined current)		NFHL AE		BLE		NFHL A / FAFDS		No FEMA or Better than Quilt	
	100YR	500YR	100YR	500YR	100YR	500YR	100YR	500YR	100YR	500YR
Existing	Local Study (if provided)	Local Study (if provided)	Floodplain quilt 100YR	Floodplain quilt 500YR	BLE 100YR	BLE 500YR	Replaced with Fathom 100YR	Replaced with Fathom 500YR	Fathom 100YR	Fathom 500YR
Future	Local Study (if provided)	Local Study (if provided)	Range between Existing 100-year and 500-year	40-foot buffer of the existing 500YR	Range between BLE Existing 100-year and 500-year	40-foot buffer of the existing 500YR	Range between Fathom Existing 100-year and 500-year	40-foot buffer of the existing 500YR	Range between Fathom Existing 100-year and 500-year	40-foot buffer of the existing 500YR

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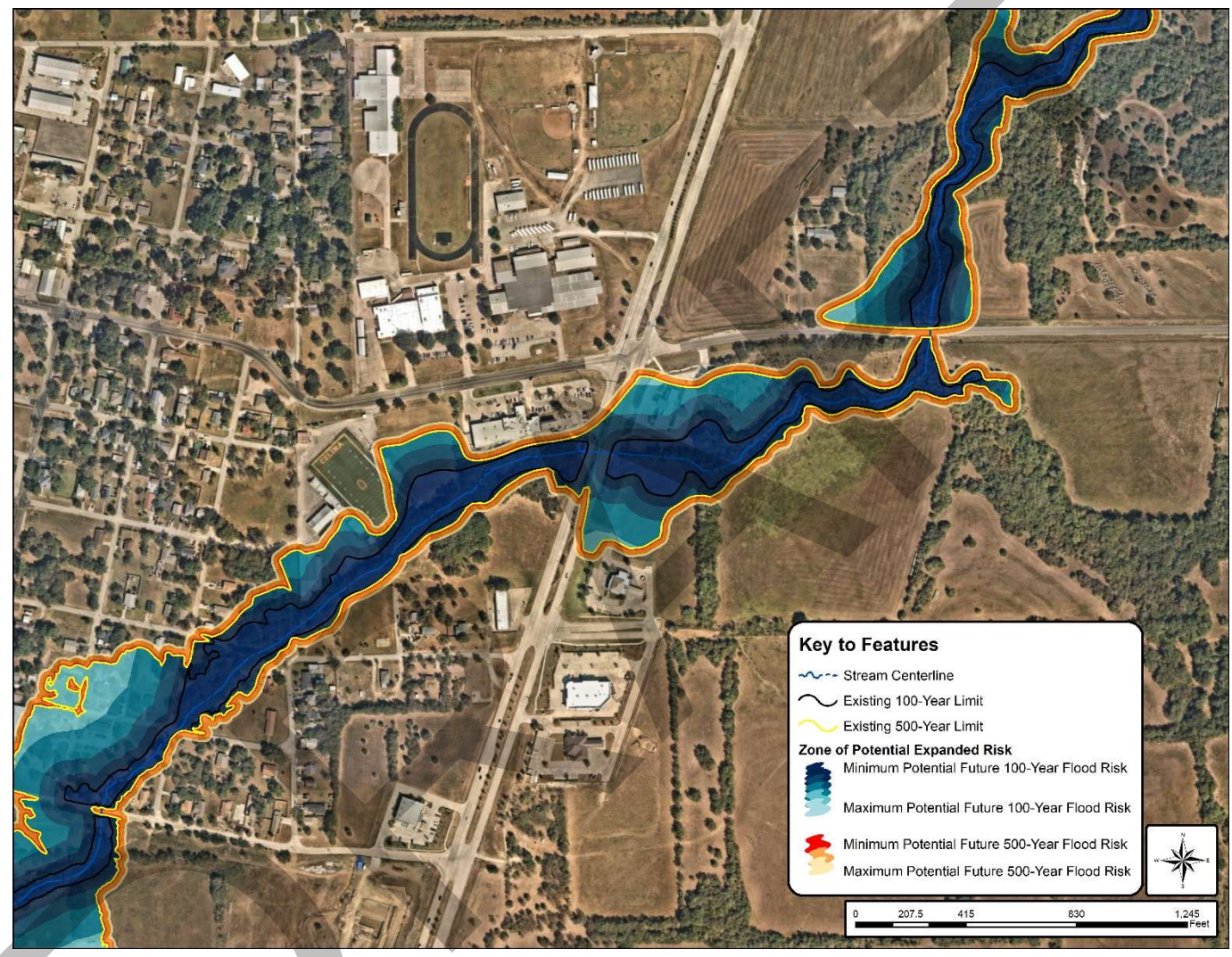

Figure 4: Example of 2020-2023 Planning Cycle Range of Potential Future Flood Risk Data

TWDB APPROVAL REQUEST

We are asking that the method discussed above be evaluated for approval to supplement future conditions mapping where data is unavailable.

Attachment 2

Task 4C.1c, 4C.1d – TWDB Required Table 3 and Table 5, Maps 4-13

- Map 4: Existing Condition Flood Hazard (2.2.A.1 Existing condition flood hazard analysis)
- Map 5: Existing Condition Flood Hazard - Gaps in Inundation Boundary Mapping and Identify Known Flood-Prone Areas (2.2.A.1 Existing condition flood hazard analysis)
- Map 6: Existing Condition Flood Exposure (2.2.A.2 Existing condition flood exposure analysis)
- Map 7: Existing Condition Vulnerability and Critical Infrastructure (2.2A.3 Existing condition vulnerability analysis)
- Map 8: Future Condition Flood Hazard (2.2.B.1 Future condition flood hazard analysis)
- Map 9: Future Condition Flood Hazard - Gaps in Inundation Boundary Mapping and Identify Known Flood-Prone Areas (2.2.B.1 Future condition flood hazard analysis)
- Map 10: Extent of Increase of Flood Hazard Compared to Existing Condition (2.2.B.1 Future condition flood hazard analysis)
- Map 11: Future Condition Flood Exposure (2.2.B.2 Future condition flood exposure analysis)
- Map 12: Future Condition Vulnerability and Critical Infrastructure (2.2.B.3 Future condition vulnerability analysis)
- Map 13- Map showing where existing hydrologic and hydraulic models needed to evaluate FMSs and FMPs are available

Due to the file sizes of the draft figures, they are available for individual download at the following link: https://halff-my.sharepoint.com/:f:/p/ah4115/EiIKqJL_5FVLoqC_bvnxeYYBccg5j1O2nBIDcQf-IlOg3A?e=SE0M3V

Because this document is intended to show progress towards the development of the draft regional flood plan, these figures will be removed from the link on March 7, 2022 when the Technical Memorandum Addendum is submitted to the Texas Water Development Board. Updated versions of these figures will be included in the draft flood plan.

DRAFT TWDB Table 3 Existing Conditions Flood Risk Summary - Technical Memorandum Attachment 2

#	County	Area in Flood Planning Region (sq mi)	1% Annual Chance Flood Risk[1]								0.2% Annual Chance Flood Risk[1]							
			Area in Floodplain (sq mi)	Number of Structures in Floodplain[2]	Residential Structures in Floodplain[2]	Population[2]	Roadway Stream Crossings (#)	Roadways Segments (miles)	Agricultural Areas (sqmi)	Critical Facilities (#)	Area in Floodplain (sq mi)	Number of Structures in Floodplain[2]	Residential Structures in Floodplain[2]	Population[2]	Roadway Stream Crossings (#)	Roadways Segments (miles)	Agricultural Areas (sqmi)	Critical Facilities (#)
1	Bowie	920.10	398.39	2,657	1,546	4,529	402	313.6	48.31	19	406.92	3,055	1,809	5,272	417	336.0	48.63	22
2	Camp	202.66	53.40	256	124	301	60	29.9	0.56	4	55.90	276	131	314	64	31.6	0.61	4
3	Cass	956.77	274.93	573	302	917	263	159.5	1.34	12	276.04	583	307	921	263	160.8	1.35	12
4	Cooke	111.18	25.22	34	20	26	20	12.7	3.06	0	27.23	38	22	30	20	13.9	3.46	0
5	Delta	277.13	96.16	120	59	82	73	41.5	22.90	2	108.19	127	62	87	74	48.6	27.55	2
6	Fannin	853.20	227.07	1,077	709	1,328	290	170.3	58.60	18	243.03	1,256	806	1,575	300	190.5	63.87	20
7	Franklin	293.47	79.20	455	341	535	61	38.6	2.46	1	87.55	555	422	713	62	40.4	2.82	1
8	Grayson	633.94	161.17	2,569	1,511	4,360	206	180.7	16.15	23	169.29	2,924	1,810	5,376	209	210.2	17.49	23
9	Gregg	28.44	5.88	58	56	76	14	3.6	0.03	0	5.91	58	56	76	15	3.8	0.03	0
10	Harrison	532.16	151.52	897	740	1,254	116	96.6	0.40	6	152.77	917	756	1,294	116	99.0	0.41	6
11	Hopkins	543.36	162.66	702	381	907	201	148.6	13.49	5	163.77	710	383	940	201	150.5	13.66	5
12	Hunt	235.01	65.51	411	282	941	220	77.2	6.62	3	66.50	432	298	1,123	220	78.9	6.89	3
13	Lamar	931.80	283.21	1,644	1,013	2,670	290	221.8	66.90	33	291.77	1,904	1,152	3,016	295	239.8	68.42	33
14	Marion	418.82	127.71	313	163	360	36	48.0	0.21	4	148.50	390	193	460	38	55.8	0.32	4
15	Morris	256.93	73.83	234	102	232	43	38.4	0.62	6	77.05	265	119	268	44	40.7	0.66	6
16	Panola	0.41	0.04	0	0	0	0	0.0	0.00	0	0.04	0	0	0	0	0.0	0.00	0
17	Red River	1,055.00	359.94	391	138	336	208	156.7	37.57	5	378.96	441	150	380	210	170.1	39.05	5
18	Titus	425.48	149.78	596	315	1,182	175	87.1	2.45	9	150.80	634	333	1,262	175	91.2	2.47	10
19	Upshur	427.79	113.79	425	250	677	183	90.8	0.96	10	114.31	432	255	688	183	92.2	0.96	10
20	Wood	56.77	11.40	26	17	10	21	8.9	0.12	0	11.44	26	17	10	21	8.9	0.13	0
	Totals		**2,821**	**13,438**	**8,069**	**20,723**	**2,882**	**1,924**	**283**	**160**	**2,936**	**15,023**	**9,081**	**23,805**	**2,927**	**2,063**	**299**	**166**
			9,160.39															

Notes:

*Population based on Night population values

DRAFT TWDB Table 5 Future Condition Flood Risk Summary - Technical Memorandum Attachment 2

#	County	Area in Flood Planning Region (sq mi)	1% Annual Chance Flood Risk[1]								0.2% Annual Chance Flood Risk[1]							
			Area in Floodplain (sq mi)	Number of Structures in Floodplain[2]	Residential Structures in Floodplain[2]	Population[2]	Roadway Stream Crossings (#)	Roadways Segments (miles)	Agricultural Areas (sqmi)	Critical Facilities (#)	Area in Floodplain (sq mi)	Number of Structures in Floodplain[2]	Residential Structures in Floodplain[2]	Population[2]	Roadway Stream Crossings (#)	Roadways Segments (miles)	Agricultural Areas (sqmi)	Critical Facilities (#)
1	Bowie	920.10	406.92	3055	1809	5272	417	336.03	48.63	22	441.80	4826	3019	9159	448	452.33	49.86	28
2	Camp	202.66	55.90	276	131	314	64	31.64	0.61	4	64.83	575	268	818	92	51.74	0.75	4
3	Cass	956.77	276.04	583	307	921	263	160.76	1.35	12	312.09	918	522	1468	283	221.63	1.66	13
4	Cooke	111.18	27.23	38	22	30	20	13.90	3.46	0	31.55	60	30	50	24	21.78	3.55	0
5	Delta	277.13	108.19	127	62	87	74	48.62	27.55	2	116.81	241	135	241	91	86.77	30.07	2
6	Fannin	853.20	243.03	1256	806	1575	300	190.47	63.87	20	275.98	1741	1128	2374	362	293.36	70.94	22
7	Franklin	293.47	87.55	555	422	713	62	40.45	2.82	1	100.92	825	595	1109	82	73.88	3.22	3
8	Grayson	633.94	169.29	2924	1810	5376	209	210.15	17.49	23	192.53	4410	3008	9353	231	307.22	19.72	31
9	Gregg	28.44	5.91	58	56	76	15	3.80	0.03	0	7.03	120	109	182	21	7.13	0.04	0
10	Harrison	532.16	152.77	917	756	1294	116	99.04	0.41	6	176.26	1237	1030	1825	123	147.55	0.49	6
11	Hopkins	543.36	163.77	710	383	940	201	150.52	13.66	5	185.58	1300	764	2226	214	211.23	15.20	7
12	Hunt	235.01	66.50	432	298	1123	220	78.88	6.89	3	74.40	737	522	1995	282	120.06	8.14	4
13	Lamar	931.80	291.77	1904	1152	3016	295	239.85	68.42	33	326.09	2892	1721	4509	333	343.15	74.95	40
14	Marion	418.82	148.50	390	193	460	38	55.82	0.32	4	165.25	544	264	697	46	81.68	0.38	6
15	Morris	256.93	77.05	265	119	268	44	40.67	0.66	6	88.26	467	220	519	66	65.73	0.80	8
16	Panola	0.41	0.04	0	0	0	0	0.00	0.00	0	0.05	0	0	0	0	0.05	0.00	0
17	Red River	1,055.00	378.96	441	150	380	210	170.09	39.05	5	423.63	768	277	713	274	250.01	41.10	10
18	Titus	425.48	150.80	634	333	1262	175	91.15	2.47	10	169.69	1147	688	2343	185	139.40	2.89	14
19	Upshur	427.79	114.31	432	255	688	183	92.15	0.96	10	131.97	751	475	1306	190	121.36	1.10	10
20	Wood	56.77	11.44	26	17	10	21	8.89	0.13	0	13.97	65	46	48	24	13.78	0.16	0
	Totals	**9,160.39**	**2,936**	**15,023**	**9,081**	**23,805**	**2,927**	**2,063**	**299**	**166**	**3,299**	**23,624**	**14,821**	**40,935**	**3,371**	**3,010**	**325**	**208**

Notes:

*Population based on Night population values

Attachment 3

Task 4C – Geodatabase

This March 7, 2022 Technical Memorandum Addendum submittal for the Lower Red-Sulphur-Cypress Basin incudes the following geodatabases named:

- FPR02_GIS_Data_03072022.gdb,
- FPR02_Addl_TechMemoData03072022.gdb
- 02_RFP_ExhibitC_Table3_5.xlsx

The geodatabases are populated with the layers and tables below:

Item Name	Description	Feature Class Name	Data Format Polygon/Line/ Point/GDB Table
Existing Flood Hazard	Perform existing condition flood hazard analyses to determine the location and magnitude of both 1.0% annual chance and 0.2% annual chance flood events	ExFldHazard	Polygon
Flood Mapping Gaps	Gaps in inundation boundary mapping	Fld_Map_Gaps	Polygon
Existing Exposure	Gaps in inundation boundary mapping Develop high-level, region-wide, and largely GIS-based existing condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events	ExFldExpPol	Polygon
	Develop high-level, region-wide, and largely GIS-based existing condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events	ExFldExpLn	Polyline

Item Name	Description	Feature Class Name	Data Format Polygon/Line/ Point/GDB Table
	Develop high-level, region-wide, and largely GIS-based existing condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events	ExFldExpPt	Point
	Combines the Exposure Poly, Line, and Point data into a single master layer, also includes Vulnerability data	ExFldExpAll	Point
Future Flood Hazard	Perform future condition flood hazard analyses to determine the location and magnitude of both 1.0% annual chance and 0.2% annual chance flood events	FutFldHazard	Polygon
Future Exposure	Perform future condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events	FutFldExpPol	Polygon
	Perform future condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events	FutFldExpLn	Polyline
	Perform future condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region	FutFldExpPt	Point

Item Name	Description	Feature Class Name	Data Format Polygon/Line/ Point/GDB Table
	for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events		
	Combines the Exposure Poly, Line, and Point data into a single master layer, also includes Vulnerability data	FutFldExpAll	Point
Existing H&H Models (Addl_TechMemoData.gdb)	Shows boundaries of where existing hydrologic and hydraulic models needed to evaluate FMSs and FMPs are available	Exis_HH_Models	Polygon
Flood Prone Areas (Addl_TechMemoData.gdb)	Known, reported flood prone areas, from public input process	Reported_FloodProneAreas	Polygon