

**NOTICE OF OPEN MEETING OF THE SAN ANTONIO REGIONAL FLOOD
PLANNING GROUP**

Region 12

05/23/2023

3:00 PM

TAKE NOTICE that a meeting of the San Antonio Regional Flood Planning Group as established by the Texas Water Development Board will be held on Tuesday, May 23, 2023, at 3:00 PM, in-person at the San Antonio River Authority, located at 100 E. Guenther St and virtually at <https://meet.goto.com/685909709>.

Agenda:

1. (3:00 PM) Roll Call
2. Public Comments – limit 3 minutes per person
3. Approval of the Minutes from the Previous San Antonio Regional Flood Planning Group Meeting
4. Communications from the Texas Water Development Board (TWDB)
5. Chair Report
6. Subcommittee Updates
7. Discussion and Appropriate Action Regarding an Amendment to Region 12 Bylaws Article V Section 2 Detailing Terms of Membership for Voting Members
8. Discussion and Appropriate Action Regarding an Amendment to Region 12 Bylaws Article VIII Section 1, Section 2(b), and Section 6 Detailing Terms of Office for Elected Officers and Members-At-Large of the Executive Committee
9. Presentation and Appropriate Action to Approve Chapter 12
10. Regional Liaison Update
11. Public Comments - limit 3 minutes per person
12. Date and Potential Agenda Items for Next Meeting
13. Adjourn

If you wish to provide written comments prior to or after the meeting, please email your comments to khayes@sariverauthority.org or physically mail them to the attention of Kendall Hayes at San Antonio River Authority, 100 E. Guenther, San Antonio, TX, 78204 and include “Region 12 San Antonio Flood Planning Group Meeting” in the subject line of the email.

Additional information may be obtained from: Kendall Hayes, (210) 302-3641, khayes@sariverauthority.org, San Antonio River Authority, 100 E. Guenther, San Antonio, TX 78204.

**AGENDA ITEM NO.3 – APPROVAL OF THE MINUTES FROM
THE PREVIOUS SARFPG MEETING**

Meeting Minutes
San Antonio Regional Flood Planning Group Meeting
Thursday, April 20, 2023
3:00 PM
San Antonio River Authority

Roll Call:

<u>Voting Member</u>	<u>Interest Category</u>	<u>Present (x) /Absent () / Alternate Present (*)</u>
Brian Yanta	<i>Agricultural interests</i>	X
David Wegmann	<i>Counties</i>	X
Doris Cooksey	<i>Electric generating utilities</i>	X
Deborah (Debbie) Reid	<i>Environmental interests</i>	X
Nefi M. Garza	<i>Flood districts</i>	X
Cara C. Tackett	<i>Industries</i>	X
Jeffrey Carroll	<i>Municipalities</i>	X
Robert Reyna	<i>Municipalities</i>	X
Suzanne B. Scott	<i>Nonprofit</i>	X
John Paul Beasley	<i>Public</i>	
Derek Boese	<i>River authorities</i>	X
Jose Reyes	<i>Small Business</i>	X
David Mauk	<i>Water districts</i>	*Hayli Hernandez
Donovan Burton	<i>Water Utilities</i>	X

<u>Non-voting Member</u>	<u>Agency</u>	<u>Present(x)/Absent()/ Alternate Present (*)</u>
Marty Kelly	Texas Parks and Wildlife Department	
James Blount	Texas Division of Emergency Management	
Jami McCool	Texas Department of Agriculture	X
Jarod Bowen	Texas State Soil and Water Conservation Board	
Kris Robles	General Land Office	X
Anita Machiavello	Texas Water Development Board (TWDB)	X
Susan Roberts	Texas Commission on Environmental Quality	

Quorum:

Quorum: **Yes**

Number of voting members or alternates representing voting members present: **13**

Number required for quorum per current voting positions of 14: **8**

All meeting materials are available for the public at: <http://www.region12texas.org>.

AGENDA ITEM NO.1: ROLL CALL

Ms. Kendall Hayes, San Antonio River Authority, called the role and confirmed a quorum.

AGENDA ITEM NO.2: PUBLIC COMMENT – LIMIT 3 MINUTES PER PERSON

No public comments.

AGENDA ITEM NO.3: APPROVAL OF THE MINUTES FROM THE PREVIOUS SAN ANTONIO REGIONAL FLOOD PLANNING GROUP MEETING (REGION 12)

Mr. Wegmann motioned to approve the minutes. Ms. Tackett seconded the motion, motion passed.

AGENDA ITEM NO.4: COMMUNICATIONS FROM THE TEXAS WATER DEVELOPMENT BOARD (TWDB)

Ms. Anita Machiavello provided an update from TWDB.

AGENDA ITEM NO.5: CHAIR REPORT

Chair Boese notified the RFPG that Region 12 is on track for July deliverable to TWDB.

AGENDA ITEM NO.6: SUBCOMMITTEE UPDATES

Chair Boese notified the RFPG that the Technical Committee met in March and April to review the 30 projects that have been developed under Task 12. The committee selected the three projects that the Technical Consultants will present today.

AGENDA ITEM NO.7: DISCUSSION AND APPROPRIATE ACTION REGARDING AN AMENDMENT TO REGION 12 BYLAWS ARTICLE VIII, SECTION 1, SECTION 2(b), AND SECTION 6 DETAILING TERMS OF OFFICE FOR ELECTED OFFICERS AND MEMBERS-AT-LARGE OF THE EXECUTIVE COMMITTEE

Ms. Hayes reviewed the regulations for the terms of voting membership and officers. She read portions of the Bylaws as pertains to the sections posed for amendment.

Discussion ensued regarding the frequency of elections, when elections should take place, and terms for Officers and Members-At-Large of the Executive Committee. The RFPG inquired

about the terms of voting membership. Discussion ensued regarding the relationship between voting membership terms and officer terms.

Chair Boese requested a future agenda item to continue the discussion and allow for action.

No action was taken.

AGENDA ITEM NO. 8: PRESENTATION BY TECHNICAL CONSULTANTS REGARDING TASK 12 SCHEDULE AND PROGRESS

Mr. Branyon, Technical Consultant, presented an overview of the work done on Task 12 to date. The consultant team reviewed three projects from Task 12. Their presentation is available on the Region 12 website at region12texas.org. The RFPG discussed the factors considered in this task's project development. A member asked the consultant team to review the scoring criteria's requirements for a total cost threshold to receive scoring benefits for nature-based solutions as no answer was provided during this item.

AGENDA ITEM NO.9: REGIONAL LIAISON UPDATE

Ms. Cooksey provided an update on Region 11. At recent meetings, Region 11 discussed ranking and scoring matrices.

AGENDA ITEM NO.10: PUBLIC COMMENTS – LIMIT 3 MINUTES PER PERSON

No public comments.

AGENDA ITEM NO.11: DATE AND POTENTIAL AGENDA ITEMS FOR NEXT MEETING

Technical Committee will meet May 11, 2023, at 1:00 PM. The RFPG will meet May 23, 2023, at 3:00 PM and June 27, 2023, at 2:00 PM.

AGENDA ITEM NO.12: ADJOURN

Ms. Tackett motioned to adjourn. Ms. Scott seconded the motion, motion passed.

AGENDA ITEM NO.7 – DISCUSSION AND APPROPRIATE ACTION REGARDING AN AMENDMENT TO REGION 12 BYLAWS ARTICLE V SECTION 2 DETAILING TERMS OF MEMBERSHIP FOR VOTING MEMBERS

Includes:

- Region 12 Bylaws Article V Section 2 Text

ARTICLE V. Voting Membership

Section 2 Terms of Office

The terms of all initial voting members shall expire on July 10, 2023. Upon the expiration of the initial terms, all voting members shall draw lots for additional terms of five years or two years, such that half of the voting members' terms will expire in two additional years and the other half in five additional years. If there is an odd number of voting members at the time that lots are drawn, one more than half shall draw lots for the two-year terms.

Except for the initial terms of the initial voting members and the two-year terms described above, all subsequent terms of office for voting members shall be five years, the goal of staggering the terms of office having been accomplished. There are no limits to the number of terms a member may serve. Upon the expiration of a member's term, a majority vote of the total voting membership shall be required for the member to continue to serve for a subsequent term. If a member fails to be affirmed for a subsequent term, then the voting members shall initiate procedures to appoint a successor utilizing the process set forth under Section 4 of this Article.

AGENDA ITEM NO.8 – DISCUSSION AND APPROPRIATE ACTION REGARDING AN AMENDMENT TO REGION 12 BYLAWS ARTICLE VIII SECTION 1, SECTION 2(b), AND SECTION 6 DETAILING TERMS OF OFFICE FOR ELECTED OFFICERS AND MEMBERS-AT-LARGE OF THE EXECUTIVE COMMITTEE

Includes:

- Region 12 Bylaws Article VIII Text

ARTICLE VIII. Officers

Section 1 Officers, Restrictions, and Terms of Office

Voting members of the Region 12 San Antonio RFPG shall select from the voting membership a Chair, Vice Chair, and Secretary to serve as officers. Each officer shall serve a term of **one** calendar year. However, the terms of the initial officers selected under Section 2 of this Article shall expire when the regular officers take office as provided under this Article. Except as provided under Section 4 of this Article, an officer shall serve until his or her successor takes office. No two voting members representing the same interest shall serve as officers at the same time. Elections shall be held **annually**, with no restrictions on the number of consecutive terms an individual may serve as an officer other than those that apply because of his or her status as a voting member under these bylaws.

Section 2 Selection

(a) Initial Officers. Within 30 days after the adoption of these bylaws, the voting members shall select initial officers. Nominations shall be made from the floor by voting members. The voting members shall select officers from among the nominees by consensus if possible, but not less than agreement of a majority of the voting members present.

(b) Regular Officers. Starting in **2022**, regular officers shall be selected at the first meeting of **each calendar year** after the calendar year in which these bylaws were **adopted**. Written notice of the meeting to select officers shall be sent to all members of the Region 12 San Antonio RFPG by the current Secretary thirty calendar days prior to the meeting. Nominations shall be made from the floor by voting members. The voting members shall select officers from among the nominees by consensus, but not less than agreement of a majority of the voting members present.

Section 6 Executive Committee

The Executive Committee shall be composed of five Region 12 San Antonio RFPG members, including the Chair, Vice Chair, Secretary, and two voting members-at-large. No two voting members representing the same interest shall serve as members of the Executive Committee at the same time. The two members-at-large shall be selected **annually** in the same manner and with the same terms as set forth for the selection of officers under this Article. Members-at-large shall be removed and their vacancies filled in the manner prescribed for officers under this Article.

The Executive Committee shall be responsible for carrying out the duties imposed on it in these bylaws. The voting members of the Region 12 San Antonio RFPG may delegate administrative decisions to the Executive Committee unless provided otherwise in these bylaws.

All meetings of the Executive Committee shall comply with the provisions related to meetings generally as set forth in Article IX of these bylaws.

AGENDA ITEM NO.9 – PRESENTATION AND APPROPRIATE ACTION TO APPROVE CHAPTER 12

Includes:

- Chapter 12 Methodologies & Procedures Memorandum
- Projects Developed in Task 12
- Projects Collected in Task 12
 - FMP Table
 - FME Table

2023 San Antonio Regional Flood Plan Amended Projects Methodologies and Procedures Memorandum

1 Background

As part of the amended 2023 San Antonio Regional Flood Plan (the Plan), Task 12 expands on previously identified projects from the Plan dated January 10th, 2023. HDR Engineering, Inc. (HDR) advanced Flood Mitigation Projects (FMPs) for several communities within the San Antonio flood planning region. This analysis was done to provide data for the 2023 San Antonio Regional Flood Plan concerning potential FMPs to be recommended in the 2023 Plan.

This memorandum documents the assumptions, methodologies and processes used to advance the FMP in accordance with the Texas Water Development Board (TWDB) Exhibit C Technical Guidelines for Regional Flood Planning FMPs.

2 TWDB Requirements

The TWDB FMP requirements include the following components and are discussed later in this document –

- Hydrologic and Hydraulic (H&H) Modeling
- Impact Analysis
- Costs Estimates
- Benefit Cost Analysis (BCA)

Table 1 summarizes the type of work completed for each recommended FMPs to meet the TWDB requirements. Additional supporting documentation for each FMP are located in the digital submittal of the Plan including Summary Sheets, Narratives, Cost Estimates, and Exhibits.

Table 1: Task 12 Work Completed Per Project

Project	Task 12 Work			
	H&H Modeling	Cost Estimate	Impact Analysis	BCA
Abbott Road at Tributary A to Salitrillo Creek and at Salitrillo Creek Bridge	✓	✓	✓	✓
Abbott Road at Unnamed Tributary 1 to Salitrillo Creek LWC Improvement	✓	✓	✓	✓
Bexar Bowling Way at Cibolo Creek Bridge	✓	✓	✓	✓
Blanco Road at Cibolo Creek	✓	✓	✓	✓
Boerne Stage Road at Balcones Creek	✓	✓	✓	✓

Concepcion				✓
Damage Center 1: Project 1A, B, C		✓	✓	✓
Damage Center 1 – Project 1 – Detention in East Branch Poth Creek	✓	✓	✓	✓
Damage Center 14- Airport Trib		✓		✓
Damage Center 2 – Project 1 Culvert Improvements at Manchaca	✓	✓	✓	✓
Damage Center 2- Project 2 Road connection from Mosspoint to Sunshine	✓	✓		✓
Damage Center 38-Olmos Creek Lower Reach Near Montview		✓		✓
Damage Center 40-San Antonio River DS Reach near Roosevelt		✓		✓
De Zavala/ Ripple Creek				✓
Elm Spring				✓
Felix Road at Dry Hollow Creek Barrier Arms	✓	✓		✓
Freudenburg Road at Salitrillo Creek Barrier Arms	✓	✓		✓
Gass Road at Culebra Creek Tributary D Bridge	✓	✓	✓	✓
LWC at Old Fredericksburg Rd and Balcones Creek	✓	✓	✓	✓
Old Frio City Road at North Prong Creek Bridge	✓	✓	✓	✓
Specht/Obst Road at Cibolo Creek	✓	✓	✓	✓
Toutant Beauregard at Balcones Creek	✓	✓	✓	✓
Ullrich Road at Cibolo Creek Barrier Arms		✓		✓
Wilson 10 - Acquisitions of Flooded Structures	✓	✓	✓	✓
Woodlawn Lake Option 2	✓		✓	✓

3 Data Collection

Data used in the FMP evaluation included previously collected information under Task 4B, as well as additional data collected from other sources.

Previous community engagement and data collection efforts are documented in the Plan under Chapter 5 - *Identification and Evaluation of Potential Flood Management Evaluations and Potentially Feasible Flood Management Strategies and Flood Mitigation Projects* and Chapter 10 - *Public Participation and Adoption of Plan*. Previously collected data can also be found in the digital submittal of the Plan.

Data gathered from other sources are summarized below. All data were obtained as digital files.

- San Antonio River Authority (SARA) Digital Data and Model Repository (D2MR) website – the SARA D2MR serves as a centralized location for the storage, management, and dissemination of H&H models and data related to the Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Maps (DFIRM) and subsequent updates. Most of the H&H models found on the D2MR website use Hydrologic Engineering Center Hydrologic Modeling System (HEC-

HMS) and Hydrologic Engineering Center River Analysis System (HEC-RAS) software. The models collected from this source are summarized below.

- Texas Natural Resources Information System (TNRIS) – United States Geological Survey (USGS) 1-meter resolution 2018 and 2019 LiDAR-based digital elevation models (DEMs)
- TWDB – 2021 Texas Buildings with Social Vulnerability Index (SVI) and Estimated Population (TWDB, Centers for Disease Control and Prevention [CDC], Oak Ridge National Laboratory [ORNL])

Table 2 summarizes the hydraulic and hydrologic models collected for the Task 12 FMPs.

Table 2: Data Sources Per Project

Project	FEMA Effective Model*			Other Source	
	HEC-HMS	HEC-RAS	Other	Modeling Software	Notes
Abbott Road at Tributary A to Salitrillo Creek and at Salitrillo Creek Bridge	✓	✓			
Abbott Road at Unnamed Tributary 1 to Salitrillo Creek LWC Improvement	✓	✓			
Bexar Bowling Way at Cibolo Creek Bridge	✓	✓			
Blanco Road at Cibolo Creek		✓			
Boerne Stage Road at Balcones Creek		✓			
Concepcion				XPSWMM	City of San Antonio
Damage Center 1: Project 1A, B, C				HEC-HMS HEC-RAS	San Antonio River Authority
Damage Center 1 – Project 1 – Detention in East Branch Poth Creek	✓	✓			
Damage Center 14- Airport Trib		✓			
Damage Center 2 – Project 1 Culvert Improvements at Manchaca	✓	✓			
Damage Center 2- Project 2 Road connection from Mosspoint to Sunshine	✓	✓			
Damage Center 38-Olmos Creek Lower Reach Near Montview		✓			
Damage Center 40-San Antonio River DS Reach near Roosevelt		✓			
De Zavala/ Ripple Creek				XPStorm	City of Shavano Park
Elm Spring				XPStorm	City of Shavano Park
Felix Road at Dry Hollow Creek Barrier Arms	✓	✓			

Freudenburg Road at Salitrillo Creek Barrier Arms	✓	✓			
Gass Road at Culebra Creek Tributary D Bridge	✓	✓			
LWC at Old Fredericksburg Rd and Balcones Creek		✓			
Old Frio City Road at North Prong Creek Bridge	✓	✓			
Specht/Obst Road at Cibolo Creek		✓			
Toutant Beauregard at Balcones Creek		✓			
Ullrich Road at Cibolo Creek Barrier Arms	✓	✓			
Wilson 10 - Acquisitions of Flooded Structures					N/A for type for FMP
Woodlawn Lake Option 2				XPSWMM	From City of San Antonio

*Please refer to the Flood Insurance Study (FIS) reports for discussions on the following topics: General Study Information, Terrain Data, Land Cover, Rainfall, Hydrologic Methodologies, Hydraulic Methodologies

4 Hydrologic and Hydraulic Modeling

4.1 Hydrologic Modeling

In most cases, hydrologic models collected for the Task 12 FMP evaluation were used without modification. These models were unmodified because they met the TWDB hydrologic model criteria and are considered best available. Two FMP hydrologic models were updated as described below.

Poth Creek

The hydrologic model named Poth Creek was updated to account for precipitation changes. Updates were made to the 10-, 25-, 50- and 100- year frequency storm events for the Meteorological Models in HEC-HMS using NOAA Atlas 14 precipitation frequency estimates for Poth, Texas. The Poth Creek hydrology model is used for Damage Center 2-Project 1 Culvert Improvements at Manchaca.

East Branch Poth Creek

The hydrologic model named East Branch Poth Creek was updated to account for precipitation changes. Updates were made to the 10-, 25-, 50- and 100- year frequency storm events for the Meteorological Models in HEC-HMS using NOAA Atlas 14 precipitation frequency estimates for Poth, Texas. The East Branch Poth Creek hydrology model is for the Damage Center 1 – Project 1 – Detention in East Branch Poth Creek project. A proposed Basin Model was created to analyze impacts of the proposed detention pond on East Branch Poth Creek.

4.2 Hydraulic Modeling

Hydraulic models collected for Task 12 were used to evaluate baseline and proposed hydraulic conditions. These models were modified to conduct the drainage analysis and

help with the other requirements (Impact Analysis and BCA). Updates for these models included:

- Adding, adjusting, or extending cross sections for more creek definition,
- Adjusting/extending the center line,
- Adding terrain, and
- Refining the Manning's values

In addition, HDR developed a new hydraulic model to study FMP impacts as described below.

Abbott Road at Salitrillo Creek and at Tributary A to Salitrillo Creek

The floodplains of Tributary A to Salitrillo Creek (Trib A) and Salitrillo Creek converge at Abbott Road where they are assumed to share the same water surface elevation (WSE). In the effective models both streams are modeled separately, which may result in an underestimation of flows crossing Abbott Road. To better evaluate the crossing conveyance capacity and assess potential improvements a new 1D model was created that includes flows for both creek segments as they cross Abbott Road.

5 Impact Analysis

An FMP is required to have no negative impacts in the neighboring area, either upstream or downstream of the project. No negative impact means that a project will not increase flood risk of surrounding properties. The increase in flood risk must be measured by the 100-year frequency storm water surface elevation and peak discharge using the best available data. No rise in water surface elevation or discharge is permissible, and the study area must be sufficiently large to demonstrate that proposed project conditions are equal to or less than the existing (baseline) conditions.

For the purposes of regional flood planning efforts, a determination of no negative impacts can be established if stormwater runoff does not increase inundation of infrastructure such as residential and commercial structures or exceed the design capacity of stormwater systems. According to the TWDB Exhibit C Technical Guidelines, all of the following requirements should be met to establish no negative impact, as applicable:

- 1. Stormwater does not increase inundation in areas beyond the public right-of-way, project property, or easement.*
- 2. Stormwater does not increase inundation of storm drainage networks, channels, and roadways beyond design capacity.*
- 3. Maximum increase of 1D Water Surface Elevation must round to 0.0 feet (<0.05 ft) measured along the hydraulic cross-section.*
- 4. Maximum increase of 2D Water Surface Elevations must round to 0.3 feet (<0.35 ft) measured at each computation cell.*
- 5. Maximum increase in hydrologic peak discharge must be <0.5 percent measured at computation nodes (sub-basins, junctions, reaches, reservoirs, etc.). This discharge restriction does not apply to a 2D overland analysis.*

If the analysis was performed using 1D modeling software, requirements #1, #2, and #3 are applicable. If the analysis was performed using a 2D modeling software, requirements #1, #2, and #4 are applicable. Please refer to the project Narratives for specific reported numbers to support these requirements.

6 Cost Estimate

Estimated project costs for all FMPs were calculated using 2020 prices. The cost estimates contain all the required applicable TWDB FMP costs including basic engineering fees, special services such as surveying, environmental, and geotech, other costs such as land/easement acquisition and administration, fiscal services, and contingency. The following assumptions were applied in estimating costs:

- Design – Design costs were estimated using the City of San Antonio 2020 Planning Studies fee table. Depending on estimated construction costs, the design fee percentage ranges between 9.5% to 20%.
- Engineering Contingency – Estimated as 10% of the estimated construction costs.
- Environmental, Archaeological, and Historical Resources – Estimated as \$10,000.
- Permit Requirements Costs – Estimated as \$8,000.
- Material Testing – Estimated as 1.5% or 2% of the estimated construction costs for projects with construction costs greater than \$3M or less than \$3M, respectively.
- Construction Contingency – Estimated as 10% of the estimated construction costs.

Utility relocation costs were not included in the FMP cost estimation, so estimated costs may increase if utility relocations are found to be required during later project design phases. For a detailed cost breakdown of each FMP, refer to the project's Cost Summary Sheet in the digital submittal of the Plan.

7 Benefit Cost Analysis

Per the TWDB, each FMP included in the Plan is required to have a benefit cost analysis (BCA) performed. Some flood mitigation studies document a computed benefit cost ratio (BCR) and those can be incorporated into the Plan. For situations where a BCR is not available for a project, TWDB has developed the BCA Input Tool to facilitate the calculation of costs and benefits. The tool estimates flood impacts before and after implementation of the FMP for up to three recurrence interval flood events. Impacts that could be evaluated include impacts to residential buildings, commercial structures, street flooding, low water crossing (LWC) ponding, and recreational benefits.

In addition to the TWDB tool assumptions, the following section describes other assumptions which were applied during the BCA.

7.1 BCA Cost

The 2023 estimated total costs were used in the BCA. A Construction Cost Index (CCI) factor 1.14 was applied to convert the costs from 2020 to 2023 dollars. Costs were input as noted in the FMP reporting tables.

7.2 Construction Year

Construction is assumed to start in the near future, dependent on funding and the community. The construction year start and end dates are set per project and can be found in the BCA in the digital submittal of the Plan.

7.3 Residential

Residential structures are evaluated by the size and amount flooded for the existing (baseline) and proposed project conditions. Based on the BCA Input Tool, size categories for residential structures are designated as “Small Home” (1000 sq. ft.), “Average Home” (2,500 sq. ft.), and “Large Home” (5,000 sq. ft.). For the analysis, the following refinements to the BCA size assumptions were made:

- Small: $x < 2500$ sq.ft.
- Average: $2500 \text{ sq.ft.} < x < 5000$ sq.ft.
- Large: $x > 5000$ sq.ft.

The TWDB tool limits the total amount of residential buildings that can be assessed per project to 100 structures. For some projects, more than 100 structures were impacted. Instead of looking at each individual structure’s damages for existing (baseline) and proposed conditions, the total amount of impacted structures within the same size categories and inundation depths (rounded to the nearest inch) were totaled per analyzed flood event.

7.4 Commercial

Commercial building damages are determined by business type and size (square footage). Due to limited available data on commercial building types, all commercial buildings were assumed to be of “Retail-Clothing” type since this type is closest in “damages per sq.ft.” to the average “damages per sq.ft.” value of all BCA commercial types. To calculate building damages from flood depth data, inundation depths were rounded to the nearest inch.

7.5 Flooded Streets

Streets are considered impassable if the flood depth is above 6 inches. The daily traffic count was estimated based on the TxDOT daily traffic count or the nearest adjacent road, as provided by the TxDOT TPP District Traffic Web Viewer (<https://txdot.maps.arcgis.com/apps/webappviewer/index.html?id=06fea0307dda42c1976194bf5a98b3a1>). The additional time that the longest detour takes for an individual is calculated assuming a speed limit of 35 miles per hour (mph). The Normal Emergency Medical Services (EMS) response time for both existing (baseline) and proposed conditions is assumed to be 14.5 minutes, based on the rural mean value from Table 2 of the NIH JAMA Surgery study (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5831456/>). The EMS response time during a storm event is assumed to double for existing (baseline) conditions compared to the normal response time. For proposed conditions, the EMS response time is scaled to match the difference between detour routes (existing [baseline] and post-project). The number of households impacted by EMS delay due to flooded streets is assumed to be equal to the total number of residential buildings

inundated during the given storm event. Similarly, the number of commercial buildings impacted by EMS delay due to flooded streets is assumed to be the total number of commercial buildings inundated during the given storm event.

7.6 Low water crossings

Low water crossings (LWC) are considered impassable if the flood depth is above 6 inches. Projects with LWC benefits are also assumed to have Flooded Streets benefits, both of these benefits were considered in the BCA. LWC benefits are based on reduced rescues/injuries/fatalities associated with people attempting to cross, whereas Flooded Streets benefits are based on reduced detours.

If there are multiple LWCs in a project that are all in close proximity to one another, it was assumed to evaluate the benefits as one LWC. Aggregate all costs and all benefits to compute one BCA for the multiple LWCs for flood planning purposes.

7.7 Acquisitions and Raising Elevations

Some proposed projects include residential and commercial structures be bought out or raised out of the floodplain by raising the finished floor elevations (FFE) of the structure. To calculate the BCR, pre-calculated benefits were assumed based on the FEMA memorandum with subject titled "Update to 'Cost-Effectiveness Determinations for Acquisitions and Elevations in Special Flood Hazard Areas Using Pre-Calculated Benefits". According to this memorandum, the pre-calculated benefits of acquisitions and elevations are:

- Acquisitions: \$323,000 per structure
- Elevations: \$205,000 per structure

7.8 Benefit Result

The BCA Input Tool is intended to be used in conjunction with the FEMA BCA Toolkit 6.0, which calculates annual benefits from the information compiled in the TWDB BCA Input Tool. The annual benefits data are then entered back into the TWDB BCA Input Tool to compute the resulting BCR for the project. The results table summarizes the impacts as well as the estimated BCR for each FMP per flood event. FMP BCA results are provided in the digital submittal of the Plan.

Projects Further Developed In Task 12

Community	Task #12 - FMX Assignment	FMP	FME	Notes
Bexar/Guadalupe County line	Bexar Bowling Way at Cibolo Creek Bridge	x		Moved FME to FMP
City of San Antonio	Damage Center 14- Airport Trib	x		Pending Stakeholder Approval
Bexar	Abbott Road and Graytown at Martinez Creek Study		x	Stayed an FME (need a more in-depth study)
Bexar/Guadalupe County line	Ullrich Road at Cibolo Creek Barrier Arms	x		Moved FME to FMP
Bexar/Wilson County line	Felix Road at Dry Hollow Creek Barrier Arms	x		Moved FME to FMP
Bexar/Atascosa County line	Old Frio City Road at North Prong Creek Bridge	x		Moved FME to FMP
Bexar	Abbott Road at Tributary A to Salitrillo Creek and at Salitrillo Creek Bridge	x		Moved FME to FMP
Bexar	Abbott Road at Unnamed Tributary 1 to Salitrillo Creek LWC Improvement	x		Moved FME to FMP
Bexar	Freudenburg Road at Salitrillo Creek Barrier Arms	x		Moved FME to FMP
Bexar	Gass Road at Culebra Creek Tributary D Bridge	x		Moved FME to FMP
Wilson County	Wilson 10 - Acquisitions of Flooded Structures	x		Moved FME to FMP
City of Floresville	Damage Center 1: Project 1A, 1B, 1C	x		Moved FME to FMP
Bexar/Kendal County line	Boerne Stage Road at Balcones Creek	x		Moved FME to FMP
City of San Antonio	Damage Center 38-Olmos Creek Lower Reach Near Montview	x		Pending Stakeholder Approval
City of San Antonio	Damage Center 40-San Antonio River DS Reach near Roosevelt	x		Pending Stakeholder Approval
City of Shavano Park	Elm Spring	x		Added per City of Shavano Park
City of Poth	Damage Center 2- Project 2 Road connection from Mosspoint to Sunshine	x		Moved FME to FMP
Kendall/Bexar County line	LWC at Old Fredericksburg Rd and Balcones Creek	x		Moved FME to FMP

Projects Further Developed In Task 12

Community	Task #12 - FMX Assignment	FMP	FME	Notes
City of Shavano Park	De Zavala/ Ripple Creek	x		Added per City of Shavano Park
Bexar/Comal County line	Specht/Obst Road at Cibolo Creek	x		Moved FME to FMP
Bexar/Kendal County line	Toutant Beauregard at Balcones Creek	x		Moved FME to FMP
Guadalupe	Cibolo Creek Spill Study		x	Added (due to Task 12 analysis)
Bexar/Comal County line	Smithson Valley Road at Cibolo Creek			Removed - RFPG meeting 2/9 Dave W. said funding was acquired.
Bexar/Atascosa County line	Smith Road at Unnamed Trib 75 to Elm Creek			Removed - No issue present in existing conditions. Bexar Co instructed us to remove 3/23.
City of San Antonio	Huebner Creek Flood Protection Barrier			Removed per City of San Antonio
City of San Antonio	Damage Center 39-Olmos Creek and Olmos Creek East Channel			Removed per City of San Antonio
City of San Antonio	Damage Center 44-San Antonio River Near Center Road			Removed per City of San Antonio
City of Poth	Build Detention Pond			Removed - duplicate of Damage Center 1 Project 1 - Detention in East Branch Poth Creek
City of Poth	Damage Center 1 Project 1 – Detention in East Branch Poth Creek	x		Moved FME to FMP
Bexar/Comal County line	Blanco Road at Cibolo Creek	x		Moved FME to FMP
Bexar/Guadalupe County li	Trainer Hale at Cibolo Creek		x	Pending Stakeholder Approval
City of Balcones Heights	Woodlawn Lawn Lake Option 1(Phase 1-3) or Option 2	x		Moved FME to FMP
City of Bulverde	FM 1863 at Cibolo Creek LWC		x	Stayed as FME 121000098 per Bexar County
City of Poth	Damage Center 2-Project 1 Culvert Improvements at Manchaca	x		Moved FME to FMP

Projects Further Developed In Task 12

Community	Task #12 - FMX Assignment	FMP	FME	Notes
Bexar County	FM1346 Crossing Upgrade Study		x	Added (due to Task 12 analysis)
Bexar County	Live Oak at Salitrillo Creek Improvements		x	Stayed an FME (need a more in-depth study)
Von Ormy	Live Oak Slough Creek Improvements Study		x	Added per Von Ormy
Von Ormy	North Benton City Road Improvements Study		x	Added per Von Ormy
Von Ormy	Quintana Road Drainage Improvements Study		x	Added per Von Ormy
Von Ormy	South Benton City Road Improvements Study		x	Added per Von Ormy
Von Ormy	S Evans Rd Road Improvements Study		x	Added per Von Ormy
City of Balcones Heights	Woodlawn Lawn Lake Option 1(Phase 1-3)			Removed existing FME 121000070; no longer feasible

FMPs Collected In Task 12

Notes	Source	FMP Name	Description	Counties	Sponsor	Estimated Project Cost (\$)
Additional Project	CoSA	Southwell Road LWC Improvements	<p>Along Huebner Creek Tributary A, the City of San Antonio (CoSA) has expressed drainage and mobility concerns regarding two existing low water crossings upstream of Huebner Road located at Southwell and Encino Park Road, respectively, on the City's northwest side. Currently, there is a severe risk located at the low water crossings, showing estimated overtopping depths exceeding 3.38 ft and 1.86 ft at the Southwell and Encino Park Road crossing, respectively, for the 100-year design storm. The crossing at Southwell Road will raise the road deck elevation to 920 ft and install four 8-ft by 6-ft RCBs; channel improvements will be implemented 400-ft upstream and downstream of Southwell Road. Similarly, the crossing at Encino Park Road will raise the road deck elevation to 894 ft and install three 8-ft by 5-ft RCBs; channel improvements will be implemented 900-ft upstream and downstream of Encino Park Road. It is anticipated the property and/or a drainage acquisition will be required to accommodate for the proposed channel and crossings improvements.</p>	Bexar	City of San Antonio	8230023
Additional Project	CoSA	Blue Ridge Dr Drainage Improvements	<p>The City of San Antonio is intending to reduce flood risk along Apache Creek to residences and businesses along Blue Ridge Dr. through this project. Currently, within the project limits there are 65 buildings inundated during the 100-yr flood event. The proposed protect involves implementation of offline detention facilities in open areas near the intersection of Memorial St. and Vadalía Ave. The detention facilities are designed such that they are not engaged in low flow events but will detain runoff from larger storms and allow the slow release of detained volume. The pond was sized to fill in all of the available area in the designated project location to a size of 2.85 acres. This design removes 5 structures out of the 100-yr floodplain.</p>	Bexar	City of San Antonio	2239000

FMPs Collected In Task 12

Notes	Source	FMP Name	Description	Counties	Sponsor	Estimated Project Cost (\$)
Additional Project	CoSA	Huebner Creek LWC #28	The purpose of this project is to improve the low water crossing of Huebner Creek and Hollyhock Road and mitigate street and property flooding. Currently the low water crossing does not pass any of the design storm events. This project will provide channel improvements from approximately 1,200 feet upstream of the crossing of Huebner Creek and Babcock Road to the intersection of Huebner Creek and Strathaven Street. The proposed channel section is trapezoidal with 100 LF bottom width and 3:1 side slopes. The existing low water crossing will be reconstructed to 9 – 10' X 6' MBC, which will be able to convey the synthetic 10-Year design storm event. Hollyhock is proposed to be reconstructed from the intersection of Babcock Road to the intersection with Strathaven Street.	Bexar	City of San Antonio	8371000
Additional Project	CoSA	Ridge Run Street Drainage Improvements	Several area residents have reported property and structure flooding from the channel located behind their homes, east of Ridge Run Dr. This project will consist of channel improvements within the existing Culebra Creek Tributary A from approximately 100' downstream of Tezel Rd. to 1,100' upstream of Timberwilde Dr. The proposed channel design includes a trapezoidal channel 3:1 side slopes overbank benching section and varying bottom width of 60-ft to 170-ft. The channel overbank benching improvements will not encroach within 1' above the channel existing channel flowline and utilizes the existing ROW to conveying the 100-yr future design storm event. The tributary will outfall into the existing Culebra Creek located south of Grissom Rd. An existing concrete pedestrian trail path, located within the tributary, requires removal and a new concrete trail will be placed in the east top of bank within a designated 20' buffer area. Channel modifications remove 26 structures from the floodplain and will not have a downstream adverse impact and does not impact the downstream floodplain limits.	Bexar	City of San Antonio	10443000
Additional Project	CoSA	Overbrook Drainage Improvements Phase 1 & 2	The proposed system upgrades include upsizing the existing 13.5' horseshoe-shaped concrete arch pipe to two 16'x9' RCB. This cannot convey the 100-year flow but is the largest system allowable given street width and downstream constraints.	Bexar	City of San Antonio	53086000
Moved from FME to FMP	K Friese	Athens	Lack of collection and conveyance infrastructure causes frequent structural and roadway flooding. Improvements to the infrastructure include new stormdrain network.	Medina	City of Castroville	\$ 19,020,814.00

FMPs Collected In Task 12

Notes	Source	FMP Name	Description	Counties	Sponsor	Estimated Project Cost (\$)
Moved from FME to FMP	K Friese	Lorenzo	Substandard collection and conveyance infrastructure north of Highway 90 cause extensive flooding. Improvements to the infrastructure include new stormdrain network.	Medina	City of Castroville	\$ 11,647,488.00
Moved from FME to FMP	K Friese	Naples	Substandard collection and conveyance infrastructure north of Highway 90 along Naples and Houston Streets cause extensive flooding. Improvements to the infrastructure include new stormdrain network.	Medina	City of Castroville	\$ 22,703,676.00
Added from Karnes FIF	Doucet - Karnes FIF	CR 294 Drainage Improvements at Dry Ecleto Creek	Upgrade CR 294 to include new bridge structure with roadway and channel improvements for 100 year roadway access	Karnes	Karnes County	
Added from Karnes FIF	Doucet - Karnes FIF	CR 302 Drainage Improvements at Ecleto Creek	Upgrade existing low water crossing to include roadway elevation, a new bridge structure, and channel improvements	Karnes	Karnes County	
Added from Karnes FIF	Doucet - Karnes FIF	CR 262 Drainage Improvements at Ecleto Creek	Upgrade CR 262 to include roadway elevation, bridge expansion, and channel improvements	Karnes	Karnes County	
Added from Karnes FIF	Doucet - Karnes FIF	Drainage Improvements at CR 337 and CR 326 Near City of Runge	Elevate CR 337 and CR 326 and upgrade low water crossings to include box culverts and channel improvements. Channel improvements along CR 337 to improve level of service	Karnes	Karnes County	
Added from Karnes FIF	Doucet - Karnes FIF	CR 336 Drainage Improvements at Ecleto Creek Tributary	Upgrade CR 336 low water crossing to include a new bridge structure with roadway and channel improvements	Karnes	Karnes County	
Added from Karnes FIF	Doucet - Karnes FIF	CR 331 Drainage Improvements at Escondido Creek	Upgrade existing low water crossing to include roadway elevation, a new bridge structure, and channel improvements	Karnes	Karnes County	
Added from Karnes FIF Moved FME to FMP - Karnes County Flood Damage Center H from Holistic Watershed Master Plan for Wilson, Karnes, and Goliad Counties	Doucet - Karnes FIF	City of Kenedy Drainage Improvements on Escondido Creek	Upgrade 5th Street culvert with additional boxes, roadway elevation, and channel modifications. Additional channel modifications through Kenedy to improve conveyance and reduce flooding of structures.	Karnes	City of Kenedy	
Added from Karnes FIF	Doucet - Karnes FIF	CR 127 Drainage Improvements at Hondo Creek	Upgrade existing low water crossing to include roadway elevation, a new bridge structure, and channel improvements	Karnes	Karnes County	

FMPs Collected In Task 12

Notes	Source	FMP Name	Description	Counties	Sponsor	Estimated Project Cost (\$)
Added from Karnes FIF	Doucet - Karnes FIF	CR 145 Drainage Improvements at Hondo Creek	Upgrade existing low water crossing to include roadway elevation, box culverts, and channel improvements to mitigate roadway and residential flooding	Karnes	Karnes County	
Added from Karnes FIF	Doucet - Karnes FIF	CR 354 Drainage Improvements at Lower San Antonio Tributary 147	Elevate roadway and upgrade existing culvert structure with a new bridge structure and channel improvements	Karnes	Karnes County	
Added from Karnes FIF Moved FME to FMP - Karnes County Flood Damage Center B from Holistic Watershed Master Plan for Wilson, Karnes, and Goliad Counties	Doucet - Karnes FIF	US 181 Drainage Improvements at Marcelinas Creek Trib	Upgrade US HWY 181 culvert crossing to include additional boxes and channel improvements to mitigate residential flooding south of the highway	Karnes	Karnes County	
Added from Karnes FIF	Doucet - Karnes FIF	Nichols Creek Tributary 2 Drainage Improvements	Upgrade Escondido Street crossing with an additional box and upstream channel improvements	Karnes	Karnes County	
Added from Karnes FIF	Doucet - Karnes FIF	Nichols Creek Tributary 4 Drainage Improvements	Channel improvements upstream (east) of Escondido Street; lower existing pond bottom at Kenedy Retreat Apartments to increase capacity	Karnes	Karnes County	
Added from Karnes FIF	Doucet - Karnes FIF	CR 325 Drainage Improvements at Ojo De Agua Creek	Upgrade CR 325 crossing with roadway elevation, bridge structure upgrades, and channel improvements	Karnes	Karnes County	
Added from Karnes FIF	Doucet - Karnes FIF	CR 163 Drainage Improvements at Panther Creek	Elevate roadway and upgrade existing culvert structure to include box culverts and channel improvements	Karnes	Karnes County	

FMEs Collected In Task 12

Notes	Source	FME Name	Description	Counties	Sponsor	Estimated Study Cost
Added per CoSA	CoSA	Delcrest Channel Improvements PER	There are major drainage concerns in the Dellcrest Neighborhood, including street ponding and inundation. The 100-year FEMA floodplain extends onto Creekmoor, Diane, Bernadine, Dellhaven and Beyhead, as well as a few properties. The total drainage area for the neighborhood is approximately 3.1 sq. miles. Improvements such as storm drain systems cannot be used to remedy these concerns because the existing system paralleling Diane is at maximum capacity; tying into this system will cause downstream impacts. This PER will investigate upgrades to this system which will allow improvements upstream.	Bexar	CoSA	\$250,000
Added per CoSA	CoSA	Overbrook Drainage Improvements Phase 3	Phase 3 of this project will tie into Phase 2 at the intersection south of John Page Dr. with the existing storm sewer conveying the Overbrook Dr. flow. Further study is required to determine where adverse impacts could be mitigated.	Bexar	CoSA	\$250,000
Added from Karnes FIF	Doucet - Karnes FIF	CR 326B at Ecletto Creek	Evaluate upgrades to existing bridge with consideration of backwater from San Antonio River	Karnes County	Karnes County	
Added from Karnes FIF Previous Study - Karnes County Flood Damage Center G from Holistic Watershed Master Plan for Wilson, Karnes, and Goliad Counties	Doucet - Karnes FIF	City of Kenedy Flooding on Escondido Creek Tributary	Evaluate alternatives to mitigate flooding within City of Kenedy commercial area along Escondido Creek tributary	Karnes County	City of Kenedy	
Added from Karnes FIF	Doucet - Karnes FIF	CR 237 at Marcelinas Creek	Evaluate upgrades to existing bridge with consideration of backwater from San Antonio River	Karnes County	Karnes County	

FMEs Collected In Task 12

Notes	Source	FME Name	Description	Counties	Sponsor	Estimated Study Cost
<p>Added from Karnes FIF</p> <p>Previous Study - Karnes County Flood Damage Center A from Holistic Watershed Master Plan for Wilson, Karnes, and Goliad Counties</p>	Doucet - Karnes FIF	Falls City Flooding from San Antonio River	Evaluate alternatives to mitigate flooding from the San Antonio River affecting buildings in the City of Falls City	Karnes County	Fall City	
<p>Added from Karnes FIF</p> <p>Previous Study - Karnes County Flood Damage Center C from Holistic Watershed Master Plan for Wilson, Karnes, and Goliad Counties</p>	Doucet - Karnes FIF	San Antonio River Flooding on US 181	Evaluate alternatives to mitigate US 181 flooding from the San Antonio River and tributaries	Karnes County	Karnes County	
<p>Added from Karnes FIF</p> <p>Previous Study - Karnes County Flood Damage Center D from Holistic Watershed Master Plan for Wilson, Karnes, and Goliad Counties</p>	Doucet - Karnes FIF	Cibolo Creek Flooding on SH 123	Evaluate alternatives to mitigate SH 123 flooding from Cibolo Creek	Karnes County	Karnes County	
<p>Added from Karnes FIF</p> <p>Previous Study - Karnes County Flood Damage Center E from Holistic Watershed Master Plan for Wilson, Karnes, and Goliad Counties</p>	Doucet - Karnes FIF	San Antonio River Flooding on SH 80	Evaluate alternatives to mitigate SH 80 flooding from the San Antonio River and tributaries	Karnes County	Karnes County	
<p>Added from Karnes FIF</p> <p>Previous Study - Karnes County Flood Damage Center I from Holistic Watershed Master Plan for Wilson, Karnes, and Goliad Counties</p>	Doucet - Karnes FIF	Localized Residential Flooding in City of Kenedy	Evaluate alternatives to mitigate localized residential flooding in the southern portion of the City of Kenedy	Karnes County	Karnes County	
<p>Added from Karnes FIF</p> <p>Previous Study -Karnes County Flood Damage Center J from Holistic Watershed Master Plan for Wilson, Karnes, and Goliad Counties</p>	Doucet - Karnes FIF	San Antonio River Flooding on SH 72	Evaluate alternatives to mitigate SH 72 flooding from the San Antonio River and tributaries	Karnes County	Karnes County	

FMEs Collected In Task 12

Notes	Source	FME Name	Description	Counties	Sponsor	Estimated Study Cost
Added from Karnes FIF	Doucet - Karnes FIF	Karnes County FEWS	Flood Early Warning System	Karnes County	Karnes County	