



**Frio River at Kenneth Arthur Crossing  
(Upper Nueces Basin)**

## Chapter 5 – Identification, Evaluation, and Recommendation of Flood Management Evaluations, Flood Management Strategies, and Associated Flood Mitigation Projects

*31 TAC § 361.38 and § 361.39*

*This page is intentionally blank.*

## 5 Identification, Evaluation, and Recommendation of Flood Management Evaluations, Flood Management Strategies, and Associated Flood Mitigation Projects

The objective of Chapter 5 is for regional flood planning groups (RFPGs) to evaluate and recommend identified flood mitigation actions, including flood management evaluations (FME), flood management strategies (FMS), and flood mitigation projects (FMP) for inclusion in the regional flood plan (RFP). This chapter summarizes and documents:

1. Process used to identify potential flood mitigation actions,
2. Evaluation and recommendation process to make final recommendations on the given flood mitigation action types,
3. Methodology used to assign costs to potential FMEs and potentially feasible FMSs and FMPs, and
4. Recommended FMEs, FMSs, and FMPs.

### 5.1 Identification of Potential FMEs, FMSs, and FMPs

The goal of this section is for the Nueces Regional Flood Planning Group (NRFPG) to identify and evaluate potential flood mitigation actions. This section builds on previous chapters with the ultimate objective of recommending flood mitigation actions that:

- reduce the risk identified in the existing and future condition flood risk analyses,
- address flood mitigation and floodplain management goals, and
- address the greatest flood risk and flood mitigation needs.

#### 5.1.1 Categorization of FMEs, FMSs, and FMPs

##### 5.1.1.1 Flood Management Evaluation

An FME, by Texas Water Development Board (TWDB) definition, is “a proposed flood study of a specific, flood-prone area that is needed in order to assess flood risk and/or determine whether there are potentially feasible FMSs or FMPs.” There are three general categories of FMEs as described below. An FME may include any or all these study elements or phases:

- Flood hazard modeling and mapping / risk identification studies
- Flood mitigation alternatives analysis / feasibility studies

- Preliminary Engineering studies

#### 5.1.1.2 Flood Mitigation Project

An FMP, by TWDB definition, is “a proposed project, either structural or non-structural, that has non-zero capital costs or other non-recurring costs and when implemented will reduce flood risk, mitigate flood hazards to life or property.”

One of the primary objectives of the regional flood plan (RFP) is to identify and fund FMPs for implementation; therefore, identifying FMPs that meet state flood plan criteria and requirements for inclusion into the state flood plan (SFP) is a high priority. Per the TWDB rules, of the four common phases of emergency management shown in Figure 5-1, the regional flood planning process focuses primarily on mitigation projects but may also include preparedness projects. Flood preparedness, response, and recovery activities are discussed in Chapter 7.

*“The regional flood planning process will focus primarily on mitigation and may include preparedness with regard to identifying and recommending FMPs by the RFPG.”*



**Figure 5-1. Four Phases of Emergency Management**

FMPs are further categorized as either structural or non-structural.

Structural FMPs are defined as building or modifying infrastructure to change flood characteristics to reduce flood risk. They are infrastructure projects with advanced analysis and 30 to 100 percent design development, including construction plans, specifications, and cost estimates. Structure FMPs include one or a combination of the following project types:

- Low-water Crossings (LWCs) or Culvert/Bridge Improvements
- Channel Improvements
- Flood Detention
- Flood Walls/Levees



- Flood Diversion – Examples include diversion channels or diversion tunnels
- Storm Drain Improvements
- Dam Improvements
- Coastal Protections – Examples include coastal levees, dikes, and seawalls and often include beach erosion countermeasures such as riprap revetments. Coastal protections can also include green or hybrid solutions such as living shorelines and breakwaters.
- Nature-based Features – Examples include stream and coastal restorations, wetlands, natural channel design, other green infrastructure elements, and land preservation. TWDB strongly encourages the RFPG to consider nature-based flood risk reduction solutions in their overall approach.

Non-structural FMPs change the way people interact with flood risk and move people out of harm's way. These types of projects do not involve modifications to the watershed or flood infrastructure; therefore, they do not have negative impacts to adjacent areas or environmental impacts. Non-structural FMPs include one or a combination of the following project types:

- Flood Readiness and Resilience – Examples include flood response plans, evacuation plans, and emergency action plans
- Floodplain Evacuation – Examples include property acquisition / buyouts
- Flood Early Warning Systems – Examples include stream gauges and warning signals to more complex early flood warning systems that can forecast floods and warn large populations to evacuate
- Floodproofing – Examples include making structures watertight and elevation of individual structures
- Regulatory Requirements for Reduction of Flood Risk – Examples include floodplain development ordinances and drainage design criteria related to planning, zoning, land development, and building codes

#### 5.1.1.3 Flood Mitigation Strategy

An FMS, by TWDB definition, is “a proposed plan to reduce flood risk or mitigate flood hazards to life or property”. The RFPG should include as FMSs any proposed action that the group would like to identify, evaluate, and recommend that does not qualify as either a FME or FMP. FMSs generally fall into the following categories:

- Flood mitigation education and outreach
- Buyout programs
- Flood management regulations

## 5.1.2 Identifying Potential FMEs, FMPs, and FMSs

The following steps were used to identify flood mitigation actions:

1. Define draft process for identifying and evaluating flood mitigation actions.
2. Extract potential flood mitigation actions from review of relevant flood studies.
3. Conducted initial stakeholder outreach to obtain information on flood mitigation actions.
4. Identify additional flood mitigation actions to address unmet greatest known flood needs and goals.
5. Perform initial screening and evaluation of flood mitigation actions to determine if actions meet minimum TWDB requirements.

### 5.1.2.1 Draft Process

TWDB requirements state that each RFPG is to develop and receive public comment on a “...proposed process to be used by the RFPG to identify and select flood management evaluations, flood mitigation strategies, and flood mitigation projects. This process is to be documented and such documentation is to be included in the draft and final adopted Regional Flood Plan.”

At the NRFPG meeting on July 26, 2021, a Region 13 subcommittee was formed to develop a draft process. The Region 13 subcommittee included Debra Barrett, Lj Francis, Kendria Ray, and Lauren Hutch Williams, who met on August 23, 2021, to prepare recommendations for the NRFPG. The resulting recommendations of a draft process to be used by the RFPG to identify potentially feasible FMEs, FMSs and FMPs for the Nueces regional flood plan (NRFP) was approved at the September 27, 2021, regional flood planning meeting. The approved draft process is provided in Figure 5-2 and Figure 5-3.

**Agenda Item #10. Proposed Process for Identifying Potential Flood Management Evaluations, Strategies, and Projects for the 2023 Nueces Regional Flood Plan**

The process outlined below for identifying and selecting FMEs, FMSs, and FMPs was developed by the Region 13 subcommittee (consisting of Debra Barrett, Lj Francis, Kendria Ray, and Lauren Williams) on August 23<sup>rd</sup> for Nueces RFPG consideration at its Sept 27<sup>th</sup> meeting with public input.

- 1) The Nueces RFPG solicited public and stakeholder comments related to identifying potential FMEs, FMS, and FMPs, as follows:
  - Deploying a public comment map on the Region 13 website [Home - Nueces Regional Flood Planning Group \(Region 13\) \(nueces-rfpg.org\)](https://www.nueces-rfpg.org), requesting feedback on flood-prone areas in the Nueces Basin. The comment map was open from April through August 2021. As of July 23<sup>rd</sup>, 185 comments on flood-prone areas were received.
  - A survey requesting information on proposed/ongoing flood projects was sent on June 18, 2021 to over 400 floodplain administrators and stakeholders in the Nueces Basin.
  - Direct outreach included four sub-regional meetings held May 17-20<sup>th</sup>, personal emails to floodplain administrators, and follow-up phone calls to selected municipalities to gather information on local and regional flood plans in the Nueces Basin and flood planning needs. As of August 17<sup>th</sup>, 32 entities had completed a survey on existing floodplain practices.
- 2) A subcommittee formed during the July 26<sup>th</sup> Nueces RFPG meeting consisted of voting and non-voting NRFPG members met on August 23<sup>rd</sup> to develop a draft process for identifying projects.
- 3) The Nueces RFPG will receive public comment at the September 27<sup>th</sup> meeting on the proposed process to be used to identify and select FMEs, FMSs, and FMPs.
- 4) Ongoing/proposed projects and flood-prone areas will be reviewed to identify project needs and data gaps.
- 5) Considering information provided by stakeholders, an initial screening of studies, projects and strategies will be performed based on the following metrics:
  - Addresses flood mitigation/ floodplain management goals adopted by the NRFPG
  - Prioritize emergency needs
  - Consider prevention projects to mitigate future flooding
  - Consider identified projects within a lens of potential impact to Agreed Order provisions
  - Indication regarding potential use of federal funds, TWDB, or other sources of funding and include a table of potential funding sources in the draft and final plan
  - Reduces flooding risk (benefits life and property) for drainage areas of 1 sq mile or more
  - Assess potential for including nature-based solutions and applicability
  - Unlikely to negatively affect a neighboring area (FMS or FMP only)
  - Reduces flood risk for 100-year storm event (1% annual chance of flood)(FMS or FMP only)
- 6) Using TWDB guidance (next page), a draft list of FMEs, FMSs, and FMPs will be compiled for consideration by the Nueces RFPG at its meeting in Oct/Nov 2021. Infeasible FMSs and FMPs will be identified, including primary reason for deeming infeasible.
- 7) A list of potential FMEs and potentially feasible FMS and FMPs identified by the NRFPG and infeasible FMSs and FMPs will be included in the Technical Memorandum due to TWDB in Jan 2022.
- 8) The Nueces RWPG will consider and submit a scope of work to the TWDB of FMEs, FMSs, and FMPs to be evaluated in the 2023 Nueces Regional Flood Plan.

*Flood Management Evaluation (FME)- flood study of a specific flood prone area needed to assess risk*

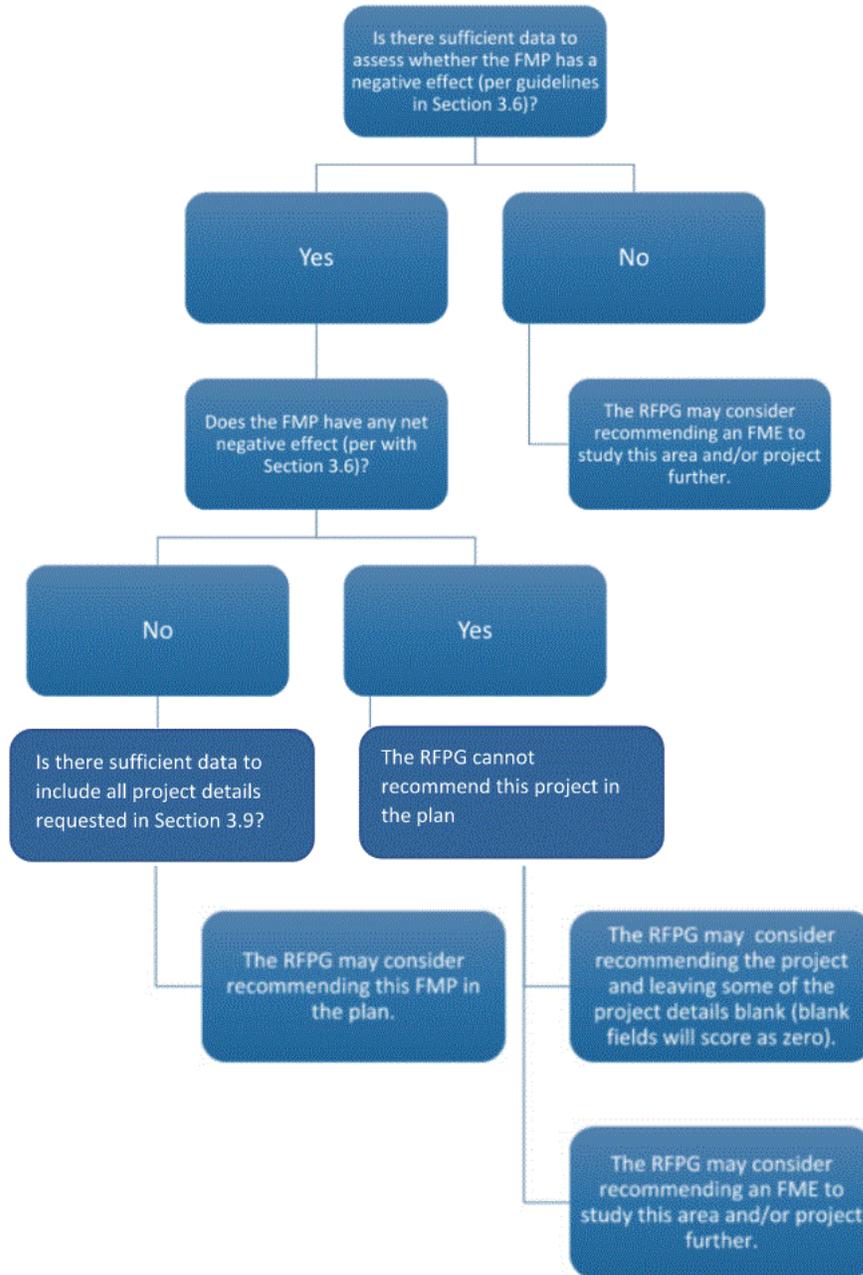
*Flood Mitigation Project (FMP)- structural or non-structural project that when implemented will reduce flood risk, mitigate hazards to life or property. Includes nature-based solutions. 'No negative impact'*

*Flood Management Strategy (FMS)- proposed plan to reduce flood risk or mitigate flood hazards. Any action that a RFPG would like to evaluate and recommend that does not qualify as FME or FMP.*

**Figure 5-2. Process for Identifying Potential Flood Management Evaluations, Strategies, and Projects for the 2023 Nueces Regional Flood Plan**

- 9) The process by which potentially feasible FMS are selected for evaluation in the 2023 Nueces Regional Flood Plan will be revisited and updated (if necessary) after submittal of the technical memorandum. A description of process will be included in draft and final plans.

**TWDB guidance for designating FMEs/FMPs (from TWDB)**



**Figure 5-3: Process for Identifying Potential Flood Management Evaluations, Strategies, and Projects for the 2023 Nueces Regional Flood Plan (Continued)**

### 5.1.2.2 Review of Relevant Flood Studies

A list of potential flood mitigation actions was derived from the review of previous relevant flood studies, which are listed in Appendix C2 – List of Previous Flood Studies. These include multiple hazard mitigation plans, regional floodplain management plans, and other flood risk reduction type plans.

### 5.1.2.3 Stakeholder Outreach

Effective outreach to individuals with knowledge of known flood-prone areas and potential flood mitigation evaluations and projects was a key step in the development of the list of flood mitigation actions. Continuous efforts have been made since the start of the flood planning process to identify and engage those with flood-related authority in the basin. Four subregional meetings were held in May 2021 to introduce the regional flood planning process and to gather local knowledge of flood-prone areas, flood mitigation projects and needs based on the pre-established subregional designed county groupings shown previously in Figure 1-2.

In February 2022, the NRFPG reached out to county judges to further refine the stakeholder list of those with flood-related authority and knowledge, to identify flood plain contacts for county and city representation, and garner interest in upcoming stakeholder outreach. Stakeholders were contacted and 20 individual interviewers and three subregional meetings were held from February through April 2022. The list of flood mitigation actions previously identified were reviewed during the additional outreach to determine if any were under consideration or no longer needed, if the list was complete, and to obtain additional information.

Initial efforts to contact potential sponsors consisted of sending surveys to communities. These surveys contained projects associated with each community identified, giving the community an opportunity to communicate any projects that are no longer relevant or any projects that they are actively pursuing. These surveys were followed by calls to those same community contacts to inform communities of the survey and its purpose. To supplement this initial outreach effort, relationships previously developed with Nueces Region communities were leveraged to inform them of the NRFPG and its purpose and inform them of the previously sent survey to gather additional input. As in-person community outreach meetings took place, additional discussions and meetings occurred that further garnered community input regarding potential mitigation actions. While these actions furthered the goal of receiving community feedback on what projects they wanted to pursue, not all communities were reached, and accordingly, the NRFPG decided that an affirmative willingness to sponsor a given action would not be a prerequisite for inclusion in the plan. As a result, all potential actions were considered for inclusion unless an entity had specifically declined to be listed as a sponsor and no

other appropriate potential sponsor was identified. This approach was adopted for the following reasons.

1. It provides a conservative estimate of the flood mitigation need in the region.
2. It does not oblige an entity to sponsorship; it simply allows an entity to be eligible for funding if interest in and capacity to sponsor a project become evident within this planning cycle.

All sponsors associated with recommended actions were subsequently sent a survey to identify potential funding needs and sources for the actions listed in the plan. This effort is detailed in Chapter 9.

#### 5.1.2.4 Identified Additional Flood Mitigation Actions to meet unmet Needs and Goals

A flood risk gap evaluation was performed in Chapter 4 to determine how the list of flood mitigation actions relate to the greatest known flood risk and mitigation needs and the regional goals. Areas identified as high risk but lacking flood studies or projects to address the flood mitigation need include:

- City of Falfurrias in Brooks County
- City Lytle in Medina County
- City of Three Rivers in Live Oak County
- aPleasanton, Jourdanton, and Poteet area in Atascosa County
- City of Dilley in Frio County
- City of Pearsal in Frio County
- Natalia and Devine area in Medina County
- aHondo area in Medina County
- City of Uvalde in Uvalde County
- aCrystal City in Zavala County
- City of Asherton in Dimmit County
- Cities of Vanderpool and Utopia area along Frio River in Real and Uvalde County
- Area along Nueces River in western Uvalde County
- Webb County – Subdivision near I59 / Becerra Creek
- City of Cotulla
- City of Refugio
- City of Hebbronville
- Sabinal River are in northeast Uvalde County and southwest Bandera County

Potential flood mitigation evaluations were identified to provide flood studies for the list of high risk areas above.

A gap evaluation was also performed in Chapter 4 to determine how the list of flood mitigation actions relate to the floodplain mitigation and floodplain management goals presented in Chapter 3. The list of flood mitigation actions was found insufficient to



achieve several of the Nueces Basin goals. Thus, additional studies were recommended as listed in Table 5-1 to help achieve Nueces basin goals while addressing areas of flood risk.

**Table 5-1. Recommended Flood Studies to address Goals**

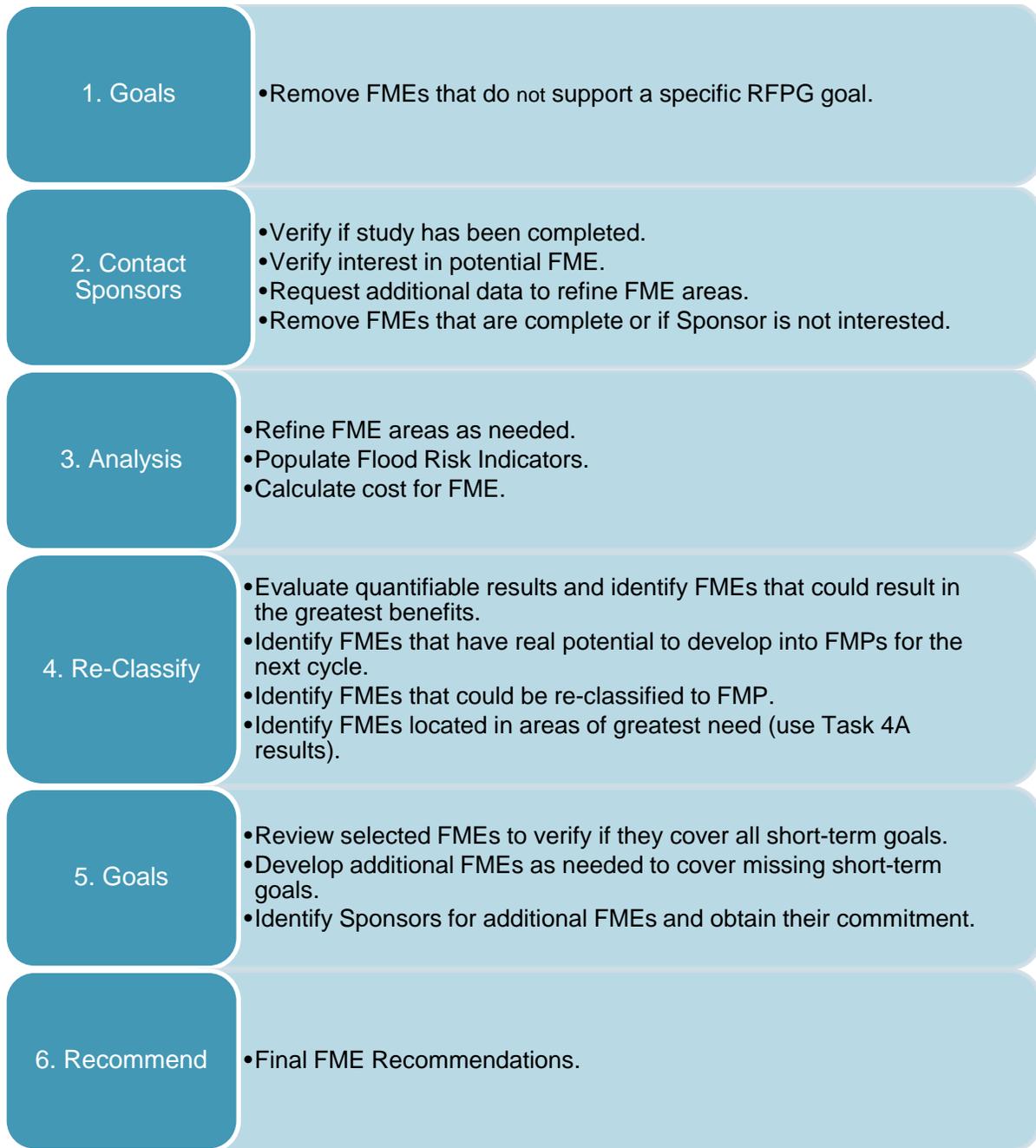
Goal #	Name of Study	Potential Sponsor
1 – Low Water Crossings	Nueces Basin low water crossing study and upgrade prioritization	Nueces River Authority
2 – High Hazard Dams	Nueces Basin High Hazard Dam identification and risk assessment	Texas State Soil Conservation and Water Conservation Board (TSSWCB)
3 – Regional Coordination / Flood Warning Systems	Nueces Basin early flood warning system	Nueces River Authority
4 – Flood Map Updates	Nueces Basin Floodplain Map Updates	Nueces River Authority
6 – Min. Flood Standards	Nueces Basin Minimum Flood Management Standards	Nueces River Authority
7 – Nature Based Practices	Nueces Basin Assessment of Flood Mitigation and Performance of Nature-based Solutions (NBS)	The Nature Conservancy
7 – Nature Based Practices	Scaling Up Nature Based Solutions (NBS) in the Nueces Flood Planning Region to support community resilience and enhance flood and hazard mitigation planning	The Nature Conservancy
8 – Flood Public Information Campaign	Nueces Basin flood public information campaign	Nueces River Authority

#### 5.1.2.5 RFPG Evaluation and Recommendation Process

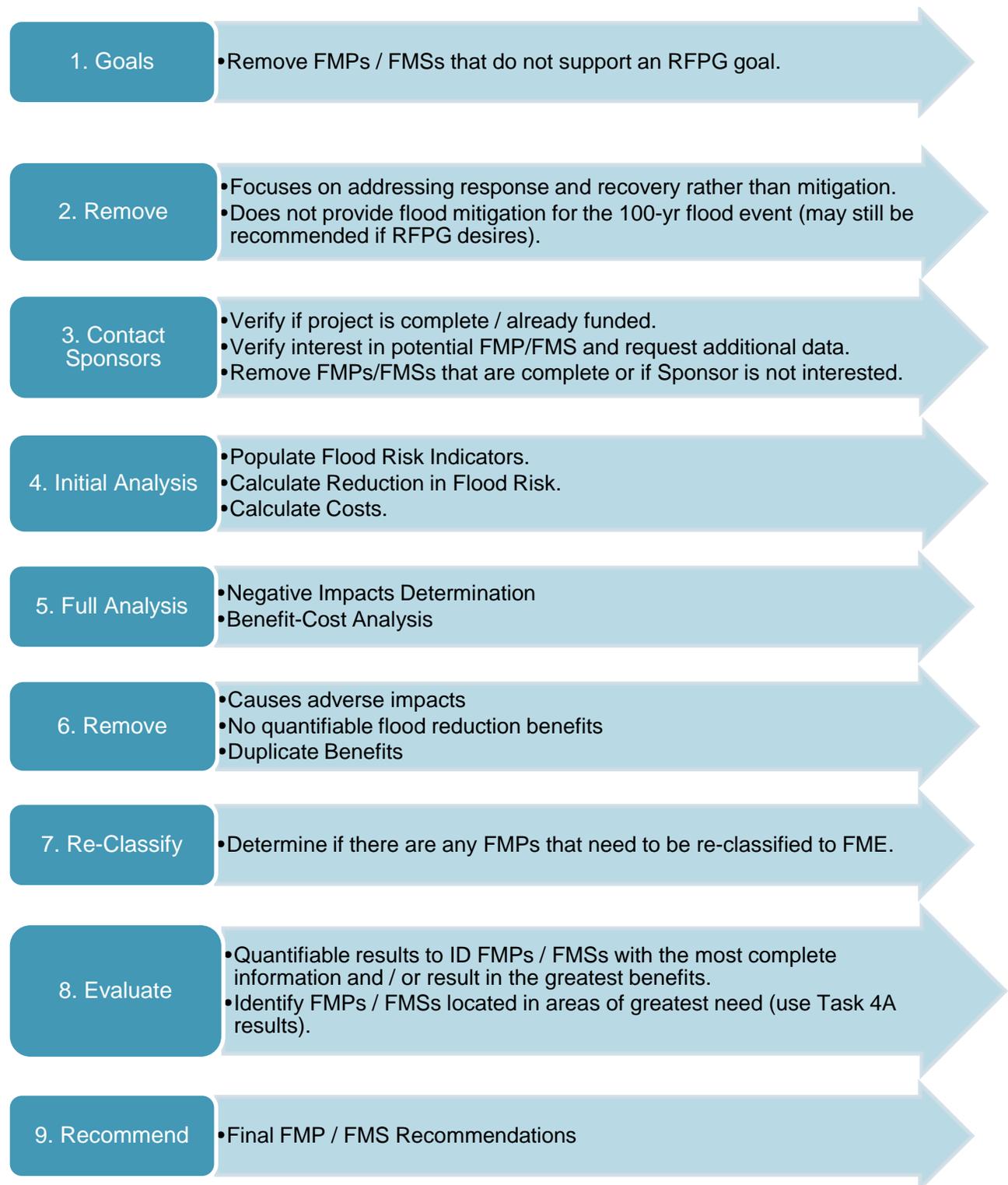
The NRFPG considered recommendations on flood mitigation actions through a multi-step process. As documented in 5.1.2.3, the NRFPG created a Technical Subcommittee tasked with establishing a selection methodology, implementing the evaluation and selection process, and reporting their findings and recommendations back to the NRFPG for formal approval. The methodology included a screening of all potential flood mitigation actions considering TWDB requirements for inclusion in the RFP and any other additional considerations established by the Technical Subcommittee. The reasons for not recommending a particular flood mitigation action were reviewed by the NRFPG as part of the evaluation and recommendation process with reasons documented in the potential flood mitigation action tables attached to this plan (see Appendix A8).

The screening process for evaluating and recommending flood mitigation actions is summarized in Figure 5-4 for FMEs and in Figure 5-5 for FMPs and FMSs. These processes were primarily developed following the TWDB rules and requirements for inclusion in the plan. However, the TWDB left some evaluation criteria at the discretion of the RFPG and additional guidance was necessary prior to implementing the screening process. The main discretionary evaluation criteria are the level of service (LOS) to be provided by an FMP and the benefit-cost ratio (BCR) for the project. The TWDB recommends FMPs should minimally mitigate flood events associated with the 1 percent annual chance flood (100-year LOS). However, if a 100-year LOS is not feasible, the RFPG can document the reasons for its infeasibility and still recommend an FMP with a lower LOS. Similarly, the TWDB recommends that proposed actions have a BCR greater than one, but the RFPG may recommend FMPs with a BCR lower than one with proper justification.

On May 6, 2022, the NRFPG voted to recommend FMEs, FMPs, and FMSs as presented. This meeting was held in accordance with the requirements of the RFPG bylaws, the Texas Open Meetings Act, and the general requirements of the Texas Water Code and the flood planning process.



**Figure 5-4: FME Screening Process**

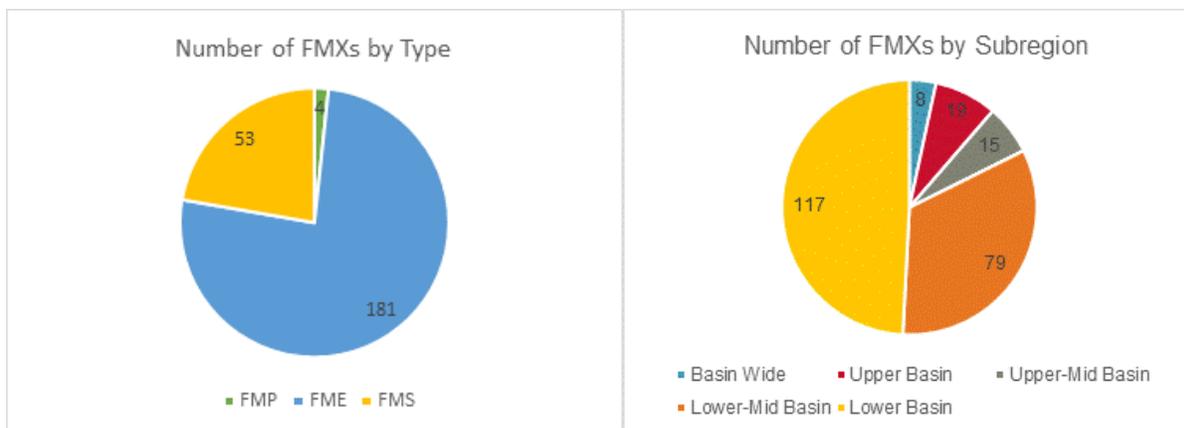


**Figure 5-5:FMP and FMS Screening Process**

### 5.1.2.6 Identification of FMPs, FMEs, and FMSs

The initial identification of Flood Mitigation Actions was documented in the mid-point Technical Memorandum submitted in December of 2021. At this mid-point, 366 flood mitigation actions were identified before initial screening was performed to determine compliance with TWDB requirements. This mid-point list was comprised of 232 FMPs, 65 FMEs, and 69 FMSs. The initial screening of flood mitigation actions removed 258 flood mitigation actions. The individual flood mitigation actions removed and the reason for their removal are documented in Appendix C7 – List of Removed Flood Mitigation Actions. Many more FMPs were reclassified to FMEs and numerous FMEs and FMSs were added as a result of the additional stakeholder outreach.

As a result of the above identification and initial evaluation process, a total of 238 flood mitigation actions were determined to meet TWDB requirements, of which four are FMPs, 181 are FMEs, and 53 are FMSs. The lower basin represents the majority of flood mitigation actions and comprises 117 of the total 238 flood mitigation actions that were identified. A breakdown of flood mitigation actions by type and subregion are provided in Figure 5-6. Refer to Appendix A7 – TWDB Table 12 – Potential Flood Management Evaluations Identified by RFPG, Appendix A8 – TWDB Table 13 – Potential Feasible Flood Mitigation Projects Identified By RFPG, and Appendix A9 – TWDB Table 14 – Potentially Feasible Flood Management Strategies Identified by RFPG.



**Figure 5-6. Breakdown of Flood Mitigation Actions by Type and Subregion**

The identified flood mitigation actions were then screened for compliance with TWDB requirements and evaluated for inclusion into the NRFP. The screening process and the resulting recommended flood mitigation actions are described fully in the next section.

## 5.2 Evaluation and Recommendation of FMEs, FMSs, and FMPs

While there is an abundant need across the Nueces Region and the State of Texas for data collection, strategy implementation, and project construction to reduce or remove risk of flooding, not every flood mitigation action can be recommended in the RFP or included in the state flood plan (SFP). The NRPFG evaluated the identified flood mitigation actions and based on the significant needs in the region, recommended all those that met the TWDB requirements and offered the greatest potential of reducing flood risks within the region, understanding that not all flood mitigation actions may be performed in the same planning cycle as they are identified. All recommendations considered alignment with NRPFG-adopted flood mitigation and floodplain management goals.

### 5.2.1 Flood Mitigation Action Costing Assumptions

To quantify the flood mitigation need within the Nueces Region, each flood mitigation action was assigned a cost. This was completed by leveraging the data available for each project and following a set of guidelines that promoted consistency while determining costs across multiple projects. Project cost estimates developed in or after September 2020 had the potential to be used directly, as it was assumed that these still provided an accurate representation of the projects' cost. For those projects that had cost estimates developed prior to September 2020, the project cost was escalated to an equivalent September 2020 dollar amount using Consumer Cost Index (CCI) values. To accommodate instances where flood mitigation action did not have project cost estimates available, a set of costing tables were developed based on action type and prevalent subcategories among the actions under review. The cost tables for FMEs and FMSs can be found in Appendix C8 – Supporting Costing Material for Flood Mitigation Actions. A table was not developed for FMPs as FMP costing was reliant upon escalating cost estimates provided by sponsors. Costing supporting materials such as factors used to derive September 2020 dollars from available cost estimates and calculators used to develop costs for Flood Mapping Updates and Dam Failure Analysis projects are also included in attached supporting costing material.

### 5.2.2 Flood Management Evaluations

#### 5.2.2.1 Summary of Approach in Recommending FMEs

In considering potential FMEs for recommendation, the NRPFG sought to determine which FMEs would be most likely to result in identification of potentially feasible FMSs and FMPs in future planning cycles. Recommended FMEs were also required to demonstrate alignment with at least one regional floodplain management and flood



mitigation goal developed under Task 3. Finally, each recommended FME should identify and investigate at least one solution to mitigate the 1 percent annual chance flood. It is the intent that all FMEs with a hydrologic and hydraulic modeling component will evaluate multiple storm events, including the 1 percent annual chance flood. The exact solutions identified through performing these FMEs cannot be defined at this time. However, it is anticipated that an impact analysis will be performed for all alternatives and project benefits will be tabulated for the 1 percent annual chance flood to help inform any recommended alternatives and to define potentially feasible FMPs under this planning framework. Based on these TWDB requirements, the NRPFG identified two main reasons for recommending FMEs.

The first subset of recommended FMEs would result in increased flood risk modeling and mapping coverage across the region as they are implemented. These types of FMEs have two major implications for identifying potentially feasible FMSs and FMPs.

First, a current and comprehensive understanding of flood risk across the basin is necessary to identify high-risk areas for evaluation and development of flood risk reduction alternatives. Secondly, FMPs, and in some cases, FMSs, require a demonstrated potential reduction in flood risk to be recommended in the regional flood plan. For this metric to be assessed, hydrologic and hydraulic modeling must be available to compare existing and post-project floodplain boundaries to determine the flood risk reduction potential of a given project.

The second subset of recommended FMEs were project planning type FMEs. These FMEs are generally studies or preliminary designs to address a specific, known flood need. However, these flood mitigation actions currently lack some or all the detailed technical data necessary for evaluation and recommendation as an FMP such as demonstrating no adverse impacts, having a BCR greater than 1.0, or confirmation that the project provides mitigation for the 1 percent annual chance flood event. An example would be an existing study that identifies a potential drainage construction project but does not provide a no adverse impact analysis or statement. Completing these components as part of an FME will result in a potentially feasible FMP for consideration during future flood planning efforts. Sponsor input was a major driver for choosing not to recommend FMEs. FMEs that were indicated by the sponsor as being in progress, completed, or lacking interest to pursue were not recommended. Additionally, FMEs in close proximity to one another were combined into a single FME for recommendation due to overlapping goals or benefits.

#### 5.2.2.2 Description and Summary of Recommended FMEs

The NRPFG identified and evaluated a total of 181 potential FMEs. Of these projects, 164 were recommended, representing a combined total of \$120,767,000 of flood management evaluation need across the region. From these evaluations, it is

forecasted that approximately \$572,769,000 in construction of flood mitigation projects will be enabled. The number, types, and costs of FME projects recommended by the NRFBPG are summarized in Table 5-2. A complete basin-wide table of FMEs is presented in Appendix A10 – TWDB Table 15 – Flood Management Evaluations Recommended by RFBPG. County-based tables and maps of FMEs are presented in Appendix B23 – Flood Hazard Risk, Flood Risk Score, and Recommended Flood Mitigation Actions. Overall, the recommended FMEs represent over 15,500 square miles of development and potential drainage improvements and provides substantial coverage of those portions of the flood planning region that are severely impacted by the 1 percent and 0.2 percent annual chance flood events, as determined through analysis performed in Chapter 2.



**Table 5-2: Summary of Recommended FMEs**

<b>FME Types</b>	<b>FME Descriptions</b>	<b># of FMEs Identified</b>	<b># of FMEs Recommended</b>	<b>Cost of Recommended FMEs</b>	<b>Estimated Cost of Construction</b>
Preparedness	Gauges, Barriers, Debris/Vegetation Removal, and Channelization	4	2	<b>\$550,000</b>	\$0
Project Planning	Previously Identified Drainage Projects and Flood Studies	143	134	<b>\$111,173,000</b>	\$565,319,000
Watershed Planning	FIS Studies, Watershed Studies	23	19	<b>\$5,111,000</b>	\$0
Other	Property Acquisition and Buyout Programs	11	9	<b>\$3,933,000</b>	\$7,450,000
<b>Total</b>		<b>181</b>	<b>164</b>	<b>\$120,767,000</b>	<b>\$572,769,000</b>

*This page is intentionally blank.*

## 5.2.3 Flood Mitigation Projects

### 5.2.3.1 Summary of Approach in Recommending FMPs

For consideration as an FMP, a project must be defined in a sufficient level of detail to meet the technical requirements of the flood planning project Scope of Work and the associated Technical Guidelines developed by the TWDB. In summary, the RFPG must be able to demonstrate that each recommended FMP meets the following TWDB requirements:

1. The primary purpose is mitigation (response and recovery projects are not eligible for inclusion in the regional flood plan).
2. Supports at least one regional floodplain management and flood mitigation goal.
3. The FMP is a discrete project (not an entire capital program or drainage master plan).
4. Implementation of the FMP results in:
  - a. Quantifiable flood risk reduction benefits
  - b. No negative impacts to adjacent or downstream properties.
  - c. No negative impacts to an entity's water supply
  - d. No overallocation of a water source based on the water availability allocations in the most recently adopted State Water Plan.

In addition, the TWDB recommends that, minimally, FMPs should mitigate flood events associated with the 1 percent annual chance flood (100-year LOS). However, if a 100-year LOS is not feasible, the RFPG can document the reasons for its infeasibility and still recommend an FMP with a lower LOS.

Updated construction cost estimates and estimates of project benefits must also be available to define a BCR for each recommended FMP. The TWDB recommends that proposed projects have a BCR greater than one, but the RFPG may recommend FMPs with a BCR lower than one with proper justification.

The NRFPG considered for recommendation all potentially feasible FMPs that had the necessary data and detailed hydrologic and hydraulic modeling results available to populate these technical requirements. Pertinent details about the FMP evaluation are provided in the following section.

### 5.2.3.2 Description and Summary of Potentially Feasible FMPs

Four potential FMPs were included in the preliminary FMP list; a general description of the scope of work for each is provided below.

***County Wide Early Flood Warning System (FMP 133000001):***

The County Wide Early Flood Warning System project is focused on providing advanced warning ahead of impending flood events to residents of Uvalde County to provide residents time to prepare for flooding and accordingly minimize loss of life and property.

***Bed-Material Entrainment in selected Streams of the Edwards Plateau (FMP 133000002):***

The original understanding of the Bed-Material Entrainment in selected Streams of the Edwards Plateau project was that this potential FMP was to make improvements in the streams to prevent damage to low water crossings. However, further investigation determined the potential project was not as fully developed as originally believed. Therefore, this potential FMP was reassigned as a FME study to focus on developing a method to assess low water crossings on a site-by-site basis to determine the most appropriate method of reducing damage associated with entrained bed material.

***Lamar Golf Course Drainage Easements (FMP 133000003):***

The Lamar Golf Course Drainage Easements project consists of acquiring drainage easements through the existing Lamar Golf Course to facilitate future drainage infrastructure projects intended to reduce flooding on county roads within the area.

***Southcentral Lamar Drainage Easement (FMP 133000004):***

The Southcentral Lamar Drainage Easement project consists of acquiring drainage easements for a surface stormwater conveyance system extending from Southcentral Lamar (Bee Tree Circle) to Hwy 35 Bypass.

Of these four projects, one project (FMP 133000001) was determined to be an ongoing project with dedicated funding, so was removed from consideration. The remaining three projects continued through the screening process described in Section 5.2.3.3.

### 5.2.3.3 FMP Evaluation

#### ***Initial Evaluation***

The scope of work for each FMP was evaluated to ensure that it would support at least one of the regional floodplain management and flood mitigation goals established in Chapter 3. The goals associated with each FMP are included in Appendix A6 – TWDB Table 11 – Flood Mitigation and Floodplain Management Goals. Based on a review of supporting information, it was determined that the primary purpose for each FMP is mitigation (rather than a response or recovery project), they are discrete projects, and they do not have any anticipated impacts to water supply or water availability allocations as established in the most recent adopted State Water Plan (TWDB, 2022 State Water Plan, Appendix B).

### ***No Negative Impacts Determination***

Each identified FMP must demonstrate that there would be no negative impacts on a neighboring area due to its implementation. No negative impact means that a project will not increase flood risk of surrounding properties. Using best available data, the increase in flood risk must be measured by the 1 percent annual chance event water surface elevation and peak discharge.

For the purposes of flood planning effort, the following requirements, per TWDB Technical Guidelines, 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 negative impacts are identified, mitigation measures may be used to alleviate such impacts. Projects with design level mitigation measures already identified may be included in the regional flood plan and could be finalized at a later stage to conform to the “No Negative Impact” requirements prior to funding or execution of a project.

Furthermore, the RFPG has flexibility to consider and accept additional “negative impact” for requirements 1 through 5 based on engineer’s professional judgment and analysis given any affected stakeholders are informed and accept the impacts. This should be well-documented and consistent across the entire region. However, flexibility regarding negative impact remains subject to TWDB review.

The typical process for this determination is to perform a comparative assessment of pre- and post-project conditions for the 1 percent annual chance event (100-year flood) for each potentially feasible FMP based on their associated hydrologic and hydraulic models. The floodplain boundary extents, resulting water surface elevations, and peak discharge values would be compared at pertinent locations to determine if the FMP conforms to the no negative impacts requirements. This comparative assessment would be performed for the entire zone of influence of the FMP. **However, for the Nueces Region, none of the identified FMPs had models or reports to review to make no negative impacts determinations.**

### ***Level of Service Evaluation***

TWDB recommends that FMPs should mitigate flood events associated with the 1 percent annual chance flood (100-year LOS). Each of the potentially feasible Nueces Region FMPs could potentially reduce flood damages; however, documentation of a 100-year LOS could not be provided for any of the three potential FMPs. **None of the FMPs reviewed for the Nueces Region had models or reports available, and the nature of the proposed FMPs (primarily easement acquisition) did not allow for determination of a LOS that could be provided by the FMP.**

### ***Benefit-Cost Analysis***

Benefit-cost analysis (BCA) is the method by which the future benefits of a hazard mitigation project are determined and compared to its costs. The end result is a BCR, which is calculated by dividing the project's total benefits, quantified as a dollar amount, by its total costs. The BCR is a numerical expression of the relative "cost-effectiveness" of a project. A project is generally considered to be cost effective when the BCR is 1.0 or greater, indicating the benefits of a prospective hazard mitigation project are sufficient to justify the costs (FEMA, 2009). However, a BCR greater than 1.0 is not a requirement for inclusion in the RFP. The RFPG can decide to recommend a project with a lower BCR with appropriate justification. **Due to the nature of the potentially feasible FMPs in the Nueces region, it was determined that a BCR could not be assigned.**

#### *Bed-Material Entrainment in selected Streams of the Edwards Plateau (FMP 133000002):*

A study to develop a methodology for assessing low-water crossings (LWCs) and ways to reduce damages associated with entrained bed material can lead to reduced maintenance costs and safer crossings, but without an understanding of the magnitude of anticipated benefits, a benefit cannot be accurately estimated at this stage.

#### *Lamar Golf Course Drainage Easements (FMP 133000003) and Southcentral Lamar Drainage Easement (FMP 133000004):*

While acquired easements can pave the way for future flood mitigation projects capable of realizing a real benefit, easement acquisition alone offers no readily quantifiable benefit until leveraged in a flood mitigation project.

### ***Evaluation Results***

Due to the high level of detail required for consideration as an FMP, no project was determined to have enough detail available for evaluation and potential recommendation as an FMP (see Table 5-3).



The potentially feasible FMPs do not provide a quantifiable LOS, benefit, or a no negative impact determination at their current stage.

Although not recommended as FMPs, these three projects have potential to be beneficial projects with further study and development through feasibility studies and preliminary engineering. Therefore, the project descriptions were modified, and they were added to the FME list.

**Table 5-3: Summary of Recommended FMPs**

FMP Type	FMP Description	# of FMPs Identified	# of FMPs Recommended	Total Cost of Recommended FMPs
<b>Natural</b>	Nature Based Solutions	1	0	\$0
<b>Preparedness</b>	Flood Warning System	1	0	\$0
<b>Other</b>	Easement Acquisitions	2	0	\$0
<b>Total</b>		<b>4</b>	<b>0</b>	<b>\$0</b>

The required Project Details Spreadsheet, which will be used for evaluation and FMP ranking by the State, is not provided as there are no FMPs recommended.

While no FMP was selected for consideration in Task 5, Task 12 will consist of performing identified potential FMEs and evaluating flood risk reduction solutions, including feasibility studies and preliminary engineering, to identify, evaluate, and recommend additional potentially feasible FMPs. The FMEs to be performed and additional FMPs to be identified, evaluated, and recommended under this task are subject to RFPG approval. FMPs developed through Task 12 will be included in the 2023 Revised RFP.

## 5.2.4 Flood Management Strategies

### 5.2.4.1 Summary of Approach in Recommending FMSs

The approach for recommending FMSs adheres to similar requirements as the FMP process. However, due to the flexibility and varying nature of RFPG’s potential use of FMSs, some of these requirements may not be applicable to certain types of FMSs. In general, the RFPG must be able to demonstrate that each recommended FMS meets the following TWDB requirements as applicable:

1. The primary purpose is mitigation (response and recovery projects are not eligible for inclusion in the regional flood plan).
2. Supports at least one regional floodplain management and flood mitigation goal.
3. Implementation of the FMS results in:

- a. Quantifiable flood risk reduction benefits
- b. No negative impacts to adjacent or downstream properties (a No Negative Impact certification is required)
- c. No negative impacts to an entities water supply
- d. No overallocation of a water source based on the water availability allocations in the most recently adopted State Water Plan.

In addition, the TWDB recommends that, at a minimum, FMSs should mitigate flood events associated with the 1 percent annual chance flood (100-year LOS). However, if a 100-year LOS is not feasible, the RFGP can document the reasons for its infeasibility and still recommend an FMS with a lower LOS.

Although each potentially feasible FMS must demonstrate that there would be no negative flood impacts on a neighboring area due to its implementation, there was no modeling available for the FMSs identified within this region, and therefore it could not be determined that there would be any reduction in flood risk or negative impacts to adjacent or downstream properties.

Multiple communities communicated an interest to pursue FMSs associated with Flood Management Standards and a Flood Public Information Campaign. Due to the number of communities expressing interest in these activities and the benefits associated with their uniform implementation across the region, it was determined that these FMSs would be more effectively executed at the regional level by the Nueces River Authority. Accordingly, community FMSs that fell under these two categories were not recommended, and instead the regional implementation of these FMSs was instead recommended.

#### 5.2.4.2 Description and Summary of Recommended FMSs

A variety of FMS types were identified for the Nueces Region. Generally, these FMSs recommend broad regional strategies and initiatives. Some strategies encourage and support communities and municipalities to actively participate within the National Flood Insurance Program (NFIP). Other FMSs recommend the establishment and implementation of public awareness and educational programs to better inform communities of the risks associated with flood waters. Additional FMSs promote preventive maintenance programs to optimize the efficiency of existing stormwater management infrastructure, recommend the development of a stormwater management manual to encourage best management practices (BMPs), or promote the establishment of community-wide flood warning systems. These FMSs support several of the regional floodplain management and flood mitigation goals established in Chapter 3.



The NRFPG identified and evaluated a total of 55 potential FMSs. Of these projects, 35 were recommended, representing a combined total cost of \$19,820,650. The number and types of projects recommended by the NRFPG are summarized in Table 5-4. The full list of FMSs and supporting technical data, including their flood risk reduction benefits as applicable, is included as Appendix A12 – TWDB Table 17 – Flood Management Strategies Recommended by RFPG. County-based tables and maps of FMSs are presented in Appendix B23 – Flood Hazard Risk, Flood Risk Score, and Recommended Flood Mitigation Actions.

**Table 5-4 Summary of Recommended FMSs**

<b>FMS Types</b>	<b>FMS Descriptions</b>	<b># of FMSs Identified</b>	<b># of FMSs Recommended</b>	<b>Cost of Recommended FMSs</b>
<b>Education and Outreach</b>	Turn Around, Don't Drown Campaigns; Flood Safety Education	17	9	\$757,000
<b>Flood Measurement and Warning</b>	Flood Gauges, Early Alert Systems, Flood Warning Systems	10	4	\$1,050,000
<b>Property Acquisition and Structural Elevation</b>	High Risk Property Acquisition, Acquisition of Open Space near Floodplain Areas	3	3	\$10,700,000
<b>Regulatory and Guidance</b>	NFIP Participation, Stormwater Management Criteria Development, Floodplain Management Staff Acquisition and Training	15	15	\$6,961,000
<b>Infrastructure Projects</b>	Maintenance of existing infrastructure, cost study of implementing infrastructure	8	2	\$100,000
<b>Other</b>	Training, Floodplain Standard Adoption, Infrastructure Inspections	2	2	\$252,650
<b>Total</b>		<b>55</b>	<b>35</b>	<b>\$19,820,650</b>

*This page is intentionally blank.*