Chapter 6: Impact and Contribution of the Regional Flood Plan

Introduction

The Regional Flood Planning Group (RFPG) was tasked with summarizing the impacts and contributions the regional flood plan is expected to have if the plan is implemented as recommended. The following sections describe the impacts and contributions of this plan to various aspects of water resources. Implementation of the plan as recommended assumes that all flood mitigation projects (FMP), flood management strategies (FMS), and flood management evaluations (FME) are fully funded and completed. Additionally, avoidance of future flood risk due to policy recommendations and potential future recommendation of all identified projects, strategies, and evaluations is described in this chapter since most FMPs, FMSs, and FMEs only require sponsor approval to be recommended by the Lower Brazos RFPG.

Task 6A: Impacts of Regional Flood Plan

The overall impacts of the Regional Flood Plan include potential benefits to areas at risk of flooding; structures and populations in the floodplain; low water crossings; water supply; and impacts on the environment, agriculture, recreational resources, water quality, erosion, sedimentation, and navigation. This chapter describes the processes undertaken by the RFPG to summarize the benefit of the regional flood plan if fully implemented.

The impact of the plan also includes how future flood risk will be avoided through implementation of recommended improvements to the region's floodplain management policies. Direct and indirect benefits of other FMPs, FMSs, and FMEs not currently recommended are also discussed. These details are provided to highlight the importance of stakeholder involvement and support in maximizing the plan's effectiveness during amendment periods and future cycles.

Relative Reduction in Flood Risk

The impacts of the plan on existing flood risk were determined based on a before-and-after (regional flood plan implementation) comparison of the same type of information provided under the Task 2 Existing Flood Risk Analysis. Since none of the recommended projects were analyzed in the 0.2 percent annual chance event, metrics were only provided to summarize benefits in the 1 percent annual chance event. The quantitative comparison of 1 percent annual chance exceedance (ACE) data with and without the plan illustrates how much the region's existing flood risk will be reduced through implementation of the plan as recommended by the RFPG.

Reduction in Flood Risk Identification Needs

In Chapter 2, 33% of the Lower Brazos Flood Planning Region was identified as needing flood risk identification or updates to existing flood risk information. After the completion of recommended flood management evaluations (FME), 28% of the region area will need flood risk identification, a reduction of 1,172 square miles (5%). Figure 6-1 represents the existing and remaining gaps in flood risk information compared to the overall area in the region. Figure 6-2 shows the location of existing gaps in flood risk information, identified FMEs, and recommended FMEs. Although additional FMEs were identified by the RFPG in Chapter 4, most were not recommended due to lack of sponsor response and small study size. More information on the process used to recommend FMEs is included in Chapter 5.

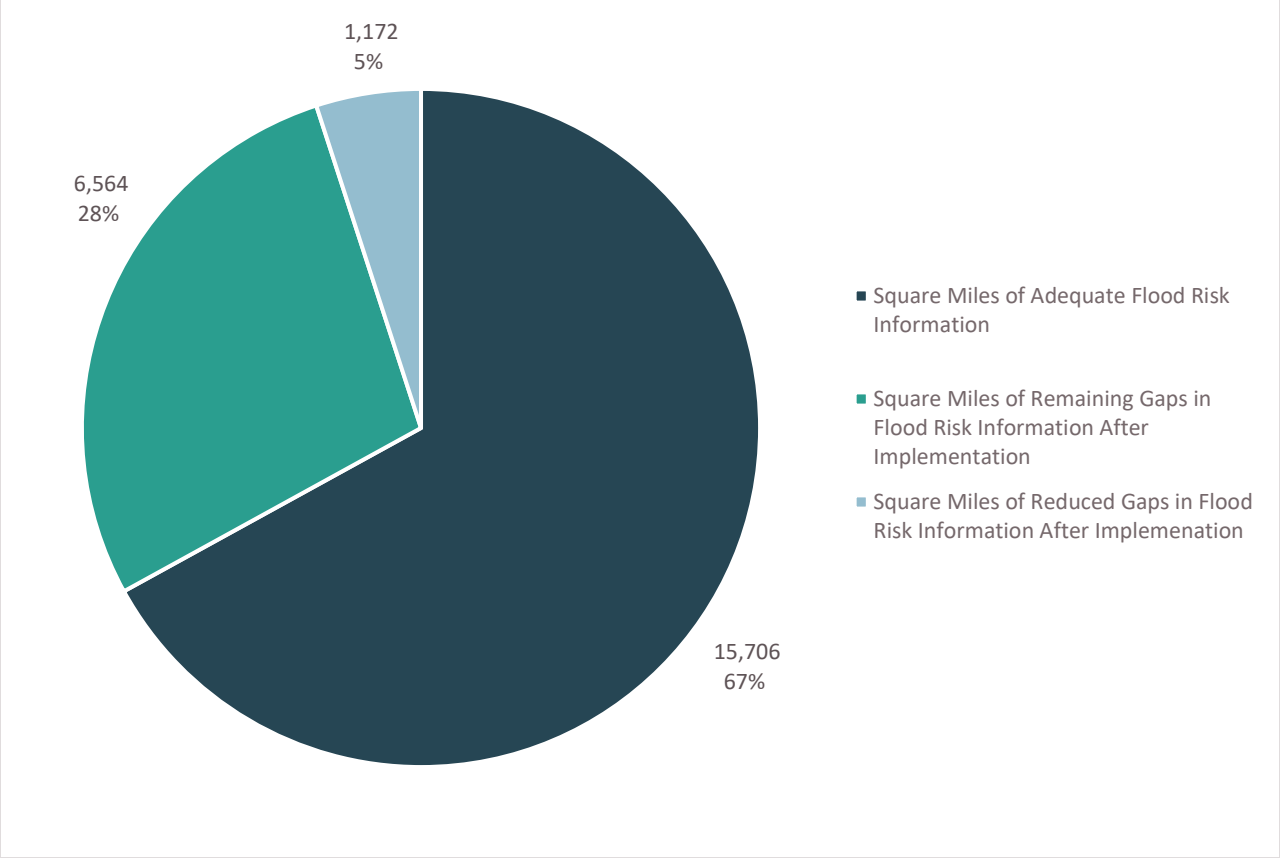

Figure 6-1: Gaps in Flood Risk Information After Implementation of Regional Flood Pan

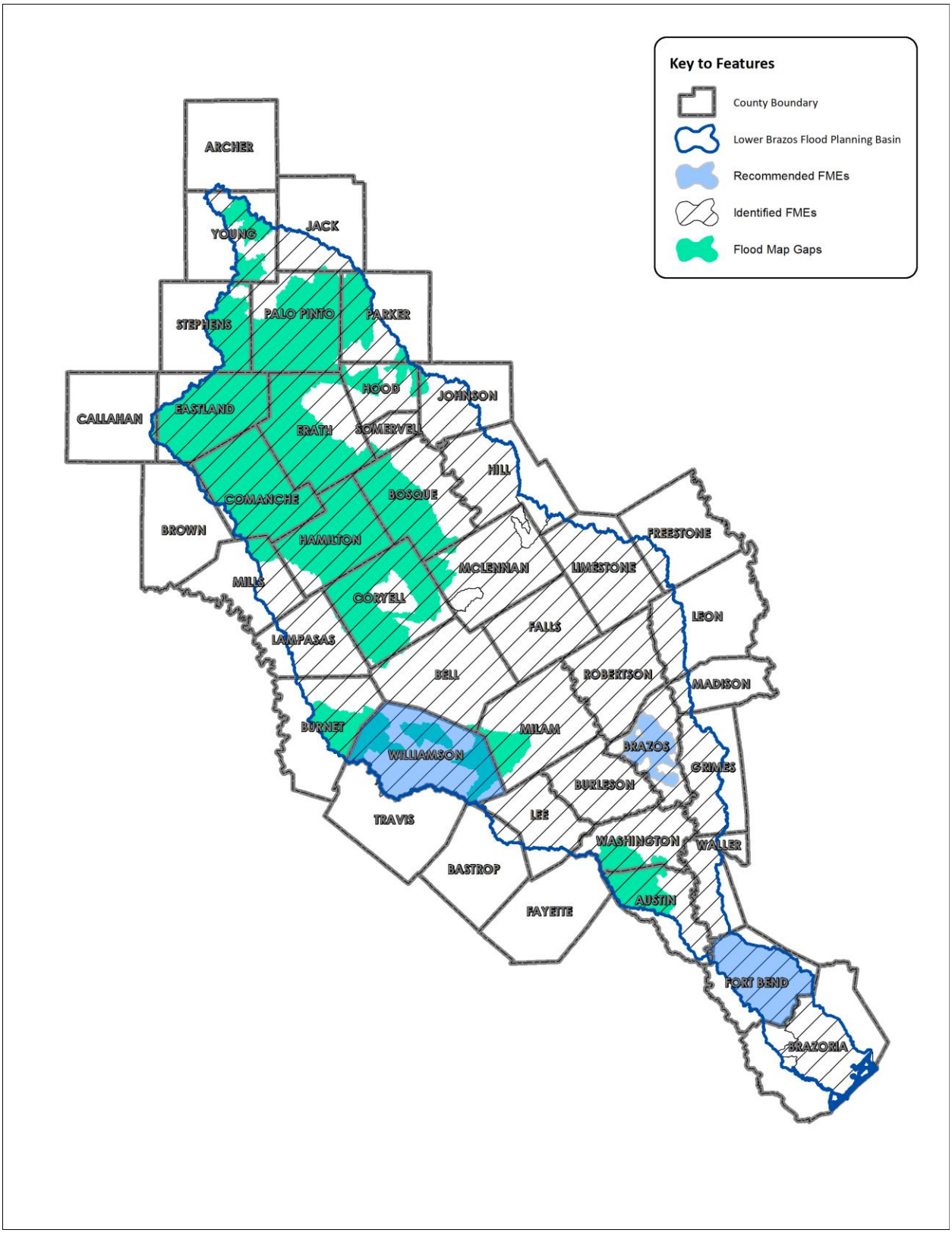

Figure 6-2: Impact of Plan on Flood Risk Information Gaps

Reduction in Flood Risk Exposure

When implemented, flood mitigation projects (FMPs) positively impact flood risk exposure by removing or reducing population and property from flood risk. The Lower Brazos RFPG recommended 25 FMPs for implementation. These projects are mostly channel conveyance improvement projects or regional detention ponds. Table 6-1 summarizes the benefit to people and property expected if the regional flood plan is implemented as recommended.

Table 6-1: Summary of Impact on People and Property After Implementation of Regional Flood Plan

Flood Exposure Region-wide	Existing Conditions	After Implementation	Reduction in Exposure
	1% ACE	1% ACE	1% ACE
Total Structures	63,056	59,196	3,860
Residential Structures	42,646	39,644	3,002
Critical Facilities	203	184	19
Population	129,888	123,467	6,421
LWC	5,170	5,170	0

All FMPs recommended by the RFPG are located in Fort Bend County, therefore all benefits shown in Table 6-1 are limited to a single county. Benefits are specifically summarized for Fort Bend County in Table 6-2. All flood risk exposure outside of Fort Bend County is considered a residual risk after the implementation of the regional flood plan. Since recommended projects were only evaluated using the 1 percent annual chance event, no summary of benefits is provided for the 0.2 percent annual chance event.

Table 6-2: Summary of Impact on People and Property in Fort Bend County After Implementation of Regional Flood Plan

Flood Exposure within Fort Bend County	Existing Conditions	After Implementation	Percent Reduction in Exposure
	1% ACE	1% ACE	1% ACE
Total Structures	14,227	10,367	27.1 %
Residential Structures	11,612	8,610	25.9 %
Critical Facilities	30	11	63.3 %
Population	26,966	20545	23.8 %
LWC	200	200	0 %

No Adverse Impact

As proposed, implementation of the recommended FMPs will not negatively affect neighboring areas located within or outside of the flood planning region. All recommended FMPs were previously modeled to ensure “no negative flood impact” on upstream, downstream, or neighboring areas. These impact analyses were conducted outside of the flood planning process and were performed using regional planning level data. The local sponsor will ultimately be responsible for ensuring the final project design has no negative flood impact prior to initiating construction.

Other Impacts

The sections below describe the anticipated impacts of the plan on each of the following categories:

socioeconomic, recreation, environment, agriculture, recreational resources, water quality, erosion, sedimentation, and navigation.

Socioeconomic Impacts

Disadvantaged socioeconomic status can limit access to resources which could hinder response and recovery from flood events. Flooding does not only result in destroyed infrastructure and damaged property, but also has an adverse social impact on affected citizens. The short-term and long-term impacts on physical and mental health result in changes to the livelihoods of affected citizens creating greater socioeconomic disparity.

The recommended projects in Fort Bend County provide watershed-wide benefits to the areas with socially vulnerable index (SVI) values ranging from 0.14 to 0.58. Watershed planning can contribute to the region's ability to prepare for, respond to, and recover from flood events. Reducing socioeconomic disparities through the implementation of measures to create equity can be initiated through planning. This is done by ensuring that vulnerable populations have the same access to resources and social infrastructure as those unaffected by flooding.

Recreational Impacts

Using natural or man-made water bodies for recreation is highly valued in the region and throughout Texas. Many waterfront parks are spaces that are designed to be flooded with minimal damage during storm events. These floodplains and wetlands can support tourism, recreation, and freshwater fisheries.

Recreational benefits can also accompany flood mitigation projects. Along the Brazos River, many flood control reservoirs are utilized for recreation including boating and fishing. The FMPs recommended by the RFPG will not impact the recreational use in these areas. In Fort Bend County, pedestrian and bike trails will accompany channel improvement FMPs, providing mobility and recreational benefits in tributary watersheds. Erosion prevention efforts included in the regional flood plan also provide recreational benefits, since all land within the streambed is state-owned property and can be used for camping, fishing, or picnicking. The recommended FMS, Project Brazos, provides recreational benefit in Fort Bend County by protecting streambeds and adjacent communities from erosion.

Additionally, the list of recommended FMSs includes the development of a property acquisition program in the City of College Station and City of Hutto, which would provide recreational benefit by opening opportunities for creation of common gathering spaces for the respective communities.

While parks and camping areas are a valuable asset to the region, there are potential disadvantages to using the floodplain and waterfront parks for recreation. Recreational waterbodies can become dangerous to use when damages due to flooding. Therefore, consideration must be made to include adequate warning systems for individuals using these facilities.

Environmental Impacts

The property acquisition FMSs mentioned above will remove structures from flood risk through demolition, and by doing so, would benefit the environment by eliminating the release of pollutants associated with flooded homes. Although it is unknown what the cities' intended use for the land is after demolition, one possible use would be as local park space, which would benefit the environment by promoting the development of habitats for native plant and animal species.

While land acquisition and development regulations can have positive impacts on the environment, structural projects recommended in the plan have the potential to harm wetland ecosystems in undeveloped land that frequently receive nutrients from flooding. During detailed design phases of recommended projects, consideration of maintaining natural conditions of these ecosystems should be

made through implementing hydraulic connections between the floodplain and improved infrastructure. In some cases, additional permitting could be required.

Agricultural Impacts

Flooding or excess precipitation can wash nutrients downstream or result in loss of crops due to excessive moisture. Livestock can be swept away, drowned, injured by flood waters, or exposed to contaminated flood waters which can result in health issues. After the implementation of the regional flood plan, 86 square miles of agricultural land is anticipated to be removed from the 1 percent annual chance flood hazard area as a result of recommended FMPs in Fort Bend County, which will reduce the risk of damage to cropland and excessive transport of fertilizers. While mitigation projects will primarily provide benefits to agricultural land and water quality, they also have the potential to negatively effect the natural process of nutrient transport in the wide floodplains of Fort Bend County. Ultimately, since farming does not reflect the land's natural condition, and soils rely on human activity for nutrients instead of natural processes, the drawbacks of protecting agricultural land from flooding are likely to be outweighed by benefits.

Table 6-3: Summary of Impact on Agriculture After Implementation of Regional Flood Plan

Flood Exposure	Existing Conditions	After Implementation	Reduction in Exposure
	1% ACE	1% ACE	1% ACE
Agricultural Land (SqMi)	837	783	54

Water Quality Impacts

Water-quality concerns within the flood planning region are high nutrient loads, high bacterial and salinity levels, and low dissolved oxygen. Mitigation of flooded agricultural land mentioned in the previous section will address nutrient load issues by reducing quantities of fertilizer conveyed in runoff.

The list of recommended FMSs includes flood proofing lift stations and manholes within the City of Georgetown. Additionally, the recommended FMPs in Fort Bend County provide widespread reductions in water surface elevations and inundation, which greatly reduces the risk of stormwater overwhelming water and wastewater treatment plants that serve many municipal utility districts (MUDs) in the area. Flood proofing and structural projects both mitigate overflow of sanitary lift stations in a flood event, preventing the release of untreated sewage that can harm water quality in the region. These strategies and projects also can reduce disruption of raw water treatment.

Erosion and Sedimentation Impacts

The list of recommended FMSs includes Project Brazos, which will primarily benefit erosion issues along the main stem of the Brazos River. The strategy includes stabilization efforts for 11 identified locations throughout Fort Bend County where critical infrastructure, such as accredited levees, highways, or historic sites, are at risk of damage due to migration of the Brazos River, which has been accelerated by recent flooding. Implementation of this strategy will reduce erosion and sedimentation along the Brazos River and potentially avoid significant future losses to public infrastructure, buildings, and vulnerability to levees.

Navigation Impacts

Historically, the Brazos River was navigable from the Gulf Coast to Washington County, for a stretch of approximately 250 miles. Today, the Brazos River is no longer used for navigation purposes. The implementation of recommended FMPs and FMSs in the regional flood plan will not impact navigation

on the Brazos River.

Avoidance of Future Flood Risk

The following sections illustrate how additional, future flood risk (that might otherwise arise if no changes were made to floodplain policies etc.) will be avoided through implementation of the regional flood plan. Impacts of the plan on existing flood risk that also impact future flood risk are not included in the discussion.

Floodplain Management Policy Future Impacts

Floodplain management recommendations and goals were established by the Lower Brazos RFPG as a part of Task 3. While most of the regional flood plan focuses on the current cycle, Task 3 establishes a long-term vision for target metrics that subsequent cycles of the plan should achieve. Of the 10 goals set forth by the RFPG, the floodplain management goals presented in **Chapter 3 Table 5,** listed below**,** will be most impactful in helping communities in the region avoid increases in flood hazard exposure.

- Increase the number of counties and communities that are enrolled in the National Flood Insurance Program (NFIP).
- Increase the number of counties and communities that have adopted higher than minimum NFIP-standards including directing development away from the floodplain.
- Increase the number of entities that have adopted the best available data and science for their designs and plans.

Regulation of development, implementation of higher standards, and use of best available data are all interdependent strategies for avoiding potential increases in flood exposure over time. “Higher standard” is defined by the *Technical Guidelines for Regional Flood Planning* as freeboard requirements, detention requirements, or fill restrictions. Higher standards provide a factor of safety to account for future uncertainty in identified flood risk. Yet, in order to set higher standards, foundational standards should be set through NFIP participation, and flood risk should be accurately identified through reliable and robust methods. The goals listed above will be realized through execution of FMSs recommended in each planning cycle.

Flood Management Strategy (FMS) Future Impacts

The RFPG identified FMSs encompassing 27 counties in the region from publicly available Hazard Mitigation Plans (HMPs) that are directly aligned with the goal of implementing higher standards in the LBFPR. These strategies are assigned the type “Regulatory and Guidance.” Through the development regulations mentioned in the previous section, the Regulatory and Guidance FMSs have the potential to reduce flood risk for newly constructed buildings in the LBFPR.

Based on the future flood hazard analysis from Task 2B, over 480,000 new structures are projected to be constructed across the region to accommodate population growth over the next 30 years. Potential flood risk can be reduced, and resiliency could be increased for many of these structures by communities adopting higher floodplain management criteria and standards. While many FMS related to updated floodplain management criteria were identified, none were recommended by the RFPG due to a lack of sponsor response. While these FMSs are not recommended by the RFPG, documentation of the strategies in HMPs implies the potential for their recommendation in subsequent amendments or cycles of the plan.

In addition to reducing risk for newly constructed buildings, higher standards also help communities avoid additional future flood risk through the following regulations:

- Mitigating impacts on receiving waterways from development due to increased runoff

conveyance, which also stabilizes erosion and sedimentation in natural channels.
- Preserving floodplain capacity by requiring compensatory storage for all fill in 1% or 0.2% ACE flood hazard areas.
- Incentivizing development away from flood hazard areas, which protects the natural environment and water quality.
- Higher freeboard requirements and improved resilience through requiring design of extreme event overflows

Flood Management Evaluation (FME) Future Impacts

As shown in Figure 6-2, FMEs in the form of regional watershed studies were identified across the LBFPR in order to address gaps in flood risk information as a part of Task 4A. While these evaluations are not recommended by the RFPG due to lack of sponsor approval, their future recommendation during subsequent amendments or cycles of the plan could result in an increase in quantified flood exposure, as defined in Chapter 2. While an increase in quantified exposure may not indicate progress in fulfilling the plan's stated goals at a first glance, identification of new flood exposure through state-of-the-art studies is a critical step in proposing solutions in the form of FMPs. Implementation of regional studies in a consistent manner throughout the LBFPR facilitates the following future benefits:

- Better understanding of flooding sources and frequency of flooding
- Equitable assessment of flood exposure throughout the LBFPR during future planning cycles
- Widespread availability of existing conditions modeling for evaluation of future FMPs
- Regional, hydrologic study extents will facilitate future FMPs that focus on regional mitigation, rather than prioritization of benefits within specific political jurisdictions

In summary, avoidance of future flood risk begins with identifying this risk through new studies. Beyond addressing the immediate need of closing knowledge gaps, execution of regional watershed studies created by the Lower Brazos RFPG will provide a foundation for effective FMP identification and recommendation in future planning cycles.

Task 6B: Contributions to and Impacts on Water Supply

Regional flood plans must include a region-wide summary and description of the contribution that the regional flood plan would have to water supply development, including positive and negative impacts of the flood plan on the state water plan. The Lower Brazos Flood Planning Region covers portions of the Brazos G, Lower Colorado (Region K), Region H, and Region F, and Region C Water Planning Regions. **Error! Reference source not found.** shows all Regional Water Planning Areas and the Lower Brazos Flood Planning area.

The Lower Brazos RFPG coordinated with each of these planning groups as a part of the flood planning process. There are no flood mitigation projects (FMP) or flood management strategies (FMS) recommended in the Lower Brazos Regional Flood Plan that, if implemented, would measurably contribute to or would negatively impact and/or measurably reduce water supply in any of the water planning regions.

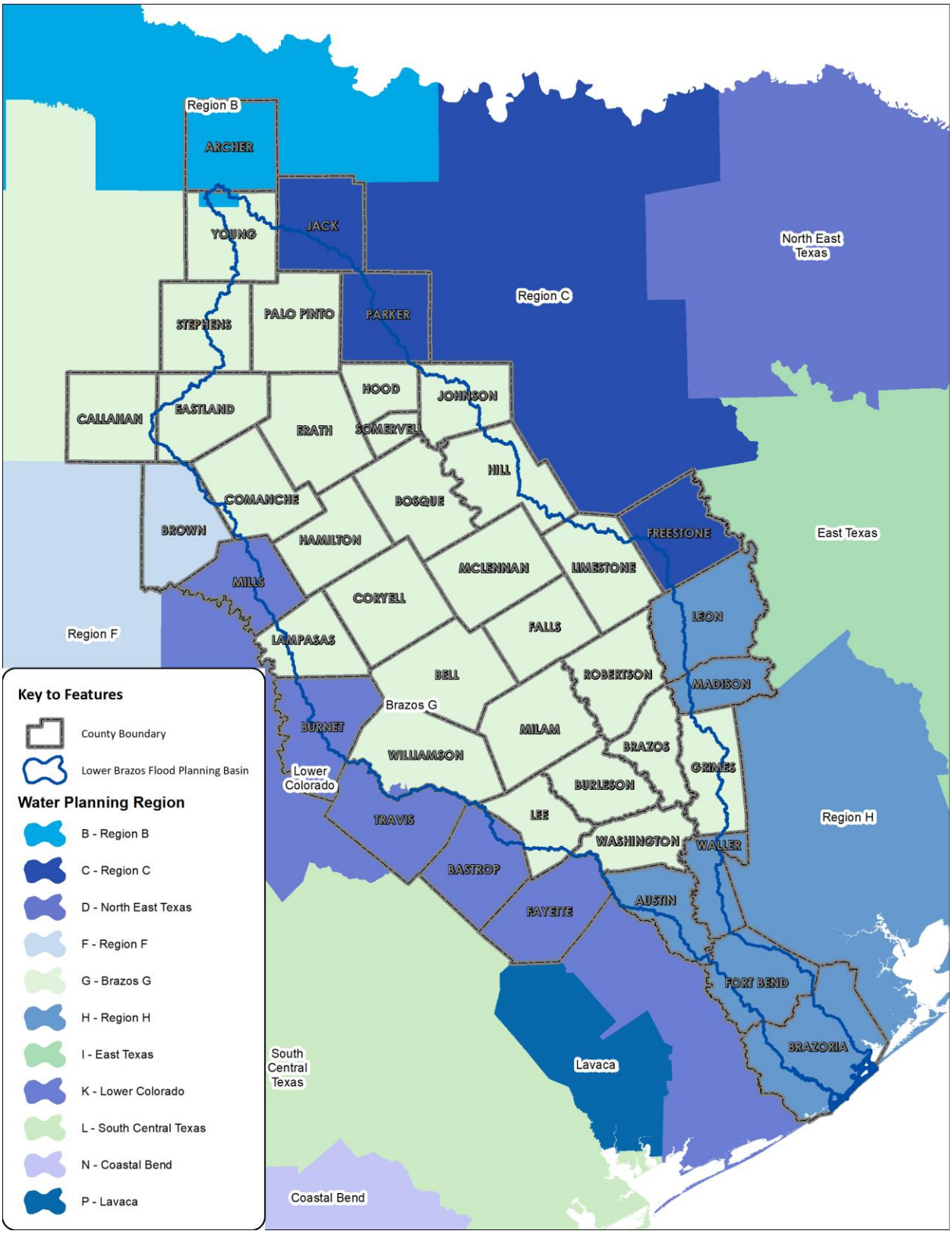

Figure 6-3: Water Planning Areas and Lower Brazos Flood Planning Region