

Chapter 6: Impact and Contribution of the Regional Flood Plan

6.1 Impacts of Regional Flood Plan

The goal of Task 6A is to summarize the overall impacts of the Regional Flood Plan. This includes potential impacts to areas at risk of flooding, structures and populations in the floodplain, number of low water crossings impacted, impacts to future flood risk, impact to water supply (details provided in **Section 6.2**), and overall impact on the environment, agriculture, recreational resources, water quality, erosion, sedimentation, and navigation. This chapter describes the processes undertaken by the Regional Flood Planning Group (RFPG) to achieve these tasks and summarizes the outcomes of this effort.

The impacts will generally be determined based on before-and-after (regional flood plan implementation) comparisons of the same types of information provided in **Chapter 2** existing flood risk and future flood risk analyses. These two comparisons may, for example, indicate a percent change in flood risk faced by various elements, including critical infrastructure. These two comparisons (one comparison each for a 1% ACE and another for a 0.2% ACE) should illustrate both how much the region's existing flood risk will be reduced through implementation of the plan as well as how much additional, future flood risk (such as risk that might otherwise arise if no changes were made to floodplain policies) will be avoided through implementation of the regional flood plan, including recommended changes/improvements to the region's floodplain management policies.

This effort included a:

1. Region-wide summary of the relative reduction in flood risk that implementation of the Regional Flood Plan would achieve within the region including with regard to life, injuries, and property.
2. Statement that the FMPs in the plan, when implemented, will not negatively impact neighboring areas located within or outside of the Flood Planning Region (FPR).
3. General description of the types of potential positive and negative socioeconomic or recreational impacts of the recommended FMSs and FMPs within the FPR.
4. General description of the overall impacts of the recommended FMPs and FMSs in the Regional Flood Plan on the environment, agriculture, recreational resources, water quality, erosion, sedimentation, and navigation.

6.1.1 FMP Impacts

Thirty-two FMPs were identified and recommended, as discussed in detail in **Chapters 4 and 5**. As proposed, the recommended FMPs within this plan will not negatively impact neighboring areas located within or outside of the FPR. The local sponsor will ultimately be responsible for proving that the final project design and implementation has no negative flood impacts prior to construction.

Of these FMPs, a little less than half are conveyance improvement projects that have the potential to increase flows downstream by expanding channels, culverts, and/or bridges. To increase the likelihood that there will be no negative impacts to neighboring areas, conveyance mitigation measures, such as detention or valley storage have been included in the projects and will have to be analyzed and designed once the projects are funded. The remaining FMPs consist of new or improved detention facilities without conveyance improvements, acquisition or elevation of repetitive loss properties, installation of emergency generators, or infrastructure hardening. The RFPG reviewed previous assessments of impact to upstream or downstream areas or neighboring regions, and deferred to the professional engineering judgement expressed in those assessments to determine whether no negative impact exists. The local sponsor will be ultimately responsible for proving the final conveyance project design has no negative flood impact prior to initiating construction. As proposed, the recommended FMPs, when implemented, will not negatively impact neighboring areas located within or outside of the FPR.

Additionally, based on the planning level data available, none of the FMPs recommended in the plan will negatively or measurably reduce water availability or water supply volumes and will not impact the State Water Plan.

As detailed in **Table 13 (Appendix 4-B)** and summarized in ~~Table 6-1~~ **Table 6-1** below, the 32 FMPs would reduce the number of structures in the 1% ACE floodplain by 667, and the number of structures in the 0.2% ACE floodplain by 411. This would help protect approximately 1,793 people from living within the 1% ACE floodplain. An estimated 19 road closure occurrences can be avoided within the 1% ACE floodplain. Some of these projects are expected to benefit agricultural lands. Additional benefits will include reduction in flooding in park lands, which will benefit recreational users. The streams impacted by the FMPs are not currently navigable, and this will not change when the projects are implemented.

If fully implemented, the [Regional Flood Plan \(RFP\)](#) will have profound and lasting impacts on flooding in Region 11. It is important to note that ~~Table 6-1~~ **Table 6-1** only demonstrates the flood exposure analysis for the -recommended FMPs.

Table 6-1: Summary of Impacts of FMPs to Flooding in Region 11

Flood Exposure	Existing Conditions		After FMP Implementation		Exposure Reduction from FMPs	
	1% ACE	0.2% ACE	1% ACE	0.2% ACE*	1% ACE	0.2% ACE*
Exposed Structures	13,438	15,023	12,771	14,612	667	411
Exposed Population	20,723	23,805	18,930	N/A	1,793	N/A
Exposed LWC	266	270	247	N/A	19	N/A

* 0.2% ACE impacts were not provided by FMP sponsor

6.1.2 FMS Impacts

The RFPG identified and reviewed more than 150 individual strategies from stakeholders within the Guadalupe FPR. Many of the identified strategies were found in existing Hazard Mitigation Action Plans, and it was noted there is a lot of similarity in the strategies. It was therefore determined to group the FMSs into the five strategy types identified in the TWDB Guidance Documents, and to consolidate the individual FMSs into five regional FMSs. The main reasons for this decision were to make each strategy inclusive of all communities within the Guadalupe FPR that choose to pursue them and to encourage collaboration between sponsors, particularly neighboring communities.

There are 31 individual actions that are bundled into the Regulatory and Guidance regional FMS. Actions listed within this category will improve regulation of development to decrease current and future flood risks. Some sample FMSs are NFIP participation, stormwater management criteria development including higher standards, floodplain management staff acquisition and training, ordinances, land use/zoning, and developing and implementing Green Infrastructure programs. Positive impacts include reducing the number of structures and roadways built in the floodplain, minimizing expansion of future floodplains, protecting riparian areas from development, which protects the environment, water quality, erosion, and sedimentation, and providing more regulatory certainty and consistency across the Guadalupe FPR. Potential negative impacts include the increased regulatory and financial burden on citizens and the increase in staff workload for communities.

Property Acquisition and Structural Elevation actions involve voluntary buyout programs and/or structural elevation assistance programs. There are 31 individual actions that are bundled into the Property Acquisition and Structural Elevation regional FMS. Although the individual actions focus on open space preservation, the regional FMS includes land acquisition to protect open space, acquiring or buying out flood prone structures, and elevation assistance programs. Anticipated positive impacts include reducing the number of structures in the floodplain and increased protection of citizens, allowing people to remove themselves from the floodplain without losing their investments, restoring/preserving floodplain functionality and conveyance,

and ultimately protecting riparian areas from development – which protects natural environments, water quality, erosion, sedimentation. Potential negative impacts include increasing the regulatory and financial burden on citizens, increasing staff workloads for each community, causing “blight” in certain neighborhoods if not handled appropriately, and could be politically objectionable in some circumstances.

Some strategies considered Education and Outreach to increase awareness of flooding issues, risks, and regulation to citizens and other stakeholders. There are 61 individual actions that are bundled into the Education and Outreach regional FMS. These include public awareness campaigns; flood safety education for residents, elected officials and real estate agents/developers; and flood insurance campaigns. Anticipated positive impacts include reduced violations of floodplain regulations which can decrease flood risks, increased public awareness of flood hazard areas, increased NFIP participation, and increased awareness of imminent flood events - which can help with early evacuations and mitigation measures to prevent further damages, save lives, and minimize risky behavior during floods which can reduce deaths, especially while driving. One negative impact of this strategy category is that it could increase staff workloads for communities. Establishing these types of programs would also introduce a small financial burden on citizens.

There are 46 individual actions that are bundled into the Flood Measurement and Warning regional FMS. This type involves the installation and operation of rainfall and flow measurement devices. These devices may have predictive systems in place to better forecast flooding, barricades, and warnings. Example FMSs include flood gauges, early alert systems, flood warning systems, evacuation/emergency management plans, and flood safety systems at Low Water Crossings. The anticipated benefits of implementing this FMS would be allowing people at risk of flooding to better prepare for flood events, mitigate damages, evaluate their respective area(s), and prevent vehicles from driving on flooded roads. All of these measures can help save lives by allowing local officials and community staff members to take proper precautions such as: closing hazardous roads and evacuating the predicted flooded areas before the actual flood begins. Potential negative impacts include increasing the financial burden on citizens, increasing staff workloads for communities, and the potential for false alarms or failed warnings if the system is not properly maintained and calibrated.

The Infrastructure Projects category is specific to Region 11 and is comprised of any other type of FMS that does not fall within the five categories outlined above. There are 16 individual actions that are bundled into the Infrastructure Projects regional FMS. While these may lead to future FMEs and FMPs, the specific actions represent the creation of programs. These include nature-based solutions (for example green infrastructure), site-specific maintenance programs, and county-wide maintenance programs. Some positive impacts include an established, routine-level maintenance plan/program to clear debris from flood-prone areas such as bridges,

box culverts, and drainage systems to prevent overtopping and backup during flood events; developing plans to increase channel and bank stabilization by reducing erosion impacts; preserving system functionality (man-made and natural); avoiding large capital expenses resulting from deferred maintenance; prolonging facilities performing at their desired level of service; and financial transparency to customers about major capital expenses. Potential negative impacts include increasing the financial burden on citizens and increasing local staff workloads to properly maintain these areas on a routine basis.

While not readily quantifiable, these strategies and measures will generally protect the health, safety, and well-being of individuals within the region while simultaneously improving the region's economic well-being by reducing the flood frequency and severity, providing advanced warning of flood risks, minimizing the number of drivers on flooded roads, giving community officials the resources they need to prevent construction in flood prone areas, and alleviating known flooding issues. Development, especially in the floodplain, leads to increases in flood flows that can cause downcutting and erosion of streams – both of which ultimately lead to environmental issues. The FMSs in Region 11's RFP will help minimize and prevent future damage, which will help preserve developable land, protect agricultural land, reduce erosion, and prevent downstream sedimentation. Most flood mitigation measures have the potential to negatively impact neighboring areas, especially when conveyance is increased. These impacts will be mitigated during design and construction to increase the likelihood that no negative impacts occur. Many of the FMSs will require more active floodplain management by communities in the region which will burden community officials who must enforce regulations and will likely meet some resistance from citizens and developers wishing to engage in floodplain construction. Most of these strategies would add costs that would be incurred by the citizens of the community. These issues can be overcome and lead to stronger communities, and this fully funded RFP would aid in providing the tools needed to accomplish these goals.

If all of these FMSs are implemented and enforced, Region 11 will prevent a significant increase in flood exposures. Without these FMSs in place, Region 11 could see the 1% ACE floodplain area increase by 183 square miles and the 0.2% ACE floodplain increase by 32 square miles. This would expose an additional 22,667 structures and 92,715 people to the 1% ACE floodplain, and 3,318 structures and 9,569 people to the 0.2% ACE floodplain.

Based on the planning level data available, none of the FMSs recommended in the plan will negatively or measurably reduce water availability or water supply volumes and will not impact the State Water Plan.

6.1.3 FME Impacts

A total of 127 FMEs were recommended by the RFPG in three broad categories. These categories, examples, and their positive and negative impacts are described below.

The Preparedness category includes evaluations pertaining to communities being prepared for flood events. Example FMEs in this category are inundation studies, dam compliance assessments, hazard/vulnerability assessments, dam integrity studies, evacuation and dam safety plans, road access studies. These actions can provide a positive impact by having preemptive evaluations and strategies to better prepare an area or community in the event of flood. There are six FMEs in this category.

Evaluations marked as Project Planning conduct up to 30 percent design for specific projects and flood mitigation measures that were previously identified by sponsors. There are 87 FMEs in Region 11 in this category. Typical projects include storm drain upgrades, culvert upsizing, and channel modifications. Expected positive impacts include reducing flooding and exposure to flooding, reducing impact of flooding on existing facilities, and reducing roadway overtopping. One negative impact is that all conveyance improvement projects have the potential to increase flooding downstream. Mitigation measures will need to be considered during the development of these actions.

Actions such as conducting watershed studies to establish accurate floodplain modeling and mapping and evaluation of potential flood mitigation measures are marked as Watershed Planning. These include Flood Insurance Studies (FIS), watershed studies, and city-wide and county-wide drainage master plans (DMPs). Typical positive impacts include:

- More accurate flood maps, which allow for risk avoidance, better regulations, and better planning
- Understanding the needs for flood reduction in a watershed, which allow for better allocation of resources, providing design details needed for eventually converting an FME into an FMP that can be funded and implemented
- Projects that come from these FMEs can reduce flooding and exposure to flooding

Potential negative impacts are that all conveyance improvement projects have the potential to increase flooding downstream; therefore, mitigation measures will need to be considered if any such projects are identified during the FME, and more projects are usually identified than there is available funding. There are 34 FMEs in this category.

The watershed studies and project specific FMEs will provide the information needed to increase the likelihood that cost-effective flood mitigation measures are implemented in Region 11 that do not negatively impact other areas. These projects will reduce flood risks, saves lives, and protect valuable infrastructure.

Detailed modeling and mapping will also help protect recreational resources and agriculture by identifying flood risk to these areas and allowing for the evaluation of future development impacts.

Until all of these FMEs are completed, their specific benefits cannot be quantified; however, upon initial analysis, it is evident that approximately 18,878 residential structures are currently in the 1% ACE floodplain. These structures house approximately 89,019 people. Tens of thousands more are exposed to risk as they travel across flooded roadways and low water crossings. These FMEs will help reduce the risks to these people and help prevent additional people from becoming exposed to the 1% ACE floodplain due to expansion of the floodplain and uncontrolled development. By providing more accurate information on the flood risks, the communities will be empowered to control development within the floodplain.

6.1.4 Impacts of RFP Implementation

Avoidance of Negative Impacts

During the evaluation of alternatives for a flood mitigation project, potential negative impacts of alternatives are analyzed and those alternatives are removed from consideration if the negative impacts cannot be reasonably mitigated for. Therefore, for each FMP considered, the preliminary engineering or alternative analysis reports that were obtained for each FMP were reviewed to determine any potentially unmitigated negative impacts. No unmitigated negative impacts were discovered for any of the 32 FMPs. Some FMPs related to installation of stream gauges or emergency generators did not include modeling but were assumed to inherently have no negative impacts.

Potential negative impacts were also considered for the FMEs and FMSs. The planning-level assessment for these actions included a much simpler review of the potential impacts, based on the limited data available to determine potential impacts. The FMEs are set forth to identify if there are any potential negative impacts of the proposed action. There are no negative impacts for completing a study or evaluation to gain a better understanding of the proposed flood mitigation action. Like the FMEs, the FMSs will also identify negative impacts if the proposed action is executed. However, there are no negative impacts to implement new flood management strategies. The sponsors for all actions will need to demonstrate a commitment to no negative impacts before they can receive funding. Ultimately, it will be the responsibility of the local sponsor to demonstrate the final project design has no negative impacts prior to construction.

As stated above, based on the planning level data available, none of the actions recommended in the plan will negatively or measurably reduce water availability or water supply volumes and will not impact the State Water Plan.

6.1.5 Potential Future Benefits

Many of the proposed actions included in this plan will reap benefits now and long into the future. Evaluations and strategies are the best candidates for actions that include current benefits, future benefits, and no negative impacts. Examples of these actions include flood warning systems, buyouts, higher design standards, education and outreach programs, and flood preparedness. These types of actions will increase the community's resiliency by providing knowledge in advance of a storm, removing development in the floodplain, and preventing future development in the floodplain. With higher design standards, population growth and economic development would occur in areas outside of the floodplain and further away from the flooding source. Together, these actions will remove people and structures from the existing floodplain and reduce the future flood risk.

Regional Detention, when sized for future development conditions, is an example of an FMP with current benefits, future benefits, and no negative impacts. This allows for future development to occur upstream while the increased flows have already been mitigated with a detention pond that has been sized to accommodate the increased flows and increased volume of runoff. There are not any anticipated negative impacts for this type of project, as the downstream discharge and volume can be controlled by the outlet structure of the impoundment.

The policies discussed and recommended in **Chapter 3** are another example of how this plan can provide long lasting benefits. The implementation of these standards will reduce the future flood risk throughout the Guadalupe FPR. Collectively, the standards listed above will protect the riparian areas of the floodplain from encroaching development, providing a buffer between development and the floodplain now and in the future.

6.1.6 Socioeconomic & Recreational Impacts of the RFP

Flooding can result in significant damage to the economy, the environment, infrastructure, and property, and a hazard to people. Various types of flooding can be caused by flash flooding, coastal flooding, urban flooding, riverine flooding, and pluvial flooding. Several types of flood strategies and projects have been developed to protect against flooding. However, the managing of flood risk and the development and implementation of flood defenses has both advantages and disadvantages in recreation and socioeconomically.

Ultimately, flood evaluations and projects protect homes and people, and decrease the rate of erosion, preventing foundation and structural damage in the long run. They also save money in terms of roadway infrastructure repairs due to the impacts of flooding.

Socioeconomic Impacts

According to the American Psychological Association, "socioeconomic advantage and disadvantage can be defined as people's access to material and social resources, and their ability to participate in society". Studies of socioeconomic status can reveal inequities in access

to resources which could prevent accessing the services to plan, respond and recover from flood events.

Flooding does not only result in destroyed infrastructure and damaged property, but also has a negative social impact on the citizens impacted. The impacts, both short-term and long-term, on physical and mental health result in changes to the livelihoods of impacted citizens creating greater socioeconomic disparity.

The FMSs and FMPs listed are intended to provide watershed wide benefits to the disproportionately disadvantaged or socially vulnerable population by reducing risk and promoting recovery. 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 unimpacted by flood.

Ensuring equity in the development and implementation of strategies and projects reduces any perceived disadvantages. Any disadvantages would occur if the socioeconomically disadvantaged population was not served directly or indirectly by the FMSs or FMPs.

Recreational Impacts

Using natural or man-made water bodies for recreation is highly valued in the Guadalupe FPR and throughout Texas. Many waterfront parks are spaces are designed to be flooded with minimal damage during storm or flood events. Additionally, urban river restorations focus on restoring aquatic and riparian habitats, increasing flood protection, and enhancing recreational potential. Wetlands also play an important role in water resources as these areas store and filter water pollutants. In agricultural areas, when floodplains are not full of water, they can grow grass and be used as grazing areas. These floodplains and wetlands can support tourism, recreation, and freshwater fisheries.

While flood defense or protection projects do protect homes, infrastructure, and people, they also provide protection to natural habitats. Many shorelines are conservation areas, and flood defenses help preserve these areas. Maintaining floodplains in their natural states can create positive impacts through potential recreational, environmental, and biological benefits. Several types of flood projects, mainly those that are classified as natural systems, promote biodiversity. Wetlands that function as flood plains support a wide range of bird species while ponds support newts, leeches, and wading birds. Riparian systems can sustain several types of animal life.

There are potential disadvantages to using the floodplain and waterfront parks for recreation. Were damages to occur to recreational waterbodies, they can become dangerous to use. While flood strategies and projects can be effective at protecting people, property, and resources, the initial and ongoing costs of installation and maintenance can be prohibitive. These costs can be

prohibitive and can overwhelm communities struggling to find funding for long-term flooding solutions.

6.1.7 Summary of the Impacts of the RFP

If fully implemented, the RFP will have profound and lasting impacts on flood risk reduction in Region 11. As a result of the 32 FMPs, the number of structures in the 1% ACE floodplain would be reduced by 700, and the number of structures in the 0.2% ACE floodplain would be reduced by 469. This would help protect approximately 1,864 people from living within the 1% ACE floodplain. An estimated 24 road closure occurrences can be avoided within the 1% ACE floodplain. These numbers can be expanded as FMPs are developed from FMEs in the future. In addition to these tangible reductions in flood risks, the FMSs and associated FMEs could significantly reduce the expansion of flood risks in the future by providing communities with the data and resources needed to control floodplain development and prevent the expansion of the floodplain. This can result in preventing an additional 22,669 structures being constructed in the 1% ACE (3,318 in the 0.2% ACE), which will help protect 92,715 people from the 1% ACE (9,569 from the 0.2% ACE).

While not readily quantifiable, these measures will protect the health and safety of the Guadalupe FPR, as well as its economic wellbeing. This is done by reducing the flooding frequency and severity, providing advanced warning of flood risks, reducing driving on flooded roads, and giving community officials the tools they need to prevent construction in flood prone areas and alleviating known flooding issues.

Development in general, and especially in the floodplain, leads to increases in flood flows that can cause downcutting and erosion of streams that can lead to environmental issues and sedimentation downstream.

Most flood mitigation measures have the potential to negatively impact neighboring areas, especially when conveyance is increased. These impacts will be mitigated during design and construction to increase the likelihood that no negative impacts occur. Many of the FMSs will require more active floodplain management by communities in the Guadalupe FPR. This will burden community officials who must enforce regulations and will meet some resistance from citizens wishing to engage in risky floodplain construction. These issues can be overcome and lead to stronger communities and this RFP, fully funded and implemented, would provide the tools needed to make this happen.

None of the FMSs, FMEs, or FMPs specifically address water supply issues and are not expected to have a significant impact on water supply. However, some flood risk reduction actions could contribute to water supply and are discussed further in **Section 6.2.5**.

6.2 Contributions to and Impacts on Water Supply Development and the State Water Plan

The Guadalupe Regional Flood Planning Group (RFPG) is tasked with evaluating potential impacts of the regional flood plan on water supply development and the state water plan. This chapter describes the processes undertaken by the RFPG to achieve these tasks and summarizes the outcomes of this effort.

This effort included a region-wide summary of:

- The contribution that the regional flood plan would have on water supply development;
- The specific flood management strategies (FMS) and/or flood mitigation projects (FMP) that would contribute to water supply, and
- Anticipated impacts that regional flood plan FMSs and FMPs may have on water supply or water availability projects in the state water plan.

The Guadalupe River Basin is almost completely contained in the Region L Water Plan (<https://www.twdb.texas.gov/waterplanning/rwp/regions/l/index.asp>). However, Kerr County is within the Region J Water Plan (<https://www.twdb.texas.gov/waterplanning/rwp/regions/j/index.asp>). The information in **Section 6.2.1** and **Section 6.2.2** below summarize the Region L Water Plan and potential FMSs and FMPs that could measurably contribute to water supply. **Section 6.2.3** and **Section 6.2.4** summarize the Region J Water Plan.

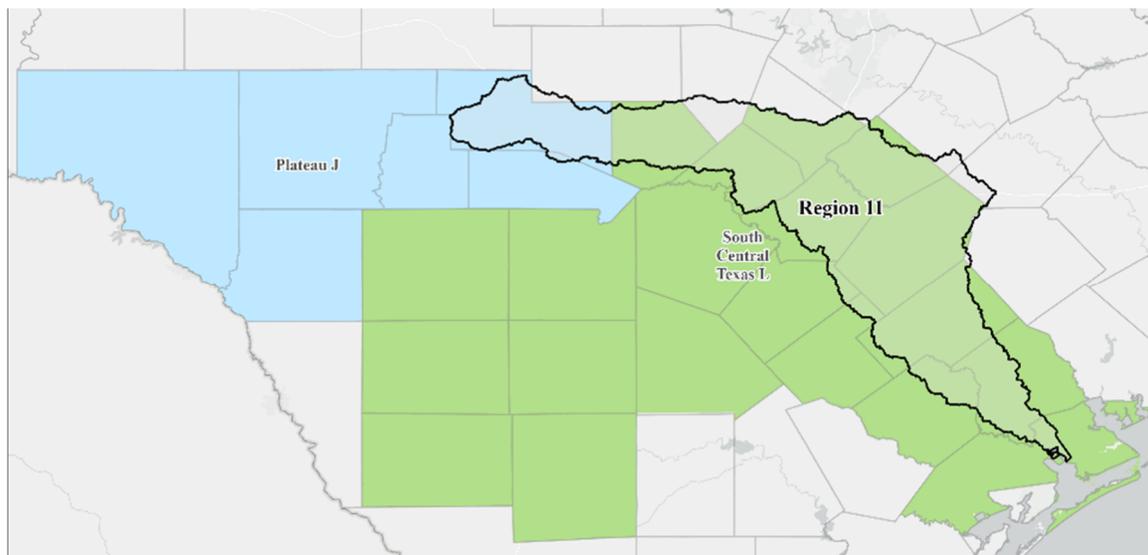


Figure 6-1: Boundaries of Plateau Water Planning Region (Region J), South Central Texas Water Planning Region (Region L), and Guadalupe Flood Planning Region (Region 11)

6.2.1 Region L Water Plan Overview

Since 1957, the Texas Water Development Board (TWDB) has been charged with preparing a comprehensive and flexible long-term plan for the development, conservation, and management of the state’s water resources. The current state water plan (SWP), 2022 State Water Plan – Water for Texas, was produced by TWDB and based on approved regional water plans (RWPs) pursuant to requirements of Senate Bill (SB) 1, enacted in 1997 by the 75th Texas Legislature. As stated in SB1 Section 16.053.a, the purpose of the regional water planning effort is to: “...provide for the orderly development, management, and conservation of water resources and preparation for and response to drought conditions in order that sufficient water will be available at a reasonable cost to ensure public health, safety, and welfare; further economic development; and protect the agricultural and natural resources of that particular region.” SB 1 also provides that future regulatory and financing decisions of the Texas Commission on Environmental Quality (TCEQ) and TWDB, respectively, be consistent with approved regional plans.

TWDB divided the state into 16 regional water planning regions and appointed members to the regional planning groups. As shown on **Figure 6-2**, the South-Central Texas Region (Region L) includes all or portions of 21 counties. The South-Central Texas Regional Water Planning Group (SCTRWPG) has a total of 31 voting members with one vacancy at the time of this report. These members represent 12 stakeholder groups (public, counties, municipalities, industry, agriculture, environmental, small business, electric generating utilities, river authorities, water districts, water utilities, and groundwater management areas), serve without pay, and are responsible for the development of the South-Central Texas Regional Water Plan (SCTRWP).

The 2021 SCTRWP represents the fifth update of an RWP as presently required to occur on a 5-year cycle. TWDB integrated this 2021 SCTRWP into the 2022 State Water Plan (SWP).

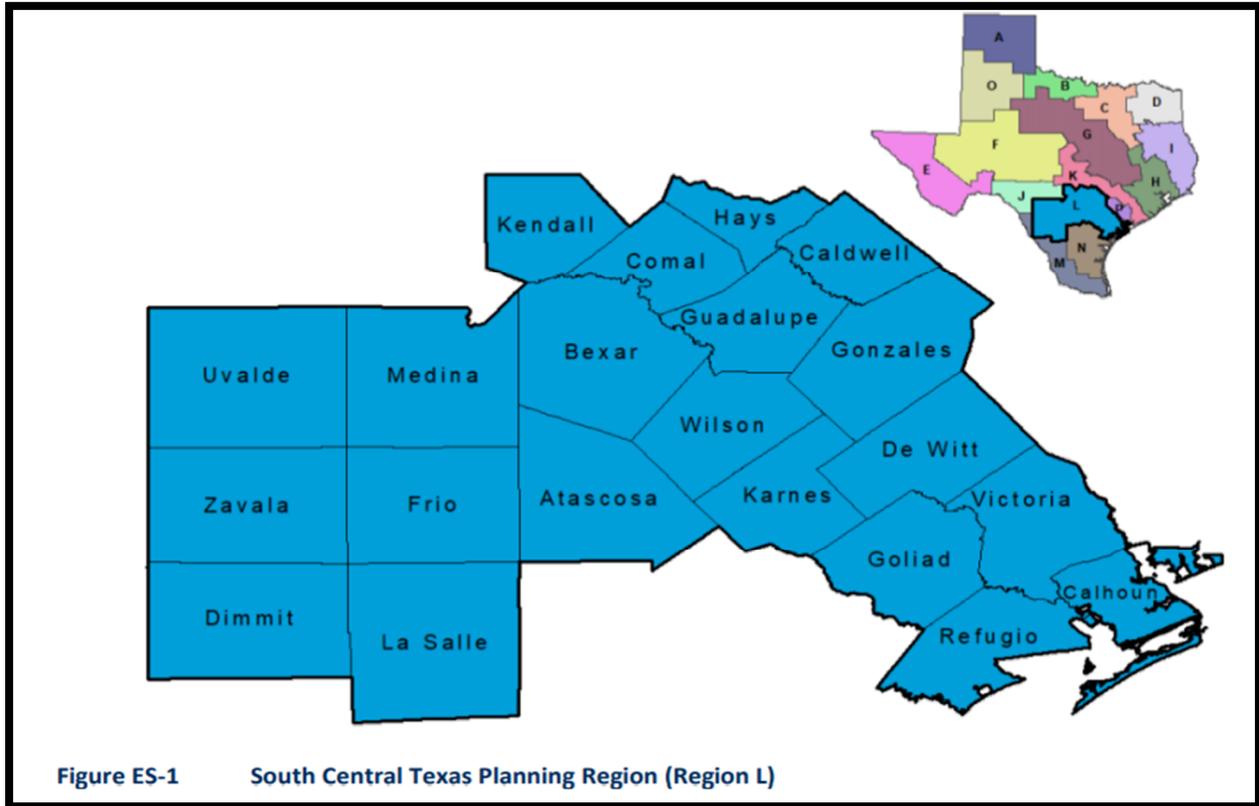


Figure 6*Error! No text of specified style in document.*-22: **South Central Texas Planning Region (Region L)**

By 2070, approximately 59 percent of the South-Central Texas Region’s total population is projected to reside in Bexar County. The counties with the largest anticipated population growth between 2020 and 2070 are Bexar, Comal, Guadalupe, and Hays Counties. The population is anticipated to grow from about 3 million people in 2020 to about 5.2 million in 2070, a 73 percent% increase.

Five major and five minor aquifers supply groundwater to the South-Central Texas Region. The five major aquifers are the Edwards-Balcones Fault Zone (including the Barton Springs Segment), Carrizo Wilcox, Trinity, Gulf Coast, and Edwards-Trinity (Plateau) Aquifers. The primary water supply reservoir in the river basin is the Canyon Reservoir upstream of New Braunfels.

6.2.2 Region L Recommended Water Strategies for Entities within Region 11

Table 6-2 below identifies the water management strategies recommended by Region L for entities within Region 11. **The 2021 Region L Water Plan notes in its Appendix 11-A that no water project or strategy involves the reallocation of flood control and does not provide any measurable flood risk reduction.**

Table Error! No text of specified style in document.-2: Water Management Strategies Recommended in 2021 Region L Plan for Entities within Region 11

County	Water User Group (WUG)	Strategy Name
Caldwell	Aqua WSC	Advanced Water Conservation
Caldwell	City of Lockhart	Advanced Water Conservation
Caldwell	City of Lockhart	ARWA/GBRA Project (Phase 1)
Caldwell	City of Luling	Advanced Water Conservation
		Local Groundwater
Caldwell	Martindale WSC	Drought Management
		Facilities Expansion: CRWA Hays Caldwell WTP Expansion
		Martindale WSC Alluvial Well Project
		Purchase from WWP (CRWA)
Caldwell	Maxwell WSC	Maxwell WSC Trinity Well
Caldwell	Polonia WSC*	Advanced Water Conservation
Caldwell	Tri Community WSC	Advanced Water Conservation
Comal	Canyon Lake Water Service*	Advanced Water Conservation
		Purchase from WWP (GBRA)
Comal	Clear Water Estates Water System	Advanced Water Conservation
		Drought Management
		Local Groundwater
Comal	City of Garden Ridge*	Advanced Water Conservation
		Drought Management
		Local Groundwater
Comal	Green Valley SUD*	ARWA/GBRA Project (Phase 1)
		ARWA Project (Phase 2)
		ARWA Project (Phase 3)
Comal	KT Water Development	Advanced Water Conservation
		Drought Management
		Local Groundwater
Comal	New Braunfels Utilities (NBU)	Advanced Water Conservation
		Facilities Expansion: NBU South WTP Expansion
		Facilities Expansion: NBU-Seguin Interconnect
		ARWA/GBRA Project (Phase 1)
		NBU ASR
		NBU Trinity Well Field Expansion
DeWitt	City of Cuero	Advanced Water Conservation
DeWitt	City of Yorktown	Advanced Water Conservation
Gonzales	City of Gonzales	Advanced Water Conservation
Gonzales	Gonzales County WSC	Advanced Water Conservation

County	Water User Group (WUG)	Strategy Name
Gonzales	City of Nixon	Advanced Water Conservation
Gonzales	City of Smiley	Advanced Water Conservation
Gonzales	City of Waelder	Advanced Water Conservation
Guadalupe	City of Schertz	Advanced Water Conservation
		CVLGC Carrizo Project
		SSLGC Expanded Carrizo Project
Guadalupe	City of Seguin*	SSLGC Expanded Brackish Wilcox Project
		Advanced Water Conservation
		Drought Management
Guadalupe	Springs Hill WSC*	SSLGC Expanded Carrizo Project
		SSLGC Expanded Brackish Wilcox Project
		Facilities Expansion: Lake Placid WTP Expansion
Hays	City of Buda	Facilities Expansion: Bored Pipeline
		Advanced Water Conservation
		ARWA/GBRA Project (Phase 1)
Hays	County Line SUD	ARWA Project (Phase 2)
		ARWA Project (Phase 3)
		ARWA Project (Phase 3)
Hays	Crystal Clear WSC	Recycled Water Strategies
		County Line SUD Trinity Well Field
		County Line SUD Brackish Edwards Project
		Advanced Water Conservation
		ARWA/GBRA Project (Phase 1)
Hays	Goforth SUD	ARWA Project (Phase 2)
		ARWA Project (Phase 3)
		Drought Management
Hays	City of Kyle	Advanced Water Conservation
		ARWA/GBRA Project (Phase 1)
		ARWA Project (Phase 2)
		ARWA Project (Phase 3)
Hays	City of San Marcos	Advanced Water Conservation
		ARWA/GBRA Project (Phase 1)
		ARWA Project (Phase 2)
		ARWA Project (Phase 3)

County	Water User Group (WUG)	Strategy Name
		Facilities Expansion: CRWA Hays Caldwell WTP Expansion
		Recycled Water Strategies: San Marcos Non-Potable Reuse
		Recycled Water Strategies: San Marcos Potable Reuse
Hays	South Buda WCID 1	Advanced Water Conservation
Hays	Texas State University	Advanced Water Conservation
Hays	Wimberly WSC	Purchase from WWP (GBRA)
Victoria	City of Victoria	Advanced Water Conservation
		Drought Management
		City of Victoria ASR
		City of Victoria Groundwater-Surface Water Exchange

*Partially within another Flood Planning Region

6.2.3 Region J Water Plan Overview

As shown on **Figure 6-3**, the Plateau Water Planning Region (Region J) includes all or portions of six counties (Bandera, Edwards, Kerr, Kinney, Real and Val Verde). Only one of those counties (Kerr) lies within the Region 11 Guadalupe Flood Planning Region (FPR). The Plateau Water Planning Region currently has a total of 22 voting members. These members represent 13 stakeholder groups (public, counties, municipalities, industry, tourism, agriculture, environmental, small business, river authorities, water districts, water utilities, groundwater management areas, and other) including at least one representative from each of the six counties, serve without pay, and are responsible for the development of the Region J Regional Water Plan (RWP).

The 2021 Region J Regional Water Plan represents the fifth update of the RWP as presently required to occur on a 5-year cycle. TWDB will integrate this 2021 Region J RWP into the 2022 State Water Plan (SWP).

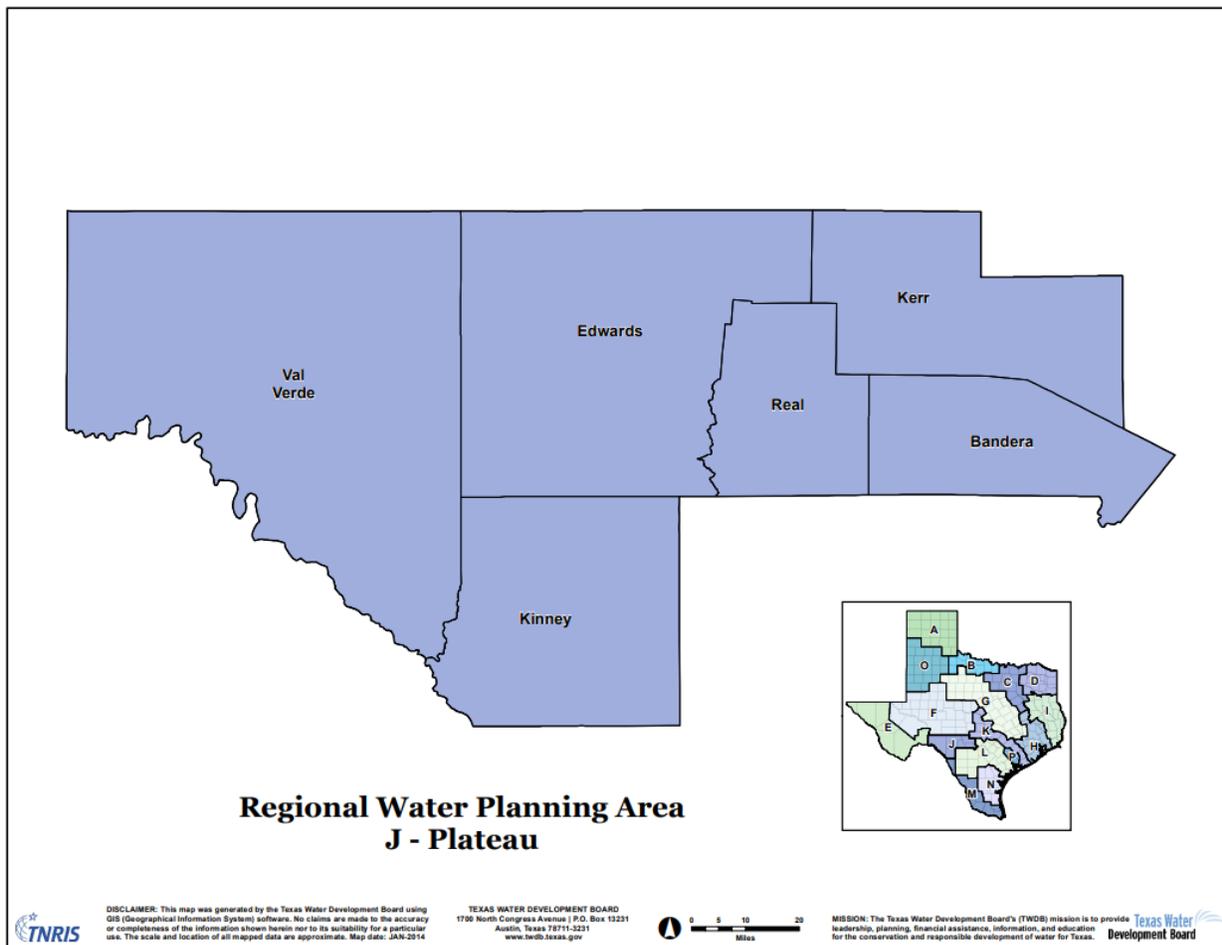


Figure 6 Error! No text of specified style in document.-33: **Region J Planning Region**

Source: Texas Water Development Board

Approximately 46 percent of the Plateau Water Planning Region's total population is located in the two largest cities: Del Rio and Kerrville. Total population of the six counties is anticipated to increase by approximately 52 percent between 2020 and 2070. These population estimates do not include a significant transient (tourism, hunting, recreation, etc.) population that has a resulting significant impact on overall water supply demand in the region. The Region J RWP emphasizes that there is likely a need for more water than is accounted for from the population-derived water demand estimates.

Land use is primarily shrub/scrub and grassland, with urban and agricultural comprising less than one percent of the region's total land area. The climate of the Plateau Water Planning Region is semi-arid to arid, with precipitation decreasing as one moves further west. Average annual precipitation for the Plateau Water Planning Region is 25 inches.

6.2.4 Region J Recommended Water Strategies for Entities within Region 11

Table 6-3 below identifies the water management strategies recommended by Region J for entities within Region 11.

Table Error! No text of specified style in document.-3: Water Management Strategies Recommended in 2021 Region J Plan for Entities within Region 11

County	Water User Group (WUG)	Strategy Name
Kerr	City of Kerrville	Increase wastewater reuse
		Water loss audit and main-line repair
		Explore and develop new Ellenburger Aquifer well supply
		Increased water treatment and ASR capacity
Kerr	Kerr County Other – Eastern Kerr County Regional Water Supply Project	Project 1. Construction of an Ellenburger Aquifer water supply well
		Project 2. Construction of off-channel surface water storage
		Project 2. Construction of surface water treatment facilities and transmission lines
		Project 3. Construction of ASR facility
		Project 4. Construction of Trinity Aquifer wellfield for dense, rural areas
		Project 4. Construction of desalination plant
Kerr	Kerr County Other – Center Point	Public conservation education
		Purchase water from EKCRWSP
Kerr	Kerr County Other – Center Point Taylor System	Public conservation education
		Purchase water from EKCRWSP
Kerr	Kerr County Other – Verde Park Estates	Water loss audit and main-line repair

The water supply connections between Region 11 and Region J derive primarily from the fact that the Guadalupe River serves as an important water supply source for the City of Kerrville and other communities in Kerr County. There is no mention in the plan of a water management strategy or project providing any measurable flood reduction risk. The 2021 Region J Water Plan does not directly comment on the connections between water planning and flood planning; however, there are some indirect ties that cannot be measured but are worth noting:

- Upper Guadalupe River Authority’s (UGRA) existing water and sediment control facilities are operating at nine different locations in the upper Guadalupe River basin. The basins temporarily retain waters along the Guadalupe River and its tributaries. During flood

events, the basins allow the flows to be released in a controlled manner to protect water quality and control erosion.

- Potential for surface water contamination resulting from urban runoff in rapidly growing population centers
- Vegetative management and land stewardship programs are not qualified as water management strategies under regional water planning guidelines as they are not considered to reduce water demand. However, the Region J RWP devotes portions of the plan to educate the public on both the potential water supply benefits (recharge of alluvial aquifers and improvement of water quality), as well as potential flood benefits (riparian areas buffer and slow floodwaters).
- Upper Guadalupe River Authority's (UGRA) existing rainwater catchment system rebate and incentive programs are a water conservation program that can retain some rainfall and potentially generate a slight decrease in peak runoff rates. The plan also recommends rainwater harvesting programs for the City of Bandera, although there is no mention of their benefit towards flood flows.

6.2.5 Region 11 Flood Management Actions with Water Supply Component

Detention Structures

FMSs, FMEs and FMPs that could measurably contribute to water supply are proposed large detention structures. This plan does not include any FMSs, FMEs or FMPs for large detention structures that [have a quantified](#) water supply component, although there are a handful of flood management actions [that could potentially be modified in the design phase to include a water supply component for irrigation or other nearby needs](#) (see **Table 6-4** below). However, [those](#) basins should be evaluated for evaporation and seepage loss to confirm that water rights and water availability are not adversely affected. There are also several existing reservoirs in the basin that are permitted for water supply but indirectly have a flood mitigation impact. Finally, small detention basins such as the nine existing basins managed by UGRA may be used as a domestic water supply for one household, as well as watering livestock.

Table Error! No text of specified style in document.-4: Detention Structures Recommended in 2022 Region 11 Flood Plan

ID	Name	Sponsor	Size (if known)	Water Supply Benefits
113000069	Detention York Creek	Guadalupe County	48,310 acre-feet	Indirect
113000068	Detention Victoria	City of Victoria	3,700 acre-feet	Indirect
113000065	Regional Detention – Seguin	City of Seguin	392 acre-feet	Indirect
111000054	Regional Detention Study	City of San Marcos	TBD	Indirect
113000047	Detention Peach Creek	Gonzales County	41,774 acre-feet	Indirect
113000044	Detention Bear Creek	Comal County	3,375 acre-feet	Indirect
113000001	Detention Blanco River	Blanco County	1,128 acre-feet	Indirect
111000127	Water and Sediment Control Facilities Study	UGRA	TBD	Indirect

Ordinances and Criteria

To promote water supply enhancement with flood management, stormwater criteria such as the LCRA Highland Lakes Watershed Ordinance rainwater harvesting measure could be adopted to meet stormwater goals and at the same time offset water needs. This stormwater management alternative could be included in drainage codes and criteria to encourage flood management with water supply benefits.

Another regulatory option is the adoption and implementation of stormwater management ordinances that manage flooding but could also include a water supply aspect of beneficial reuse for irrigation purposes. This approach could use an automated batch detention system combined with an irrigation system to help meet local outdoor watering needs. The TCEQ Edwards Aquifer Protection Program allows new development projects to use this stormwater management measure to obtain compliance with the technical criteria to protect water quality and minimize stream degradation. The Edwards Aquifer and its Contributing Zone are found in Travis, Hays, and Comal counties in the Guadalupe River Basin.

[Currently, these types of actions generally target onsite reuse opportunities and the overall potential impacts to water supply are not quantified.](#)

Recharge Enhancement

There are several initiatives within the basin to enhance aquifer recharge for environmental and water supply benefits, as well as reduce flood risk. These initiatives are captured as flood management actions, as well as legislative recommendations in this plan. The [Great Springs Project](#) is leading an initiative to conserve an additional 50,000 acres of sensitive land in the Austin-San Antonio corridor. Much of the 50,000 acres will be aquifer recharge and contributing zone land in Hays and Comal Counties in the most densely populated area of the Region 11 flood planning area. Great Springs Project intends to acquire aquifer recharge and contributing zone land which is strategically valuable for flood mitigation purposes, since this ~~c~~would simultaneously reduce flood risk while enhancing the recharge of the Edwards Aquifer. The [Camp Bullis Sentinel Landscape Project](#) can provide funding opportunities for flood mitigation projects on the Edwards Aquifer Recharge and Contributing zones that could enhance recharge, including acquisition and permanent protection of land.

Currently the potential contribution to water supply is unknown. In fact, one of the goals for some of the studies such and the Great Springs Project is to develop methods to quantify additional potential benefits.

Nature Based Solutions

Finally, while not generating a measurable water supply, green infrastructure, natural channel design, stormwater detention, low impact development, and other measures can help mitigate flood flows and at the same time protect water quality. This can help manage downstream water treatment costs and benefit rate payers.

Potential Model for Floodplain Management and Water Supply Enhancement

New Braunfels Utilities (NBU), in coordination with the City of New Braunfels and the Guadalupe-Blanco River Authority (GBRA), developed a One Water plan to guide coordination and cooperation to maximize water supply availability while doing so in a manner that protects the streams and rivers. The plan recognizes the value of all water including stormwater runoff that can be harvested for beneficial use and managed through green infrastructure practices to avoid negatively impacting water supply (surface and groundwater) amount and quality and providing flood management. These practices take a conservation and nature-based approach to limit water supply and floodplain management costs while creating habitat and attractive projects to bring the residents and visitors to the community in support of their economic goals.

The One Water Plan was completed in 2021 and includes a road map for success that established a vision, targets, indicators, and an action plan to define roles and responsibilities to move from the plan to implementation of multiple measures. NBU hired a One Water Coordinator to lead the effort and there are ongoing meetings with the City Commissions and Boards, GBRA, and other stakeholders to further share the plan and obtain support across the community.