

Executive summary

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QUICK FACTS

- This is Texas' first state flood plan resulting from the inaugural regional and state flood planning process that was created by Senate Bill 8 (2019) during the 86th Texas Legislature and modeled partly after Texas' water supply planning process.
- This state flood plan presents information from the 15 regional flood plans that were developed through the efforts of more than 350 regional flood planning group members, their sponsors, and technical consultants who held over 550 public meetings during the inaugural cycle of regional flood planning.
- This regional and state flood planning process identified existing risk to lives and property from flooding and potential actions to mitigate those flood risks; the plan also looks ahead and provides floodplain management recommendations for preventing an increase to flood risks.
- The state flood plan provides a comprehensive first look at the flood risk across the entire state of Texas, comprising three components of flood risk: the flood *hazard* (the magnitude and extent of flooding), the potential *exposure* of people and property to that hazard (who and what might flood), and the *vulnerability* (degree to which communities or critical facilities may be affected) of the people and property exposed to that flood hazard.
- This plan confirms that the flood risk across Texas is significant and widespread. Almost one-fourth of Texas' land area (66,831 square miles) is in either the 1 percent (100-year) or 0.2 percent (500-year) annual chance flood hazard areas, with approximately 21 percent of the land area (56,053 square miles) within the 1 percent annual chance flood hazard areas.
- There is significant risk of flooding within all 15 planning regions, although the extent and types of flood hazard vary by region due to differences in population, land development, topography, rainfall patterns, and proximity to rivers and the coast.
- Approximately one in every six people in Texas lives or works in known flood hazard areas, including in the 1 percent (100-year) and 0.2 percent (500-year) annual chance floodplains. Approximately 2.4 million people live or work in the 1 percent annual chance floodplain, and an additional 2.8 million people are in the 0.2 percent annual chance floodplain.
- Planning groups identified approximately 878,100 buildings within the 1 percent (100-year) annual chance floodplain and an additional 786,100 buildings within the 0.2 percent (500-year) annual chance floodplain.
- Planning groups identified 6,258 hospitals, emergency medical services, fire stations, police stations, and schools within the 1 percent (100-year) and 0.2 percent (500-year) annual chance floodplains.
- Regional flood planning groups identified 9,322 low water crossings within flood hazard areas.

- The projected future condition 1 percent (100-year) annual chance floodplain is estimated to increase by 11 percent over the existing flood hazard area to a total of 62,245 square miles.
- The regional flood planning groups project an increase of approximately 2.6 million people and 740,000 buildings in the 1 percent (100-year) annual chance floodplain under projected future condition flood hazard.
- A total of 1,239 Texas communities and counties with flood-related authority participate in the National Flood Insurance Program.
- More than 500 Texas entities have floodplain management standards that exceed National Flood Insurance Program minimum standards.
- The regional flood planning groups recommended 4,609 flood risk reduction solutions: 3,097 flood management evaluations, 615 flood mitigation projects, and 897 flood management strategies in the regional flood plans with an estimated total implementation cost of more than \$54.5 billion.
- The total cost of recommended flood management evaluations exceeds \$2.6 billion.
- The total cost of recommended flood mitigation projects is over \$49.1 billion; nearly half of this cost is associated with the Galveston Bay Surge Protection Coastal Storm Risk Management project.
- The total cost of recommended flood management strategies is more than \$2.8 billion.
- Planning groups reported sponsors requiring financial assistance with 80–90 percent of the costs to implement recommended flood risk reduction solutions.
- Planning groups reported an estimated 843,339 people and 214,292 buildings would be removed from the 1 percent (100-year) annual chance floodplain if the state flood plan is implemented.
- Three regions identified potential water supply benefits for 37 recommended flood mitigation projects, and one region recommended a flood management strategy with a potential water supply benefit.
- The flood planning groups included legislative, administrative, and policy recommendations in the regional flood plans, and their policy recommendations informed the development of many of the legislative and floodplain management recommendations in this plan.

Texas has a long history of flooding and flood-related loss that has taken an enormous toll on people and property. In 2017, the Texas coast was hit by Hurricane Harvey, the second most expensive natural disaster to impact the U.S. The losses associated with Hurricane Harvey are estimated to be more than \$125 billion (in 2017 U.S. dollars). In the aftermath of Hurricane Harvey, and

many previous devastating flood events across the state, the Texas Legislature passed Senate Bill 8 in 2019 that created Texas' first statewide regional flood planning program based on river basins. The Texas Water Development Board (TWDB) was charged with administering the regional and state flood planning program.

The 15 newly designated regional flood planning groups first convened in fall 2020, during the global pandemic. Over the following 2.5 years, the planning groups managed to meet more than 550 times and successfully delivered Texas' first 15 regional flood plans¹ to the TWDB in January 2023.

The administrative process of the river basin-based, bottom-up regional flood planning program was modeled after Texas' successful and longstanding water planning process that has been in place since 1997. Although the technical aspects of the flood planning process are vastly different from water supply planning, the overall process of building a state plan using a set of regional plans developed under a state framework is very similar.

This first cycle of the statewide flood planning process is Texas' first attempt to perform comprehensive planning to reduce flood risk and take a broad look at flood hazard across the state. A tremendous amount of information was generated by the planning groups during the historic first cycle of regional flood planning, which aimed to identify who and what might be exposed to flooding; identify the state's major flood risk reduction infrastructure; consider existing floodplain management practices or lack thereof; and identify and recommend flood risk reduction solutions across the state. The recommended flood risk reduction solutions include flood management evaluations, flood mitigation projects, and flood management strategies. The 2024 State Flood Plan is supported by the **Interactive State Flood Plan Viewer**.² The viewer allows stakeholders to view and disseminate the extensive dataset generated by the flood planning process.

This state flood plan brings together the findings of the 15 regional flood plans and makes legislative and floodplain management recommen-

dations to guide state, regional, and local flood control policy (Figure ES-1).

Why do we plan?

The adage that "prevention is better than cure" is highly relevant to flood planning. Resources applied, up front, to reduce the risk and impact of flooding extend much further than the cost of disaster recovery efforts. In addition to reducing human suffering and economic damage caused by a storm event, flood planning and preparedness are wise financial investments for our future.

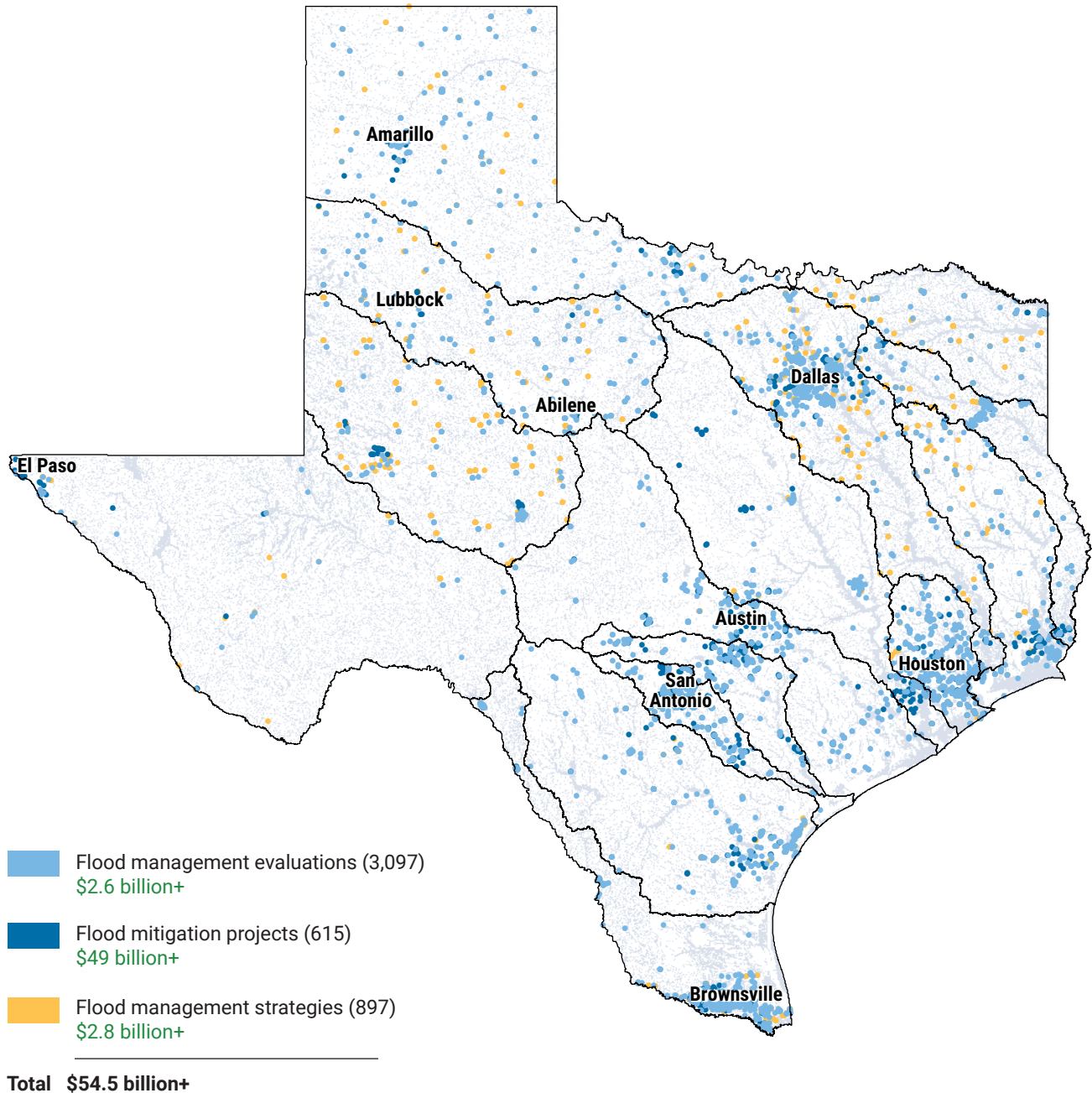
In Texas, the recurrent and devastating impacts of floods have underscored the necessity of comprehensive flood planning across the state. Understanding that floods do not adhere to political boundaries, Texas has embarked on a coordinated, innovative approach that transcends local jurisdictions. This approach aims to anticipate and reduce existing and future flood risks. The proactive approach of regional and state flood planning in Texas was designed to protect lives, property, Texas' economy, and the well-being of communities across the state. Prior to establishing the regional and state flood planning efforts in 2019, Texas' approach to managing flood risks was largely decentralized and primarily reliant on local initiatives. While this approach is valuable, it is unable to adequately address the complex, cross-jurisdictional nature of flood management, which requires broader thinking as well as careful consideration of those downstream of potential flood risk reduction solutions.

Historically, Texas has endured catastrophic floods, leaving long-lasting marks on its landscape and population. From the 1921 Williamson County event that set a national record with more than 36 inches of rain in 18 hours, to the extensive flooding across rivers like the Pecos and Sabine in 1957, and the more recent devastation of Hurricane Harvey in 2017, Texas has witnessed the full spectrum of flood-related disasters. Flood events claim lives, damage properties and economies, and strain or even threaten emergency services

¹ www.twdb.texas.gov/flood/planning/plans/index.asp

² Texasstatefloodplan.org

Figure ES-1. An overview of findings from the first cycle of regional and state flood planning



Existing flood risk

(in 1 percent [100-year] and 0.2 percent [500-year] annual chance flood hazard areas)



5,219,900
Population



1,664,200
Buildings



12,654,000
Agricultural area (acres)



63,900
Roadway miles



1,295,700
Residential buildings



6,258
Hospitals, emergency medical services, fire stations, police stations, and schools

and critical public facilities. Identifying and mitigating flood risk is widely recognized as a wise investment compared to the enormous costs required to recover from disasters.

An equally important part of the planning process is engaging and educating Texas communities in assessing their flood risk and mitigating flood hazards in their communities. By fostering a culture of awareness, involvement, and preparedness, communities become active participants in reducing their own flood risks.

The TWDB estimates that there are over 1,450 communities in Texas across 254 counties, including more than 1,200 cities and municipalities. The 15 regional flood plans include flood risk reduction solutions from more than 1,050 unique entities and communities. While the need for public outreach persists, the number of participating communities during the first regional flood planning cycle is encouraging.

How do we plan?

Texas is a large state with over 268,000 square miles of diverse geography and rainfall patterns. The river basin-based regional flood planning process enabled each planning group to address its region's unique flood risk and flood risk reduction needs.

Texas' approach to flood planning is comprehensive and rooted in a bottom-up regional process that becomes the basis for the state flood plan, emphasizing local involvement and collaboration. The state is divided into 15 regional flood planning areas based on river basin boundaries (Figure ES-2). Each of these regions is represented by a regional flood planning group composed of voting members from at least 12 required interest categories that include the public, counties, municipalities, agricultural interests, industry, river authorities, small business, water districts, environmental interests, electric generating utilities, flood districts, and water utilities.

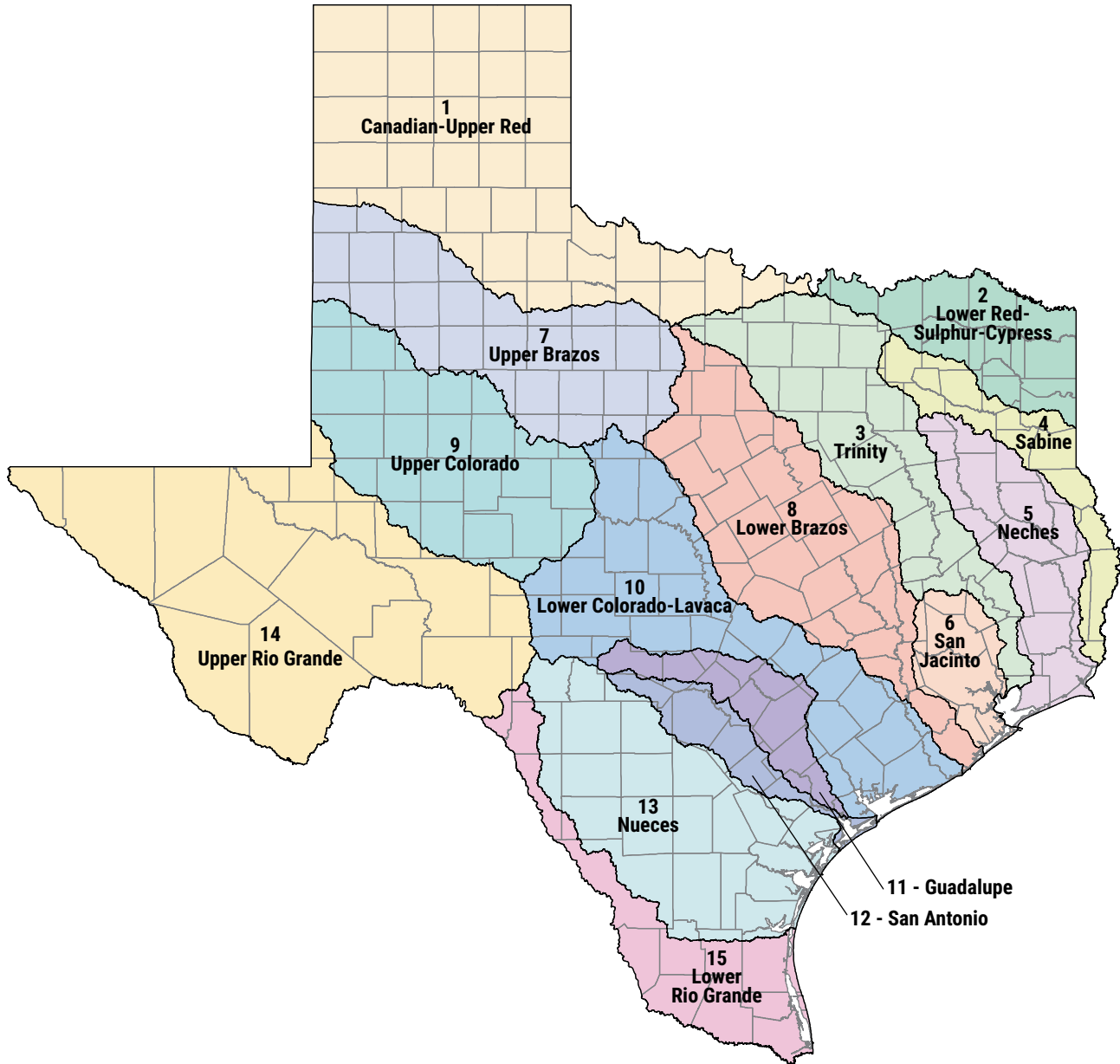
The current population of Texas is approximately 30 million and expected to increase to 51.5 million by 2070. While it is essential to understand our existing flood risk and work to reduce the risk and impact of flooding for those currently in harm's way, it is equally important to prevent an increase in future flood risk. Floodplain management practices play a key role in this. The regional flood planning process also focuses on reducing existing flood risk and avoiding the creation of future flood risks.

The planning groups operate and develop their regional plans on a five-year cycle, setting goals, evaluating flood risks, and recommending potential flood risk reduction solutions. Upon their adoption, each group's goals guide the development of their regional flood plan. The planning groups identify and recommend flood risk reduction solutions, ensuring each is aligned with the associated goals for mitigating flood impacts, and considering local specificities and potential impacts on the region's resources and communities. Each plan is a comprehensive regional flood planning document that reflects the diverse aspects of flood management within its region.

The 2019 Texas Legislature appropriated funds to enable the flood planning program. Each flood planning group selected a political subdivision sponsor that entered into a contract with the TWDB to support regional plan development with the assistance of technical consultants. During the first cycle of statewide regional flood planning, a total of \$29.5 million was provided to the 15 planning groups and primarily used to hire technical consultants.

The regional flood planning groups are required to adhere to all statutory, administrative, and contractual requirements in accordance with the regional and state flood planning framework and guidance principles. This includes maintaining group membership, designating a state political subdivision for administrative support, applying for grant funding, selecting and directing technical consultants,

Figure ES-2. The 15 flood planning regions designated by the TWDB on April 9, 2020



ensuring public participation and transparency, and adopting their regional flood plans.

This state flood plan synthesizes the information from the 15 regional flood plans to create a cohesive summary of statewide flood risk and mitigation opportunities. All numbers in the state flood plan are compilations of estimates based on the best available data that the planning groups could identify within the regional planning schedule. The consolidated local knowledge and strategies ensure that the state flood plan is both inclusive

and effective, addressing the unique challenges faced by each region while aligning them with overarching state-level flood management objectives. This approach allows for a nuanced, data-driven, and regionally sensitive response to flood risks across the state.

It is important to note that this document is a high-level planning guide offering, for the first time, statewide flood risk information and reduction recommendations, but nothing within the process or results of this process is reg-

ulatory. This plan recognizes the importance of well-orchestrated emergency response and disaster recovery, but it does not address or propose changes to the existing regime for disaster response and recovery beyond what already exists. Rather, it focuses on proactively, systematically, and collaboratively identifying, assessing, and reducing the risk of impact and flooding across the state to greatly reduce the need for costly and time-consuming response and recovery efforts.

Where are our flood hazards?

The first round of regional flood planning identified and compiled existing condition flood hazards, including riverine flooding, urban flooding, coastal flooding, playa flooding, and possible flood prone areas for the entire state of Texas. While some flood planning regions were already data-rich with flood risk information (e.g., some coastal areas and within Flash Flood Alley of Dallas, Waco, Temple, Austin, and San Antonio), there are several regions in the Texas Panhandle area and West Texas where much of the flood risk was either unmapped or based on outdated maps. As a result, most of the flood risk across these regions was not well quantified, meaning lives and property were unknowingly in harm's way.

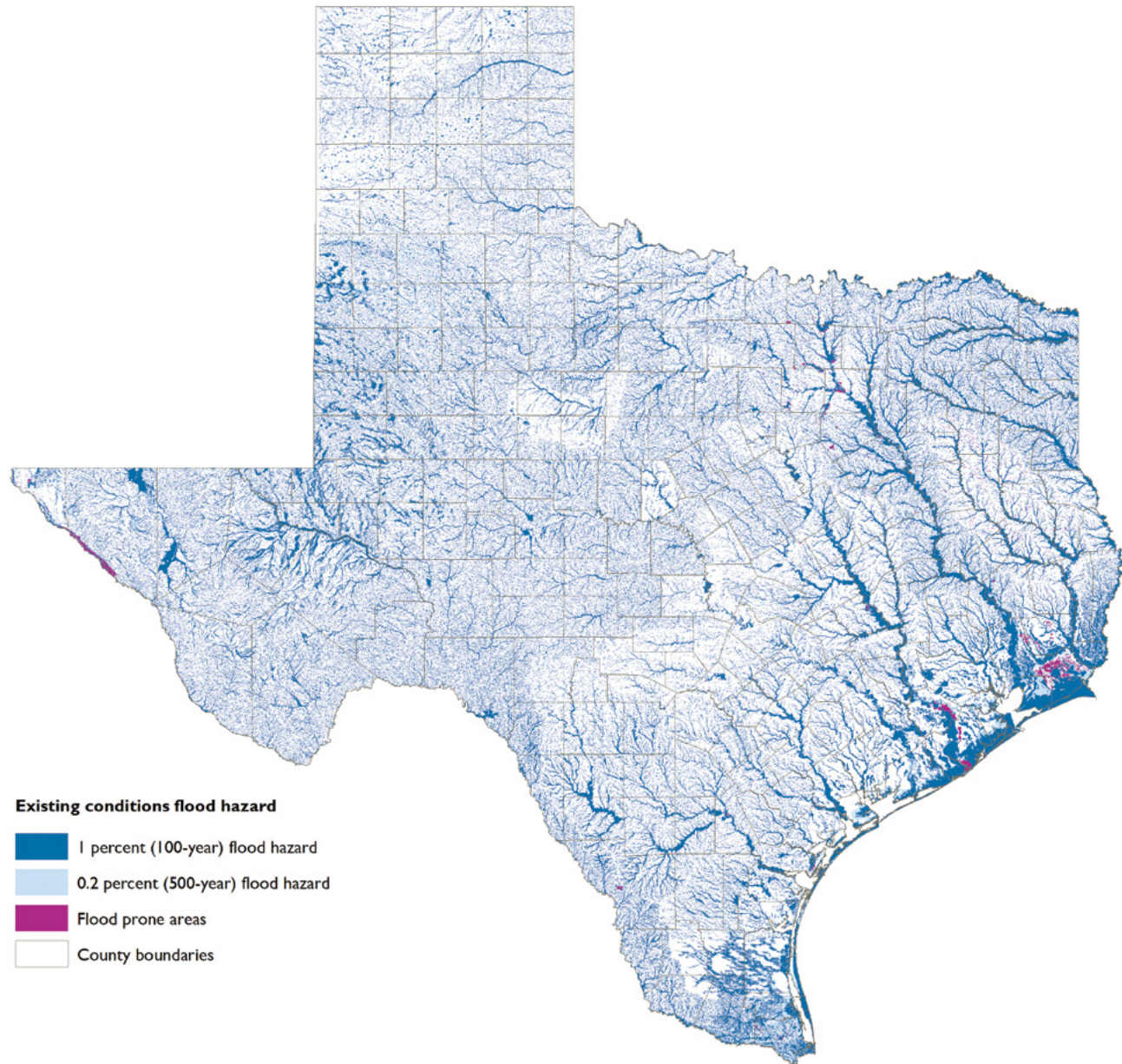
The first step of addressing flood risk is to identify the existing flood hazard. Flood hazard is the first of three components to flood risk and represents the location, magnitude, and frequency of flooding events. The regional flood planning groups identified the 1 percent annual chance floodplain, the 0.2 percent annual chance floodplain, and flood prone areas based on local knowledge and stakeholder feedback where the flood frequency was unknown. The 1 percent floodplain—often referred to as the 100-year floodplain—is the land predicted to flood during a 100-year storm event and has a 1 percent chance of occurring in any given year. The 0.2 percent floodplain—or 500-year floodplain—is the land predicted to flood during a 500-year storm and has a 0.2 percent chance of occurring in any

given year. Areas that are not located in known floodplains or flood hazard areas but are identified as flood prone areas via stakeholder input have an unknown probability of flood occurrence and are classified as having an unknown frequency of flood hazard.

Approximately 21 percent (56,053 square miles) of Texas' land area (268,597 square miles) is estimated to be within the 1 percent (100-year) annual chance floodplain (Figure ES-3). Most of the 1 percent (100-year) annual chance floodplain in the state is concentrated along rivers and streams, indicating that riverine flooding, referred to as “fluvial,” is the predominant type of flooding in these areas. Other instances of flooding include urban flooding—also referred to as “local” or “pluvial” flooding—in which rainfall overwhelms the drainage capacity of engineered drainage systems leading to localized flooding. Pluvial flooding is also an issue in the flat Panhandle region where both engineered drainage systems and natural playa lakes are overwhelmed by acute intense rainfall, leading to urban flooding. Coastal flooding is prevalent along the Gulf Coast and ranges from nuisance flooding during high tide events to deadly hurricane-driven storm surges. Land subsidence in certain areas contributes to and magnifies the impact of coastal flooding by increasing the rate of relative sea level rise.

Who and what are at risk of flooding?

Understanding who and what may be exposed to flooding is a critical aspect of flood risk management and reduction and is the second of three components required to assess flood risk. By identifying the populations, buildings, and infrastructure within the 1 percent (100-year) and 0.2 percent (500-year) annual chance floodplains, as well as other flood prone areas, decision-makers can develop targeted strategies to mitigate risk. The flood exposure analyses performed by the regional flood planning groups informed the development of robust regional and state flood plans and play a vital role in ensuring the safety

Figure ES-3. Existing condition flood hazard areas

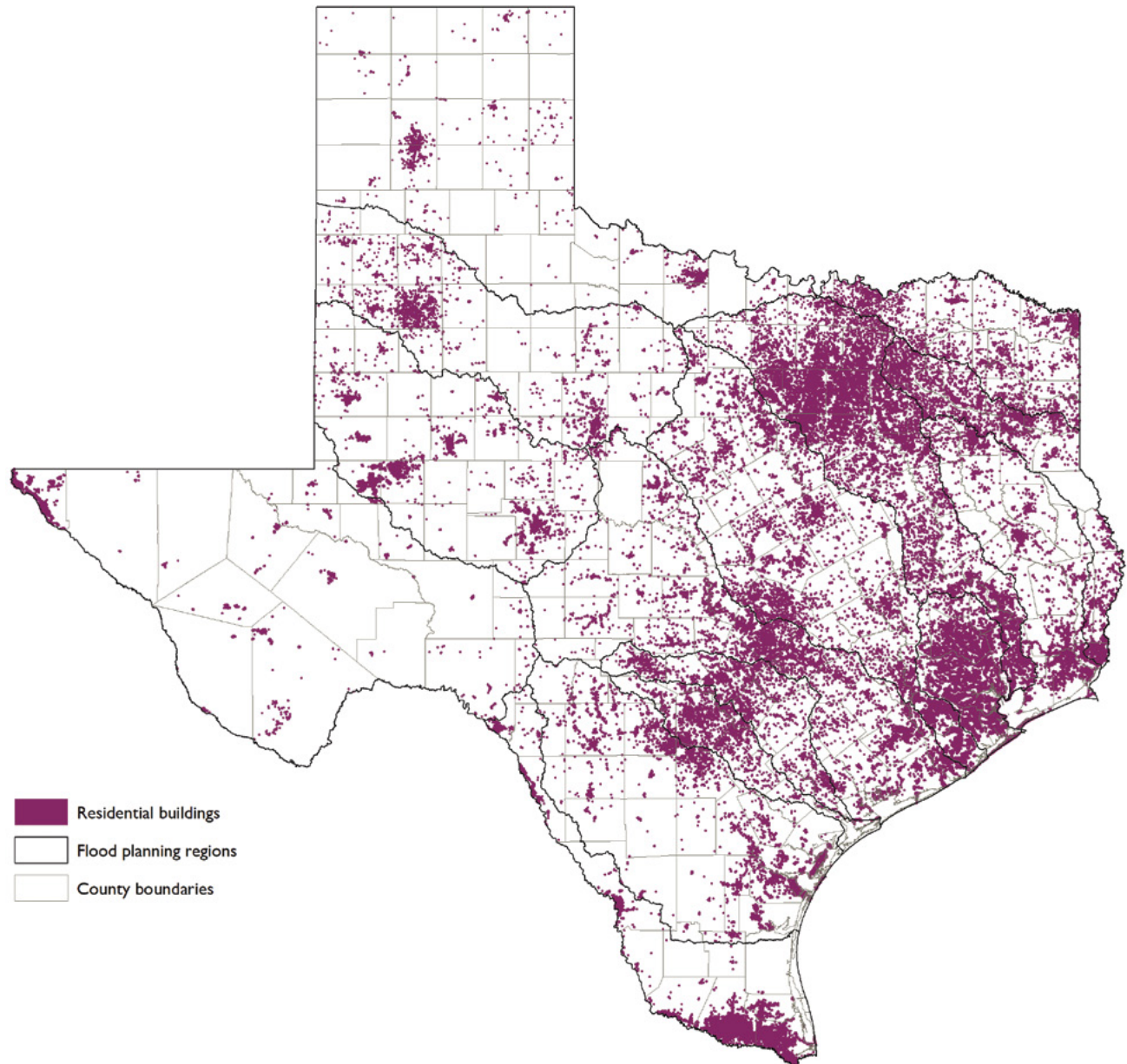
and resilience of communities against the devastating impacts of floods.

Of the approximately 30 million Texas residents, the regional flood planning groups estimated that more than 5.8 million live or work in flood hazard areas, with approximately 2.4 million in the 1 percent (100-year) annual chance floodplain, an additional 2.8 million within the 0.2 percent (500-year) annual chance flood floodplain, and approximately 666,000 located within flood prone areas of undetermined flood risk. Regional flood

planning groups identified approximately 878,100 buildings within the 1 percent (100-year) annual chance floodplain and an additional 786,100 buildings within the 0.2 percent (500-year) annual chance floodplain. (Figure ES-4).

Planning groups also evaluated Texas' transportation infrastructure, citing more than 69,000 roadway crossings and over 43,000 miles of roadways identified within the 1 percent (100-year) annual chance floodplain. The groups identified 9,322 low water crossings within flood hazard areas

Figure ES-4. Existing residential buildings in the 1 percent (100-year) annual chance floodplain



and approximately 10.2 million acres of farmland in the 1 percent annual chance floodplain.

Vulnerability, the third component of flood risk analysis, identifies the degree to which communities and critical facilities may be affected by flooding. Planning groups identified more than 6,258 hospitals, emergency medical services, fire stations, police stations, and schools within the 1 percent (100-year) and 0.2 percent (500-year) annual chance floodplains. The results of these analyses highlight the need for comprehensive

flood risk reduction solutions in Texas, recognizing both the scale of risk and the potential impact that flooding of critical facilities can have on community resilience.

What has already been done?

Texas has long recognized the importance of mitigating flood risks to safeguard lives and property. Prior to establishing the regional and state flood planning program in 2019, there were various measures implemented at the local, regional, state, and federal levels to manage and mitigate

flood risks. These efforts ranged from constructing and maintaining flood-related infrastructure like dams and levees to developing comprehensive watershed management programs. Such initiatives helped lay the groundwork for the flood risk management solutions outlined in this plan.

Existing flood infrastructure in Texas forms the backbone of the state's current flood mitigation strategy. The statewide regional planning process is Texas' first attempt to generate a statewide inventory and assessment of major flood infrastructure. Collecting information regarding the condition of existing infrastructure is effort intensive and time consuming. This exercise is only truly feasible at the regional level to the extent that the asset owners already possess the sought-after information, which they often do not. While the information collected during the first cycle of regional flood planning is not a complete assessment of all major infrastructure in the state, it is invaluable to the ongoing planning process. The expectation is that the inventory and assessment of existing major infrastructure will improve during each successive iteration of the state flood plan. Planning groups identified more than 1.3 million existing flood infrastructure features, both natural and constructed. However, the functionality and condition for most of the identified flood infrastructure was not available and therefore reported as unknown.

The planning groups were tasked with cataloging existing and prospective flood mitigation projects with dedicated construction funding. This involved a variety of data collection methods ranging from community surveys to analyzing disaster mitigation plans. Planning groups identified 2,798 proposed and ongoing flood mitigation projects currently under construction, being implemented, or with dedicated construction funding. Together, the projects have an overall cost of \$8 billion dollars. However, the complexity of these projects, coupled with varying levels of community engagement, presented challenges

in acquiring detailed information, such as project costs and completion timelines.

One of the most efficient and cost-effective ways to mitigate existing and future flood risks is implementing and enforcing sensible floodplain management practices. The planning groups assessed the various existing floodplain management practices across each of their regions, noting how many entities with flood-related authority have minimum standards, participate in the National Flood Insurance Program, and enforce their standards (among other practices). While many communities do not have minimum floodplain regulations, remarkably more than 98 percent of Texas' population resides within communities that participate in the National Flood Insurance Program. Of Texas' 1,473 counties and municipalities, 1,239 participate in the program. More than 500 of those 1,239 entities have floodplain management standards that exceed National Flood Insurance Program minimums. Participation in the National Flood Insurance Program can go a long way to reducing future flood risk and providing financial assistance for post-disaster recovery. However, the program does not assess flood risk to lives or property, nor does it mitigate existing flood risks. There is much work to be done through the regional flood planning program to identify flood risk and implement flood mitigation projects.

There are a variety of other, ongoing flood efforts that further demonstrate Texas' commitment to flood risk management. In addition to implementing the regional and state flood planning programs, the TWDB is working to generate base level engineering flood hazard data for the entire state, cooperating as a partner to the Federal Emergency Management Agency (FEMA), managing the Flood Infrastructure Fund, and providing community assistance for entities interested in participating in the National Flood Insurance Program. Other significant ongoing flood efforts are provided by the Texas Commission on Environ-

mental Quality, the Texas Division of Emergency Management, the Texas General Land Office, and the U.S. Army Corps of Engineers, amongst other state and federal agencies.

The Flood Infrastructure Fund, administered by the TWDB, is the result of a 2019 voter-approved state constitutional amendment to assist in financing drainage, flood mitigation, and flood control projects. Since its inception, the Flood Infrastructure Fund has committed over \$643 million dollars to more than 140 active and completed projects. Upon adoption of this state flood plan, only projects recommended in the state flood plan will be eligible for funding under the Flood Infrastructure Fund.

What are we doing to make Texas more flood resilient?

The regional flood planning groups recommended a wide range of potential flood risk reduction solutions that are organized into three categories: flood management evaluations, flood mitigation projects, and flood management strategies.

A **flood management evaluation** is a proposed study to identify, assess, and quantify flood risk or identify, evaluate, and recommend flood risk reduction solutions.

A **flood mitigation project** is a proposed structural or non-structural flood project that has a non-zero capital cost or other non-recurring cost and that, when implemented, will reduce flood risk or mitigate flood hazards to life or property.

A **flood management strategy** is a proposed plan to reduce flood risk or mitigate flood hazards to life or property that does not fit within the former two categories. Examples may include regulatory enhancements, development of buyout programs, and public outreach and education. Each regional flood planning group had flexibility on how it chose to utilize flood management strategies in the regional flood planning process.

A total of 4,609 flood risk reduction solutions were recommended across all 15 regional flood planning groups: 3,097 flood management evaluations, 615 flood mitigation projects, and 897 flood management strategies. If each recommended project is implemented, an estimated 843,300 people, 214,300 structures, and 577 low water crossings would be removed from the 1 percent (100-year) annual chance floodplain. The planning groups were required to determine “no negative impacts” for each recommended flood mitigation project and flood management strategy, meaning that implemented projects will not increase the flood risk upstream or downstream of the proposed project.

The recommended flood management evaluations include engineering project planning, watershed planning, flood preparedness studies, and others. Examples of recommended structural flood mitigation projects include low water crossing improvements, constructing or upgrading storm sewers and roadside ditch systems, constructing detention basins, bridge elevation, channel grading, dam improvements, and nature-based solutions (including playa improvements and conservation easement acquisition). Examples of non-structural flood mitigation projects include preparedness studies, property acquisition, and structural elevation.

Structural flood mitigation projects are most often noticed by the public because they can take the physical form of low water crossing or bridge improvements, detention ponds, flood walls and levees, and stream channel improvements. The regional and state flood planning rules and guidance principles (31 Texas Administrative Code § 362.3) also required that flood planning groups consider a balance of structural and non-structural flood mitigation measures, including projects that use nature-based solutions that lead to long-term mitigation of flood risk.

Several recommended flood mitigation projects and flood management strategies may also ben-

officially impact water supply, including projects and strategies that contribute to natural aquifer recharge and additional surface water inflows directed to reservoirs. Three regions (Region 11 Guadalupe, Region 12 San Antonio, and Region 15 Lower Rio Grande) identified potential water supply benefits for 37 recommended flood mitigation projects with an estimated water supply amount of 2,001 acre-feet per year. One region (Region 14 Upper Rio Grande) recommended a flood management strategy with a potential water supply benefit estimated at 70 acre-feet per year.

Other important flood risk reduction solutions include implementing or expanding flood measurement and warning systems, providing flood-related education, and performing public outreach. There are many solutions identified by the regional flood planning groups that, when implemented, will make Texas more flood resilient.

How much will it cost?

The estimated total implementation cost of all flood risk reduction solutions recommended by the planning groups in the first planning cycle is estimated to exceed \$54.5 billion dollars, without accounting for future inflation. Approximately \$24 billion of this amount is associated with the various Galveston Bay Surge Protection Coastal Storm Risk Management projects. Project sponsors would typically borrow funds for capital costs and repay them through annual debt service payments. It is important to note that even after this first cycle of regional flood planning, not all flood risk or flood risk reduction solutions could be identified and incorporated into the regional and state flood plans. This is because there will be additional flood mitigation projects identified as the flood management evaluations are funded and performed. Those studies will, in turn, identify specific projects that can be implemented to reduce identified flood risk, and the resulting cost to reduce flood risk will likely be larger than the amount identified in this inaugural state flood plan.

How will flood risk reduction solutions be funded?

The regional flood planning groups were required to indicate how individual local governments, regional authorities, and other political subdivisions in their region that will sponsor flood risk mitigation efforts propose to finance the region's recommended evaluations, projects, and strategies. This effort was intended to identify the overall funding availability and unmet need to implement flood risk reduction solutions. The planning groups administered funding surveys toward the end of the planning cycle to estimate the amount of state financial assistance that communities might require to implement the recommended solutions. They received limited responses to these surveys. However, results indicated that, overall, many local sponsors may require financial assistance with up to 80 to 90 percent of the project implementation costs. This result is generally in line with what the TWDB learned when developing its 2019 State Flood Assessment.

The nature of flood infrastructure can make it difficult to fund and may be under-funded in many cases at least partly because, unlike water supply projects, flood mitigation projects do not generate revenue. In some cases, those entities incurring the cost of flood mitigation measures are not the same entities that realize the benefits. For example, the costs of dam maintenance are incurred by the dam's owner, but downstream residents are among those that benefit from the maintenance. Local and regional governments will need public support to implement and finance expensive flood mitigation projects and other flood mitigation efforts such as floodplain management strategies. Current sources of local funds to pay for flood activities and make debt payments vary by entity and may include a variety of taxes, permitting or utility fees, and bond programs. State financial assistance programs include the Flood Infrastructure Fund and the Texas Water Development Fund. Federally funded financial assistance programs include state revolving fund programs and FEMA's Flood Mitigation Assistance grant program.

What if we do nothing?

Inaction in the face of existing and growing flood hazards will continue to leave life and property vulnerable to floods in Texas. Texas' vulnerability to flood risk will likely increase into the future, especially in the absence of better floodplain management or failure to implement flood risk reduction solutions. Regional flood planning groups projected flood hazards across the state will increase over the 30-year (long-term) planning horizon, due to changes in precipitation regimes and expanding or shifting land use as Texas' population grows.

Many of the groups projected the future 1 percent (100-year) annual chance floodplain within their region to become equal to the existing 0.2 percent (500-year) annual chance floodplain, with the future 0.2 percent annual chance floodplain extending out from that. Using current or projected population and development information, the planning groups estimated that state-wide future 1 percent annual chance floodplain may grow to 62,245 square miles, representing an approximately 11 percent increase over the existing expanse of flood risk. Coupled with this increase in flood hazard, the associated flood exposure would increase significantly. Based on planning group estimates, an additional 2.6 million people may be exposed to 1 percent annual chance flood events—an increase of 110 percent. Critical facilities in that floodplain would increase by an estimated 137 percent. Roadway stream crossings, including low water crossings—where we most commonly see flood-related deaths—in the 1 percent annual chance floodplain would increase by an estimated 12 percent. By recognizing this potential increase in flood risk, Texas has the opportunity now to protect against loss of life and property.

What more can we do?

A tremendous amount of resources are currently spent on reducing existing risk and the impacts of flood risk, and more are needed. The flood planning effort focused on not only reducing the existing flood risk, but also taking steps to pre-

vent increasing the risk of flooding in the future, including not placing additional lives and property at risk. The planning groups offered a variety of administrative, legislative, and regulatory recommendations they deem necessary to better reduce the risk and impact of flooding in Texas. Having considered their recommendations and other potential policy and floodplain management considerations, the TWDB includes three categories of key recommendations in Chapter 2. The Texas Water Development Board makes five legislative recommendations, shares four regional flood planning group recommendations, and includes six floodplain management recommendations:

1. TWDB legislative recommendations regarding
 - a. Flood funding and financial mechanisms
 - b. Community financial and technical assistance
 - c. Low water crossing safety
 - d. Flood early warning systems
 - e. Enhanced dam and new levee safety programs
2. Select regional flood planning group legislative recommendations regarding
 - a. Authority of counties, including regarding drainage fees
 - b. Statewide floodplain management standards for infrastructure and buildings for flood risk reduction
 - c. Statewide building codes regarding flood risk
 - d. Transportation infrastructure considerations
3. TWDB general recommendations for floodplain management include
 - a. Existing minimum FEMA floodplain standards required for cities and counties under Texas Water Code § 16.3145 and recommendations for higher standards
 - b. Enhance current floodplain management activities
 - c. Nature-based solutions
 - d. Asset management
 - e. Education and outreach
 - f. State flood planning