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AGENDA ITEM MEMO

BOARD MEETING DATE: August 15, 2024

TO: Board Members

THROUGH: Bryan McMath, Interim Executive Administrator
Ashley Harden, General Counsel
Matt Nelson, Deputy Executive Administrator

FROM: Reem Zoun, P.E., CFM, Assistant Deputy Executive Administrator,
Office of Planning

SUBJECT: Adoption of the 2024 State Flood Plan

ACTION REQUESTED

Consider adoption of the 2024 State Flood Plan.

BACKGROUND

The Texas Water Development Board (TWDB) is required by Texas Water Code (TWC) § 16.061(a) to adopt a comprehensive state flood plan that incorporates the approved regional flood plans every five years. Under TWC § 16.061 the state flood plan must:

- provide for orderly preparation for and response to flood conditions to protect against the loss of life and property;
- be a guide to state and local flood control policy; and
- contribute to water development where possible.

The state flood plan must include:

- an evaluation of the condition and adequacy of flood control infrastructure on a regional basis;
- a statewide, ranked list of ongoing and proposed flood control and mitigation projects and strategies necessary to protect against the loss of life and property from flooding and a discussion of how those projects and strategies might further water development, where applicable;
- an analysis of completed, ongoing, and proposed flood control projects included in previous state flood plans, including which projects received funding;
- an analysis of development in the 100-year floodplain areas as defined by the Federal Emergency Management Agency; and

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Brooke T. Paup, Chairwoman | L'Oreal Stepney, P.E., Board Member
Bryan McMath, Interim Executive Administrator

- legislative recommendations the board considers necessary to facilitate flood control planning and project construction.

The 2024 State Flood Plan must be adopted by the Board by September 1, 2024. This will be Texas' first state flood plan developed through the regional flood planning process as mandated by Senate Bill 8 from the 86th Texas Legislative Session (2019). The 2024 State Flood Plan incorporates the findings from the 2023 amended Regional Flood Plans that were approved by the Board. The final adopted 2024 State Flood Plan will also include, by reference, the 2024 online State Flood Plan Viewer. The viewer will provide the public with much more detailed visual information and data that cannot be presented in a bound plan document.

The 2024 State Flood Plan is the culmination of a first of its kind effort as envisioned by the Texas Legislature. It is a product of extensive collaborative work including over 550 public meetings of the 15 regional flood groups, administrative support from 15 political subdivision sponsors, communities across Texas, members of the public, and other state and federal agencies including the General Land Office, Texas Commission on Environmental Quality, Texas Department of Agriculture, Texas Division of Emergency Management, Texas Parks and Wildlife Department, Texas State Soil and Water Conservation Board, the Texas Department of Transportation and the U.S. Army Corps of Engineers.

The 2024 State Flood Plan provides the first comprehensive assessment of flood risk throughout the state. The plan identifies flood hazard exposure for the 1 percent (100-year) and 0.2 percent (500-year) annual chance flood hazard areas (Table 1). In addition to the 1 and 0.2 percent flood hazard areas, the regional flood planning groups also identified known flood-prone (unknown annual chance) areas based on historic flooding and feedback from public or local knowledge. It is important to note that not all buildings and people located within flood hazard areas for specific storm events are at risk of flooding during that event since the finished floor elevations of some buildings within the flood hazard area will likely have higher than base flood elevations.

Table 1. Estimated existing flood risks identified within Texas¹

	1 percent (100- year) floodplain	0.2 percent (500- year) floodplain²	Total
Population	2,408,600	2,811,300	5,219,900
Buildings ³	878,100	786,100	1,664,200
Residential buildings	662,100	633,600	1,295,700
Hospitals, emergency medical services, fire stations, police stations, and schools	2,924	3,334	6,258
Roadway miles	43,400	20,500	63,900
Agricultural area (acres)	10,200,000	2,454,000	12,654,000

¹Compilation of data as reported by the regional flood planning groups. Statistics are rounded.

² In addition to flood exposure in 1-percent annual chance floodplain.

³Includes all residential, agricultural, commercial, industrial, power generation, public, and vacant or unknown.

The 15 regional flood planning groups recommended over 4,600 flood risk reduction solutions, which are presented in the state flood plan. The total estimated implementation cost of all recommended flood risk reduction solutions is estimated to be more than \$54.5 billion dollars.

As required by TWC § 16.061(b)(2), the state flood plan must include a statewide, ranked list of ongoing and proposed flood control and mitigation projects and strategies necessary to protect against the loss of life and property from flooding and a discussion of how those projects and strategies might further water development, where applicable. The initial draft of the proposed ranking method was released for stakeholder review and comment in the spring of 2023. The TWDB received helpful and constructive feedback in response and made changes to the ranking method based on the feedback. The resulting method and resulting project rankings were included in the draft state flood plan for comment. The state flood plan includes ranked lists of 3,097 recommended flood management evaluations, 615 recommended flood mitigation projects, and 771 recommended flood management strategies that include non-recurring non-capital costs.

KEY ISSUES

The Board authorized publishing the Draft 2024 State Flood Plan document for public comment at its May 9, 2024, meeting. The public comment period extended from May 10 to June 17, 2024. Notice of the public comment period, public hearing, and the Board's intent to adopt the 2024 State Flood Plan was published in the *Texas Register* on May 24, 2024. The TWDB solicited public comments and held a public hearing on May 30, 2024, at the Stephen F. Austin Building in Austin, Texas to receive comments on the Draft 2024 State Flood Plan. A total of 40 people attended the public hearing in-person and virtually, with 4 organizations and 4 individuals providing oral comments.

During the comment process, the TWDB received written comments from 58 organizations and 71 individuals. The TWDB appreciates all the comments that were submitted. Many of the public comments addressed multiple items.

All substantive changes made to the plan, in addition to the relative public comment on which they are based, are included in Attachment A. These substantive changes are organized by plan chapter. A compilation of all substantive comments received and TWDB responses to comments will be posted on the TWDB website, organized by comment category. Responses to substantive comments include a brief description of associated changes made to the plan, if any. A number of beneficial minor editorial and numerical corrections were made in response to public comments but are not included in Attachment A as they were not substantive. These changes included, but were not limited to, concision, word clarifications, formatting, and minor edits to address redundancies.

The plan, if adopted, will initially be posted online as a transitory document that will be replaced by a graphically enhanced version for the purpose of final publication and distribution.

RECOMMENDATION

The Executive Administrator recommends the Board's adoption of the 2024 State Flood Plan, including the changes described herein to comply with TWC § 16.061. The Executive Administrator also recommends authorization for additional minor technical and non-substantive language edits, as necessary, prior to the final publication of the graphically enhanced version.

Attachment:

- A. Summary of substantive changes made in response to comments received on the Draft State Flood Plan

Attachment A: Substantive changes to the Draft 2024 State Flood Plan in response to public comments

The TWDB appreciates all comments received during the public comment period. Only those comments submitted that resulted in substantive changes to the Draft 2024 State Flood Plan are included in this document. All substantive comments submitted on the draft flood plan will be available on the TWDB website.

Note to reader: Each substantive change is described following the associated comment on which it is based. These comments are organized by location of the change in the 2024 State Flood Plan.

General

Similar comments from American Society of Civil Engineers, Freese and Nichols, Bayou Land Conservancy, and the Nature Conservancy: Page 217, 10.2.3 Integrating nature-based solutions: The definition of nature-based solutions provided in the introductory paragraph is incomplete and misleading and points to projects that “mimic” natural functions, or only restore natural functions, rather than already are naturally functioning, such as preserved floodplains. We recommend that the complete definition for nature-based solutions by FEMA be quoted here as it discusses existing natural features and ideas for preservation, protection, and conservation.

The TWDB modified the definition of nature-based solutions provided under Section 10.2.3 and added this term and definition to the glossary. Nature-based solution: Sustainable planning, design, environmental management and engineering practices that weave natural features or processes into the built environment to promote adaptation and resilience.

Executive summary

Comment from American Society of Civil Engineers: In addition to the statement on page 13 that flood mitigation projects do not generate revenue, often the entity incurring the project costs is not the same as the entities that realize the benefits. For example, a dam owner incurs the costs to upgrade a dam, but residents further downstream accrue the benefits of the upgrade.

The TWDB updated the following language under “How will flood risk reduction solutions be funded” of the Executive Summary to include the underlined text: 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.

Comment from Cindy Engelhardt (Halff): Last three sentences in the section “How much will it cost?” should be emphasized and/or mentioned earlier. The real dollar value needed to reduce flood risk consistent with this plan is likely exponentially larger once the recommended studies are conducted.

The TWDB updated the following language under “How much will it cost” of the Executive Summary to include the underlined text: 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 real dollar value needed to reduce flood risk will likely be much larger than the amounts printed in this state flood plan.

Chapter I

Comment from Jennifer Hundle: Pg 16 Every county has experienced a federal flood declaration in what time period? Floods are expensive. I have heard statistics that could make this statement more understandable for the general public to grasp.

The TWDB amended the following language to Section 1.1 to provide greater clarity: Although flooding has certain benefits, like recharging groundwater and providing vital nutrients to ecosystems and agricultural lands, it remains a significant threat to the health and safety of Texans. Each of the state's 254 counties has experienced flooding, tropical storms, severe storm events, or all three, proof that floods can affect all areas of Texas (FEMA, 2024). As of the writing of this plan there have been a total of nine billion-dollar flood events to affect Texas from 1980 to 2024. These range in cost from \$10.0 billion to \$20.0 billion (Consumer Price Index-adjusted) (NOAA, 2024).

Comment from Scott Hubley (Freese and Nichols): Section 1.2.3 – There is no mention of arroyos in the Lower Rio Grande Valley area and Alluvial Fans. [Also] Consider including a brief discussion of the geology and climate of Texas, which shapes the various types of flooding across the state. This background would also serve as a good foundation for Section 1.2.4

The TWDB included the following text (underlined) to Section 1.2.3 to better describe the diversity of flood risk across the state: Texas is defined by a diverse range of landscapes, each characterized by a variety of geological formations and climatic conditions, affecting regional flooding in distinct ways. Storms in the Texas Panhandle cause flooding in and around playa lakes, shallow, circular wetlands primarily fed by rainfall. West Texas' dry climate experiences extended periods of drought conditions. When it rains, alluvial fans, or fan-shaped deposits of water-transported material common to the region, can rapidly redirect water flow across wide areas, creating complex and sudden flooding scenarios (FEMA, 2020). In the Lower Rio Grande Valley, where rainfall can be highly variable, arroyos, dry creeks or stream beds that temporarily fill and flow after heavy rain, can rapidly channel large volumes of water, leading to sudden and severe storm events (Love, 2023).

Comment from Texas Housers: As stated in 1.3.2 Program requirements, we are hopeful to see further improvements and implementation of regional plans developed, according to 1.3.3. It was unclear if these regional plans have already been written and submitted to TWDB. If they have, it is equally important for this State Flood Plan to make reference to or have access to these regional flood plans and explicitly state where the public can access this information. (p 24)

The TWDB included the link to the adopted 2023 amended regional flood plans [www.twdb.texas.gov/flood/planning/plans/index.asp] to pages 3, 17, 160 in the state flood plan.

Comment from Texas Parks and Wildlife Department: TPWD recommends adding a statement to the definition of “flooding” on page 20 (1.2.1 Key terminology), stating that flooding is a natural occurrence and can be necessary to maintain the natural hydrology of rivers and streams and is a necessary part of the life history of some fish and other aquatic natural resources.

The TWDB included the following text (underlined) to Section 1.2.1 to better communicate the importance of flooding as a natural phenomenon: Flooding is a longer-term event than flash flooding; it may last days or weeks (NVWS, n.d.). While it can threaten people and infrastructure and cause

economic damage, flooding is also a naturally occurring phenomenon providing beneficial ecosystem services and helps to maintain the natural hydrology of rivers and streams.

Chapter 2

Comment from Scott Hubley (Freese and Nichols): Consider the following revised language: “The legislature should consider:

- developing a Levee Safety Program
- enhancing the existing Dam Safety Program to further identify and assess risks to and from dams and levees
- potentially assist local units of government (“Sponsors”) owning high-hazard dams built by the Natural Resources Conservation Service (NRCS) in partnership with the Texas State Soil and Water Conservation Board (TSSWCB) with the costs associated with evaluation, repair, maintenance, and upgrade of dams
- potentially assist private dam owners and other governmental dam owners with the costs associated with evaluation, repair, maintenance, and upgrade of dams. [Supported by Regions 1, 2, 3, 6, 7, 8, 10, 11]

The TWDB modified the policy recommendation and included the following underlined language in recommendation 2.1.5 in response to this comment:

- Creation of a levee safety program [Supported by Regions 1, 2, 3, 6, 8, 10]
- Assistance for local units of government (“Sponsors”) owning high hazard dams built by the Natural Resources Conservation Service in partnership with the Texas State Soil and Water Conservation Board with the costs associated with evaluation, repair, maintenance, and upgrade of dams. [Supported by Regions 1, 2, 3, 6, 7, 8, 11]
- Assistance for private dam owners and other governmental dam owners with the costs associated with evaluation, repair, maintenance, and upgrade of dams. [Supported by Regions 1, 2, 3, 7, 8, 11]
- Resources for high and significant hazard dam emergency action plans

Comment from Texas Association of Builders (TAB): TAB respectfully requests that this potential recommendation as it relates to residential construction and development be stricken from the draft and not be included in any final plan, as it has the possibility to increase housing costs, negatively affect housing attainment, and conflict with various other existing regulatory requirements. Any increase in the price of a home has the effect of pricing tens of thousands of households out of the market and has an especially chilling effect on those most vulnerable to price increases. Please note that Sec. 232.108 of the Local Government Code gives all counties the authority to require certain provisions of the Model Subdivision Rules. Sec 232.108 also allows counties to require that the subdivision provides positive drainage, that the subdivision meets state standards on water, wastewater, electric and gas, and that an engineer certify that water and wastewater are in compliance with Model Subdivision Rules. [Sec. 232.108 allows all counties to require the Sec. 232.023, Subchapter B requirements, which include all the preceding.] Finally, Secs. 232.003(5) and (8), Local Government Code allow a county to adopt reasonable specifications that provide for adequate drainage in accordance with standard engineering practices, and reasonable specifications that provide for drainage that efficiently manages storm water runoff and coordinates drainage with the general storm drainage pattern for the area.

Regarding the recommendation to clarify the regulatory authority of counties, that authority is clear and vast under the current state statutes. Sec. 16.3145, Water Code requires cities and counties to adopt flood ordinances necessary for the city/county to participate in the National Flood Insurance Program (NFIP), which

requires certain permitting and strict construction requirements to build in the flood plain. Furthermore, Sec. 16.315 Water Code authorizes all political subdivisions in Texas to engage in floodplain management, adopt and enforce permanent land use and control measures that are not less stringent than the National Flood Insurance Act, and provide for penalties on violators. Sec. 16.315 also authorizes political subdivisions to adopt permanent land use and control measures for flooding that are not less stringent than the land management criteria adopted by the Director of FEMA. Furthermore, Sec. 232.0032, Subchapter A (which applies to all counties) of the Local Government Code, requires counties to require certification by a licensed engineer or geoscientist that there is adequate groundwater available if the plat states that groundwater will be the source of water. This certification would be part of the current platting process. Chapter 232, Local Government Code, gives counties injunction powers over those who violate platting requirements and gives them inspection authority to make sure subdivisions meet the platting requirements.

Additionally, HB 2833 from 2009 allows counties to require homes to be built to code and puts into place a tried-and-true third-party inspection system. In 2017, the 85th Legislature passed HB 2040, which expanded these powers by giving counties enforcement authority (injunction and Class C Misdemeanor) over builders that do not provide notice that a home shows compliance with the building code. [See Subchapter F, Chapter 233, Local Government Code.]

The work of Harris County to implement its flood land-use authority shows that current county flooding powers work if implemented and enforced properly. This is illustrated by the fact that during the unprecedented flooding in that area due to Hurricane Harvey, only 467 of the 75,000 plus homes that were built in subdivisions developed in 2009 and later utilizing Harris County's current infrastructure requirements for drainage were flooded. This is all according to John Blount, P.E, from the Harris County Engineering Department.

Comment from Allen Boone Humphries Robinson (ABHR): ABHR concurs in the comments provided by the Texas Association of Builders. We are opposed to this recommendation. Counties already have vast and adequate land use and regulatory authority in Chapter 232 of the Local Government Code. Counties also have the authority to levy a property tax to pay for authorized purposes. Additional regulation and fees directly correlate to increases in the cost of development and home-building, thereby further exacerbating the current housing affordability crisis in Texas. Some counties even attempt to utilize regulatory authority to prohibit growth altogether. We have significant concerns about any increases in county land use authority or additional fees that would ultimately be passed through to the homebuyer.

Comment from Bayou City Waterkeeper: We seek further clarification on recommendation 2.2.1 considering "providing counties with legislative authority to establish and collect drainage fees, at their own discretion, in unincorporated areas." Granting counties authority for new drainage fees without financial safeguards could potentially burden residents, particularly low-income homeowners.

Comment from Cindy Engelhardt (Halff): Recommend adding some sort of reference to support [the] statement, "By comparison, counties in Texas have floodplain, drainage, and flood mitigation responsibilities but do not currently have authority to assess drainage fees" as it has been a contested statement in multiple meetings through the RFPs and the TWDB. Bexar County has established a drainage fee and others have considered it. It seems the perception is that counties do not have authority, however clarity is needed in the governance.

Comment from Texas Coast and Water Program, National Wildlife Federation: We also support enhanced county authority to protect communities from flooding. Land development codes and the location of infrastructure can play a major role in exacerbating or mitigating flooding. The Texas Water Code gives counties the power to mitigate stormwater runoff and protect their constituents from flooding, but it is not clear how widely that authority can be applied. With the rapid development of unincorporated areas of the state, it is increasingly important to clarify and expand county tools to regulate land use for the purpose of flood hazard mitigation. TWBD should recommend that the legislature clarify the regulatory authority of counties regarding land use and floodplain management.

The TWDB added the following underlined language under recommendation 2.2.I in response to the comments from the Texas Association of Builders, ABHR, Bayou City Waterkeeper, Cindy Engelhart (Halff), and the National Wildlife Federation: Under Local Government Code, Title 13, Subtitle A, Chapter 552,¹ municipalities in Texas have statutory authority to establish public utilities to provide various services to their residents, including drainage. Municipal public utilities can assess and collect user fees to fund operations and maintenance for land acquisition and implement drainage improvement and flood risk reduction problems. These funds create a direct and reliable source of revenue to assist in the implementation and long-term maintenance and repair of drainage and flood risk reduction projects. This same authority is not currently granted to unincorporated areas of counties. This limits counties' abilities to self-finance flood mitigation and drainage projects and provide adequate ongoing maintenance of drainage and flood mitigation infrastructure. Regional flood planning groups recommend that the Texas Legislature should provide counties with authority to establish drainage utilities and assess drainage fees.

The TWDB provides a summary of key relevant authorities here. Despite the existing authorities, described below, many of the regional flood planning groups identified the need to establish authority for drainage fees and utilities in unincorporated areas. The Attorney General has made it clear that the county authority requested by the regional flood planning groups does not currently exist.² Currently, counties may establish a "flood control fund" and impose ad valorem taxes according to Transportation Code 256.006 and 256.054.³

Comment from Scott Hubley (Freese and Nichols): The TWDB should consider aligning minimum design guidelines or flood management standards, where appropriate, with the Federal Flood Risk Management Standard (FFRMS) developed by FEMA. The standard for federally funded projects should not drastically differ from the standards state or other locally funded projects are held to.

In particular, the proposed guidelines recommended 1 – 2 feet of freeboard compared to the BFE. However, FFRMS looks to establish freeboard requirements as compared to the 500-year floodplain and increases those freeboard requirements for critical infrastructure. More information can be found via the Federal Register: Updates to Floodplain Management and Protection of Wetlands Regulations To Implement the Federal Flood Risk Management Standard

The TWDB added the following underlined language under recommendation 2.3.I in response to this comment: Table 2-I summarizes existing requirements under FEMA's National Flood Insurance Program standards and recommendations to consider for associated higher standards. TWDB recommends considering the Federal Flood Risk Management Standard developed by FEMA⁴, where appropriate, while developing the design guidelines or flood management standards.

Chapter 3

Comment from Texas Parks and Wildlife Department: TPWD feels that it is important to educate the public on the importance of rivers, streams, and floodplains and highlight that flooding is a normal part of the

¹ statutes.capitol.texas.gov/Docs/LG/htm/LG.552.htm

² www.texasattorneygeneral.gov/sites/default/files/opinion-files/opinion/2005/ga0366.pdf

³ <https://statutes.capitol.texas.gov/docs/TN/htm/TN.256.htm#:~:text=Sept.%201%2C%201995.-,Sec.%20256.006,-USE%20OF%20FLOOD>

⁴ www.fema.gov/floodplain-management/intergovernmental/federal-flood-risk-management-standard

hydrology of a river system and is necessary to maintain healthy geomorphology and is necessary for the life cycle of some fish and other aquatic organisms.

The TWDB included the following underlined language under Section 3.1.1: Natural features refer to the ecological characteristics and functions of the physical landscape that mitigate flood risk. A lake or wetland, whether man-made or naturally occurring, can mitigate the effects of flooding through water storage; the conveyance of stormwater runoff to creeks, streams, and rivers; or through natural infiltration of water into the ground. The efficiency of natural systems varies by soil type, bedrock type, and the amount of vegetation. When allowed to effectively infiltrate the ground, water from rain events is less likely to overwhelm tributaries and stormwater systems. Rivers, streams, and floodplains are important parts of our natural features and systems. Flooding, to an extent, is a normal part of the hydrology of a river system and is necessary to maintain healthy fluvial geomorphology and for the lifecycle of some fish and other aquatic organisms.

Comment from Scott Hubley (Freese and Nichols): Page 64, Figure 3-14: TWDB apparently pulled ExFldInfraPol for Infra Type = Pond to prepare Figure 3-14. For regions where FNI was the Prime Technical Consultant, this query would include both named and unnamed ponds in this category. Other regions had a different approach and, therefore, the obvious discrepancy in this map. FNI recommends using a query on the regions showing a high density of ponds. These regions include 1, 4, 5, 6, 7, 8, 9, and 11. After inspection of the ExFldInfraPol data, the query to best match the other regions is where INFRA_TYPE = 'Pond' And NAME <> 'Unnamed Pond' for regions 1, 4, 5, 6, 7, 8 & 11. Region 9 will have a slightly different query where INFRA_TYPE = 'Pond' And NAME <>.

The TWDB included the following note below Figure 3-14 Locations of identified detention and retention ponds to explain variations between reported data between flood planning regions: Data density on this map demonstrates the variability of how flood infrastructure was identified by the regional flood planning groups. While some planning groups chose to include small, unnamed ponds others included only large ponds designed for flood control.

Comment from Cindy Engelhardt (Halff): Consider removal of Figures 3-14 and 3-15. Figure 3-14 map implies that other regions do not have detention or retention ponds. Similarly Figure 3-15 implies Texas has limited stormwater management systems across the state. This is an inconsistency within the database population or reported data by the varying regions, so it should not be used as a graphic. Suggest clarification of guidance for these fields or observations in the second cycle of planning.

The TWDB included the following note below Figure 3-15 Locations stormwater management systems as reported by the regional flood planning groups, to explain variations between reported data between flood planning regions: Map reflects stormwater management systems as reported by the regional flood planning groups. This information is displayed with the acknowledgement that much of the state's stormwater infrastructure may not have been identified by the regional flood planning groups due to constraints in the availability of infrastructure data across the state. The TWDB is currently funding and guiding a research project to developing an infrastructure assessment guidance and toolkit to help local communities identify and determine functionality of their existing stormwater infrastructure.

Chapter 4

Comment from Scott Hubley (Freese and Nichols): Page 82, Figure 4-4: This map mixes the quality of NFHL available with the data ultimately used by the RFPs. FNI recommends a map of NFHL quality (Zone AE, Zone A, year effective etc.) and a separate map of what data the RFPs used (will need hatch for multiple data if AE was only available on main reaches).

In response to this comment, the TWDB updated the Figure 4-4 classes to better reflect flood mapping gaps reported by the regional flood planning groups.

Comment from American Society of Civil Engineers: *In the third paragraph of Section 4.1.2 on data gaps, it would be good to mention the number of unmapped counties that still exist in Texas that do not even have a FIRM map.*

The TWDB included additional information regarding the number of unmapped counties in Texas under Section 4.1.2: Floodplain data gaps generally included the absence of detailed hydraulic and hydrologic modeling, modernized data, and broad coverage of digitized flood hazard information from previously published sources. Outdated information included studies over 10 years old, approximate data, outdated modeling software, base level flood elevation data, outdated FEMA maps, and inadequate flood risk mapping. According to FEMA's National Flood Hazard Layer data, of the 133 counties that do have Flood Insurance Rate Maps, four are only partially mapped. There are 121 counties in Texas that do not have any effective Flood Insurance Rate Maps (FEMA, 2024).

Chapter 5

Comments from Darrell Hahn, Gary Bezemek, and Mark Garcia: In reviewing the TWDB Draft 2024 State Flood Plan, we noticed in Figure 5-6 on page 127 Harris County is incorrectly listed as not enforcing the Regulator Floodplain. Harris County takes great pride in being a leader in floodplain management in Region 6 encouraging all cities and municipalities to adopt the same higher standards. Currently Harris County requires and enforces the floodplain regulations during the permitting and inspection process. Also, property owners that develop and fail to permit are issued violations and tracked for compliance with the floodplain regulations.

The TWDB updated figures 5-5, 5-6, 5-7 and all associated text in Chapter 5 of the state flood plan to indicate that Harris County and several of its municipalities have higher floodplain regulations, high levels of enforcement, and strong levels of floodplain management standards.

Comment from Scott Hubley (Freese and Nichols): Page 138: Sources do not appear to be cited to support how the level of enforcement was populated for communities. FNI recommends including relevant sources if the information reported in the SFP differs from what was published and adopted in the RFPs.

The TWDB included additional context (underlined) under Section 5.1.5 regarding the diversity of methods used to report information on entities' floodplain management practices in each flood planning region: Through outreach, the regional flood planning groups identified the level of enforcement of floodplain regulations by entities with flood-related authority. While some flood planning regions collected this data from self-reported surveys, other regions reported enforcement based on level of National Flood Insurance Program participation.

Comment from Cindy Engelhardt (Halff): Consider update of the footnotes in Tables 5-1, 5-2, 5-3, 5-4 and 5-5 to clarify that the data was self-reported by the entities or participants rather than developed by the RFPGs. Suggest the following note: "Blank cells in this table do not necessarily signify zero entities; they indicate that data was either not available or not reported by entities." The RFPGs could not report information they did not receive. In Figures 5-6 and 5-7, reconsider denoting counties and communities with a level of enforcement of "None" to be "Unknown". The data is based on self-reported information. The text in this section states "that many communities may have been reluctant to share this information, fearing its potential impact on flood insurance." Those entities who either did not respond or chose to respond with "unknown" look more favorably in these figures than those who responded "None".

The TWDB included the following note under Figures 5-1, 5-2, 5-3, 5-4, 5-5, 5-6, and 5-7: This table contains self-reported information obtained by the regional flood planning groups through outreach surveys to entities throughout the state. For example, blank cells may not signify zero entities; relevant information may not have been available or reported to the regional flood planning groups.

Chapter 7

Comment from James Bronikowski (Ardurra): We recommend adding language in this section to inform consumers of the state flood plan that this list represents a snapshot in time based on best available data, and that the need for flood risk reduction solutions is most likely much larger.

The TWDB included additional context (underlined) for clarity under Section 7.1: The additional time and funding provided to the regional flood planning groups tripled the number of flood mitigation projects identified and significantly increased the number of recommended flood risk reduction solutions that the flood planning groups included in their first regional flood plans. The flood risk reduction solutions identified and recommended in the state flood plan represent a snapshot in time based on best available data. The need for flood risk reduction solutions in the state is greater than what is identified and recommended in the inaugural cycle of the flood planning.

Chapter 8

Comment from Cindy Engelhardt (Halff): Section 8.4.5 – Recommend rewording the last paragraph to: “Other solutions that positively affect water quality include floodplain preservation through regulations and ordinances. Preserving natural floodplains promotes the natural filtration and treatment of water through natural riparian habitat with native vegetation adjacent to streams. Pollution prevention regulations and ordinances emphasize the proactive prevention of pollution at the source.

The TWDB included additional text (underlined) under Section 8.4.5 to add clarification for reader understanding: Other solutions that positively affect water quality include floodplain preservation and regulations and ordinances. Preserving natural floodplains promotes the natural filtration and treatment of water through the creation of natural riparian habitat with native vegetation adjacent to streams. Pollution prevention regulations and ordinances emphasize the proactive prevention of pollution at the source.

Comment from American Society of Civil Engineers: In the first full paragraph on uncertainty, it would be helpful to mention the relatively short period of record for most of our rainfall and stream gages – which results in additional statistical uncertainty when estimating the larger and less frequent events.

The TWDB included additional text (underlined) added under Section 8.5: Predicting the exact nature, scale, and frequency of floods is inherently uncertain. Natural events can be more extreme than historical records indicate or than models predict. Even the most robust flood mitigation projects may be insufficient to handle unprecedented flood events. Flood risk reduction solutions are often engineered to address, manage or protect against certain design storm events or floods. These storm events, such as the 1 percent (100 year) annual chance storm event, are determined based on historical rainfall data. The relatively short period of record for some rainfall and stream gages results in additional statistical uncertainty when estimating the larger and less frequent events.

Chapter 9

Comment from Cindy Engelhardt (Halff): Suggest adding a note to section 9.1 or 9.2 about the specific congressional allocation for the Galveston Bay Surge Protection Coastal Storm Risk Management.

The TWDB included additional text (underlined) under Section 9.1: Aside from one-time costs for activities like studies, the estimated total capital costs of all flood risk reduction solutions recommended by the 15 regional flood planning groups in this plan amount to approximately \$54.5 billion dollars. Note that approximately \$24 billion of this cost is for the Galveston Bay Surge Protection Coastal Storm Risk Management projects, towards which the U.S. congress allocated \$950 million between 2022 and 2023 (Zuvanich, 2023).