DRAFT Technical Memorandum Addendum

TO:	Mr. Jeff Walker, Executive Administrator Texas Water Development Board Stephen F. Austin Building 1700 N. Congress Avenue, 6th Floor Austin, Texas 78701	DATE:	Draft: February 16, 2022 To be submitted to TWDB on March 7, 2022
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Addendum Overview

In August 2021, TWDB extended the deadline for completion and submittal of three subtasks associated with the Technical Memorandum to be submitted as an addendum by March 7, 2022. The purpose of this extension was to accommodate the delayed release of the Fathom data associated with the TWDB's floodplain quilt (TWDB Data Hub, 2021). Results presented in this memorandum are considered interim due to ongoing incorporation of best available data into the floodplain quilt. The Technical Memorandum Addendum includes:

- Existing and potential future conditions flood risk (Task 4C.1.c);
- Flood hazard data gaps and additional flood-prone areas (Task 4C.1.d); and
- Available hydrologic and hydraulic models needed to evaluate FMS's and FMP's (Task 4C.1.e)

Task 4C – Technical Memorandum Addendum Deliverables

The following sections introduce the technical memorandum addendum deliverables associated with the March 7th extension. Several additional attachments are included at the end of this document. **Table 1** indicates which subtasks and information are contained in each one.

Table 1: Technical Memorandum Addendum Attachments

Attachment	TWDB Task	Description
2,3,4	4C.1.c	A geodatabase and associated maps for: region-wide 1.0% annual chance flood event and 0.2% annual chance flood event inundation boundaries, and the source of flooding for each area, for use in its risk analysis, including indications of locations where such boundaries remain undefined. Includes TWDB-required Tables 3 and 5.
2,3	4C.1.d	A geodatabase and associated maps that identifies additional flood-prone areas not included in the floodplain quilt based on hydrologic features, historic flooding, and or local knowledge.
2,3	4C.1.e	A geodatabase and associated maps in accordance with TWDB Flood Planning guidance documents that identifies areas where existing hydrologic and hydraulic models needed to evaluate FMSs and FMPs are available

4C.1.c – Existing and potential future conditions flood risk

Existing Conditions Flood Quilt

As of May 20, 2021, TWDB provided regional planning groups with an official version of the existing conditions floodplain quilt. The quilt was provided to establish a starting point in identifying flood risk within the region. The floodplain quilt compiled flood risk boundaries from several sources.

- National Flood Hazard Layer (NFHL) Pending Data
- National Flood Hazard Layer (NFHL) Preliminary Data
- National Flood Hazard Layer Effective Data (Detailed Study Areas only)
- Estimated Base Flood Elevation Data
- National Flood Hazard Layer (NFHL) Effective Data (Approximate Study Areas only)
- First American Flood Data Services (FAFDS)

On October 29, 2021, TWDB provided the planning group with Fathom floodplain data to estimate flood risk in locations where floodplain information was unavailable. Five counties within Region 2 had no flood quilt data while most others relied on outdated, approximate Zone A floodplain maps. Region 2 relied on the following methodology to prioritize the best available floodplain data for incorporation into the floodplain quilt, with the first being considered the best and the last being considered the least reliable.

1. Local Detailed Studies
   a. Local detailed studies were included only if they are city/county-wide studies completed to FEMA or TWDB standards.
   b. To date, no such studies have been provided that have not already been incorporated into FEMA Zone AE studies.
2. FEMA Zone AE Detailed Studies
   a. These are generally considered to be high quality studies and are typically used for regulatory and insurance purposes.
   b. Hydrologic and hydraulic models and supporting data are typically available for Zone AE mapped areas, although this data is less available in older study areas
   c. In Region 2, these are limited to most of Grayson County and the larger municipalities in the area.
   d. Typically includes 1% and 0.2% annual chance floodplains.
   e. Some cities, such as Sherman, Paris, and Texarkana have previously incorporated their own detailed studies.

3. Base Level Engineering (BLE)
    a. BLE is an approximate study based on recent high-resolution topographic data and typically lacks detailed hydrologic modeling, bridge and culvert modeling, and other details.
    b. Hydraulic models and study documentation are available for BLE areas, although hydrologic models are not typically available because of the hydrologic estimations used in lieu of detailed modeling
    c. BLE is not considered a regulatory product, but, where available, is considered to be better quality than similarly prepared, but older Zone A floodplain maps.
    d. Includes 1% and 0.2% annual chance floodplains.
    e. Currently, BLE is only available within the Lower Red River Basin portion of Region 2.
4. FEMA Zone A Approximate Studies
    a. FEMA Zone A floodplains are typically based on approximate hydrologic and hydraulic methods without floodplain details, such as bridges.
    b. Models are not usually available for such areas.
    c. The topographic data used to develop this mapping usually lower resolution and several decades older than that used for BLE mapping.
    d. Typically only includes 1% annual chance floodplains.
    e. For these reasons, FEMA Zone A floodplain is considered of lower reliability for flood planning than BLE in Region 2
    f. Zone As are a regulatory product and hold more weight in flood insurance rates and determinations.
    g. Zone As make up most of the effective floodplain mapping that is available in the region.
5. Fathom Cursory Floodplain Dataset
    a. Data sets provided by TWDB as a cursory floodplain dataset to be used in areas lacking other floodplain mapping.
    b. Includes 1% and 0.2% annual chance floodplains.
    c. Developed using recent, but moderately detailed topography.
    d. Developed using a proprietary, third-party methodology, that has not yet been vetted against FEMA standards.
    e. No modeling is publicly available for Fathom floodplains.
    f. For these reasons, Fathom is being used only where floodplain data does not exist:
        i. Fluvial
            1. Riverine/Channel flooding, similar to areas typically mapped by FEMA.
            2. Data will be used where no other floodplain data was available (Camp, Delta, Franklin, Marion and Morris Counties)
            3. Was used to replace FAFDS data.
        ii. Pluvial
            1. More upland/urban flooding than typically mapped by FEMA
            2. Fathom Pluvial data was added to all portions of the region to extend mapping beyond the typical FEMA mapping limits in order to more fully capture flood risks in the region.

This methodology was modified slightly from that proposed in the initial January 7 Technical Memo submittal by raising the prioritization of BLE above Zone A floodplains. An existing conditions flood hazard quilt was assembled using this prioritization approach and was made available, via a web map interface, to the RFPG, public and

stakeholders between January 24 and February 24, 2022. Public comments from this and the RFPG meetings will be considered in the final flood plan.

Future Conditions Flood Quilt

The future condition methodology was based on Method 2 from the TWDB-approved Region 3 *Potential Future Conditions Flood Risk Methodology Memorandum* dated January 7, 2022, included as **Attachment 1**. Since limited hydrologic data is available in the basin, predicting future conditions is not feasible using currently available data. Therefore, the existing 0.2% annual chance floodplain was used as a proxy for the future 1.0% annual chance floodplain. This should be a conservatively high estimate of the impacts of development and climate change within Region 2, which are expected to have minimal impacts compared to other regions that are rapidly developing and experiencing more significant climate impacts.

Future 0.2% annual chance floodplain was developed using the horizontal buffer approach described in the Region 3 *Potential Future Conditions Flood Risk Methodology Memo*. The underlying assumption of this method is that if the existing 0.2% AC floodplain is a reasonable proxy for the future 1% AC floodplain, then a similar offset could be used to estimate the future 0.2% AC flood floodplain. A Region 2 specific analysis was conducted to determine this 0.2% AC buffer by comparing existing 0.1% and 0.2% AC floodplains to determine the average offset. Newly published Base Level Engineering data was analyzed, measuring cross-section distances between the existing 1.0% and 0.2% AC. The median distance between over 11,400 cross-sections was 22'. The future 0.2% annual chance area has been estimated by buffering the future 1.0% annual chance area 22 feet. Future flood condition methodology was presented to the RFPG February 10, 2022 and results were shown at the March 3, 2022 meeting.

Exposure and Vulnerability Analysis

On December 1, 2021, TWDB supplied the planning groups with the final buildings dataset to be used for the existing and future conditions flood exposure analysis. Exposure analysis was performed to determine the number of at-risk structures (buildings, roadways, critical facilities, etc.), population estimates, the length of impacted roadways and area of agricultural land contained within the previously developed existing and potential future flood hazard boundary. **Table 3** provides overall Lower Red Sulphur Cypress flood exposure results.

Table 2: Region 2 Existing and Potential Future Flood Exposure Analysis Results

Potential Flood Risk Event	Number of At-Risk Structures	Number of At-Risk Critical Facilities	Number of Roadway-Stream Crossings*	Impacted Agricultural Area (sq. mi.)
Existing 1% Annual Chance (100-year)	13,438	160	2,882	283
Future 1% Annual Chance (100-year)	15,023	166	2,927	299

includes all locations of stream and road intersections

Following the exposure analysis, a vulnerability analysis was performed for both existing and potential future conditions using the Social Vulnerability Index (SVI) dataset. The vulnerability analysis was performed to assess a community's resilience, with values closer to 1 denoting greater vulnerability.

The flood risk analyses (existing and potential future flood risk, exposure, and vulnerability) for this submittal are considered interim. TWDB-required **Table 3** and **Table 5** located in **Attachment 2** provide the results per county of the existing and future exposure and vulnerability analysis as outlined in the Technical Guidelines for Regional Flood Planning. A geodatabase and associated maps are provided in **Attachment 3** as digital data.

4C.1.d – Flood hazard data gaps and additional flood-prone areas

During review of the final floodplain quilt, a flood hazard data gap assessment was performed. Preliminary analysis identified gaps as areas with no prior mapping or recent detailed studies, which consists of most of the region except for the cities of Sherman, Paris, and Texarkana. An ongoing effort is being made to determine the validity of the associated hydrologic and hydraulic modeling in areas of greater risk.

In addition to incorporation of recently published BLE data and the Fathom dataset, a region-wide data collection and outreach effort was made to identify flood-prone areas. These areas were identified by the region's stakeholders along with public datasets and are based on hydrologic features, historic flooding, and local knowledge. These areas were all predominately captured by the revised flood quilt and there are no plans to modify the quilt accordingly, unless additional data is provided by stakeholders. A data gaps and additional flood-prone area feature class and associated **Maps 5 and 9** are provided in **Attachments 2 and 3** as digital data.

4C.1.e – Available hydrologic and hydraulic models needed to evaluate FMS's and FMP's.

A list of previous studies containing modeling data was submitted as part of the January 7, 2022 Technical Memorandum. The location of these studies were added to a geodatabase to provide a georeferenced representation of model- backed study areas for use when conducting FMS and FMP evaluations. It should be noted that for use in developing an FMS or FMP, these models will need some level of enhancement to provide fully detailed flood risk reduction evaluations per TWDB technical requirements. Available model locations geodatabase and associated **Map 13** are provided in **Attachment 3** as digital data.

4C.1.c,d,e – Technical Memorandum Addendum Geodatabase and Tables

As outlined in the TWDB Extension of Time to Complete Technical Memorandum dated August 17, 2021 and associated Technical Memorandum Data Deliverable Clarification dated October 29, 2021, documentation in **Attachment 3** outlines geodatabase deliverables included in this Technical Memorandum as well as spatial files and tables. Specific data deliverables align with the TWDB's Exhibit D: Data Submittal Guidelines for Regional Flood Planning. The geodatabase files require ArcGIS software to be used to view the files. The RFPG can provide these files to anyone requesting said files by emailing rfpg2@halff.com. Please keep in mind that these files will continue to be updated and enhanced throughout the development of the Regional Flood Plan and simply reflect a snapshot in time of the project as it stands today.

Attachment 1

Task 4C.1c – Potential Future Conditions Flood Risk Methodology Memorandum

Attachment 2

Task 4C.1c, 4C.1d – TWDB Required Table 3 and Table 5, Maps 4-13

- Map 4: Existing Condition Flood Hazard (2.2.A.1 Existing condition flood hazard analysis)
- Map 5: Existing Condition Flood Hazard - Gaps in Inundation Boundary Mapping and Identify Known Flood-Prone Areas (2.2.A.1 Existing condition flood hazard analysis)
- Map 6: Existing Condition Flood Exposure (2.2.A.2 Existing condition flood exposure analysis)
- Map 7: Existing Condition Vulnerability and Critical Infrastructure (2.2A.3 Existing condition vulnerability analysis)
- Map 8: Future Condition Flood Hazard (2.2.B.1 Future condition flood hazard analysis)
- Map 9: Future Condition Flood Hazard - Gaps in Inundation Boundary Mapping and Identify Known Flood-Prone Areas (2.2.B.1 Future condition flood hazard analysis)
- Map 10: Extent of Increase of Flood Hazard Compared to Existing Condition (2.2.B.1 Future condition flood hazard analysis)
- Map 11: Future Condition Flood Exposure (2.2.B.2 Future condition flood exposure analysis)
- Map 12: Future Condition Vulnerability and Critical Infrastructure (2.2.B.3 Future condition vulnerability analysis)
- Map 13- Map showing where existing hydrologic and hydraulic models needed to evaluate FMSs and FMPs are available

Due to the file sizes of the draft figures, they are available for individual download at the following link:
https://halff-my.sharepoint.com/:f:/p/ah4115/EiIKqJL_5FVLoqC_bvnxeYYBccg5j1O2nBIDcQf-IlOg3A?e=SE0M3V

Because this document is intended to show progress towards the development of the draft regional flood plan, these figures will be removed from the link on March 7, 2022 when the Technical Memorandum Addendum is submitted to the Texas Water Development Board. Updated versions of these figures will be included in the draft flood plan.

Attachment 3

Task 4C – Geodatabase

This March 7, 2022 Technical Memorandum Addendum submittal for the Lower Red-Sulphur-Cypress Basin incudes the following geodatabases named:

- FPR02_GIS_Data_03072022.gdb,
- FPR02_Addl_TechMemoData03072022.gdb
- 02_RFP_ExhibitC_Table3_5.xlsx

The geodatabases are populated with the layers and tables below:

Item Name	Description	Feature Class Name	Data Format Polygon/Line/ Point/GDB Table
Existing Flood Hazard	Perform existing condition flood hazard analyses to determine the location and magnitude of both 1.0% annual chance and 0.2% annual chance flood events	ExFldHazard	Polygon
Flood Mapping Gaps	Gaps in inundation boundary mapping	Fld_Map_Gaps	Polygon
Existing Exposure	Gaps in inundation boundary mapping Develop high-level, region-wide, and largely GIS-based existing condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events	ExFldExpPol	Polygon
	Develop high-level, region-wide, and largely GIS-based existing condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events	ExFldExpLn	Polyline

Item Name	Description	Feature Class Name	Data Format Polygon/Line/ Point/GDB Table
	Develop high-level, region-wide, and largely GIS-based existing condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events	ExFldExpPt	Point
	Combines the Exposure Poly, Line, and Point data into a single master layer, also includes Vulnerability data	ExFldExpAll	Point
Future Flood Hazard	Perform future condition flood hazard analyses to determine the location and magnitude of both 1.0% annual chance and 0.2% annual chance flood events	FutFldHazard	Polygon
Future Exposure	Perform future condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events	FutFldExpPol	Polygon
	Perform future condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events	FutFldExpLn	Polyline
	Perform future condition flood exposure analyses using the information identified in the flood hazard analysis to identify who and what might be harmed within the region	FutFldExpPt	Point

Item Name	Description	Feature Class Name	Data Format Polygon/Line/ Point/GDB Table
	for, at a minimum, both 1.0% annual chance and 0.2% annual chance flood events		
	Combines the Exposure Poly, Line, and Point data into a single master layer, also includes Vulnerability data	FutFldExpAll	Point
Existing H&H Models (Addl_TechMemoData.gdb)	Shows boundaries of where existing hydrologic and hydraulic models needed to evaluate FMSs and FMPs are available	Exis_HH_Models	Polygon
Flood Prone Areas (Addl_TechMemoData.gdb)	Known, reported flood prone areas, from public input process	Reported_FloodProneAreas	Polygon