RIVER BASIN FLOOD STUDY

Standard Operating Procedure for Alternatives Analysis

100 Percent Final
June 23, 2025

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Revision History

Version Number	Version Date	File Name	Description/Updated Content
1	January 6, 2023	Ph3_Deliverable17_AASOP _25pct.pdf	Alternatives Analysis/ Phase 3 Deliverable #17: Alternatives Analysis Standard Operating Procedure: Outline (25%)
	May 26, 2023		Interim products, including preliminary 75% draft and screening/evaluation criteria provided to Regional Study Teams and CHARM for review
	July 11, 2023		West Regional Study Team sends memo including comments on interim products
2	July 14, 2023	Ph3_Deliverable18_AASOP _75pct.pdf	Alternatives Analysis/ Phase 3 Deliverable #18: Alternatives Analysis Standard Operating Procedure: Draft (75%) sent to East, Central, and West Regional Study Teams for review
	July 28, 2023		Central Regional Study Team comments received
3	July 28, 2023	Ph3_Deliverable18_AASOP _75pctv3.pdf	Alternatives Analysis/ Phase 3 Deliverable #18: Alternatives Analysis Standard Operating Procedure: Draft (75%) delivered to GLO
	July 28, 2023		West Regional Study Team comments received
	August 18, 2023		East Regional Study Team comments received
4	November 28, 2023	Ph3_Deliverable18_AASOP _75pctv4.pdf	75% Draft revised document, comments, and responses compiled and posted for Technical Flood Model Reviewer
5	January 26, 2024	Ph3_Deliverable18_AASOP _75pct_2024_01_26_v5_post_ TFMR_backcheck.pdf	75% Draft revised document, resolved backcheck comments and posted for Technical Flood Model Reviewer
6	March 1, 2024	Ph3_Deliverable18_AASOP _100pct_2024_03_01.pdf	100% Draft revised document, addressing outstanding regional study team comments, delivered to GLO
	Summer 2024		Multiple updates based on development of QC checklists, implementation of pilot studies
7	October 17, 2024	Ph3_Deliverable18_AASOP _100pct_2024_09_ForOctober Presentation.pdf	100% Draft revised document, addressing outstanding regional study team and TFMR comments
	Winter 2024/2025		Multiple updates and interim versions based on alternatives analysis pilot study submittals and reviews, comments received across multiple meetings

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Version Number	Version Date	File Name	Description/Updated Content
8	April 18, 2025	Ph3_Deliverable18_AASOP _100pct_2025_04-18_For Review.docx	100% Draft revised document, addressing regional study team, USACE, GLO, and TFMR comments
9	May 19, 2025	Ph3_Deliverable18_AASOP _100pct_2025_05-19.docx	100% Draft revised document incorporating remaining comments and discussion during May 13, 2025 in person meeting, for backcheck
10	June 11, 2025	Ph3_Deliverable18_AASOP _100pct_FINAL.docx	100% Final revised document addressing backcheck comments provided on June 4, 2025
11	June 23, 2025	Ph3_Deliverable18_AASOP _100pct_FINAL.docx	100% Final revised document addressing additional backcheck comments provided on June 17, 2025

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Background

Overview

This standard operating procedure (SOP) document will guide the analysis of alternatives conducted as part of the Texas General Land Office (GLO) River Basin Flood Studies (RBFS). This alternatives analysis will be conducted during Study Phase 4 of the GLO RBFS by regional study teams representing the West Region, Central Region, East Region, and Lower Rio Grande Valley Region. A Technical Flood Model Reviewer (TFMR) is serving as the GLO's technical reviewer for this project.

The GLO initiated the RBFS:

> *…to collect, analyze, and communicate flood risk information to help decision makers with protecting Texas from future floods. The goals for the flood study are to:*
>
> - *Evaluate flood risks to our communities*
> - *Identify flood projects that strengthen the resilience of our communities*
> - *Identify possible funding sources for community flood projects*
>
> *These studies will analyze regional and local flood mitigation solutions to promote sound short- and long-term recovery. These studies will increase the resilience of communities most at risk of flooding by enabling them to undertake the most effective projects that reflect local priorities and needs.*[1]

Further, the intent is to prioritize regional solutions to optimize the cost-effectiveness of any proposed solution. Note that there are funding and time constraints associated with the RBFS, as the studies must be conducted within a certain amount of money and duration as defined by the Community Development Block Grant Program.

Prior to the effort described herein, each of the four regional study teams have conducted RBFS planning efforts (e.g., stakeholder engagement plan, data collection plan, etc.), data collection, outreach, baseline modeling, and "hot spot" identification. The current effort includes the identification of potential flood mitigation solutions and creation of alternatives to address the flood risks detected, evaluation of these alternatives, and recommendation of an alternative(s) to proceed into the following RBFS phase.

The purpose of this Alternatives Analysis Standard Operating Procedure (AASOP) is to define a consistent methodology for the regional study teams to identify mitigation concepts and evaluate potential alternatives to affect flood risk reduction within the areas identified by the Hot Spot Analysis (conducted in Study Phase 3), as well as provide screening and evaluation criteria with which to compare the mitigation concepts and alternatives, respectively. The result is a set of one or more recommended alternatives and documentation of the methodology used. Regional study teams will "advance" recommended alternatives, to include working with local stakeholders to identify the most appropriate funding source and conduct efforts that allow the recommended alternative to best align with that funding source. The alternatives analysis will leverage the baseline modeling (conducted in Study Phase 3) or best-available data (i.e., master drainage plans or similar as appropriate), which will serve as the basis for without-project conditions. The GLO RBFS is a unique opportunity to apply innovative alternatives analysis methods to promote flood risk reduction.

For the Hot Spot Analysis (conducted in Study Phase 3), regional study teams identified "hot spots," defined as, "…localized flood prone areas with notable flood damage potential…" This resulted in maps

[1] Source: *About the GLO's Combined River Basin Flood Studies, July 2023*

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that identify flood prone areas in need of further analysis, better defining the scope of the alternatives analysis to be conducted in Study Phase 4. The regional study teams had clusters of semi-contiguous hot spots that they grouped into a single "mitigation area" (MA) that promotes using regional (where viable) alternatives that mitigate flood risk across the multiple hot spots that constitute the mitigation area. The alternatives analysis conducted as described in this document shall occur for individual MAs, as identified in Study Phase 3; note it is possible for an MA to be equivalent to a single hot spot. In general, the AASOP recommends that the regional study teams provide one alternatives analysis report for each MA; an outline has been provided in Attachment A. The regional study team may determine it is appropriate to document alternatives analyses for multiple MAs within an individual watershed within one report.

Development of the AASOP

The Lower Rio Grande Valley (LRGV) regional study team worked collaboratively with the East, Central, and West regional study teams; the GLO; the TFMR; the Study Oversight Vendor; the Texas Disaster Information System (TDIS); the Texas Water Development Board (TWDB); the Texas Integrated Flooding Framework (TIFF); Community Health and Resources Management (CHARM); and the United States Army Corps of Engineers (USACE) to create this AASOP (outline, draft, and final version) to capitalize on the specific experience and perspective of each.

The LRGV regional study team advanced the AASOP through submittal of the following milestones for GLO and TFMR review and approval.

- 25% Outline Submittal – An outline of the AASOP was prepared and submitted to the GLO, USACE, and other regional study teams for review via a comment matrix. (Submitted January 6, 2023)
- 75% Draft Submittal – Using the approved AASOP outline, a draft of the AASOP was prepared and submitted to the GLO, the TFMR, and other regional study teams for review via a comment matrix. (Submitted July 28, 2023)
- 100% Draft Submittal – A draft final AASOP that incorporated outstanding comments was prepared and submitted to the GLO, the TFMR, and other regional study teams for final approval. (Submitted March 8, 2024)

Following the March 2024 submittal, the regional study teams and GLO conferred further regarding desired changes to the document. In addition, the LRGV team developed checklists for use in the TFMR review of each of the alternatives analysis submittals, which were distributed for comment and modified to address those comments. During implementation of the alternatives analysis pilot studies, the regional study teams, the TFMR, and USACE identified additional changes to the process that would provide for a better alternatives analysis framework.

While the sections that follow include the items potentially relevant to each region's alternatives analysis, every item may not be applicable to each study area, and specific study areas may have unique needs. Each study's alternatives analysis report(s) may include minor variations of specific deliverable contents described in this document. However, GLO expects that each regional study team will follow the process described in this document so that evaluations remain consistent, and stakeholders do not see discrepancies between regions or MAs. If a regional study team determines a variation is appropriate, that team will provide written documentation of the variance to TFMR and GLO via a Deviation Memo for review and approval.

Key Terms

Key terms used throughout the AASOP include:

1. Hot spot: localized flood prone areas with notable flood damage potential identified during the Hot Spot Analysis (conducted in Study Phase 3).
2. Mitigation area: typically clusters of semi-contiguous hot spots grouped into a single location that will be the focus for flood mitigation alternatives. A mitigation area can be equivalent to a single hot spot.
3. Mitigation concept: concepts intended to reduce flood risk within the mitigation areas, developed as part of the 25% submittal.
4. Alternative: one or more mitigation concepts identified for evaluation as a single, potential project using hydrologic and hydraulic modeling during development of the 50% submittal.

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Alternatives Analysis Process

Purpose

The objective of each alternatives analysis is to identify and compare potential alternatives that could reduce regional (preferred) or local flood risk for a specific MA, as defined in Study Phase 3. The comparison includes both qualitative and quantitative criteria, such as constructability, stakeholder support, and benefit cost ratio (BCR) values; hydrologic and hydraulic (H&H) modeling is also used to support the comparison. The alternatives analysis will result in a recommended alternative(s) for that specific MA, as well as documentation of the process and justification for selecting the recommended alternative(s) for use in future, more detailed analysis; funding applications; etc. Two important items of note:

1. *The modeling conducted as part of the RBFS is feasibility level, to be used for planning purposes. This level of detail is sufficient for grant application purposes, not effective floodplain modeling or detailed design, for example.*
2. *While GLO's desire is to facilitate resilient projects, or projects that work well into the future independent of changed conditions, several grant funding sources require evaluation of current conditions only. Future conditions will be considered for the recommended alternative(s) to the extent necessary based on an assumed grant funding source, stakeholder input, expected timing of construction, phasing needs, and available data. Future conditions may not be considered for all MAs.*

Desired Outcomes

The recommended alternative(s) will be advanced for funding analysis and any associated, additional analysis in Study Phase 5 of the RBFS. The criteria selected for comparing the potential alternatives were identified and endorsed by professionals who have extensive experience in obtaining funding for similar types of flood mitigation solutions, thus the comparison conducted should provide preliminary information necessary for future funding requests. However, the alternatives analysis described in this document is not anticipated to include all data and information required for every viable funding stream for flood mitigation, including but not limited to USACE funding. Any identified data gaps will be noted and, when feasible, addressed during Study Phase 5.

Submittal Requirements

25% Submittal

The first step includes defining the sources or causes of flooding and identifying appropriate mitigation concepts and performance targets. Existing information will serve as the basis for data collection at this step, and the regional study teams will estimate "with-project" conditions based on engineering judgement derived from best available data and experience. The regional study teams will screen these mitigation solutions to determine which are potentially feasible and which may be cost prohibitive or otherwise not meet desired objectives for flood risk reduction or desired future funding requirements (e.g., a low BCR). This allows the teams to identify and remove less viable mitigation concepts, reducing the modeling and evaluation efforts in subsequent steps. Once the mitigation concepts have been screened and identified as potential solutions, they either become an alternative or they are combined with other mitigations concepts to become an alternative. At this point, the regional study teams have identified the alternatives to be simulated using H&H modeling, and the regional study teams will develop a preliminary modeling plan. Documentation of the efforts described in this paragraph will be included with each 25% draft submittal.

50% Submittal

Following approval of the 25% draft submittal, the regional study teams will conduct H&H modeling to estimate the impact (positive and negative) of each proposed alternative via comparison of with- and without-project conditions and perform the work needed to meet the requirements for a 50% draft submittal. Positive impacts could include decreased floodplain extents, reduced number of flooded structures or road miles, avoided cost of emergency responses, decreased social vulnerability, etc. Likely, alternatives will be modified (i.e., "tweaked") at this stage to optimize benefits to the extent possible and practicable. The primary intent of this phase is to complete a preliminary comparison of with- and without-project conditions for each alternative. Documentation of the efforts described in this paragraph will be included with each 50% draft submittal.

Note: An alternative may be removed from consideration at any point, in this submittal or later ones, if the regional study team determines further evaluation effort is not warranted. If this occurs, the regional study team will provide detailed justification in the alternatives analysis report that refers to the specific RBFS objectives and constraints that support the removal of the alternative from further consideration.

75% Submittal

Following approval of the 50% draft submittal, the regional study teams will compare with-project conditions across the alternatives. At this stage, the regional study teams must perform a detailed Benefit Cost Analysis (BCA) to support this comparison of alternatives. Using the model results, supporting alternative analyses, and the BCA, specific metrics (that are consistent across all regional study teams) will facilitate comparing each MA-specific alternative and ranking them. The regional study teams will generate a preliminary recommendation or prioritization of one or more alternatives for each MA. Note the recommendation or prioritization generated will be specific to the RBFS objectives, schedule, etc.; alternatives not recommended may be beneficial but not consistent with the RBFS. Documentation of the efforts described in this paragraph will be included with each 75% draft submittal.

100% Final Submittal

Following approval of the 75% draft submittal, the regional study teams will refine the recommended alternative(s) to the extent practicable for advancement to funding identification and optimization in Study Phase 5. For the 100% final submittal, the TFMR will verify all outstanding comments have been addressed.

Alternative Analysis Framework

The technical process conducted for each alternatives analysis can be captured across the six steps shown in Figure 1. The remainder of this document provides details regarding the process (and associated documentation) based on these steps. ***The section numbers that follow are aligned with the chronologic step numbers, which are aligned with the alternatives analysis report section numbers.*** Attachment A and Attachment B provide more detailed requirements, including supporting data and exhibit requirements.

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Figure 1. Overview of Alternatives Analysis Process

Alternatives Analysis Step	Alternatives Analysis Report Section		Description	25%	50%	75%	100%
1	Identify Problems and Opportunities	1.1	Summarize RBFS Efforts to Date				
		1.2	Define Source, Risk, and Need				
		1.3	Define Objectives				
		1.4	Identify Mitigation Concepts that Could Meet Objectives				
2	Collect Site-Specific Data and Define Mitigation Targets	2.1	Collect Site-Specific Data				
		2.2	Establish Performance Targets				
		2.3	Identify Future Condition Data Sources				
3	Formulate Alternatives	3.1	Evaluate Mitigation Concepts Using Screening Criteria				
		3.2	Generate Alternatives				
		3.3	Develop Preliminary Modeling Plan				
4	Analyze Alternatives	4.1	Develop Without-Project Model				
		4.2	Develop With-Project Model				
		4.3	Compare Alternatives (Preliminary)				
5	Compare Alternatives	5.1	Evaluate Alternatives Using Evaluation Criteria				
		5.2	Rank/Prioritize Alternatives, Including Preliminary Recommendation				
6	Recommend an Alternative	6.1	Select Recommended Alternative				
		6.2	Refine Recommended (or Prioritized) Alternative(s)				
Model Package							
Benefit-Cost Analysis Data (Excel format)							

1. Identify Problems and Opportunities

Identification of the problems and opportunities is an important step to focus the formulation, evaluation, and comparison of mitigation concepts and alternatives on the underlying challenges identified for each specific MA. The main concepts in this step are:

- Problems are existing, negative conditions.
- Opportunities are potential, beneficial, future conditions and describe the desired results with a solution in place.
- Constraints are limitations to the process, actions to avoid doing, or things that cannot be changed in the study process.

These basic concepts structure the discussion of objectives and performance metrics and focus the evaluation and selection on priority issues.

Following the description of previous efforts, the regional study team should, based on the Study Phase 3 Baseline Modeling and Hot Spot Analysis to the extent applicable, describe the problem area, flood source or cause, flood risk, need for mitigation, any constraints that may need to be considered, and high level (not yet modeled) ideas for mitigation concepts. The subsequent sections provide additional detail expected in the report.

1.1 Summarize RBFS Efforts to Date

The report should begin with what is essentially an executive summary of the RBFS work done to date, including a summary of the baseline modeling, hot spot analysis, stakeholder outreach, and approved deviations to the AASOP. The summary should be written for a broad audience and should not be overly technical. Applicable links and locations of previous deliverables should be provided, as appropriate.

1.2 Define Source, Risk, and Need

This section of the report should begin with a description of the geographic area, noting any unique challenges or constraints and any other information relevant to defining flood risk, such as critical infrastructure, evacuation routes, relation to vulnerable populations, etc. Low to Moderate Income (LMI) or Social Vulnerability Index (SVI) information should also be included in this section. Subsequently, the report should introduce the sources of flood risk throughout the identified MA based on storm event types. This will define the scale of potential flood risk, thus defining the problem statement for a specific area.

1.3 Define Objectives

Key to the alternatives analysis is the definition of objectives the recommended alternative is intended to meet; in other words, the objectives the RBFS has set for the recommended alternatives resulting from this effort. Objectives are developed to address the identified needs, and alternatives are formulated to meet the objectives. Examples of objectives could be general, such as reducing flood risk to the extent practicable within the associated constraints and limitations, and/or they could be more site-specific.

1.4 Identify Mitigation Concepts that Could Meet Objectives

To identify potential mitigation concepts that are appropriate for the identified flooding source or cause and order of magnitude, regional study teams should consider structural, nature-based, and non-structural measures; the first two are intended to physically control stormwater runoff and the third can reduce risk by reducing the structures, people, etc. within a high risk area. While non-structural measures like policy changes and flood warning systems are important and often

successful in reducing flood risk, the alternatives analysis process described in this document is intended to assess mitigation measures that result in BCRs that can facilitate the use of state and federal grant funding sources. Non-structural measures such as policy changes and flood warning systems will be considered generally as part of the RBFS grant funding and technical assistance services in Phases 4 and 5. For the alternatives analysis, regional study teams should prioritize structural or nature-based strategies that address the root causes of flooding, such as improved drainage systems, storage, redirection of flow, flood proofing, and removal and/or elevation of structures from risk, if practicable.

To identify potential mitigation concepts, regional study teams will consider information specific to the MA, such as prior stakeholder engagement, historical flooding, baseline modeling, flood type, population density, social vulnerability, and infrastructure vulnerability, among others. Previously identified projects should be leveraged to the extent possible to optimize existing data and reduce redundancies. Regional study teams will review existing drainage master plans; Flood Infrastructure Fund studies that have completed alternatives analysis; and projects identified in Hazard Mitigation Action Plans, RBFS technical action plans (TAPs), and flood risk analyses or mitigation planning as part of other grant-funded efforts. The regional study teams will also consider flood management evaluations (FMEs), flood management strategies (FMSs), and flood mitigation projects (FMPs) from the regional flood plans. Some potential projects are identified as FMEs in these plans because sufficient data was unavailable to include as FMPs. Also, some FMSs may be useful as non-structural mitigation measures to be considered as part of the RBFS funding and technical assistance services.

Regional study teams, prior to initiating H&H modeling, will identify between five and ten potential mitigation concepts that might be viable within and appropriate for a specific MA. This should include an array of options for consideration in a screening process, which will be conducted in a subsequent step to determine which mitigation concepts show enough value (at a high level) to warrant further evaluation. Citations for sources of mitigation concepts should be included if applicable. Common mitigation concepts to be considered include:

- Stream conveyance improvements
- Bridge/roadway elevation
- Structure elevation
- Land acquisition
- Culvert replacement
- Detention/Retention
- Stormwater network upgrades
- Pumping systems
- Levees/floodwalls
- Flood Diversions
- Green infrastructure

For each potential mitigation concept, regional study teams will document relevant information in the report, such as source of mitigation concept (e.g., regional flood plan, stakeholder outreach, or regional study team-generated), relevant stakeholders, maps and figures, existing nearby projects, and related studies, as applicable. Additionally, regional study teams will:

- Perform New Stakeholder Engagement
  - Preliminary discussions with stakeholders are valuable at this stage, informing what may or may not be supported in the future. Regional study teams should continue discussions with stakeholders before the 25% submittal.

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  - As potential mitigation concepts are formulated, it may be beneficial to coordinate with multiple entities associated with a MA. Identification of project sponsors at an early stage in the process adds to a project's viability.

- Identify Existing and Ongoing Studies – There are many planned or ongoing mitigation activities across the RBFS regions. To make the best use of public funds, good faith effort should be taken to leverage applicable data and modeling produced by other studies and to share GLO RBFS data and modeling with ongoing studies, e.g., Community Development Block Grant (CDBG) projects (if applicable scale), USACE projects, and TWDB Flood Infrastructure Fund studies performing alternatives analysis. Where possible, all existing and ongoing related studies in the area should be clearly documented with sufficient detail to communicate their potential relevance to identified mitigation concepts, under what authority the study is being conducted, and contact information for the study owner or lead. Anticipated schedule, if readily available, could also provide valuable context.

  Note that interpreting previous or ongoing studies and models from other programs can require substantial effort, and attempting to utilize some of these studies in Study Phase 4 may be challenging. When utilizing non-RBFS developed models or associated flood mitigation projects for the alternatives analysis process, potential challenges include: (1) cases when the data needed for evaluation may be lacking or not well documented, such as BCAs; (2) the models may not meet the AASOP requirements or standards, e.g., certain annual exceedance probabilities (AEPs) may not have been evaluated, common for local drainage improvements; (3) future conditions or hazards may not be included; and (4) a broad range of mitigation strategies may not have been considered. To account for these challenges, the regional study teams may choose the appropriate level of detail for the discussion and consideration of previous studies and include a statement that duplicative efforts have been minimized to the extent possible and practicable.

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2. Collect Site-Specific Data and Define Mitigation Targets

The RBFS Study Phase 3 Baseline Modeling and Hot Spot Analysis form the basis for identifying site-specific data collection needs, establishing existing conditions, and defining performance targets. It is important to establish with- and without-project conditions that will enable evaluation of the viability of alternatives, as well as tradeoffs and consequences of one or more of the alternatives to be considered. Note that the inventory of data sources will be "frozen" following the 25% submittal; any data sources identified or made available following the 25% submittal will be considered for use in the alternatives analysis but may require a level of effort and schedule beyond Study Phase 4. Regional study teams will provide a statement in the alternatives analysis report that the data sources identified in Step 2 are those determined to be appropriate for the RBFS and available at the time of submittal, and that any new data sources identified following the 25% submittal will be considered for inclusion on a case-by-case basis.

2.1 Collect Site-Specific Data

Leveraging previous RBFS data collection, stakeholder engagement, and baseline modeling, identify and collect site-specific data necessary to conduct the alternatives analysis, if applicable. This may include locally collected high water marks, damage assessments, building inventories, demographics, and other data if not already collected as part of Phase 3. Any new stakeholder discussions may warrant use, as well.

2.2 Establish Performance Targets

Establish performance targets for the MA. At a planning level, the targets may be established but may require refinement as the alternatives analysis advances.

The regional study team should determine a specific return period for each alternative, or level of service, and the event should align with most potential federal or state funding and/or regulatory requirements. The target return period is expected to vary based on the assets mitigated (critical assets to a higher threshold, like 0.2% AEP or higher) and the type of risks mitigated. Implementation costs for incremental return periods could also be used to optimize the return period and the provided benefits, which would be area- and alternative-specific.

In coastal watersheds, which are influenced by storm surge and tides, the level of service may be variable depending upon the hazard being mitigated. Regional study teams intending to address storm surge hazards are likely to target the current-day 1% AEP event at a minimum (current-day 0.2% AEP for critical assets) but may also need to target a 2085 future condition surge, as well. Adaptability of the mitigation strategy may be warranted, enabling a phased approach, with a short-term level of service equivalent to the current 1% AEP event but adaptable to respond to future changes to flood risk over the life of the project.

Further, mitigation of tidal flooding in the future is likely to require a different level of service than mitigation of surge, likely focusing on the mean higher high water (MHHW) event adjusted for sea level rise projections into the future. The National Oceanic and Atmospheric Administration (NOAA) or USACE future sea level rise projections can be applied, but the selection of the scenario (low, intermediate, high, etc.) and the future year (2050, 2080, 2100, etc.) should be justified in the report.

The regional study team's choices for performance targets should be well documented and justified within the associated reporting. For each mitigation concept, provide one of the following:

- Level of Service – Assume alternative-specific target to reduce risk at 1% AEP event for sensitivity evaluation. Based on the lessons learned from the Study Phase 3 Baseline Modeling and Hot Spot Analysis, including the relative scale of the flooding problem identified (flooding extent, depth, duration, e.g.), optimize alternative for target level of service event.
- Period of Performance – Depending on the problem area and specific alternative, establish a targeted period of performance (i.e., anticipated service life) of the alternative. Typical examples include 30-years (standard for FEMA projects) and 50-years (standard for USACE projects).

2.3 Identify Future Condition Data Sources

While GLO's desire is to facilitate resilient projects, or projects that work well into the future independent of changed conditions, several grant funding sources only require evaluation of current conditions. Once the recommended alternative(s) is selected, future conditions will be considered to the extent necessary based on an assumed grant funding source, stakeholder input, expected timing of construction, phasing needs, and available data. While little to none of that information would be known at the time of Step 2, regional study teams should identify data sets that include (justifiable) estimated future conditions. Examples include future land use, projected rainfall intensities, and sea level rise. Regional study teams will identify data sets that are readily available and functional for the RBFS and correspond with appropriate data resolution and include this inventory in the alternatives analysis report. Regional study teams will determine if evaluations including future conditions are appropriate and conduct those evaluations during Step 6.

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3. Formulate Alternatives

3.1 Evaluate Mitigation Concepts Using Screening Criteria

Using the screening criteria provided, regional study teams must evaluate potential mitigation concepts; the goal is to identify the most viable solutions, which will then advance to modeling in Step 4 of the alternatives analysis for a specific MA. The screening of mitigation concepts is primarily based on the work and data collection/creation done to date, including the baseline modeling and Hot Spot Analysis, and is intended to be high-level. Each mitigation concept will be reviewed at a qualitative level, with ranges provided as possible responses. The screening criteria selected for use includes the following bulleted items:

- Community Support – Community, region, and stakeholder support for a mitigation concept is often critical for the concept to ultimately be implemented. Strong opposition to a concept reduces its viability. Regional study teams may have gleaned information during prior stakeholder engagement, including any initiated as directed in Section 3.4, that provides insight into anticipated support.
- Constructability – There are factors that may jeopardize the viability of construction of specific alternatives. The following are examples:
  - Major Railroad/Utility Considerations/Relocations: For the screening process, a desktop evaluation of potential railroad or utility conflicts may reveal significant impacts to the viability of a project.
  - Real Estate Considerations: This criterion considers the land or easement acquisition necessary for the alternative to be implemented.
  - Project Timing: Project timing considers the time it takes to design, permit, and construct each alternative.
  - Environmental/Permitting Needs: This criterion is based on the perceived complexity of regulatory compliance for a given alternative.
- Potential Conflicts with Ongoing Study/ies – Potential for duplication of ongoing or planned efforts should be identified and reduced or removed.
- Technical Feasibility – One of the most critical items to determine is whether the mitigation concept is technically feasible, considering the hydraulics of the area, among other things. This is the only item that is pass/fail at this level.
- Social Vulnerability Index and Low to Moderate Income Population Status – These two metrics evaluate the populations at risk through the GLO's LMI and SVI metrics as obtained in Study Phase 2 Data Collection (and updated with the latest data provided by GLO); the regional study team will select low, medium, or high. Projects should be optimized to maximize benefits to LMI communities and/or decrease a community's SVI.
- Opportunity for Co-Benefits – Multi-benefit projects are often more impactful than projects that only provide flood risk reduction. While these benefits cannot be quantified at the screening phase, this criterion will consider an alternative's ability to provide additional benefits. Examples of potential, additional benefits include the following:
  - Increased water supply
  - Water quality improvement
  - Ecological uplift

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  - Increased quality of life, including recreational and health-related benefits

- Opportunity for Nature-Based Solutions – Nature-based solutions are designed to have less impact to the environment and facilitate a natural cycle. Benefits may include groundwater recharge, increased pervious areas, increased water quality, and reduced erosion.
- Cost/Benefit Estimation – Even though relatively little is known, an initial analysis of potential benefits versus costs for a given MA is required at this step. This may allow for concepts to be eliminated from consideration at this point, if the BCR is infeasible. For the screening process, any economic analysis will be high-level and the BCR developed will be assigned a range (Table 1). The TWDB State Flood Plan BCA Input Tool[2,3], in conjunction with FEMA's BCA Toolkit 6.0[1], is recommended (but not required) for use due to the ability to apply high level project details. Further, becoming familiar with necessary inputs may facilitate easier application later. In addition, the GLO is currently funding development of ecosystem service values to inform BCAs for green infrastructure and nature-based solutions project types as part of the Green Infrastructure in Texas (GIFT) project; these values are due to be complete in June 2025 and should be incorporated to the extent possible. Gross estimations of cost, including construction costs and potential damages resulting from no action estimated during the Hot Spot Analysis, provide insight regarding the alternative's cost effectiveness and benefitting populations, thus the likelihood of receiving state or federal funding. The following are to be considered and documented in this collective criterion:
  - Benefit of Mitigation Concept: This is a high-level dollar value intended to quantify floodplain reduction, structure removal from floodplains, reduced population at risk, increased emergency access, reduced flooding along evaluation routes, and increased level of service. County Appraisal District data can be used to estimate the value of structures and land.[4]
  - Construction Costs: For the screening process, construction costs will be order of magnitude, screening-level estimates, and comparisons between alternatives will be on a relative basis. Recent Texas Department of Transportation bid tabulations and bid tabs can be found at the state level, as well as the local district level, on the Department's website[1]. For the most comparable costs, local district bid tabs are preferred, if available. At this level of cost estimation, large contingencies should be included. More refined cost estimations will be conducted later in the Alternatives Analysis.

The initial screening criteria and the qualitative, available responses are included as Table 1. The intent of the initial screening process is to optimize the time and effort spent on the alternatives analysis, eliminating mitigation concepts that can be deemed infeasible at this stage. The initial screening process must be documented in the associated reporting in enough detail for stakeholders and other interested parties to understand why a mitigation concept was or was not considered further. Note the screening incorporates the perspective of this study only, which includes specific

[2] Note the explicit intent of this tool was to simplify development of a BCA at a planning level, specifically for Texas-based agencies applying for Flood Infrastructure Funding consideration. The results may not be compatible with all federal grant programs.
[3] Sources of tools recommended for use can be found in the *Potential References and guidance Documents* section.
[4] Structures that are "flooded" should be defined as anything above the finished floor elevation found in the National Structure Inventory, property datasets provided by TWDB for use in regional flood planning, or other appropriate data source. Otherwise, regional study teams should assume "flooded" in riverine environments is equivalent to the elevation as defined by the latest LiDAR data plus 6 inches. In coastal areas, "flooded" would be equivalent to the elevation as defined by the latest LiDAR data plus 8 feet for coastal zone VE.

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Table 1. Mitigation Concept Screening Criteria

SCREENING CRITERIA		DESCRIPTION OF EVALUATION	RESPONSE
Feasibility/Duplication of Effort	Community Support	• Is this mitigation concept considered viable and implementable by the community(ies) that are impacted? • Is this mitigation concept politically viable at the community level? How strong is community support for the mitigation concept? Could community support wane or gain? • Has the community previously submitted for funding to implement this type of mitigation concept?	Low Medium High
	Constructability	• Based on readily available information, would this mitigation concept be associated with significant railroad/utility relocations or negotiations? • Would this mitigation concept be associated with significant property acquisition needs? Would property acquisition in the area be feasible? • How much time would be required to implement this mitigation concept, from current status to final completion? • Based on readily available information, how feasible is regulatory compliance? Would necessary permits add prohibitive schedule extensions?	Low Medium High
	Potential Conflicts with Ongoing Study/ies?	• Is there potential for duplication of ongoing or planned efforts	Low Medium High
	Technical Feasibility	• Is the mitigation concept technically feasible in the area?	Yes/No
Other Considerations	Social Vulnerability Index	• Review of latest data available.	Low SVI: <0.4 Medium: 0.4≤SVI<0.8 High SVI: ≥ 0.8
	Low to Moderate Income Population Status	• Review of latest data available.	Low LMI: ≤0.3 Medium: 0.3≤LMI<0.75 High LMI: ≥0.75
	Opportunities for Co-Benefits	• Is there potential for multiple benefits from the mitigation concept? Examples include increased water supply, increased groundwater infiltration, improved water quality, ecological uplift, improved quality of life, and other environmental benefits.	Low Medium High

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SCREENING CRITERIA		DESCRIPTION OF EVALUATION	RESPONSE
	Opportunities for Nature-Based Solutions	• Does the mitigation concept present opportunities for the use of nature-based solutions?	Low Medium High
Cost/Benefit Estimates	Benefit	• To the extent possible and practicable, estimate potential benefits provided by the mitigation concept. Examples include floodplain reduction, structure removal from floodplains, reduced population at risk, increased emergency access and evacuation routes, and increased level of service. • This will be a range of values based on the uncertainty at this stage of analysis, with a most likely value.	$ Value
	Cost	• To the extent possible and practicable, estimate implementation cost. • This will be a range of values based on the uncertainty at this stage of analysis, with a most-likely value.	$ Value
	Benefit-Cost Ratio	• Using the Benefit and Cost dollar values, provide a preliminary (very high level) benefit cost ratio.	Low BCR: <0.5 Medium: 0.5≤ BCR < 1 High: BCR>1

Notes: The evaluations developed using these criteria are to be used solely for comparing alternatives for a specific, identified MA. *These evaluations are not to be used to compare between MAs or other study regions.*

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schedules, regional approaches, project phases (i.e., design versus construction), etc.

3.2 Generate Alternatives

Once the regional study teams have determined which mitigation concepts are feasible (at least at a high level), they will then combine mitigation concepts into alternatives. Alternatives should be developed by assembling mitigation concepts into systems designed to meet, fully or partially, one or more of the planning objectives and avoid the planning constraints. An alternative can consist of a single mitigation concept or multiple concepts that work together as a cohesive alternative. Per direction from GLO, the intent is to, "…analyze regional and, to a lesser degree, local solutions." If a regional solution is not achievable, the report must provide justification.

A range of alternatives should be identified to ensure a comprehensive set of alternatives is considered, including a do-nothing alternative. In Step 4, regional study teams will evaluate (i.e., model) up to three alternatives; the regional study teams may choose additional alternatives if desired. The alternatives will be screened and refined in subsequent iterations throughout the evaluation process, and additional alternatives may be identified at any time during the process. Nature-Based Solutions (NBS), as well as alternatives that are adaptable and resilient to changing future conditions, should be included to the extent possible.

3.3 Develop Preliminary Modeling Plan

Mitigation concepts that pass the initial screening and advance as alternatives (or components of alternatives) must be further defined to support effective modeling. The report should present descriptions of each proposed alternative, including key components, dimensions, and elevations. This information should be presented using figures and/or tables, as appropriate. The level of detail provided should be sufficient to represent each alternative in the with-project models. Design-level detail will not be achieved.

The regional study teams will conduct H&H analysis of each identified alternative in Step 4; associated models will be provided with the 50% deliverable package. For the 25% deliverable package, the report should contain any anticipated changes to the baseline models for the purpose of creating the without-project models that will be used during the alternatives analysis.

Preliminary sensitivity or pre-screening analyses are optional but may be appropriate at this stage or throughout the alternatives analysis process. For example, regional study teams can perform sensitivity analysis to help limit the detailed modeling needed in the next step. Sensitivity analysis can be used to estimate the peak flow reduction and water surface elevation (WSEL) reduction required to mitigate flood risk within a specific area. Alternatives can be evaluated for a range of baseline modeling frequency events. If the evaluation results associated with a specific MA change drastically between the target event (e.g., the 1% AEP) and a slightly more frequent event (e.g., the 2% AEP), then an alternative may be viable and warrant more detailed evaluation. On the other hand, if the evaluation results associated with a specific MA do not change significantly between the 1% AEP and the 10% or 50% AEP, it may be more difficult to develop a viable alternative.

At least one regional study team plans to update baseline models developed during Study Phase 3 for the purpose of improving the results compared to observed data. At least one regional study team intends to use models developed by others within their region as "best available data" to create without-project conditions models for MAs that do not have associated baseline models developed during Study Phase 3. These efforts will be conducted during these early alternatives analysis steps to enable use of the new or improved models in Step 4. Whether and how similar efforts are occurring will be communicated with TFMR prior to initiation of the alternatives analysis.

25% Draft Alternatives Analysis Milestone

Following the previous efforts described, the regional study teams will have collected or generated the data needed to provide a 25% draft alternatives analysis milestone. This milestone for each MA will build on the information provided in the Study Phase 3 alternatives analysis work plans or TAPs and will form the basis for the alternatives analysis report to be delivered at the 50%, 75%, and 100% alternatives analysis milestones. In general, the 25% report will provide an overview of the study area and the work that has been done to date to identify that study area as an MA. The report will summarize the initial screening process, as well as the alternatives that the project team will evaluate in Step 4. Finally, the report will contain a summary of the technical modeling plan. The report may be worded as appropriate for the final deliverable, referencing things that have not yet been done as if they have been completed, to prevent re-writing sections later. Comments or parentheticals may be added as appropriate to help the reviewer understand the actual progress.

The regional study team will not necessarily submit supporting data from standard data sources (e.g., Texas Geographic Information Office [TxGIO], Light Detection and Ranging [LiDAR], National Land Cover Dataset [NLCD], or Soil Survey Geographic Database [SSURGO]) for the 25% deliverable package. Locally sourced, non-standard data sources will be submitted for review by the TFMR.

Minimum exhibits required with this submittal include:

- Mitigation Area Location (inset recommended)
- Hot Spot Results
- SVI/LMI Information
- Conceptual Mitigation Alternatives Location and Layout (inset recommended)
- Potential Mitigation Alternatives Location and Layout (inset recommended)

The 25% deliverable package will include a blank QC Checklist spreadsheet (Attachment C) with the basic project information populated, ready for the TFMR to add 25% comments during review. A “modeler justification” column is included in the checklist, to be completed at the discretion of the regional study team to add context, section references, or other notes for reviewers.

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4. Analyze Alternatives

This step includes the creation of the without-project conditions model, as well as detailed modeling of proposed alternatives for a specific MA. Following the simulation of alternatives, the regional study teams will conduct a preliminary analysis of the simulated results.

The evaluation should estimate the differences between each with- and without-project condition forecast for each alternative, incorporating the most likely with-project condition expected for that alternative. *Without-project conditions scenarios should be analyzed using procedures outlined in the Baseline Flood Modeling SOP. This analysis should also consider outputs from the Hot Spot Analysis.* Note the modeling conducted as part of the RBFS is concept level, to be used for planning purposes; this modeling level of detail is sufficient for grant application purposes, not design. File naming and structure conventions associated with the modeling effort are provided in Attachment D.

The regional study team will implement the modeling plan developed for the 25% deliverable, starting with the without-project conditions model. Any changes to a previously approved baseline model to create the without-project conditions model will be included in a model change log (Attachment E).

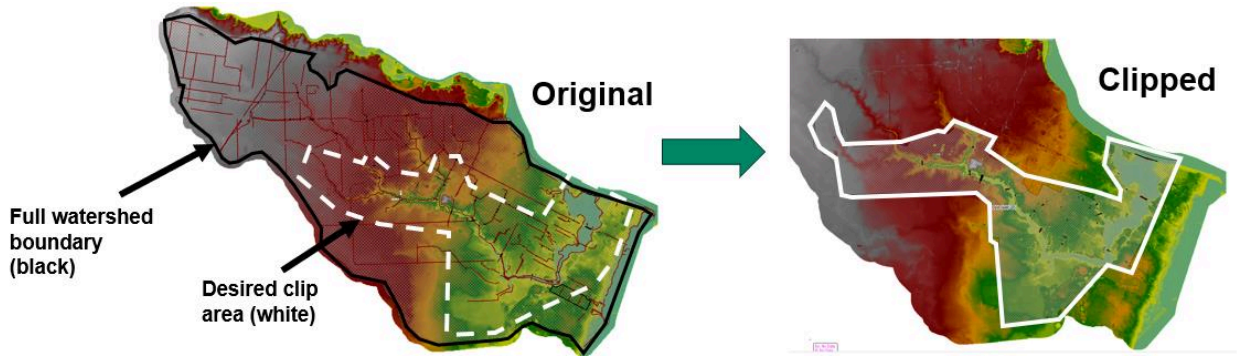
4.1 Develop Without-Project Model

To develop the without-project model and to improve efficiency during alternatives analysis, regional study teams may choose to truncate baseline models to reduce run times as refinements are made. Regional study teams should be mindful of maintaining a manageable file size for communities, with specific focus on resolution of input terrain and output rasters. Truncation decisions should be informed by engineering judgment and include sufficient buffer zones. For example, truncation may extend just beyond the 0.2% AEP floodplain, with a recommended buffer of approximately 1,000 feet or another appropriate limit determined by the team. The truncated model boundary should align with defined MAs or other appropriate limit as determined by the regional study team. For models using rain-on-mesh hydrology, truncation must be handled with particular care to avoid removing contributing drainage areas. If truncation is necessary, teams must either preserve the full hydrologic catchment or implement methods to account for runoff lost due to reduced domain extent (e.g., upstream inflow hydrographs). Any hydrograph development used to supplement lost drainage area must be thoroughly documented in the report, including assumptions, methodology, and supporting data. Note that, if analyzing future conditions, a separate without-project model may be required.

In general, the truncation process will adhere to the following process:

1. Perform any existing condition model enhancements within mitigation area(s) to the full HUC 10 model (e.g., more refined mesh, structure updates based on new data, etc.).
2. Create copies of the model geometry for with project conditions: MA1, MA2, etc. If model clipping is necessary, at this step you may also “clip” your model geometry to a smaller size (Figure 2).

Figure 2. Example of Truncation Process, or Clipping



3. Model any proposed alternatives, which will result in multiple HEC-RAS geometry files for each MA.
4. For final recommended projects, those potentially hydraulically connected or impacted (e.g., in the same watershed) should be simulated in a single model as well as separated models for the "with project condition". This is done to ensure no adverse impacts and simulate how the projects would interact with each other, as well as in case only one of the alternatives receives funding and is implemented, respectively.
    a. If the models were truncated, this step *may* mean bringing any with-project changes back into the larger HUC 10 model. This is at the discretion of the regional study team.
    b. Note that the existing conditions/without project conditions model will also need to be ran a final time to incorporate any changes related to the project physically (e.g., if you recommend a detention pond, the detention pond breakline needs to be incorporated into the without-project model to keep the mesh the same and minimize unwanted differences.

Additional refinements may include the use of more detailed features such as breaklines, smaller mesh sizes, or two-dimensional flow connections. It will be useful to consider the modeling needs for each of the proposed alternatives when developing without-project model refinements so that they can be easily integrated when developing the with-project models, while not requiring further changes to the without-project model mesh. These refined without-project models are not required to be incorporated into the larger regional models due to the complexity and time required. However, regional study teams must evaluate and communicate the impact of the without-project model on the broader model system through boundary condition exchanges. An iterative approach may be necessary to ensure that WSEL differences at the model boundaries are reasonable (refer to the Baseline Model SOP for guidance). The regional study teams will provide details regarding any updates to the baseline model, along with some context or explanation for each update, in the alternatives analysis report.

The report must present the results of the without-project model and compare them with the original baseline model results. The intent is to verify the without-project conditions models are comparable to the baseline models when compared to existing (and appropriate) data. Comparisons should be made at key locations, particularly where observed data exists and at critical points along the stream, such as major roadway crossings. If the without-project model results differ from the baseline model by more than 15% in peak flows or 0.5 feet in WSEL — without corresponding improvement relative to observed data — additional model refinement and discussion may be required and will be coordinated with TFMR. If this exercise is infeasible due to lack of observed and/or appropriate data, the regional study team will document this in the report.

4.2 Develop With-Project Model

Following development of the without-project conditions, the regional study teams will update the without-project model to produce the with-project conditions models for each alternative, including each individual mitigation concept included, and document the methodology. This step includes the detailed modeling of alternatives and refinement of comprehensive risk reduction plans.

The Baseline Flood Modeling SOP may be referenced for modeling procedures of proposed improvements, but this high-level evaluation and comparison of the alternatives does not warrant the detail provided in the baseline model. Regional study teams may exercise judgement on with-project modeling and how to simplify and include different project type elements for HEC-RAS. Further, regional study teams may incorporate additional models for the alternatives analysis if deemed appropriate; examples include models that estimate piped flow. The QC Checklist (Attachment C) includes additional requirements specific to different types of mitigation concepts.

A minimum of three recurrence intervals should be analyzed as part of project evaluation. To generate readily usable input for the TWDB State Flood Plan BCA Input Tool, in conjunction with FEMA's BCA Toolkit 6.0, at least three recurrence intervals must be selected and analyzed. One of these must be the 1% AEP. While these specific tools are not required, the regional study teams have found these to be most easily applied with preliminary level data.

No Adverse Impact is the ability of the alternative to include mitigation measures such that adverse impacts are not created and is a requirement of any stormwater management effort. Mitigation measures may include but are not limited to detention, channel improvements, drainage easements, right of way acquisition, or other options that address any adverse impacts to adjacent properties. Adverse impacts should be determined in accordance with *Exhibit C: Technical Guidelines for Regional Flood Planning* (TWDB, 2024), Section 3.6, which states No Negative Impact (synonymous with No Adverse Impact) means that a project will not increase flood risk of surrounding properties. Guidelines for acceptable adverse impacts at the flood planning level are included in the referenced document section. Each alternative must be compared against these requirements, and additional adjustments to the alternative may be required. The analysis and any adjustments should be summarized in the alternatives analysis report, and the regional study teams should include a table showing the difference in WSEL between without- and with-project conditions. The "No Negative Impact" Table and the No Negative Impact Certification required by the TWDB for the regional flood planning efforts are not required to be included in the alternatives analysis report.

Benefits facilitated by the alternatives should be expressed via the number of structures removed from the floodplain, the reduction in miles of flooded roads, etc. If applicable, all event types should be considered when evaluating benefits or adverse impacts from a project, and the impacts should be considered as a collective sum. An alternative may provide benefits for one type of event but adverse impacts in another. For example, new conveyance alternatives can allow riverine flooding more efficient pathways to the coast. Conversely, implementing that same conveyance alternative, surge-dominated events can more readily propagate upstream. For this reason, the baseline modeling SOP requires quantification of multiple scenarios to identify the most conservative.

4.3 Compare Alternatives (Preliminary)

The regional study team will conduct a preliminary comparison of alternatives, with- and without-project, to determine if the alternatives meet the objectives previously defined. If modeling showed an alternative would not meet the objectives, that alternative may be eliminated from further consideration. Specific metrics for comparison include number of structures removed from the floodplain, the reduction in miles of flooded roads, any adverse impact (WSEL or otherwise), etc.

Appropriate documentation should be provided in the report.

50% Draft Alternatives Analysis Milestone

Once the alternatives analysis is completed, the regional study teams will have collected or generated all the data needed to provide a 50% draft alternatives analysis milestone. The 50% draft alternatives analysis milestone for each MA will include the first draft of the alternatives analysis modeling.

If significant changes were made to sections of the report that the TFMR had previously reviewed, the regional study team should summarize the changes for the reviewers' benefit by adding a new line in the QC checklist and/or comment in the transmittal email, as appropriate.

Minimum exhibits required with this submittal include:

- Mitigation Area Hydraulic Model Extents (needed only if model is truncated; include HUC10 and Baseline Model extents as well)
- Preliminary Alternative "X" Water Surface Elevation Raster Comparison (to without project results)
- Preliminary Alternative "X" Flood Inundation Extents Polygon Comparison (to without project results) for the 1% AEP event

The 50% deliverable will include the QC checklist spreadsheet (Attachment C) with responses addressing all previous comments. TFMR will conduct a "backcheck" to close the 25% comments and will add new 50% comments as applicable. Per GLO guidance, all comments received regarding the 25% submittal must be resolved during the 50% milestone review.

5. Compare Alternatives

5.1 Evaluate Alternatives Using Evaluation Criteria

For the alternative comparison, regional study teams will refine the information developed for the feasibility screening. While there are more and further detailed criteria for use in the evaluation (Table 2), most criteria are still qualitative in nature. Actual values are requested for the social vulnerability and cost/benefit estimates. The additional analysis conducted following the initial screening should provide for more comprehensive numbers.

The overarching categories for the evaluation remain the same, with more nuanced evaluation requested. Regional study teams may want to prioritize types of projects based on limited resources or program objectives for a specific MA. Prioritization may seek to:

- Ensure that a variety of types of actions are advanced to address broader goals such as equity and geographic reach instead of concentration in one sub-region, preferred improvements, and alternate approaches like nature-based solutions.
- Make an impact sooner by ensuring that the project alternatives array includes some early implementation projects in addition to relatively complex, larger projects that do not demonstrate impact until far into the future.
- Describe “tiebreaker” considerations if performance (dollar denominated net benefits and/or evaluation criteria) is comparable. Numerical evaluation is intended to provide a starting point, and each regional study team should consider the other evaluation factors as provided in the evaluation criteria.

The criteria intended for use in the evaluation are provided in Table 2. Use of the TWDB State Flood Plan BCA Input Tool, in conjunction with FEMA’s BCA Toolkit 6.0, is recommended but not required. While these specific tools are not required, the regional study teams have found these to be most easily applied with preliminary level data. Further, the GLO is currently funding development of ecosystem service values to inform BCAs for green infrastructure and nature-based solutions project types as part of the GIFT project; these values are due to be complete in June 2025 and should be incorporated to the extent possible. Note alternatives with a BCR less than 1.0 or that do not meet other RBFS objectives may become the recommended alternative with sufficient justification.

In the economic analysis, factors to consider would likely include the following, subject to customization by regional study teams based on local factors:

- Reduced Damage to Structure and Contents
- Displacement Costs
- Ecosystem Benefits
- Green Infrastructure
- Other Quantitative or Qualitative Benefits, To Be Determined

The report should describe each alternative’s cost drivers, the sources of the unit prices used, and the process for estimating quantities. A contingency (and appropriate justification) should be included. Estimates of probable construction cost are expected to be consistent with a "Class 5" estimate, as defined by the Association for the Advancement of Cost Engineering in 18R-97, *Cost Estimate Classification System - As Applied in Engineering, Procurement, and Construction* for the Process Industries. If life cycle costs are incorporated to determine the current value of future expenditures, a discount rate of 3.5% per annum should be used.

The report should describe potential co-benefits (qualitatively) for each alternative, as well as potential

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Table 2. Alternative Evaluation Criteria

CATEGORY	CRITERIA	DESCRIPTION OF EVALUATION	RESPONSE
Community Support	Community Support	• Is this alternative considered viable and implementable by the community(ies) that are impacted? • Will financial resources be made available to support implementation (in kind services, cash match, community grant for match)? • Is this alternative politically viable at the community level? How strong is community support for the alternative? Could community support wain or gain? • Has the community previously submitted for funding to implement this alternative?	Low Medium High
Constructability	Utility Conflicts	• Based on data collected, would this alternative concept be associated with significant utility relocations or negotiations?	Low Medium High
	Real Estate	• Would this alternative be associated with significant property acquisition needs? Would property acquisition in the area be feasible?	Low Medium High
	Project Timing	• How much time would be required to implement this mitigation concept, from current status to final completion?	Short Medium Long
	Environmental Compliance/Permitting Needs	• Based on readily available information, how feasible is regulatory compliance? Would necessary permits add prohibitive schedule extensions?	Minor Medium Major
Social Vulnerability	Social Vulnerability Index	• What percent of the benefitting area is considered low SoVI?	% Value
	Low to Moderate Income	• What percent of the benefitting area is considered LMI?	% Value

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CATEGORY	CRITERIA	DESCRIPTION OF EVALUATION	RESPONSE
Co-Benefits	Water Supply	• Does the alternative result in improved or increased water supply?	Yes/No
	Water Quality	• Does the alternative result in improved water quality?	Yes/No
	Ecological Uplift	• Does the alternative result in ecological uplift?	Low Medium High
	Quality of Life	• Does the alternative result in increased quality of life, including (but not limited to) additional green space or recreational opportunities?	Low Medium High
	Environmental Equity	• Does the alternative result in increased environmental equity?	Low Medium High
	Nature-based Solutions	• Does the alternative result in the use of nature-based solutions?	Low Medium High
Cost/ Benefit Estimates	Benefit	• Estimate potential benefits provided by the alternative. Examples include floodplain reduction, structure removal from floodplains, reduced population at risk, increased emergency access and evaluation routes, and increased level of service.	$ Value
	Cost	• To the extent possible and practicable, estimate implementation cost.	$ Value
	Benefit-Cost Ratio	• Using the Benefit and Cost dollar values, provide a BCR.	Value

Abbreviations: WSEL = water surface elevation

1. *This evaluation criteria cannot be used for anything other than comparing alternatives for a specific, identified* MA. *These are not to be used to compare between locations or other study regions.*

adverse effects and associated tradeoffs, including the no action plan. Regional study teams are encouraged to include stakeholder input as applicable.

During this step, regional study teams will refine (using information developed following the mitigation concept screening) the outputs of the beneficial and adverse effects of various alternatives, both monetary and non-monetary benefits and costs and including the no action plan. The output of the comparison step should be a preliminary ranking of plans.

5.2 Rank/Prioritize Alternatives (Preliminary)

Based on the analysis conducted, the regional study teams will provide a preliminary ranking or prioritization of the alternatives evaluated, and associated justifications, as well as a preliminary recommendation.

75% Draft Alternatives Analysis Milestone

Upon completion of the alternative evaluation and preliminary ranking, the regional study teams will have collected or generated all the data needed to provide a 75% draft alternatives analysis milestone. The 75% draft alternatives analysis milestone for each MA will include the second draft of the alternatives analysis models, as well as documentation of whether the regional study teams performed additional analysis of the candidate alternatives.

If significant changes were made to sections of the report that the TFMR had previously reviewed, the regional study team should summarize the changes for the reviewers' benefit by adding a new line in the QC checklist and/or comment in the transmittal email, as appropriate.

The 75% deliverable will include the QC checklist spreadsheet (Attachment C) with responses addressing all previous comments. TFMR will conduct a "backcheck" to close the 25% and 50% comments and will add new 75% comments as applicable. Per GLO guidance, all comments received on the 50% submittal must be resolved during the 75% milestone review.

6. Recommend an Alternative

6.1 Select Recommended Alternative

Following project evaluation, regional study teams will provide a recommended alternative for each MA. The regional study teams will recommend an alternative that is found to be preferred to the no action plan and to reasonably achieve study objectives established in the initial steps relative to all those that have been considered. The regional study teams should clarify that the prioritization conducted through this alternatives analysis effort is specific to the RBFS, and selection for advancement does not mean that other projects do not merit further investigation for other funding sources. This step also includes the development of final deliverables to document the alternatives analysis for each project area.

6.2 Refinement of Recommended Alternative

This step also includes the refinement of the recommended alternative for advancement in Study Phase 5 – Pursuit of Additional Funds. Different funding sources often have differing scoring criteria and varying project requirements, among other differences. Regional study teams should attempt to optimize projects for potential matches to available funding sources. These refinements may include location/area of influence adjustments, LOS to match funding sources, optimization for co-benefits (e.g., ecosystem services, social benefits, etc.), or consideration of future conditions (reference Step 2 for data sources). Refinements will be described and justified in detail in the alternatives analysis report.

The report should document stakeholder engagement activities conducted during the alternatives analysis, as well as how the resulting input was considered in the recommended alternative and any ongoing or planned, subsequent stakeholder engagement.

100% Alternatives Analysis Milestone

Upon refinement of the recommended alternative, the regional study teams will have collected or generated all the data needed to provide a 100% alternatives analysis milestone. The 100% deliverable will include the report, models, supporting data, and risk reduction files, including final presentation materials for GLO and stakeholders in the associated river basin. Minimum exhibit requirements with this submittal include:

- Recommended Alternative Location and Layout (inset recommended)

While only the model for the recommended alternative will be transferred with the 100% deliverable, the shp files of all alternatives considered will also be included with the 100% deliverable. This data has been requested by a project partner (CHARM), and a detailed description of the files will be provided following the issuance of this AASOP. Prior versions of the model(s) with all considered alternatives (from the 50% and 75% submittals) can be made available to communities upon request to the GLO. This will be explicitly stated in the report. Provided with this deliverable, the QC checklist spreadsheet (Attachment C) should include responses addressing all outstanding comments, ready for backcheck by the TFMR. Once the TFMR has closed all outstanding comments, the alternatives analysis is complete.

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Submittal and Review Process

Each regional study team will be responsible for determining a submittal schedule at the beginning of Study Phase 4 and must communicate it to GLO/TFMR prior to the first submittal. GLO/TFMR will generally have a two-week turnaround time on comments for each submittal. Regional study teams are responsible for providing the deliverables schedule in the Alternative Analysis Flood Model Review (AAFMR) Tracker. Adjustments to the Alternatives Analysis deliverable schedule must be discussed with the GLO before consideration for approval.

The following describes the review process to be used for the Alternatives Analysis. Unless prior approval is received from GLO in writing, regional study teams are expected to resolve all outstanding comments from previous review round before advancing to the next project phase or submittal milestone: *"Ex: 25% comments must be resolved in 50% submittal."*

1. The regional study team must submit the report, models (if applicable), supporting data, and a completed alternatives analysis quality control (QC) checklist spreadsheet. For each checklist item, the originator must complete Column F, Vendor Justification, to verify that each checklist item has been addressed and to provide any additional context or clarification to assist the TFMR in review. The QC checklist will serve as a cumulative record, capturing all comment and response documentation across submittals.
2. The TFMR reviews the submittal for completion; if all required files are included, the review is marked as "Accepted" and the official review period begins. If a submittal is incomplete or contains a fatal flaw, the GLO/TFMR rejects the submittal and provides a reason for rejection. A rejection requires the regional study team to resubmit.

   GLO and/or TFMR will reject submittals if:

   - Not all checklist items (for the current submittal) have been completed.
   - Not all open comments from previous submittal have been addressed (determined upon backcheck).
   - Any fatal flaws, critical deficiencies, or major issues requiring attention are detected.
   - There are deviations from the SOP without approval or justification. This approval will occur via collaboration TFMR and GLO, and will be requested via memorandum.
3. Once the submittal is marked as "Accepted", TFMR reviews the submittal, provides comments on the Alternatives Analysis checklist spreadsheets, and provides the checklist spreadsheets to the regional study team, generally within 2 weeks. A delay from the regional study team beyond the original submittal schedule may result in additional days beyond the 10- working-day review period.

   a. TFMR should provide all comments, including report comments, on the checklist spreadsheet for tracking purposes. The comments may be supplemented with report pdf comments, shapefiles or pasted screen captures of models, figures, or exhibits where appropriate.

   b. If TFMR provides additional files in support of their comments (such as shapefiles, marked-up PDFs, reference information, or other supplementary data), these should be referenced in checklist spreadsheet comments for tracking purposes.

   c. Editorial comments will be provided via a separate tab in the QC Checklist and will not be considered an "open" comment, thus will not hinder the ability to approve the submittal.

4. Regional study team will provide comment responses and conduct an informal screen-sharing session with TFMR reviewers to discuss a plan for resolution, generally within 1 week.
    a. Minor comments require mutual agreement between the TFMR and the regional study team but do not require full resolution before the next submittal.
    b. Major comments must be fully addressed prior to the next submittal.
5. The regional study team is responsible for fully addressing all open comments and providing complete, specific responses in the QC checklist spreadsheet included with the next submittal. Comments will be considered addressed when the regional study team and TFMR are in agreement.
6. Submittals with unresolved or partially addressed comments may be returned without full review until comment resolution is complete. Substantial changes to items that had previously been reviewed and closed should be brought to the attention of the reviewer by creating a new comment line for that item and adding a note to the "Review Item Description" field describing the need for re-opening that review item. A highlight in the transmittal email to reviewers may also be appropriate.
7. The TFMR will backcheck all comment responses during the next submittal review. Comments that remain open from the prior submittal after the backcheck must be addressed immediately through documented revisions or direct coordination. The TFMR will not advance review of subsequent tasks or deliverables until all outstanding comments are resolved.
8. The regional study team should deliver submittals for review via the latest electronic file transfer methods approved by the GLO. The regional study team should also refer to the Baseline Modeling SOP for methods to limit file size, particularly as it relates to hydrologic and hydraulic models (if applicable). Excessively large file sizes may be prohibitive to future transmission of data.

Reports should be submitted in PDF format with bookmarks. Reports should include all sections in the report outline (Attachment A), even if those sections are not relevant to the study area or the current report submittal. Sections not relevant should include an explanation for their exclusion and may include an indication of the submittal that will include that section. This will minimize changes in section numbering that may impede comparisons of different report versions.

Model submittals should be complete and include all terrain, land use, results, and other supporting data necessary for the reviewer to open the model and view model results without having to re-run the model.

All supporting data should be included with each submittal, even if it has not changed since the prior submittal. For example, a benefit-cost analysis may not have changed between the 75% and 100% submittals but should be included as part of the 100% submittal to provide a complete product and avoid reviewers having to search for previously submitted information.

RIVER BASIN FLOOD STUDY

Potential References and Guidance Documents

1. Federal Emergency Management Agency Benefit-Cost Analysis Toolkit, https://www.fema.gov/grants/tools/benefit-cost-analysis
2. Federal Emergency Management Agency Full BCA, https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis/full-bca
3. Federal Emergency Management Agency Streamlined BCA, https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis/streamlined-bca
4. Texas A&M Agrilife Extension, Green Infrastructure for Texas, https://agrilife.org/gift/
5. Texas Comptroller, Local Property Appraisal and Tax Information, https://comptroller.texas.gov/taxes/property-tax/county-directory/
6. Texas Department of Transportation, Bid Tabulations Dashboard, https://www.txdot.gov/business/road-bridge-maintenance/contract-letting/bid-tabulations-dashboard.html
7. Texas Water Development Board, Exhibit C: Technical Guidelines for Regional Flood Planning (2024), https://www.twdb.texas.gov/flood/planning/planningdocu/2028/doc/Exhibit_C_TechnicalGuidelines_2028RFP_Jan2025.pdf
8. Texas Water Development Board State Flood Plan BCA Input Tool, https://www.twdb.texas.gov/flood/planning/planningdocu/2028/doc/BCA-Input-Workbook.xlsm
9. U.S. Army Corps of Engineers, Flood Damage Reduction Analysis (HEC-FDA) software. https://www.hec.usace.army.mil/software/hec-fda/

RIVER BASIN FLOOD STUDY

Attachment A: Alternatives Analysis Report Outline

Alternatives Analysis Report, <Hot Spot or Watershed Name>

1. Identify Problems and Opportunities

1.1 Summarize RBFS Efforts to Date

1.2 Define Source, Risk, and Need

1.2.1 Geographic Area

1.2.2 Existing Flood Risk

1.2.3 Need for Mitigation

1.2.4 Project Opportunities

1.2.5 Project Objectives/Problem Statement

1.2.6 LMI/SVI Information

1.3 Define Objectives

1.4 Identify Mitigation Concepts that Could Meet Objectives

1.4.1 Prior and Ongoing Efforts within the Area

1.4.2 New Stakeholder Engagement (if applicable)

1.4.3 Potential Mitigation Concepts

2. Collect Site-Specific Data and Define Mitigation Targets

2.1 Collect Site Specific Data

2.2 Establish Performance Targets

2.3 Identify Future Condition Data Sources

3. Formulate Alternatives[1]

3.1 Evaluate Mitigation Concepts Using Screening Criteria

3.2 Generate Alternatives

3.3 Develop Preliminary Modeling Plan

1. *If the report is written for a single watershed with multiple hot spots, repeat the following headings for each hot spot within this section.*
2. *If more than one alternative is recommended, repeat this heading for each recommended alternative.*
3. *This refinement may include the addition of a future conditions version of the model.*

4. Analyze Alternatives[1]
    - 4.1 Develop Without-Project Model
    - 4.2 Develop With-Project Model
    - 4.3 Compare Alternatives (Preliminary)
5. Compare Alternatives[1]
    - 5.1 Evaluate Alternatives Using Evaluation Criteria
    - 5.2 Rank/Prioritize Alternatives (Preliminary)
6. Recommend an Alternative[1,2]
    - 6.1 Select Recommended Alternative
    - 6.2 Refine Recommended (or Prioritized) Alternative(s)[3]

1. *If the report is written for a single watershed with multiple hot spots, repeat the following headings for each hot spot within this section.*
2. *If more than one alternative is recommended, repeat this heading for each recommended alternative.*
3. *This refinement may include the addition of a future conditions version of the model.*

RIVER BASIN FLOOD STUDY

Attachment B: Alternatives Analysis Report Requirements

AA step	Applicable Report Section	Proposed Report Section/ Subsection	Milestone Submission	Supporting Data to be Submitted	Minimum Exhibits Required
1	1.1	Summarize RBFS Efforts to Date	25%	Provide a summary of efforts to date including: - Baseline flood modeling for the watershed - Historical flooding - Hot spot analysis and results for the mitigation area (MA) being addressed - Stakeholder outreach summary for the communities impacted	
1	1.2	Define Source, Risk, and Need	25%	Include a sub-section for each of the following: Geographic Area, Existing Flood Risk (from baseline modeling and historical reports), Need for Mitigation, Project Opportunities, Project Objectives/ Problem Statement, LMI/SVI Information	Mitigation Area Location (inset recommended) Hot Spot Results SVI/LMI Information
1	1.4	Identify Mitigation Concepts that Could Meet Objectives	25%	Present between 5 and 10 mitigation concepts, and provide the following for each concept: - Identify any related existing/ongoing studies in the mitigation area - Provide outcome of new stakeholder engagement and potential project sponsor(s) for each mitigation concept - Estimate rough order of magnitude cost estimate for each concept - Estimate rough order of magnitude anticipated benefits and preliminary BCR	Conceptual Mitigation Alternatives Location and Layout (inset recommended)
2	2.1	Collect Site-Specific Data	25%	Present results of site-specific data collected such as high water marks, building inventories, demographics, etc. as relevant for the MA	
2	2.2	Establish Performance Targets	25%	Explain performance target selection for the MA, to be updated as appropriate during future submissions	
2	2.3	Identify Future Condition Data Sources	25%	Provide an inventory of data sets available (and appropriate for the RBFS) for use in potential future conditions evaluation; use will be determined during Step 6.	
3	3.1	Evaluate Mitigation Concepts Using Screening Criteria	25%	Provide table and discussion of screening categories and value for each. Screening should include, at a minimum, the screening categories and subcategories within the AASOP, as well as explanation for any categories or subcategories added and their associated value.	
3	3.2	Generate Alternatives	25%	Include table and narrative that clearly explains which potential mitigation concepts met objectives, as well as justification for any mitigation concepts that were not progressed further. Describe the process of combining (or not) mitigation concepts into potential alternatives. Note that the regional study vendors must evaluate up to three alternatives in the subsequent phase; additional alternatives are allowed, as well.	Potential Mitigation Alternatives Location and Layout (inset recommended)
3	3.3	Develop Preliminary Modeling Plan	25%	The following will be included with this report section: - explanation of proposed model refinements to develop the "without-project model" from the baseline model in the subsequent step. - description of proposed updates to "with-project" model for each of the alternatives to be developed. - description of design storms and scenarios to be evaluated. Design storms to be presented should be consistent with the FMDP.	

4	4.1	Develop Without-Project Model	50%	The following will be included with this report section: - comparison of without-project model to baseline model. - discussion of performance of model refinements with respect to observed conditions, if applicable.	Mitigation Area Hydraulic Model Extents (needed only if model is truncated; include HUC10 and Baseline Model extents as well)
4	4.2	Develop With-Project Model	50%		
4	4.3	Compare Alternatives (Preliminary)	50%	Provide a quantitative presentation and discussion of performance of each "with-project" alternative and preliminary comparison to without-project model. Should include impacts to peak flows, water surface elevations, inundation extents, roadways, structures, and agricultural flooding (as relevant for the MA) for selected storms. Submit model package in accordance with Baseline Modeling Standard Operating Procedure submission standards for both with- and without- project plans.	Preliminary Alternative "X" Water Surface Elevation Raster Comparison (to without project results) Preliminary Alternative "X" Flood Inundation Extents Polygon Comparison (to without project results) for the 1% AEP event
5	5.1	Evaluate Alternatives Using Evaluation Criteria	75%	The report will include a table and discussion of scoring categories and value for each. It should include, at a minimum, the scoring categories and subcategories within the AASOP, as well as explanation for any categories or subcategories added and their associated value.	
5	5.2	Rank/Prioritize Alternatives (Preliminary)	75%	The report will include the following: -Tabulation of benefits based on model performance results - Preliminary comparison to without project conditions in text discussion and graphical or tabular format - Preliminary comparison between with-project alternatives and corresponding text discussion and graphical or tabular format -updated table and narrative that clearly presents the scores for each of the with -project plans with discussion on performance, feasibility, etc. (using scoring table criteria) to provide justification for recommended alternative(s)	
6	6.1	Select Recommended Alternative	100%	The report will include the following: - description of preliminary selected alternative with both narrative and figures/schematics in greater detail than previous with-project alternatives descriptions - description of final proposed model updates to this alternative	Recommended Alternative Location and Layout (inset recommended)
6	6.2	Refinement of Recommended Alternative	100%	The report will include the following: - updated presentation of selected alternative with both narrative and figures/schematics in greater detail than previous with-project alternatives descriptions and that reflects TFMR comments and vendor iterations/tweaks - present updated results of recommended alternative with respect to without-project conditions to reflect TFMR comments and vendor iterations/tweaks - updated cost, benefits, and BCR for final recommended plan - updated model package in accordance with Baseline Modeling SOP submission standards, which includes with and without project plans for recommended alternative only. - .shp files for use in grant applications to show other alternatives evaluated. - updated BCA print out and excel file for final selected plan	

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Attachment C: Submittal QC Checklists

Provided electronically only.

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Attachment D: File Naming and Structuring Conventions

File Naming Conventions and Structure

Five different modeling types:

1. Baseline model: existing conditions model as of the end of Phase 3
2. Current conditions, without-project model: may be the same as baseline, may be altered from baseline to be comparable to the with-project model (which may require additional breaklines, revised subbasins, etc.)
3. Future conditions, without-project model, also known as “Do Nothing”: includes future land use, rainfall, sea level or other conditions
4. Current conditions, with-project model (optional): foundation is #2, then one or more structural* projects are added to emulate an alternative.
5. Future conditions, with-project model: foundation is #3, then one or more structural* projects are added to emulate an alternative.

*The project team assumes modeling is not relevant to non-structural projects.

Clarifiers to be added to the model/file names:

- Current conditions = _EC
- Future conditions = _FC
- With project = _WI[Alt(#)]
- Without project = _WO

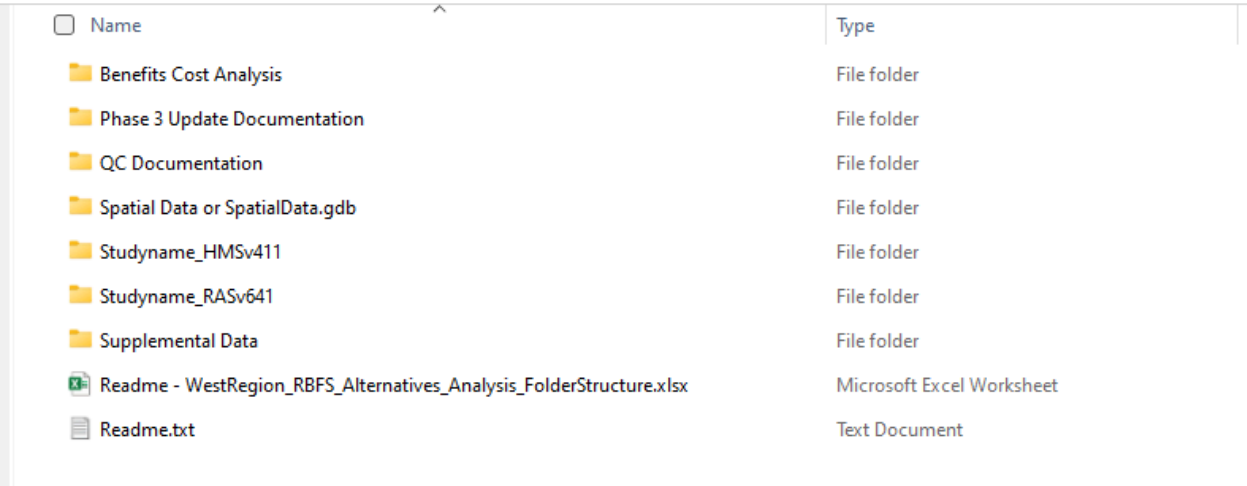
Naming conventions for the models to be constructed with the alternatives analysis:

- All files and models will retain their name as developed for the baseline model (phase 3).
- Models that need to be clipped to a smaller geographical area will add a 3 digit clarifier immediately after the baseline file name. Something associated with the nearest city is recommended.
- Alternatives modeled will be given a number and the report will include a master list. These are interim files that will not be provided as deliverables, although shp files of each of the alternatives will be part of the final submittal. The project team will remove the alternative number from the final deliverable.

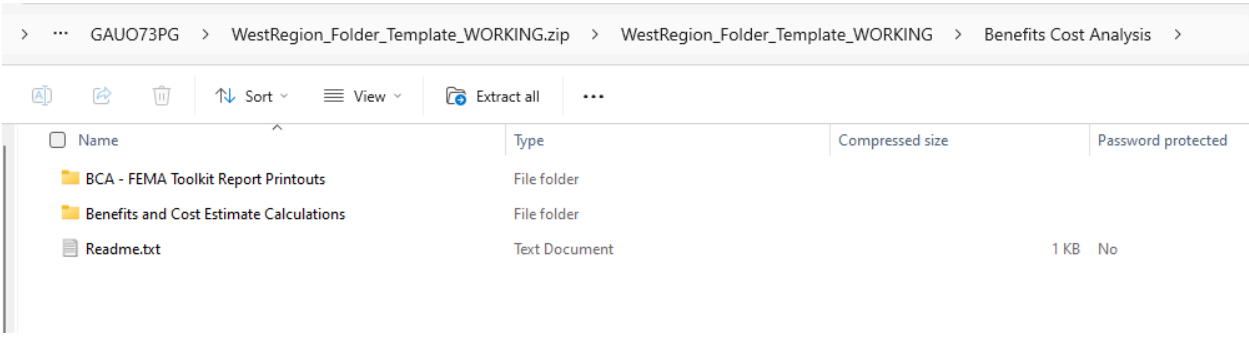
Example: Model snapped to hot spot near Harlingen, future conditions, with-project, alternative 02

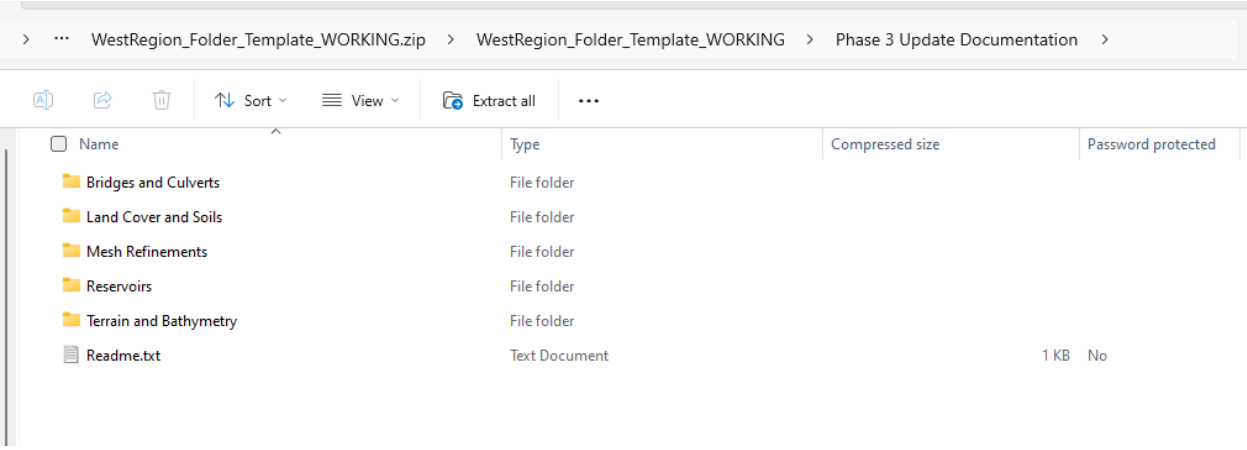
BASELINE_MODEL_NAME_Har_FC_WI02

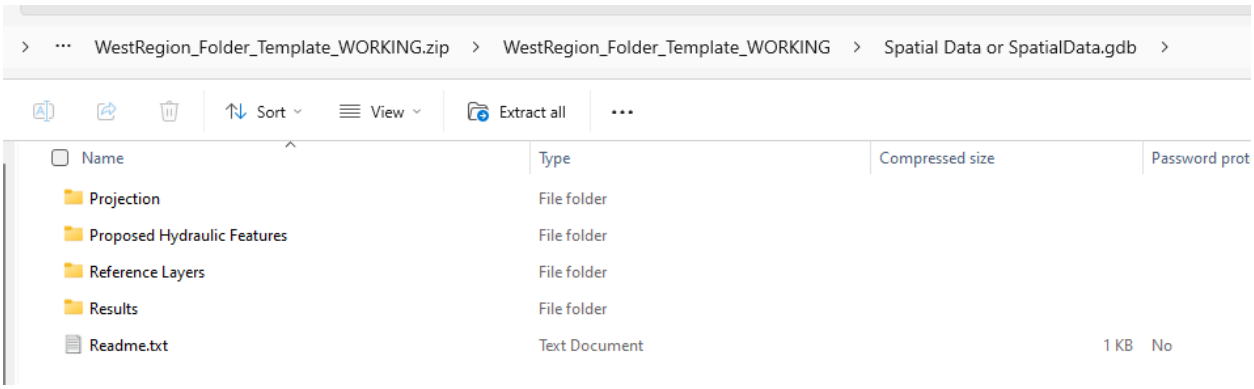
For file folder structure organization, the following provides an example for the regional study teams' use:

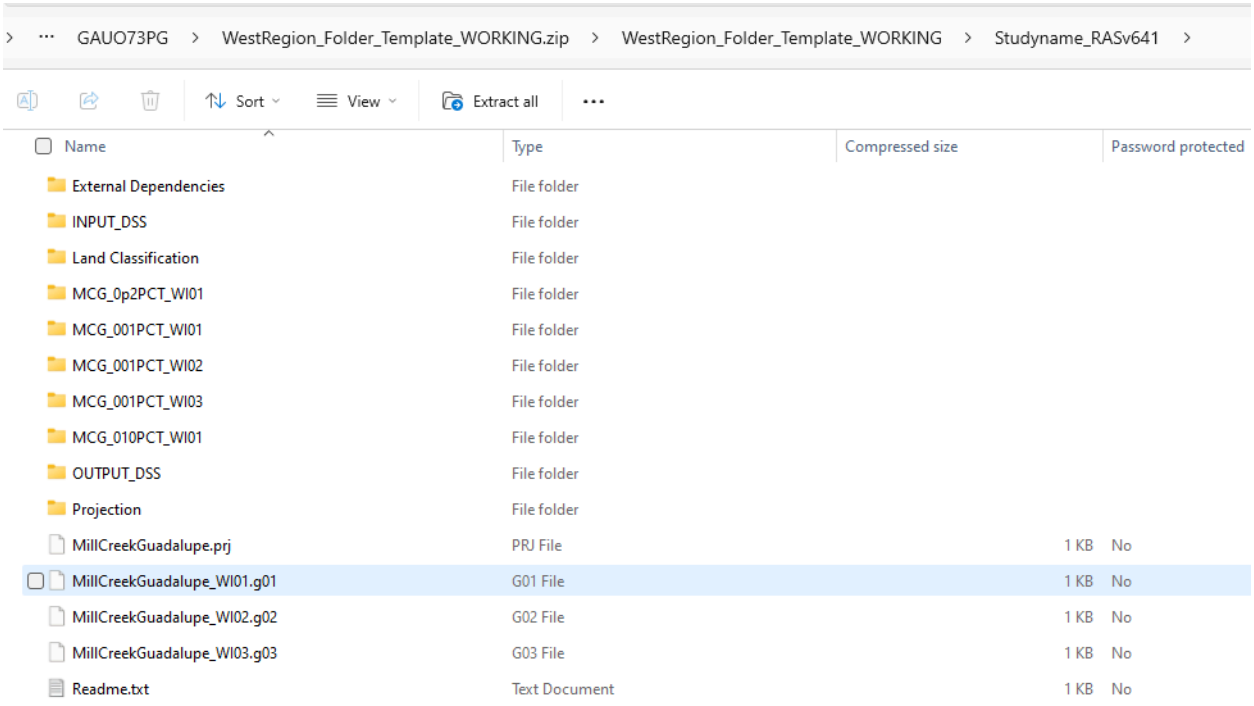


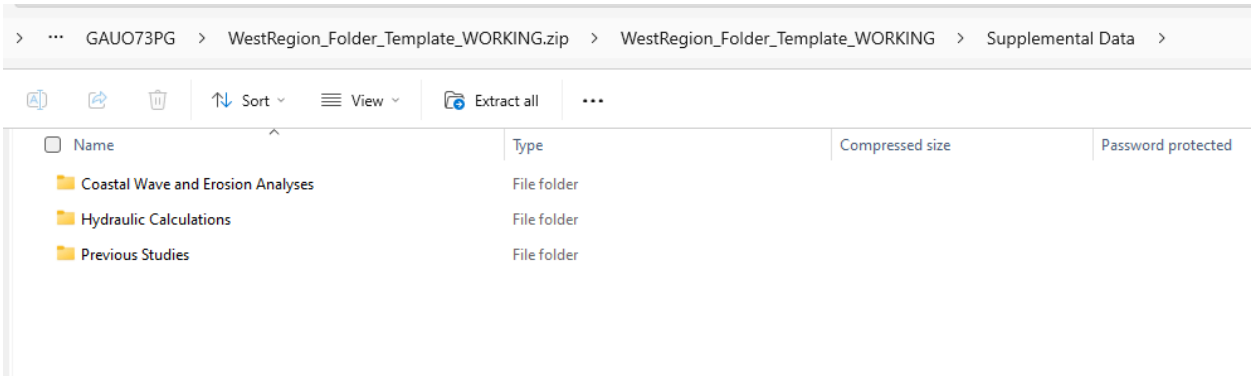
Examples of subfolder (when appropriate) organization are as follows:






WestRegion_Folder_Template_WORKING.zip
WestRegion_Folder_Template_WORKING
Spatial Data or SpatialData.gdb
Sort
View
Extract all
Name
Type
Compressed size
Password prot
Projection
File folder
Proposed Hydraulic Features
File folder
Reference Layers
File folder
Results
File folder
Readme.txt
Text Document
1 KB
No


GAUO73PG
WestRegion_Folder_Template_WORKING.zip
WestRegion_Folder_Template_WORKING
Studyname_RASv641
Sort
View
Extract all
Name
Type
Compressed size
Password protected
External Dependencies
File folder
INPUT_DSS
File folder
Land Classification
File folder
MCG_0p2PCT_WI01
File folder
MCG_001PCT_WI01
File folder
MCG_001PCT_WI02
File folder
MCG_001PCT_WI03
File folder
MCG_010PCT_WI01
File folder
OUTPUT_DSS
File folder
Projection
File folder
MillCreekGuadalupe.prj
PRJ File
1 KB
No
MillCreekGuadalupe_WI01.g01
G01 File
1 KB
No
MillCreekGuadalupe_WI02.g02
G02 File
1 KB
No
MillCreekGuadalupe_WI03.g03
G03 File
1 KB
No
Readme.txt
Text Document
1 KB
No


GAUO73PG
WestRegion_Folder_Template_WORKING.zip
WestRegion_Folder_Template_WORKING
Supplemental Data
Sort
View
Extract all
Name
Type
Compressed size
Password protected
Coastal Wave and Erosion Analyses
File folder
Hydraulic Calculations
File folder
Previous Studies
File folder

RIVER BASIN FLOOD STUDY

Attachment E: Model Change Log

GLO RBFS - Alternatives Analysis (AA) Model Change Log

Version: Feb 2025

Basic Model Information	
AA Model Name:	
Baseline Model(s):	
AA Flood Damage Center(s):	
AE Firm, Region:	{Firm or Subcontracting Firm}, {Name} Region
Project Manager (Name, email):	{Region Lead}
Technical Lead (Name, email):	{Model Contact for TFMR}

Disclaimer

This change log is intended to cover the technical items for the TFMR to promote efficient and effective review for the outlined in the AASOP. This document is for internal facilitation and is not intended for final submission. The information documented in this log should be summarized in the final reporting as described in the AASOP.

Log entry	Descriptions	Screenshots
50% Changes - CC_WO		
Log CC_WO_50%_01 {name for quick reference}	{Long description of the change (Details on the additional survey, changed, or added structure; XY locations if needed; what the changes were in some detail; any additional information needed to review.)}	
Log CC_WO_50%_02 {Bridge at US90 near Raymond}	{Long description of the change (Details on the additional survey, changed, or added structure; XY locations if needed; what the changes were in some detail; any additional information needed to review.)}	{Screenshots details if easier to use than written descriptions}
Log CC_WO_50%_03 {name for quick reference}		
50% Changes - FC_WO		
Log FC_WO_50%_01 {name for quick reference}	{Long description of the change (Details on the additional survey, changed, or added structure; XY locations if needed; what the changes were in some detail; any additional information needed to review.)}	
50% Changes -CC_WI01		

{screenshot A}

Log CC_WI01_50%_01 {name for quick reference}	{Long description of the change (Details on the additional survey, changed, or added structure; XY locations if needed; what the changes were in some detail; any additional information needed to review.)}	
50% Changes - FC_WI01		
Log FC_WI01_50%_01 {name for quick reference} If all "FC_WI" changes are the same as "CC_WI" changes, add a single note stating "The FC_WI01 changes are identical to the CC_WI01 changes." If not, explain each change and note why they are different from the CC_WI01 changes.	{Long description of the change (Details on the additional survey, changed, or added structure; XY locations if needed; what the changes were in some detail; any additional information needed to review.)}	
75% Changes - CC/FC/WO/WI01, etc.		
Log CC_WO_75%_01 {name for quick reference}	{Long description of the change (Details on the additional survey, changed, or added structure; XY locations if needed; what the changes were in some detail; any additional information needed to review.)}	