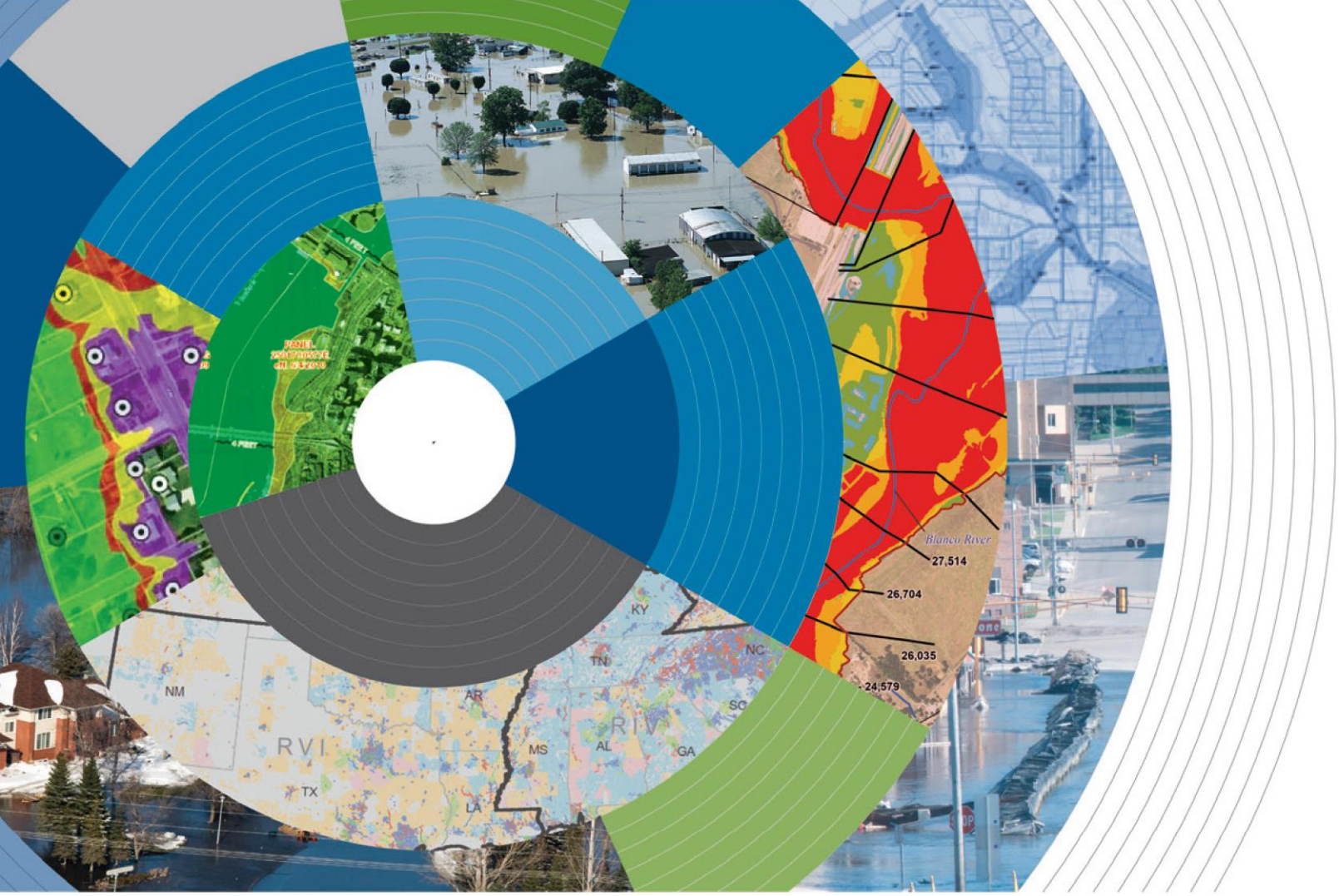

Flood Risk Report

Bayou Macon Watershed

HUC-8 08050002

FEMA CASE NUMBER: 22-06-0011S

July 2023

FEMA

Project Area Community List in Scope

Community Name
Catahoula Parish (Unincorporated Areas)
East Carroll Parish (Unincorporated Areas)
Franklin Parish (Unincorporated Areas)
Madison Parish (Unincorporated Areas)
Richland Parish (Unincorporated Areas)
West Carroll Parish (Unincorporated Areas)
Town of Delhi
Village of Epps
Village of Forest
Village of Kilbourne
Town of Oak Grove
Village of Pioneer

Flood Risk Report History

Version Number	Version Date	Summary
v1.0	7/10/2023	Discovery and Flood Risk Report

Preface

The Department of Homeland Security, Federal Emergency Management Agency's (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) program provides states and local communities with flood risk information, datasets, risk assessments, and tools that they can use to increase their resilience to flooding and better protect their residents. By pairing accurate floodplain maps with risk assessment tools and planning and outreach support, Risk MAP transforms the traditional flood mapping efforts into an integrated process of identifying, assessing, communicating, planning for, and mitigating flood-related risks.

The Flood Risk Report (FRR) is one of the tools created though the Risk MAP program. An FRR provides non-regulatory information to help local officials, floodplain managers, planners, emergency managers, and others. Local, federal, and state officials can use the information in the FRR to establish a better understanding of their flood risk, take steps to mitigate those risks, and communicate those risks to residents and local businesses.

The FRR serves as a guide when communities update local hazard mitigation plans, community comprehensive plans, and emergency operations and response plans. It is meant to communicate risk to officials and inform them of the modification of development standards, as well as assist in identifying necessary or potential mitigation projects. The FRR extends beyond community limits to provide flood risk data for the Bayou Macon watershed.

Flood risk is always changing, and studies, reports, or other sources may be available that provide more comprehensive information. This report is not intended to be the regulatory nor the final authoritative source of all flood risk data in the watershed. Rather, it should be used in conjunction with other data sources to provide a comprehensive picture of flood risk within the project area.

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Executive Summary

The Federal Emergency Management Agency's (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) program provides communities with flood information to help them understand their current flood risk and make informed decisions about taking action to become stronger and more resilient in the face of future risk. The Risk MAP process provides communities with new or improved information about their flood risk based on watershed models that use information from local, regional, state, and federal sources. Communities can use the resulting tools and data to enhance mitigation plans and better protect their residents.

This report is one such tool for communities impacted by an updated flood hazard analysis of the Bayou Macon Hydrologic Unit Code 8 (HUC-8) watershed. The FRR has two goals: (1) **inform communities of their risks** related to certain natural hazards, and (2) **enable communities to act** to reduce their risk. It is intended to assist federal, state, and local officials with the following:

- Updating local Hazard Mitigation Plans and community comprehensive plans
- Updating emergency operations and response plans
- Communicating risk
- Informing the modification of development standards
- Identifying mitigation projects.

Most importantly, during this phase of the process, communities are encouraged to review the flood hazard changes closely and provide feedback to FEMA Region 6 based on their local knowledge and any additional data available.

About the FEMA Risk Mapping, Assessment, and Planning (Risk MAP) Program

Flood risk is continually changing over time due to factors such as new building and development and weather patterns. The goal of FEMA's Risk MAP program is to work with federal, state, tribal, and local partners to identify and reduce flood risk across communities. These projects are conducted using watershed boundaries and bring together multiple communities to identify broader mitigation actions and create consistency across the watershed. The program provides resources and support that are tailored to each community to help mitigate their risk and work towards a reduction in risk and future loss.

Through coordination and data sharing, the communities in the watershed work as partners in the mapping process. In addition to providing data, the communities can also provide insight into flooding issues and flood prevention within their areas. To prepare for a future study and assist in mitigation, FEMA provides several data sources, including information from the community, such as the following:

- Areas of repeated flooding and insurance claims
- Future development plans
- Areas of low water crossings
- High water marks from recent flooding events
- Areas of evacuation during high water
- Master drainage plans, flood risk reduction projects, and large areas of fill placement
- Local flood studies
- Other flood risk information

For more information about ways communities can act or take advantage of available resources, please review the attached appendices.

FEMA provides communities with Base Level Engineering (BLE) data for select watersheds during the Risk MAP process. BLE is a form of automated hydrologic and hydraulic modeling which, when completed, can provide modeled flood hazard data for all flooding sources within the HUC-8 watershed. Knowing the extent of flooding during the 1-percent-annual-chance flooding event supports both risk reduction efforts and more resilient community planning. Completed BLE data is provided to watershed communities for planning, risk communication, floodplain management, and permitting activities, and to inform future flood study needs. BLE is large scale watershed-based modeling that lacks the detail of Zone AE modeling such as road crossings and the effects of routing storage. BLE does not replace Zone AE data and should be used for comparison purposes only in these areas.

For the Bayou Macon watershed BLE datasets and products, see Mapping Information Platform (MIP) case number 20-06-0045S, or visit the Interagency Flood Risk Management (InFRM) estimated Base Flood Elevation (BFE) Viewer. For a review of these BLE products, see Appendix III.

About the Bayou Macon Watershed

The Louisiana Department of Transportation and Development (LADOTD) became a FEMA Cooperating Technical Partner (CTP) in Fiscal Year 2015 (FY15). In FY21, LADOTD contracted with FEMA to provide Risk MAP Discovery for the portion of the Bayou Macon HUC-8 watershed located in Louisiana. The project area covers the portions of the parishes included within the Bayou Mason HUC-8 watershed: Catahoula, East Carroll, Franklin, Madison, Richland, and West Carroll Parishes. Though some hydrologically and hydraulically significant data in the upstream Arkansas section of the HUC is included to provide a full picture of engineering considerations in the watershed. It is important to note that only the part of the HUC inside the Louisiana boundary is scoped for this contract. Location maps covering the study area can be found in Appendix I.

The oldest effective FEMA flood hazard mapping for the parishes within the Bayou Macon watershed were released in the 1970s. Most of the parishes received modernized parish-wide Digital Flood Insurance Rate Maps (DFIRMs) as part of FEMA's Map Modernization (MAP MOD) program in the 2010s. However, East Carroll and Catahoula Parishes still have paper maps with flood hazard data developed during the 1970s and 1980s.

According to the 2019 National Land Cover Data, approximately 94 percent of the area in the Bayou Macon watershed is undeveloped, including cultivated cropland, woody wetlands, and small patches of evergreen forest. Roughly four percent of the area is developed, and the remaining two percent is open water.

The Bayou Macon watershed runs through a diversity of landscapes and physical conditions, with dams (e.g. the Poverty Point Reservoir Dam in Richland Parish), levees (e.g. the AR-LA MS River Levee), and urbanized towns, villages, and unincorporated areas. Over the past half century, the study area has experienced many flash floods. In 2008, Hurricane Gustav caused widespread damage to the crops within the study watershed, totaling approximately $37 million dollars in crop damages. Over the past decade, the population overall has decreased slightly in the watershed. Additional background information for the watershed is depicted in Appendix I.

In 2021, FEMA authorized LADOTD to leverage the previously completed BLE data to perform Discovery in the Bayou Macon watershed. The goal of the Discovery project is to work closely with communities to better understand local flood risks, mitigation efforts, and other topics to spark watershed-wide discussions about increasing resilience to flooding.

Introduction

Flood Risk

Floods are naturally occurring phenomena that can and do happen almost anywhere. In its most basic form, a flood is an accumulation of water over a normally dry area. Floods become hazardous to people and property when they inundate an area where development has occurred, causing losses. Mild flood losses may have little impact on people or property, such as damage to landscaping or the accumulation of unwanted debris. Severe flood losses can destroy buildings and crops and cause severe injuries or death.

Calculating Flood Risk

It is not enough to simply identify where flooding may occur. Even if people know where a flood might occur, they may not know the level of flood risk in that area. The most common method for determining flood risk, also referred to as vulnerability, is to identify both the probability and the consequences of flooding:

> **Flood Risk** (or Vulnerability) **= Probability x Consequences**; where
>
> **Probability** = the likelihood of occurrence
>
> **Consequences** = the **estimated** impacts associated with the occurrence on life, property, and infrastructure

The probability of a flood is the likelihood that it will occur. The probability of flooding can change based on physical, environmental, and/or engineering factors. Factors affecting the probability that a flood will have an impact on an area range from changing weather patterns to the existence of mitigation projects. The ability to assess the probability of a flood, and the level of accuracy for that assessment, are also influenced by modeling methodology advancements, better knowledge, and longer periods of record for the body of water in question.

The consequences of a flood are the estimated impacts associated with its occurrence. Consequences relate to human activities within an area and how a flood affects the natural and built environment.

The FRR has two goals: (1) inform communities of their risks related to certain natural hazards, and (2) enable communities to act to reduce their risk. The information within this Risk Report is intended to assist federal, state, and local officials to:

- **Communicate risk** – Local officials can use the information in this report to communicate with property owners, business owners, and other residents about risks and areas of mitigation interest.
- **Update local hazard mitigation plans and community comprehensive plans** – Planners can use risk information to develop and/or update hazard mitigation plans, comprehensive plans, future land use maps, and zoning regulations. For example, zoning codes can be changed to provide for more appropriate land uses in high-hazard areas.
- **Update emergency operations and response plans** – Emergency managers can identify high-risk areas for potential evacuation and low-risk areas for sheltering. Risk assessment information may show vulnerable areas, facilities, and infrastructure for which continuity of operations plans, continuity of government plans, and emergency operations plans would be essential.

- **Inform the modification of development standards –** Planners and public works officials can use information in this report to support the adjustment of development standards for certain locations.
- **Identify mitigation projects –** Planners and emergency managers can use this risk assessment to determine specific mitigation projects of interest. For example, a floodplain manager may identify critical facilities that need to be elevated or removed from the floodplain.

This FRR focuses on the Risk MAP BLE and Discovery projects. It showcases risk assessments, which analyze how a flood hazard affects the built environment, population, and local economy to identify mitigation actions and develop mitigation strategies.

The information in this report should be used to identify areas for mitigation projects as well as for additional efforts to educate residents on the hazards that may affect them. The areas of greatest hazard impact are identified in the Areas of Mitigation Interest section of this report, which can serve as a starting point for identifying and prioritizing actions a community can take to reduce its risks.

Watershed Basics

Background

The Bayou Macon watershed stretches through southeast Arkansas and northeast Louisiana and covers portions of Chicot, Desha, and Lincoln Counties and Catahoula, East Carroll, Franklin, Madison, Richland, and West Carroll Parishes. See Figure 1 for an overview map of the Bayou Macon watershed. The watershed impacts over 20 communities which include approximately 15,000 people across Louisiana and Arkansas. The total watershed size is approximately 1020 square miles (sq. mi.). The watershed size within the Louisiana state limits is approximately 450 sq. mi. of which approximately 260 sq. mi. is mapped floodplain. See Appendix I for figures showing effective floodplain locations in the Bayou Macon watershed.

The BLE study covers the entirety of the HUC-8 watershed. However, LADOTD's Discovery effort focuses on the communities in Louisiana. Information relevant to flooding sources within the watershed but outside the Louisiana state limits, including dams, levees, flash flood frequencies, and rainfall totals, will still be represented in the report for a fuller depiction of the watershed risk.

Bayou Macon is the primary river that flows from west of the City of Lake Village in Chicot County, Arkansas, to the Tensas River in Tensas Parish. All streams in the watershed are either direct or indirect tributaries to Bayou Macon. There are approximately 1,003 stream miles in the Bayou Macon watershed that drain all of the 59 HUC-12 watersheds within the study area. Flooding is highly dependent on rainfall and often follows tropical thunderstorm events hitting the watershed. Average rainfall amounts increase from north to south of the watershed, with an average rainfall of 52 inches in Desha County to 58 inches in Tensas Parish, Louisiana, per USClimateData.com.

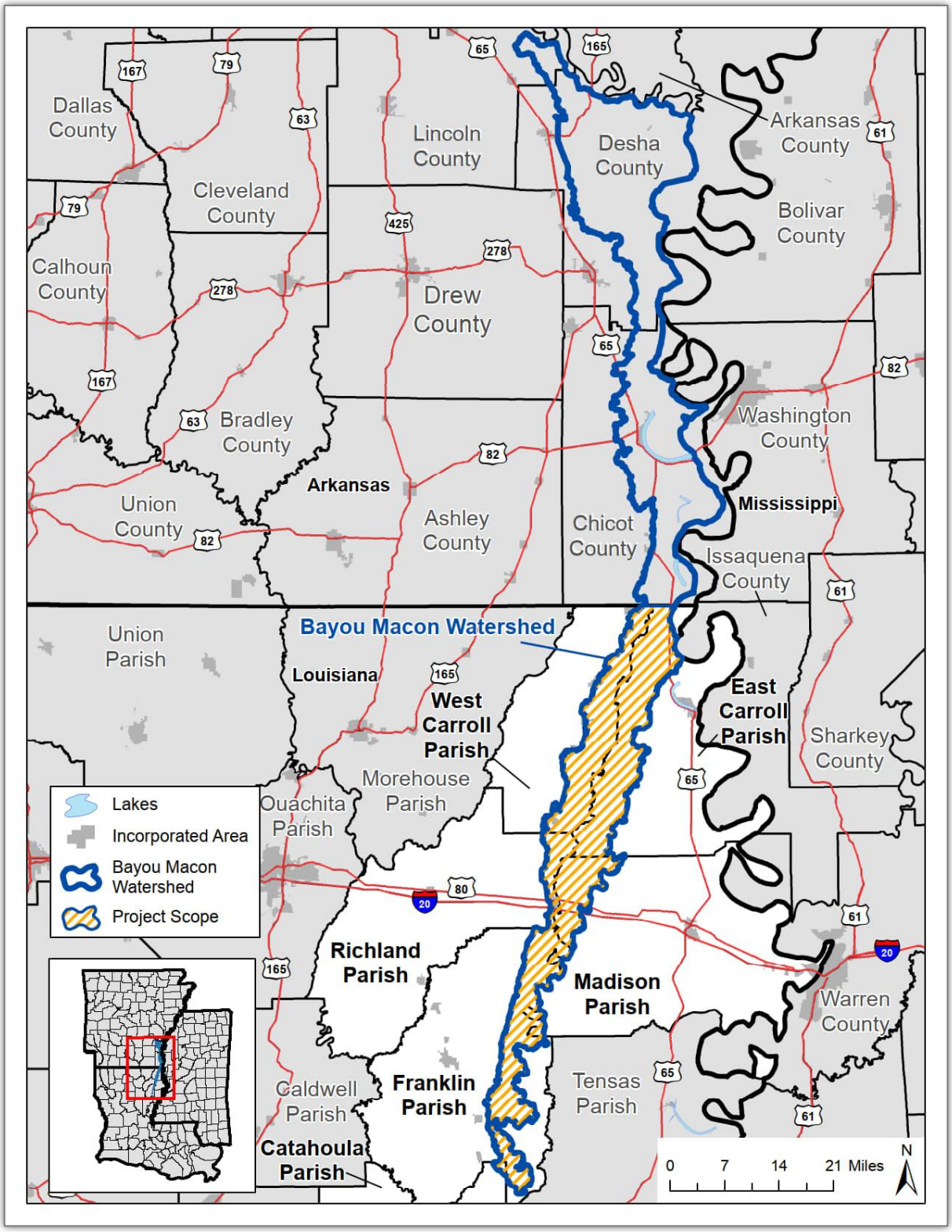


Figure 1: Overview map of the Bayou Macon watershed

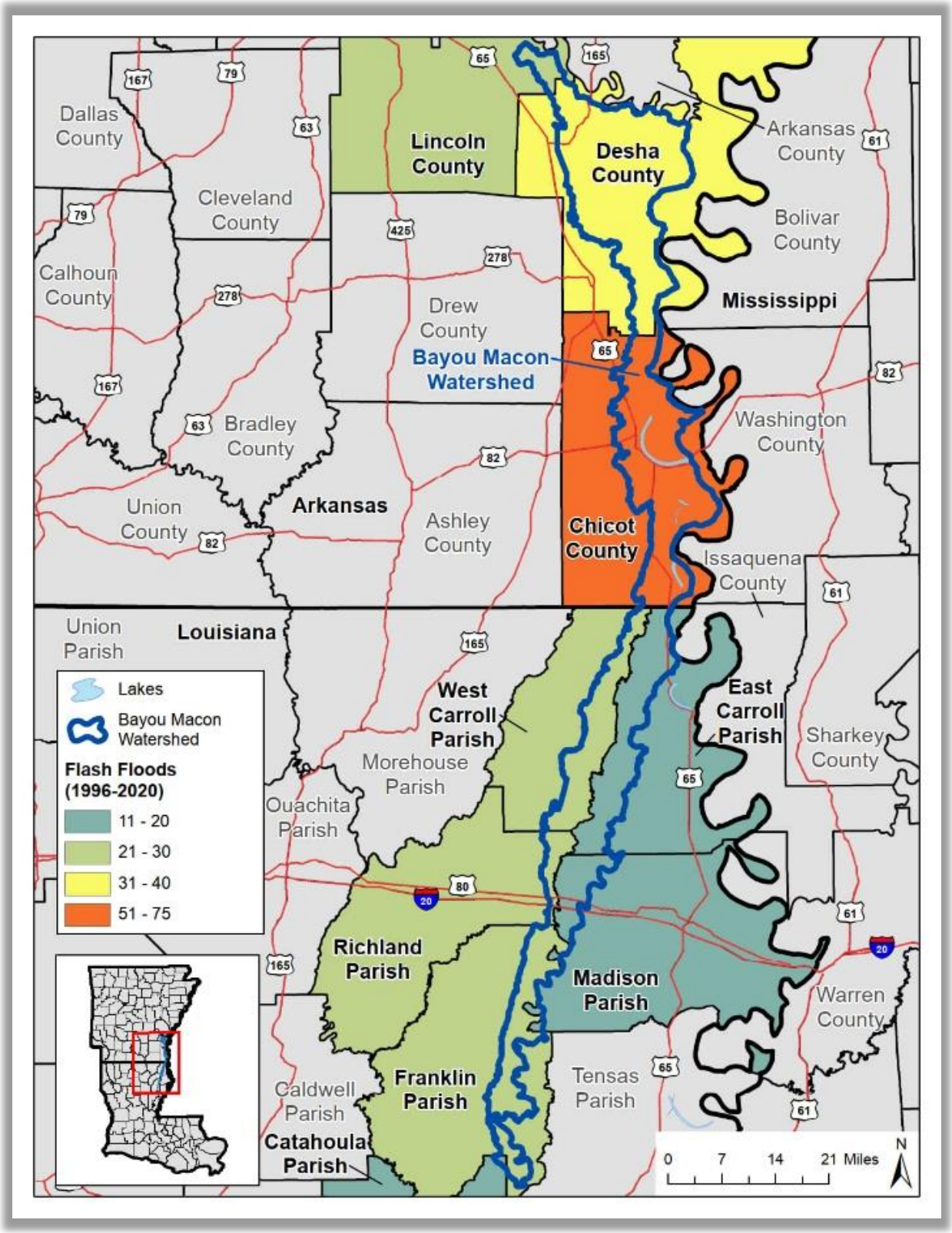


Figure 2: Flash Flood Incidents

The Bayou Macon watershed is comprised of several ecoregions within the larger Mississippi Alluvial Plain ecoregion. The Mississippi Alluvial Plain ecoregion consists of the following subregions: Macon Ridge, the Northern Holocene Meander Belts, and the Northern Backswamps. This is an area characterized by poorly drained overflow floodplains rich in nutrients from previous flood events, making it ideal for growing crops such as cotton, corn, soybeans, and rice. Native vegetation includes bald cypress-water tupelo forest, overcup oak-water hickory forest, willow oaks, and Nuttall oaks.

Intense, localized thunderstorms and frontal-type storms in spring and summer cause most of the flooding issues in the Bayou Macon watershed. Flash flooding occurs throughout the watershed, with the typically finer-textured soil often eroding during large rain events. The parishes within the Bayou Macon watershed have experienced up to 75 flash floods between 1996 and 2020. Figure 2 shows the number of flash floods per county and parish in Arkansas and Louisiana.

Most parishes that have recorded flood events within the Bayou Macon watershed have major crop loss due to flood damage. Most of the flooding is in West Carroll and Richland Parishes. Between the two areas, 38 flash flood events occurred from the late 1990s to 2020. While there is typically little damage to homes when it floods, roadways and highways are often inundated, preventing residents from evacuating.

Population

A review of land cover changes and population growth patterns in the watershed revealed that minimal development and a steady decrease in population occurred from 2010 to 2020 in most of the Bayou Macon watershed. According to the United States Census Bureau, almost every town and village decreased in population between 2010 and 2020. The study area's population within Louisiana dropped from 10,776 to 9,502, a decrease of approximately 12 percent. In comparison, the total population of Louisiana increased by 2.7 percent in the same timeframe.

Since 2010, East Carroll Parish's population has increased by about one percent. All other communities have experienced a decline in population. The largest population drop between 2010 and 2020 occurred in the Village of Epps, in West Carroll Parish, whose population dropped 58 percent. Madison Parish serves approximately 23 percent fewer people, West Carroll Parish serves approximately 12 percent fewer people, and East Carroll Parish serves approximately three percent fewer people. The towns and villages in the study area have a current population range of approximately 150 to 2,400. Catahoula Parish and Richland Parish were not calculated for population change due to the small sample sizes of citizens within the HUC boundary. Assuming the average decrease rate experienced between 2010 and 2020, it is possible that the region population may decrease by another six percent between 2020 and 2025. See Figure 5 and Figure 7 in Appendix I for a watershed population density map and a population change map, respectively.

Watershed Land Use

The Bayou Macon watershed is predominately cultivated cropland, which makes up about 80 percent of its land area. Woody wetlands comprise another 12 percent of the watershed's land area, while the rest of the watershed consists of open water, developed areas, and small patches of emergent herbaceous wetlands and evergreen forests. Oil and gas exploration sites are limited throughout the study area. There are few gas wells, and a large concentration of oil wells in Richland Parish. Excluding the combined areas

of previously developed land and open water, roughly 422 sq. mi. of the Bayou Macon watershed still has the potential for new development. Table 1 shows both population and land use within the Louisiana study area in the Bayou Macon watershed. See Figure 6 in Appendix I for a land cover map.

Table 1: Population and Area Characteristics [1]

Risk MAP Project	Total Population in Louisiana Study Area (2020)	Average % Population Growth Yearly (2010-2020)	Predicted Population (2025)	Land Area (sq. mi.)	Developed Area (sq. mi.)	Open Water (sq. mi.)
Bayou Macon Watershed (HUC-8 08050002)	9,502	-1.3	8,923	447*	18	7

*Total Land Area includes land and water.

National Flood Insurance Program (NFIP) Status and Regulations

To be a participant of the NFIP, all interested communities must adopt and submit floodplain management ordinances that meet or exceed the minimum NFIP regulations. These regulations can be found in the Code of Federal Regulations and most of the community ordinance requirements are in Title 44 parts 59 and 60. The level of regulation depends on the level of information available and the flood hazards in the area. The levels are as follows:

- A: The Federal Emergency Management Agency (FEMA) has not provided any maps or data – 60.3(a)
- B: Community has maps with approximate A Zones – 60.3(b)
- C: Community has a Flood Insurance Rate Map (FIRM) with Base Flood Elevations (BFE) – 60.3(c)
- D: Community has a FIRM with BFEs and floodways – 60.3(d)
- E: Community has a FIRM that shows coastal high hazard areas (V Zones) – 60.3(e)

To help mitigate the risk to areas where increased population and development are expected, communities can adopt (or exceed) the minimum standards of the NFIP. This is recommended as a proactive strategy to manage construction within the floodplain and avoid negative impacts to existing and future development. The Association of State Floodplain Managers (ASFPM) No Adverse Impact Floodplain Management is a good example.

To increase mitigation efforts and community flood awareness through potentially discounted premium rates, an NFIP community that has adopted more stringent ordinances or is actively completing mitigation and outreach activities is encouraged to consider joining the Community Rating System (CRS). The CRS is a voluntary incentive-based program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions.

Communities can review their current ordinances and reflect potential flood hazard changes by adopting updated ordinances early. This action can reduce future flood losses by affecting how substantial improvements or new construction are regulated. Figure 10 in Appendix I illustrates the NFIP flood losses within the project scope.

[1] Data obtained from the U.S. Census Bureau; ESRI Demographic 5-year Projections; and National Land Cover Database

Hazard Mitigation Plan (HMP)

State and local governments must develop and adopt HMPs to be eligible for certain types of funding. To remain eligible, communities need to update and resubmit their plans every five years for FEMA approval. HMPs are created to increase education and awareness, identify strategies for risk reduction, and identify other ways to develop long-term strategies to reduce risk and protect people and property.

HMPs for East Carroll, Franklin, and Richland Parishes and Town of Delhi that participates in the Richland Parish HMP have all expired, but new plans are in development. Madison Parish's HMP is set to expire in August 2024, and Catahoula Parish's HMP is set to expire in February 2027. West Carroll Parish's HMP, which includes the Town of Oak Grove and the Villages of Epps, Forest, Kilbourne, and Pioneer, is set to expire in April 2027.

HMPs effectively allow for FEMA to assess hazards identified through local, state, and federal partnerships and mitigation action items that communities have identified. These HMPs were used in the compilation and preparation of this report.

Community Rating System (CRS)

CRS is a voluntary incentive-based program that recognizes and encourages community floodplain management activities that communities undertake in addition to the minimum requirements they must meet when joining the NFIP. Individuals that carry flood insurance in a community that participates in the CRS program can receive a discount on their flood insurance premium. Discounts can range from 5 to 45 percent. As of March 2023, there are no participating CRS communities in the Bayou Macon watershed. Table 2 depicts NFIP and CRS participation status and provides an overview of the effective flood data availability.

Table 2: NFIP and CRS Participation [2]

Risk MAP Project	Participating NFIP Communities/ Total Communities	Number of CRS Communities	CRS Rating Class Range	Average Years since Latest FIRM Update	Level of Regulations (44 CFR 60.3)
Bayou Macon Watershed (HUC-8 08050002)	11/12	0	N/A	15	60.3(b) 60.3(c)

[2] Data obtained from FEMA Community Information Systems.

Flood Insurance Rate Maps (FIRMs)

The average age of the effective FIRMs within the study watershed is 20 years. The oldest effective map is in East Carroll Parish; it is 44 years old and has an effective date of October 16, 1979. The newest effective maps in West Carroll Parish are five years old and have an effective date of October 5, 2018. As of 2023, all communities except East Carroll and Catahoula Parishes have modernized parish-wide effective digital FIRMs (DFIRMs).

Dams and Levees

As recorded by the United States Army Corps of Engineers (USACE) National Inventory of Dams (NID) datasets and the FEMA DFIRM databases, there are 12 dams within the study watershed. There are six dams in Chicot County (these are outside of CTP scope area but can still impact Louisiana parishes downstream), three dams in Richland Parish, two dams in Franklin Parish, and one dam in Madison Parish. Several dams along numerous streams in the watershed are used to maintain water storage, control flooding, or divert flow. Figure 3 shows locations of dams and levees in the study watershed.

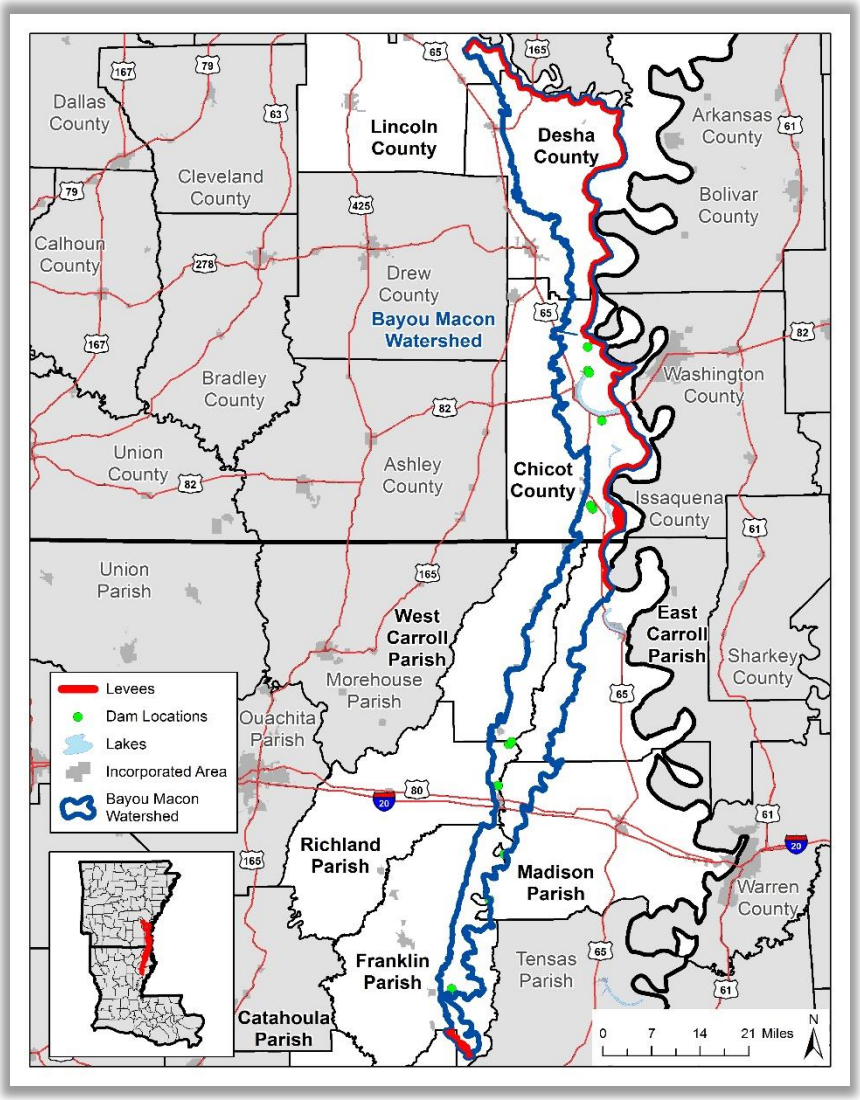


Figure 3: Dam and Levee Location Map for Bayou Macon

These 12 dams have been used primarily for flood control and recreation but also provide other benefits such as irrigation, fire protection, water supply, and small fishponds. Most dams are owned by either federal, state, or local governments, but there are a few privately owned dams. Eleven of the dams in the watershed are classified as low hazard and one is classified as a high hazard dam. For high-hazard dams, the owners and operators are required to develop and maintain Emergency Action Plans (EAP) to reduce the risk of loss of life and property if the dam fails. The Natural Resources Conservation Service (NRCS) has designed two dams in the study watershed. These NRCS dams are mainly used for flood control, prevent erosion damage, improve water supply and irrigation, and create a habitat for wildlife. The largest and oldest dam in the watershed is the Lake Chicot Dam North, which was completed in 1942 and stores 45,080 acre-feet of water. The largest dam in the project area is the Poverty Point Reservoir Dam, which stores 31,000 acre-feet of water. Table 3 provides the characteristics of the dams identified in the entire HUC-8 watershed.

Table 3: Risk MAP Project Dam Characteristics[3]

Risk MAP Project	Total Number of Identified Dams	Number of Dams Requiring EAP	Percentage of Dams without EAP	Average Years since Inspection	Average Storage (acre-feet)
Bayou Macon Watershed (HUC-8 08050002)	12	1	0	4*	10,262

*Date of last inspection not provided for all records as of March 2023

There are two levees within the Louisiana portion of the Bayou Macon watershed. The AR-LA Mississippi River levee system runs along the eastern border of the watershed and protects the watershed areas from Mississippi River flooding. The Sicily Island Levee, a FEMA accredited levee system, runs near the watershed's southernmost border.

[3] Data obtained from USACE National Inventory of Dams

Project Phases and Map Maintenance

Background

FEMA manages several risk analysis programs, including Flood Hazard Mapping, National Dam Safety, the Earthquake Safety Program, Multi-Hazard Mitigation Planning, and the Risk Assessment Program, all of which assess the impact of natural hazards and lead to effective strategies for reducing risk. These programs support the Department of Homeland Security's objective to "strengthen nationwide preparedness and mitigation against natural disasters."

FEMA manages the NFIP, which is the cornerstone of the national strategy for preparing American communities for flood hazards. In the nation's comprehensive emergency management framework, the analysis and awareness of natural hazard risk remains challenging. A consistent risk-based assessment approach and a robust communication system are critical tools to ensure a community's ability to make informed risk management decisions and take mitigation actions. Flood hazard mapping is a basic and vital component for a prepared and resilient nation.

> *Flood-related damage between 1980 and 2013 totaled $260 billion [dollars], but the total impact to our Nation was far greater—more people lose their lives annually from flooding than any other natural hazard.*
>
> *FEMA, "Federal Flood Risk Management Standard (FFRMS)" (2015)*

In Fiscal Year 2009, FEMA's Risk MAP program began to synergize the efforts of federal, state, and local partners to create timely, viable, and credible information identifying natural hazard risks. The intent of the Risk MAP program is to share resources to identify the natural hazard risks a community faces and ascertain possible approaches to minimizing them. Risk MAP aims to provide technically sound flood hazard information to be used in the following ways:

- To update the regulatory flood hazard inventory depicted on FIRMs and the National Flood Hazard Layer
- To provide broad releases of data to expand the identification of flood risk (flood depth grids, water-surface elevation grids, etc.)
- To support sound local floodplain management decisions
- To identify opportunities to mitigate long-term risk across the nation's watersheds

How are FEMA's Flood Hazard Maps Maintained?

FEMA's flood hazard inventory is updated through several types of revisions.

Community-submitted Letters of Map Change (LOMCs)

First and foremost, FEMA relies heavily on the local communities that participate in the NFIP to carry out the program's minimum requirements. These requirements include the obligation for communities to notify FEMA of changing flood hazard information and to submit the technical supporting data needed to update the FIRMs.

Although revisions may be requested at any time to change information on a FIRM, FEMA generally will not revise an effective map unless the changes involve modifications to Special Flood Hazard Areas (SFHAs). Be aware that the best floodplain management practices and proper assessments of risk result when the flood hazard maps present information that accurately reflects current conditions.

Under the current minimum NFIP regulations, a participating community commits to notifying FEMA if changes take place that will affect an effective FIRM no later than 6 months after project completion.

Section 65.3, Code of Federal Regulations

Letters of Map Amendment (LOMAs)

The scale of an effective FIRM does not always provide the information required for a site-specific analysis of a property's flood risk. FEMA's LOMA process provides homeowners with an official determination on the relation of their lot or structure to the SFHA. Requesting a LOMA may require a homeowner to work with a surveyor or engineering professional to collect site-specific information related to the structure's elevation; it may also require the determination of a site-specific BFE. Fees are associated with collecting the survey data and developing a site-specific BFE. Local surveying and engineering professionals usually provide an Elevation Certificate to the homeowner, who can use it to request a LOMA. A successful LOMA may remove the federal mandatory purchase requirement for flood insurance, but lending companies may still require flood insurance if they believe the structure is at risk.

FEMA-Initiated Flood Risk Project

Each year, FEMA initiates a number of Flood Risk Projects to create or revise flood hazard maps. Because of funding constraints, FEMA can study or restudy only a limited number of communities, parishes, or watersheds each year. As a result, FEMA prioritizes study needs based on a cost-benefit approach whereby the highest priority is given to studies of areas where development has increased, and the existing flood hazard data has been superseded by information based on newer technology or changes to the flooding extent. FEMA understands communities require products that reflect current flood hazard conditions to best communicate risk and implement effective floodplain management.

Flood Risk Projects may be delivered by FEMA or one of its Cooperating Technical Partners (CTPs). The CTP initiative is an innovative program created to foster partnerships between FEMA and participating NFIP communities, as well as regional and state agencies. Qualified partners collaborate in maintaining up-to-date flood maps. In FEMA Region 6, which includes the State of Louisiana, CTPs are generally statewide agencies that house the State Floodplain Administrator. However, some Region 6 CTPs are also large river authorities, flood control districts, regional planning agencies, or cities. They provide enhanced coordination with local, state, and federal entities, engage community officials and technical staff, and provide updated technical information that informs the national flood hazard inventory.

Risk MAP has modified FEMA's project investment strategy from a single investment by fiscal year to a multi-year phased investment, which allows FEMA to be more flexible and responsive to the findings of the project as it moves through the project lifecycle. Flood Risk Projects are funded and completed in phases.

General Flood Risk Project Phases

Each phase of the Flood Risk Project provides both FEMA and its partner communities with an opportunity to discuss the data that has been collected and to determine a path forward. Local engagement throughout each phase enhances the opportunities for partnership, furthers the discussion on current and future risk, and helps identify local projects and activities to reduce long-term natural hazard risk.

Flood Risk Projects may be funded for one or more of the following phases:

- Phase Zero – Investment
- Phase One – Discovery
- Phase Two – Risk Identification and Assessment
- Phase Three – Regulatory Product Update

Local input is critical throughout each phase of a Flood Risk Project. More details about the tasks and objectives of each phase are included below.

Phase Zero: Investment

Phase Zero of a Flood Risk Project initiates FEMA's review and assessment of the inventories of flood hazards and other natural hazards within a watershed area. During the Investment Phase, FEMA reviews the availability of information to assess the current floodplain inventory. FEMA maintains several data systems to perform watershed assessments and selects watersheds for a deeper review of available data and potential investment tasks based on the following factors:

Availability of High-Quality Ground Elevation Data

FEMA reviews readily available and recently acquired ground elevation data. This information helps identify development and earth-moving activities near streams and rivers. Where necessary, FEMA may partner with local, state, and other federal entities to collect necessary ground elevation information within a watershed.



If The National Map - Advanced Viewer can provide high-quality ground elevation data that is both available for a watershed area and compliant with FEMA's quality requirements, FEMA and its mapping partners may prepare engineering data to assess, revise, replace, or add to the current flood hazard inventory.

Mile Validation Status within Coordinated Needs Management Strategy (CNMS)

FEMA uses the CNMS database to track the validity of the flood hazard information prepared for the NFIP. The CNMS database reviews 17 criteria to determine whether the flood hazard information shown on the current FIRM is still valid.



Communities may also inform and request a review or update of the inventory through the CNMS website at https://msc.fema.gov/cnms/. The Coordinated Needs Management Strategy (CNMS) Technical Reference (fema.gov) provides an overview of the online tool. Requests should be directed to the appropriate FEMA Regional Offices for review.

Local Hazard Mitigation Plans

Reviewing current and historic hazard mitigation plans provides an understanding of a community's comprehension of its flood risk and other natural hazard risks. The mitigation strategies within a local

hazard mitigation plan provide a lens to local opportunities and underscore a potential for local adoption of higher standards related to development or other actions to reduce long-term risk.

Cooperating Technical Partner (CTP) State Business Plans
In some states, a CTP generates an annual state business plan that identifies future Flood Risk Project areas that are of interest to the state. The Louisiana Department of Transportation and Development (LADOTD) works to develop user-friendly data. In this project area, FEMA has worked closely with LADOTD to develop the project scope and determine the necessary project tasks.



Communities that have identified local issues are encouraged to indicate their data needs and revision requests to the State CTP so that they can be prioritized and included in the State Business Plans.

Possible Investment Tasks
After a review of the data available within a watershed, FEMA may choose to (1) purchase ground elevation data and/or (2) create some initial engineering modeling against which to compare the current inventory, also known as BLE modeling.

Phase One: Discovery

Phase One, the Discovery Phase, provides opportunities both internally (between the state and FEMA) and externally (with communities and other partners interested in flood potential) to discuss local issues with flooding and examine possibilities for mitigation action. This effort is made to determine where communities currently are with their examination of natural hazard risk throughout their community and to identify how state and federal support can assist communities in achieving their goals.



The Discovery process includes an opportunity for local communities to provide information about their concerns related to natural hazard risks. Communities may continue to inform the project identification effort by providing previously prepared survey data, as-built stream crossing information, and engineering information.

For a holistic community approach to risk identification and mapping, FEMA relies heavily on the information and data provided at the local level. Flood Risk Projects are focused on identifying (1) areas where the current flood hazard inventory does not provide adequate detail to support local floodplain management activities, (2) areas of mitigation interest that may require more detailed engineering information than is currently available, and (3) community intent to reduce the risk throughout the watershed to assist FEMA's future investment in these project areas. Watersheds are selected for Discovery based on these evaluations of flood risk, data needs, availability of elevation data, Regional knowledge of technical issues, identification of a community-supported mitigation project, and input from federal, state, and local partners.

Possible Discovery Tasks
Discovery may include a mix of interactive webinar sessions, conference calls, informational tutorials, and in-person meetings to reach out to and engage with communities for input. Data collection, interviews, and interaction with community staff and data-mining activities provide the basis for watershed-, community-, and stream-level reviews to determine potential projects that may benefit the communities. A range of analysis approaches are available to determine the extent of flood risk along streams of

concern. FEMA and its mapping partners will work closely with communities to determine the appropriate analysis approach, based on the data needs throughout the community.

These potential projects may include local training sessions, data development activities, outreach support to local communities wanting to step up their efforts, or the development of flood risk datasets within areas of concern to allow a more in-depth discussion of risk.

Phase Two: Risk Identification and Assessment

Phase Two (Risk Identification and Assessment) continues the risk awareness discussion with communities through watershed analysis and assessment. Analyses are prepared to review the effects of physical and meteorological changes within the project watershed. The new or updated analysis provides an opportunity to identify how development has affected the amount of stormwater generated during a range of storm probabilities and shows how effectively stormwater is transported through communities in the watershed.



Coordination with a community's technical staff during engineering and model development allows FEMA and its mapping partners to include local knowledge, based on actual on-the-ground experience, when selecting modeling parameters.

The information prepared and released during Phase Two is intended to promote better local understanding of the existing flood risk by allowing community officials to review the variability of the risk throughout their community. As FEMA strives to support community-identified mitigation actions, it also looks to increase the effectiveness of community floodplain management and planning practices, including local hazard mitigation planning, participation in the NFIP, use of actions identified in the CRS Manual, risk reduction strategies for repetitive loss and severe repetitive loss properties, and the adoption of stricter standards and building codes.



FEMA is eager to work closely with communities and technical staff to determine the current flood risk in the watershed. During the Risk Identification and Assessment phase, FEMA would like to be alerted to any community concerns related to the floodplain mapping and analysis approaches being taken. During this phase, FEMA can engage with communities and review the analysis and results in depth.

Possible Risk Identification and Assessment Tasks

Phase Two may include a mixture of interactive webinars, conference calls, informational tutorials, and in-person meetings to reach out to and engage with communities for input. Flood Risk Project tasks may include hydrologic or hydraulic engineering analysis and modeling, floodplain mapping, risk assessments using Hazus-Multi Hazard software, and preparation of flood risk datasets (water-surface elevation, flood depth, or other analysis grids). Additionally, projects may include local training sessions, data development activities, outreach support to local communities that want to step up their efforts, or the development of flood risk datasets within areas of concern to allow a more in-depth discussion of risk.

Phase Three: Regulatory Products Update

If the analysis prepared in the previous Flood Risk Project phases indicates that physical or meteorological changes in the watershed have significantly changed the flood risk since the last FIRM was printed, FEMA will initiate the update of the regulatory products that communities use for local floodplain management and NFIP activities.

Delivery of the preliminary FIRM and Flood Insurance Study (FIS) report begins another period of coordination between community officials and FEMA to discuss the required statutory and regulatory steps both parties will perform before the preliminary FIRM and FIS report can become effective. As in the previous phases, FEMA and its mapping partners will engage with communities through a variety of conference calls, webinars, and in-person meetings.

Once the preliminary FIRMs are prepared and released to communities, FEMA will initiate the statutory portions of the regulatory product update. FEMA will coordinate a Consultation Coordination Officer meeting and initiate a 90-day comment and appeal period. During this appeal period, local developers and residents may coordinate the submittal of their comments and appeals through their community officials to FEMA for review and consideration.

FEMA welcomes this information because additional proven scientific and technical information increases the accuracy of the mapping products and better reflects the community's flood hazards identified on the FIRMs.

Communities may host or hold Open House meetings for the public. The Open House layout allows attendees to move at their own pace through several stations, collecting information in their own time. This format allows residents to receive one-on-one assistance and ask questions pertinent to their situations or their interests in risk or flood insurance information.

All appeals and comments received during the statutory 90-day appeal period, including the community's written opinion, will be reviewed by FEMA to determine the validity of the appeal. Once FEMA issues the appeal resolution, the associated community and all appellants will receive an appeal resolution letter and FEMA will revise the preliminary FIRM, if warranted. A 30-day period is provided for review and comment on successful appeals. Once all appeals and comments are resolved, the flood map is ready to be finalized.

After the appeal period, FEMA will send community leaders a Letter of Final Determination stating that the preliminary FIRM will become effective in six months. The letter also discusses the actions each affected community participating in the NFIP must take to remain in good standing in the NFIP.

After the preceding steps are complete and the six-month compliance period ends, the FIRMs are considered effective maps and new building and flood insurance requirements become effective.

The following sections describe FEMA's Risk MAP investment in the Bayou Macon watershed to date.

Bayou Macon Watershed Risk MAP Project

Watershed Selection Factors

FEMA Risk MAP Project life cycles begins with Phase Zero (Investment) and Phase One (Discovery). The investment in these two phases in the Bayou Macon watershed paves the way for the local communities to move towards flooding resilience. FEMA selected and prioritized the watershed for BLE Investment and Discovery with the overall goal of assisting the local governments in identifying flood risks and strengthening their ability to make informed decisions about reducing these risks. Figure 4 shows communities within the Bayou Macon watershed.

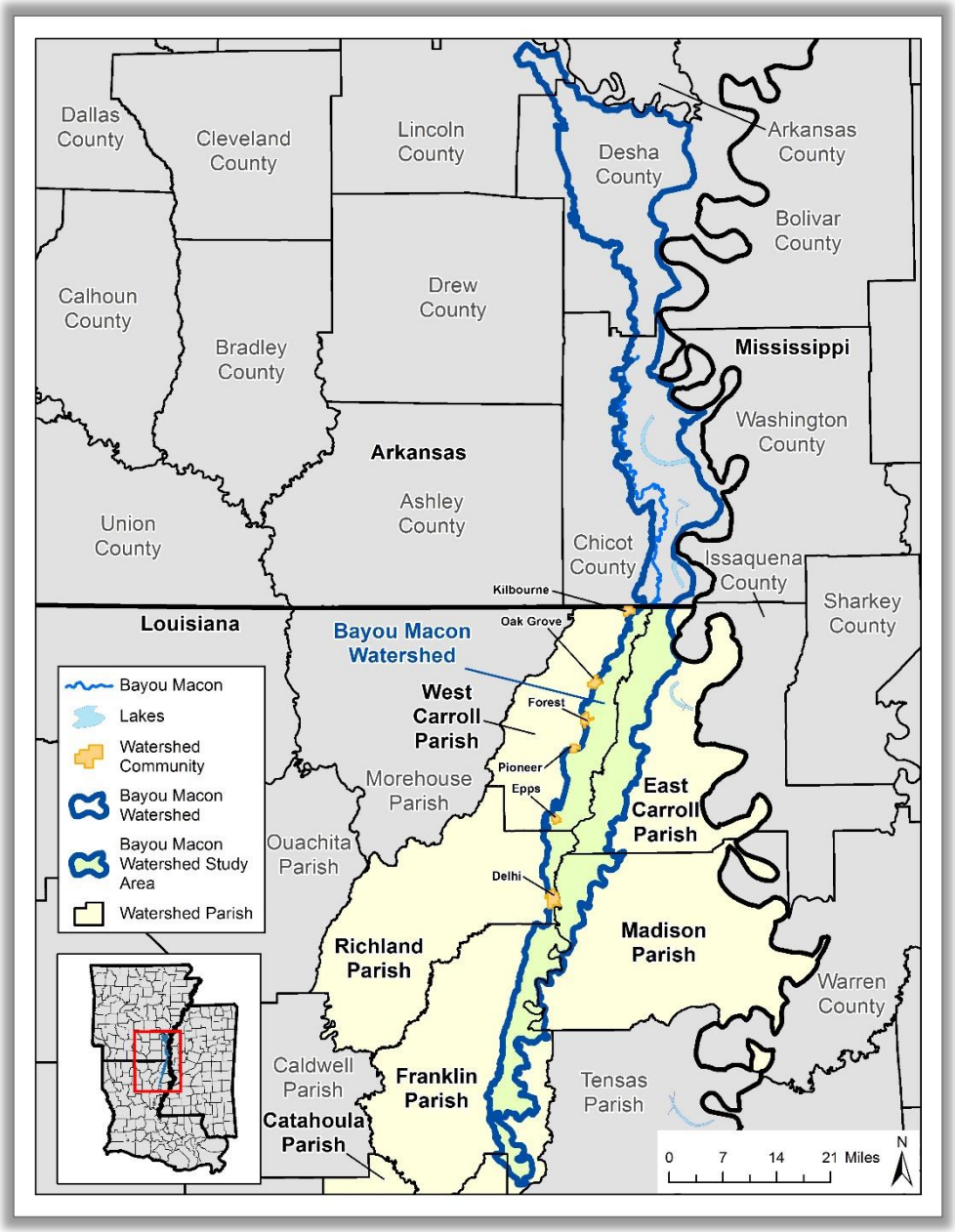


Figure 4: Overview of communities located within the Bayou Macon watershed

Many factors and criteria are reviewed for watershed selection: flood risk, the age of the current flood hazard data, population growth trends and potential for growth, recent flood claims, and disaster declaration history. The availability of local data and high-quality ground elevation data is reviewed for use in preparing flood hazard data. The CNMS database is reviewed to identify large areas of unknown or unverified data for streams. FEMA consults the State of Louisiana CTP, the State NFIP Coordinator, and the State Hazard Mitigation office for watershed selection for further study.

Flood Risk

As recently as November 2020, the Town of Oak Grove and the Village of Pioneer in West Carroll Parish experienced flash flooding and road closures as a warm front moved through the area. In 2016, a slow-moving high-pressure system caused over $1.3 million dollars in damages in West Carroll Parish. The watershed felt the effects of Hurricane Gustav in 2008; the Village of Epps alone experienced $1.3 million dollars in property damages and $33 million dollars in crop damages as a result.

Many additional flood related damages have been recorded in the various communities in the watershed. These flood events cause extensive damage to local infrastructure and illustrate the ongoing threat in the Bayou Macon watershed. Despite a population decline, most communities in the watershed have slightly increased their urban area footprint with more impermeable surfaces.

Growth Potential

The Bayou Macon watershed is predominately cultivated cropland with very little developed area. All the towns and villages within the watershed are lightly to moderately developed. Because of a steady decline in population, future development is likely to happen gradually over time.

Age of Current Flood Information

All parishes, except Catahoula and East Carroll Parishes, in the Bayou Macon watershed have been updated to modernized parish-wide DFIRMS and FIS reports as part of FEMA's MAP MOD program that began in 2004. The study in West Carroll Parish went effective as recently as 2018. Other studies in Madison Parish went effective in 2012, while the studies in Franklin and Richland Parishes went effective in 2011 and 2013, respectively. However, both Catahoula and East Carroll Parishes' respective studies are over 30 years old. Almost two-thirds of the mapping shown on these FIRMs are also Zone A floodplains with no readily available Base Flood Elevations (BFEs).

The combination of related severe floods and outdated flood information indicate that this watershed needs updated flood hazard information to support floodplain management activities, especially in East Carroll Parish.

Availability of High-Quality Ground Elevation Data

FEMA's data availability review indicated that high-quality ground elevation data was available for all the Bayou Macon watershed in the form of Light Detection and Ranging (LiDAR) data. This data provides a great basis for preparing hydrologic and hydraulic modeling and help identify development and earth-moving activities near the streams and creeks. The available LiDAR data was collected from three separate studies. The project area's data was collected by USGS between 2000 and 2008 for the 2008 Louisiana Statewide LiDAR project. The source and date of the LiDAR topographic data coverage used in the Discovery and BLE projects for the Bayou Macon watershed are shown in Figure 5. See Figure 9 in Appendix I for topographic data sources for the whole watershed.

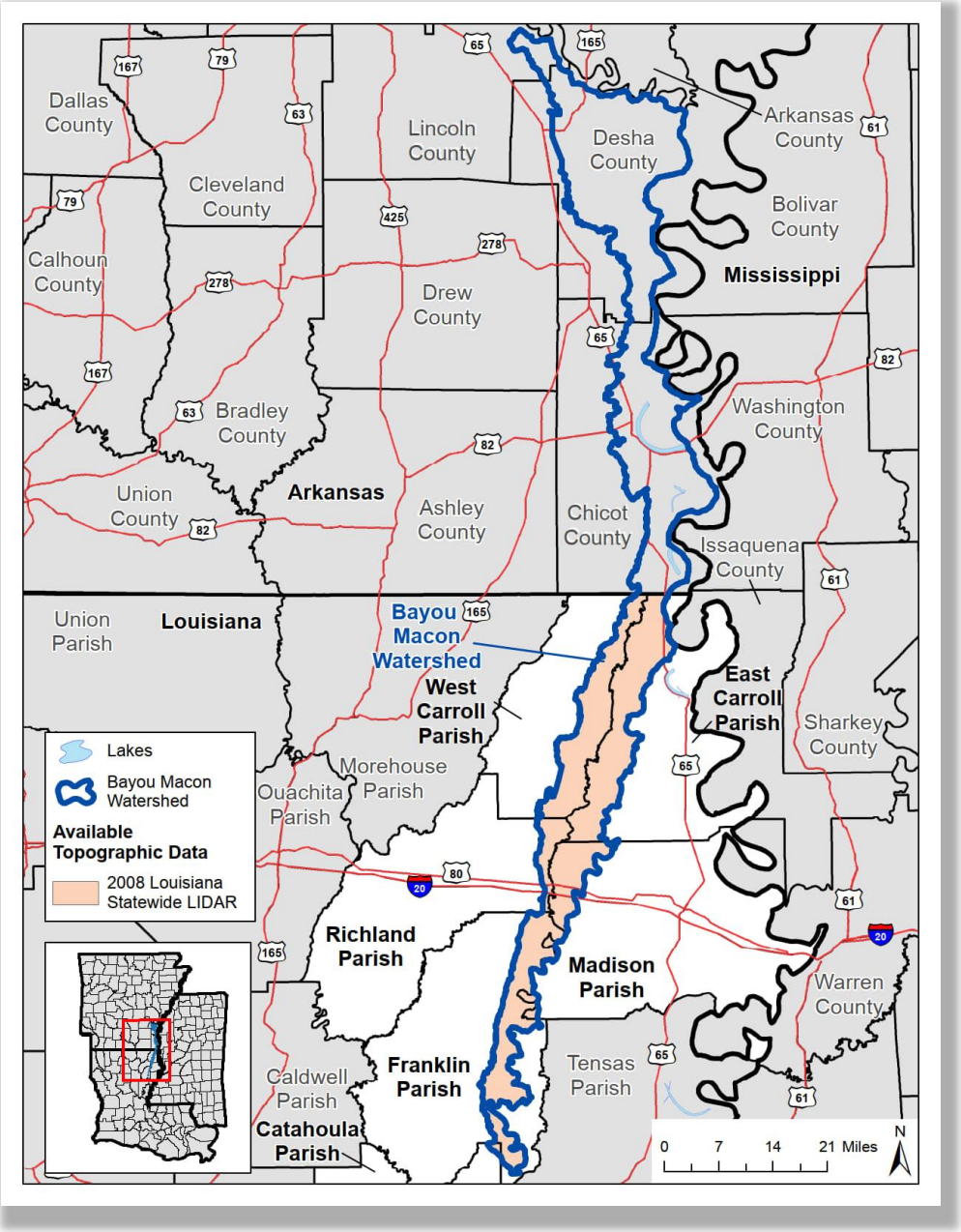


Figure 5: Availability of LIDAR Data

Coordinated Needs Management Strategy (CNMS) Database Review

The CNMS database indicates the validity of FEMA's flood hazard inventory. CNMS reviews 17 criteria to determine whether flood hazard information shown on the current FIRMs is still valid. Streams that are indicated as ***Unverified*** or ***Unknown*** in the database indicate that the information used to map the floodplains currently shown on the FIRM is inaccessible or that a complete evaluation of the critical and secondary CNMS elements could not be performed. Figure 6 shows the CNMS-based attributed streams for the study watershed.

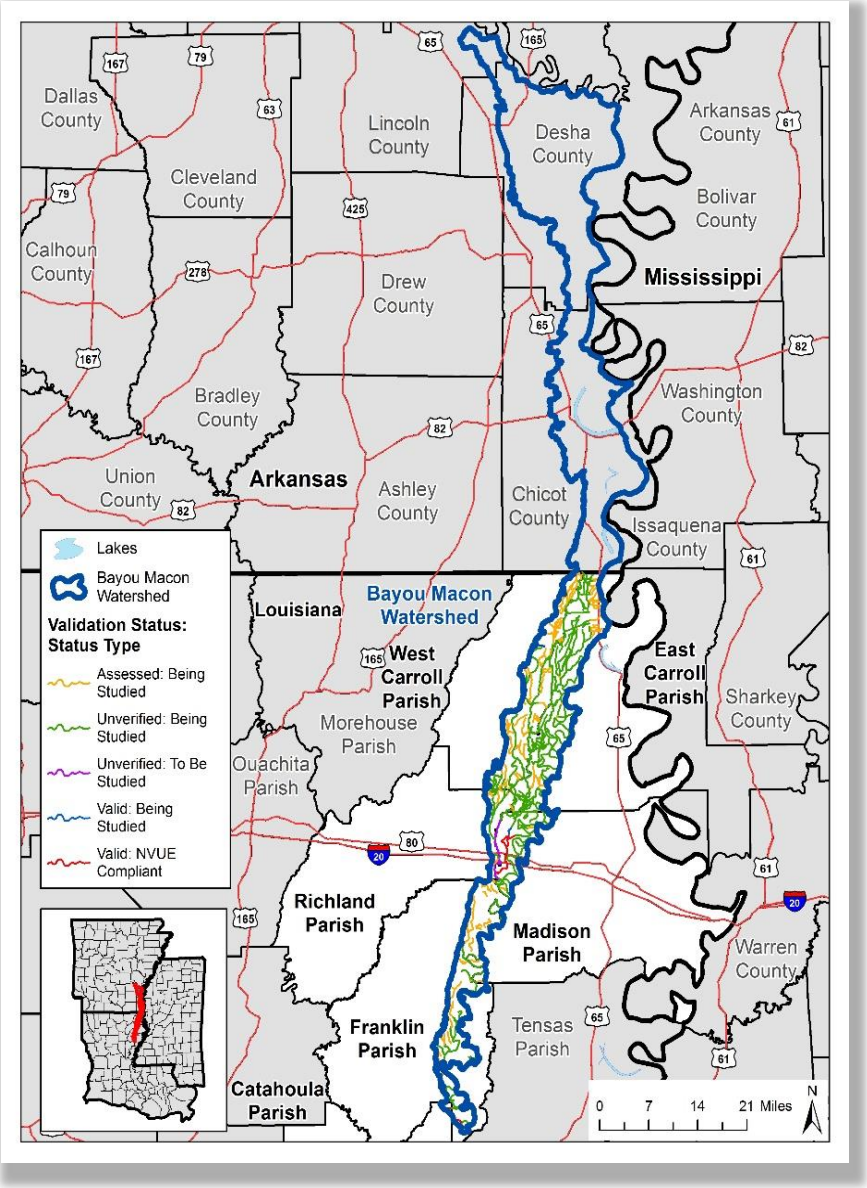


Figure 6: Overview of CNMS streams

Unmapped Stream Coverage

FEMA also reviewed the current stream coverage and reviewed the areas against the National Hydrography Dataset (NHD). The NHD medium-resolution data inventoried by the USGS maps created at a 1:100,000 scale was used to review the watercourses within the Bayou Macon watershed. Population centers of 1,000 or more were reviewed for additional mileage against the high-resolution data inventoried by the USGS Quadrangle maps created at a 1:24,000 scale. CNMS was completed as part of the BLE project in August 2020 and was updated as part of the Discovery process. The intent of this review was to identify streams and watercourses and create a complete stream network for preparing BLE data.

Phase Zero – Base Level Engineering (BLE) – Bayou Macon Watershed (2020)

In 2020, FEMA began investing in BLE data development for the Bayou Macon watershed in Louisiana and Arkansas. This 2D approach prepared multi-profile hydrologic (how much water) and hydraulic (how is water conveyed in existing drainage) data for a large stream network or river basin to generate floodplain and other flood risk information for the basin area. BLE utilized a gridded surface and precipitation model in conjunction with breaklines at significant hydraulic features and structures (streams, roads, dams, etc.) to develop a pluvial and fluvial flooding model that is calibrated to reflect data collected with USGS stream gages. The BLE project was published in August 2020 as MIP case number 20-06-0045S for Bayou Macon watershed. The BLE report is included in Appendix III.

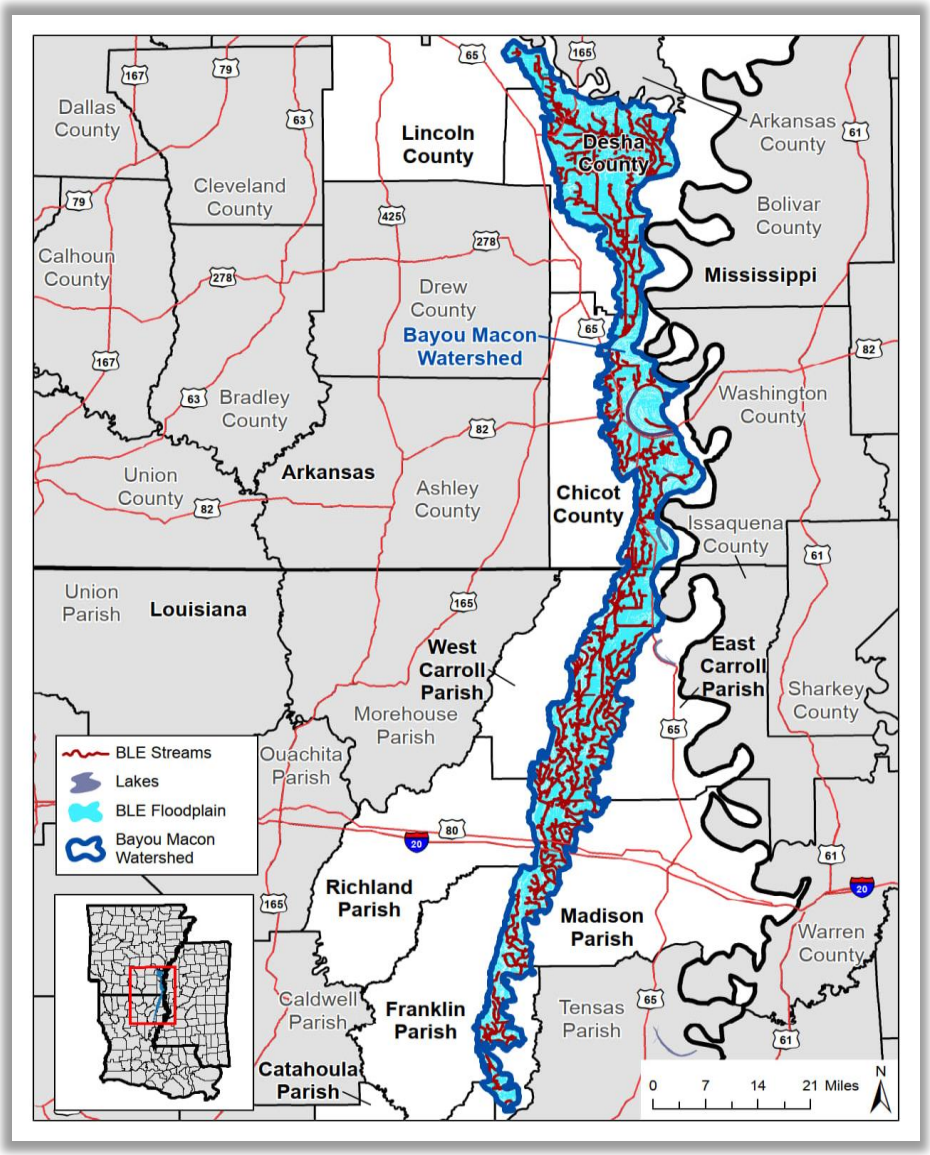


Figure 7: Overview of BLE streams and BLE floodplain

BLE provides an opportunity for FEMA to produce and provide non-regulatory flood risk information for a large watershed area in a much shorter time. The data prepared through BLE provided planning-level data that is prepared to meet FEMA's Standards for Floodplain Mapping. BLE is scalable and can be updated for use as regulatory and non-regulatory products. Communities can choose to adopt the BLE as approximate, model-backed mapping in locations without model-backed Zone A mapping. Detailed studies can add structures to the BLE modeling for further refinement into Limited Detail studies or Detailed studies with or without floodway. Figure 7 shows the network of streams analyzed using the BLE approach. The results of this BLE study have been incorporated into the Discovery process to support the engagement and communication activities that take place during the Discovery phase.

FEMA Base Level Engineering (BLE) Deliverables

The BLE provided the following items for use in the Bayou Macon watershed:

- Hydrologic modeling (regression) flow values for the 10%, 4%, 2%, 1%, 1%+ and 0.2%, and 1%- frequencies
- Hydraulic (HEC-RAS) modeling for all study streams (for the same frequencies listed above)
- 10-, 1-, and 0.2-percent-annual-chance floodplain boundaries
- 1- and 0.2-percent-annual-chance Water Surface Elevation Grids
- 1- and 0.2-percent-annual-chance Flood Depth Grids
- HAZUS flood analysis for the watershed
- Point file indicating the location of culverts and inline structures that may be informed by local as-built information
- Flood Risk Map (See Appendix I)

The BLE information is available on FEMA's Estimated BFE viewer for communities to use for planning, risk communication, floodplain management and permitting activities.

CNMS Validation and Assessment

Per the Bayou Macon BLE Report, "[as] described in Title 42 of the Code of Federal Regulations, Chapter III, Section 4101(e), once every five years, FEMA must evaluate whether the information on Flood Insurance Rate Maps (FIRMs) reflects the current risks in flood prone areas. FEMA makes this determination of flood hazard data validity by examining flood study attributes and change characteristics, as specified in the Validation Checklist of the Coordinated Needs Management Strategy (CNMS) Technical Reference. The CNMS Validation Checklist provides a series of critical and secondary checks to determine the validity of flood hazard areas studied by detailed methods (e.g., Zone AE, AH, or AO)."

The Regional CNMS database, National Flood Hazard Layer, and paper inventory were used as reference data to ensure extent of the BLE results represents appropriate flooding extent. The BLE CNMS database was revised for the study watershed during Discovery and the report tables are available in Appendix I.

Phase One – Discovery: Bayou Macon Watershed

The LADOTD-led Discovery project focused on the "Discovery" of flood hazards and risks throughout the Bayou Macon watershed. Through the Discovery process, flood risks are identified and local communities have an opportunity to collaborate with the State CTP to identify specific regions within the watershed that may benefit from future FEMA funded studies and assessments. Discovery initiates open lines of communication and relies on local involvement for productive discussions about flood risk. The process provides a forum for a watershed-wide effort to understand the interrelationships between upstream and downstream community flood risk throughout the watershed. At the conclusion of the Discovery process, the identified needs of the watershed will be considered for future investment in the Risk MAP process.

The Bayou Macon watershed Discovery project was completed through the following activities:

- Data Gathering
- Pre-Discovery Engagement Efforts
- Discovery Meeting
- Watershed Findings and Prioritizations

All possible efforts were made to ensure that stakeholders understood Discovery and the Risk MAP process through emails, phone calls, newsletters, and a developed website created for this Discovery project.

Data Gathering

Federal and state databases were downloaded and reviewed during the Pre-Discovery phase to highlight areas of concern where additional information from stakeholders would be most beneficial to fully understand the flood risk and damages in the area. Dams, levees, soils classification, recent developments, various population metrics, collections of high-water marks and low water crossings, historical flooding information, and more were reviewed to best prepare for in-depth conversations surrounding local action and impact. Additionally, the BLE water surface elevation rasters were compared to the effective flood extents and base flood elevations to check for any differences that might have been the result of changes in terrain or modeling considerations used in the non-regulatory model development. The final BLE Report is available in Appendix III. Table 4 summarizes the geospatial data collected.

Table 4: Geospatial Data Collection

Data Type	Data Source	Data Description
HUC Watershed Boundaries	USGS	HUC boundary for the Bayou Macon HUC-8. Also includes HUC-10 and HUC-12.
Roadways	US Census Bureau	2021 TIGER Line Roads
Jurisdictional Boundaries - Louisiana	LADOTD	Data includes city and parish boundaries
Jurisdictional Boundaries - Arkansas	Arkansas GIS Office (AGO)	Data includes city and county boundaries
Current Effective Floodplain Information	FEMA DFIRMs	Data includes Floodplains, BFEs, and Cross Sections
Stream Lines	FEMA DFIRMs	Stream Centerlines and Profile Baselines from DFIRM
BLE Floodplains and Stream	FEMA	Base Level Engineering Study for the Bayou Macon Watershed
Locations of Letters of Map Revision (LOMRs)	FEMA	LOMRs incorporated into Effective DFIRM databases and LOMRs filed after Effective DFIRM dates for watershed parishes and counties
Coordinated Needs Management Strategy	FEMA	CNMS database dated December 31, 2021
Topography - Louisiana	LADOTD	2007 & 2008 Statewide LiDAR
Topography - Arkansas	NRCS	2016 NRCS Ouachita LiDAR
HAZUS-based Loss Estimates	FEMA	HAZUS 5.0 (2021) building exposure and flood lost estimates per Census Tract
Location of Dams	National Inventory of Dams	Dam locations with Emergency Action Plan (EAP) status
Stream Gauges	USGS	Stream Gauge locations
Flood Claims	FEMA NFIP	Total number and value of claims by community for Louisiana
Land Cover	USGS	National Land Cover Dataset for 2011 and 2019
Land Use	USGS	Derived from National Land Cover Dataset 2019
Population	US Census Bureau	2020 U.S. Census
Population Growth	US Census Bureau	Calculated change between the 2010 and 2020 U.S. Census
U.S. Congressional Districts - Louisiana	LADOTD	Congressional District Boundaries
State House & Senate Districts - Louisiana	LADOTD	State House and Senate District Boundaries
U.S. Congressional Districts - Arkansas	AGO	Congressional District Boundaries
State House & Senate Districts - Arkansas	AGO	State House and Senate District Boundaries
National Risk Index	FEMA	NRI Rating data at the census tract level

The Discovery engagement process also included the development of a user-friendly website for data collection, verification, and coordination. The website was developed to become a repository to collect project information such as community background data; newsletters; planned meeting dates, times, and locations; project data deliverables; and reports. Figure 8 and Figure 9 show the website splash screen and progress tracking page, respectively.

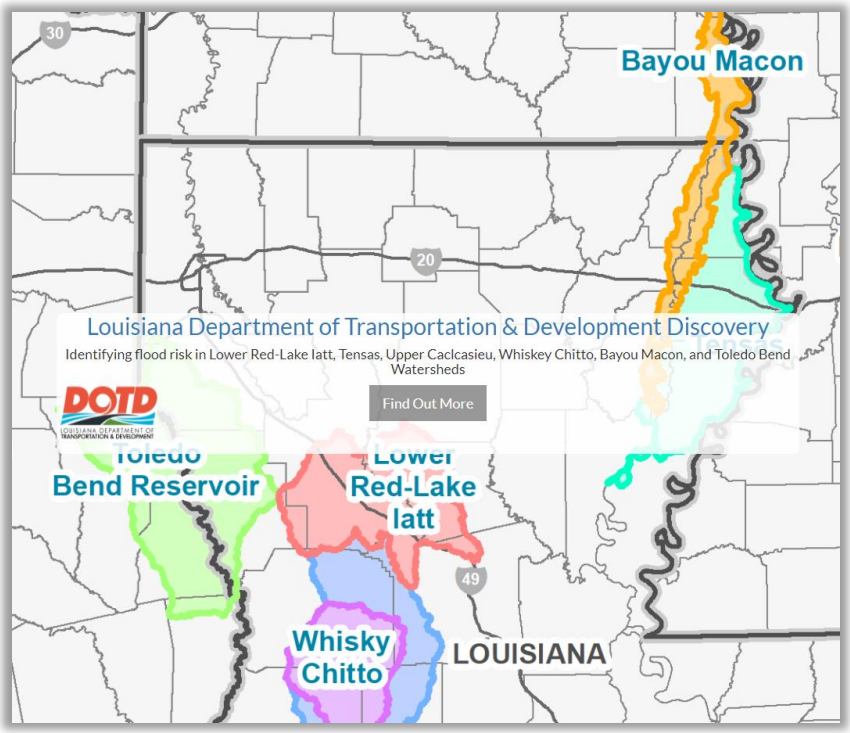


Figure 8: Website Splash Screen

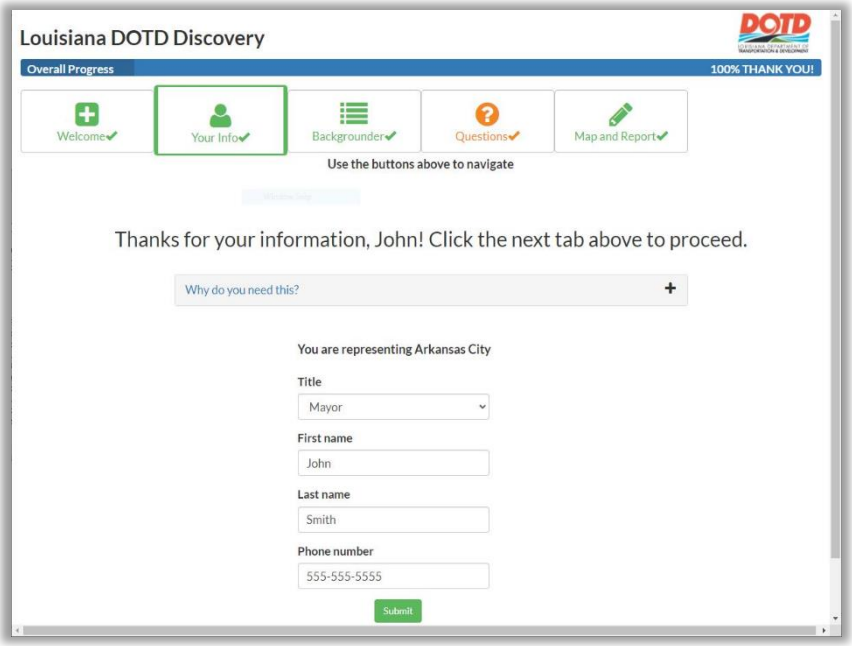


Figure 9: Website Progress Tracking Page

For the FEMA LADOTD Discovery project, the Discovery website allowed participating stakeholders to view basemap layers pertinent to the study area, including BLE rasters and polygons, effective FIRM layers, and satellite and street view imagery. Users were then able to update flood-related information about their community, including local flood risks, flood hazards, mitigation plans, mitigation activities, flooding history, development plans, and floodplain management activities. It also allowed stakeholders to input Areas of Mitigation Interest (AOMI) such as mitigation concerns, mapping needs, and requests on a web map. The website tracked community participation and helped accelerate the Discovery process by creating easy-to-use GIS shapefiles with attribute tables relevant to flood sources and community comments. Figure 10 shows the webmap interface.

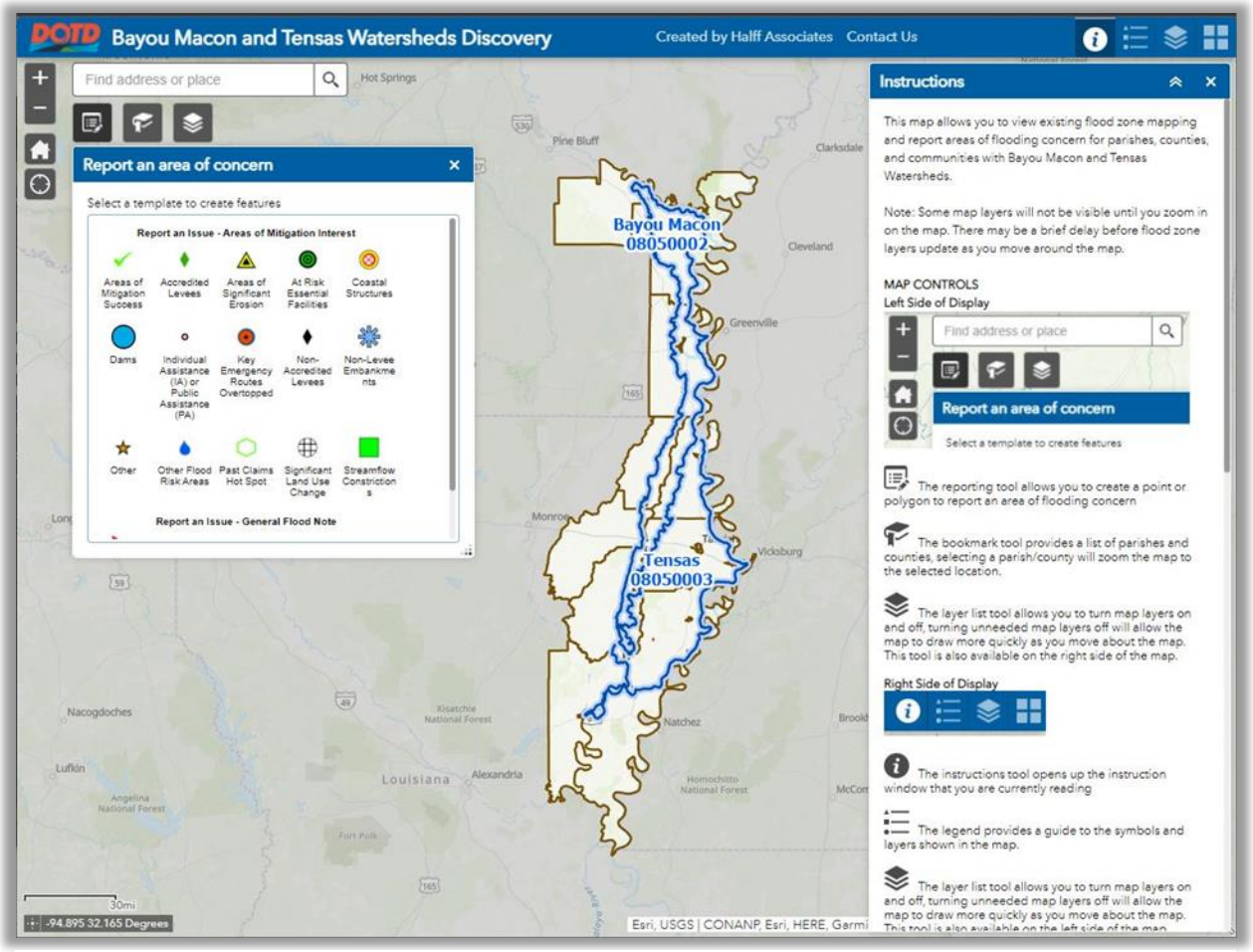


Figure 10: Webmap Interface

Pre-Discovery Engagement Efforts

A Discovery flyer was emailed out to the communities on file two weeks prior to the Pre-Discovery Meeting. A Discovery newsletter was also developed and distributed to all stakeholders to gain public awareness of the Bayou Macon Discovery process. The newsletter contained information about FEMA's Risk MAP program, the Discovery process, details of the upcoming Pre-Discovery Meeting, the data collection process, and the Risk MAP process beyond Discovery. A copy of the flyer and the newsletter is included in Appendix I.

LADOTD held a virtual informational Pre-Discovery Meeting on January 19, 2022, for stakeholders in the study watershed. A copy of the presentation is available in Appendix I. The Pre-Discovery informational meeting was held to increase awareness of the Discovery process prior to the Discovery Meeting so the stakeholders would be prepared to fully participate in the Discovery process. Seven stakeholders participated in the meeting. The goals of the Pre-Discovery Meeting were to:

- Explain the Discovery process
- Explain why the LADOTD was conducting Discovery in the Bayou Macon watershed
- Explain FEMA's Risk MAP program and benefits
- Introduce the website with a tutorial and open website enrollment
- Obtain information for Discovery in the watershed

Discovery Meeting

An in-person Discovery Meeting was held in the watershed with the goals of gathering additional flood risk data; discussing the communities' flooding history, development plans, flood mapping needs, and flood risk concerns; and discussing the vision for the watershed's future and the importance of mitigation planning and community outreach. The Discovery Meeting occurred on March 15, 2022, from 12:00 pm - 4:00 pm at the West Carroll Parish Library in Oak Grove, Louisiana. Additionally, an in-person Discovery Meeting was held in the Tensas watershed on March 16, 2022, from 12:00 pm - 4:00 pm at the Tallulah City Hall in Tallulah, Louisiana. Local stakeholders were invited to join for either meeting to offer flexibility in schedules and ideally collect more data.

Community stakeholders were able to participate in the meeting when most convenient to them. Discovery Ambassadors assisted stakeholder attendees through various stations in a "come and go" format. The stations included:

- *Laptops* – stakeholders were able to review, edit, or add information entered on the Discovery website.
- *Discovery Maps* – data collection process to capture information on identifying flood risk locations and problems, areas of growth or planned development, answering floodplain questions, and identifying map need locations.

Following the Discovery Meeting, stakeholders were contacted through email and phone calls to discuss their concerns and comments in detail. Often, in-person meetings were scheduled to offer a more in-depth webmap training and fuller conversations surrounding the identified areas of mitigation interest. Through these efforts, 100% community participation and representation were achieved via either phone/email coordination, in person meetings, or webmap usage.

The Bayou Macon Discovery project gathered 38 comments from the Discovery Meeting, from phone calls, and from the online webmap. Of these 38 comments, no new mapping requests were made.

Watershed Findings and Prioritizations

Watershed Findings

Following the Discovery Meeting, the gathered community comments were placed into categories by comment type and summarized by parish, as shown in Table 5.

Table 5: Bayou Macon Comment Distribution by Parish

Parish Names	Stakeholder Comments						Total Number of Comments
	Areas of Mitigation Success	Past Claim Hot Spot	Areas of Significant Erosion	Streamflow Constrictions	Flooding Hot Spot	Other (As Reported)	
Catahoula	No Comments Received						0
Franklin	5	4		1		"1. Individual Assisstance(IA) or Public Assistance (PA) 2. Flood River Pump - insufficient pump capacity, partially disabled, discharged too small"	12
Madison	2						2
Richland	No Comments Received						0
West Carroll		1	8		11	1. Why is this watershed not under study? When do we expect BLE data 2. Highpoint, everything east of 585 goes to Colewa (this is causing the flooding in farmland) 3. Talked about USACE and a flood gauge and how it contributes to about 70% of drainage for the parish 4. Two pumps not always operational. Colewa. Supposed to be a dam to keep tiger. River was so high; Tiger bayou stand still. All the green, Colewa- Floods farmlands. Corps of Engineers won't let any clearing occur. Catahoula Parish Police Jury asking: Levee around Jonesville, Corps says levee is accredited, NFIP does not	24

*Some comments were general to watershed naming, do not provide flooding or pertinent information, or are conversations had and are not represented in this table.

Figure 11 shows a sample of the comments submitted by communities. There were 11 comments about flooding hotspots. There were eight comments about areas with significant erosion, whether it was merely stream erosion or also structures impacted by erosion. There were seven comments related to areas of mitigation success. There were five comments related to past claim hot spots. Additionally, there was one comment about streamflow constrictions. All stakeholder comments were submitted to FEMA in the digital supplemental data deliverable associated with this project.

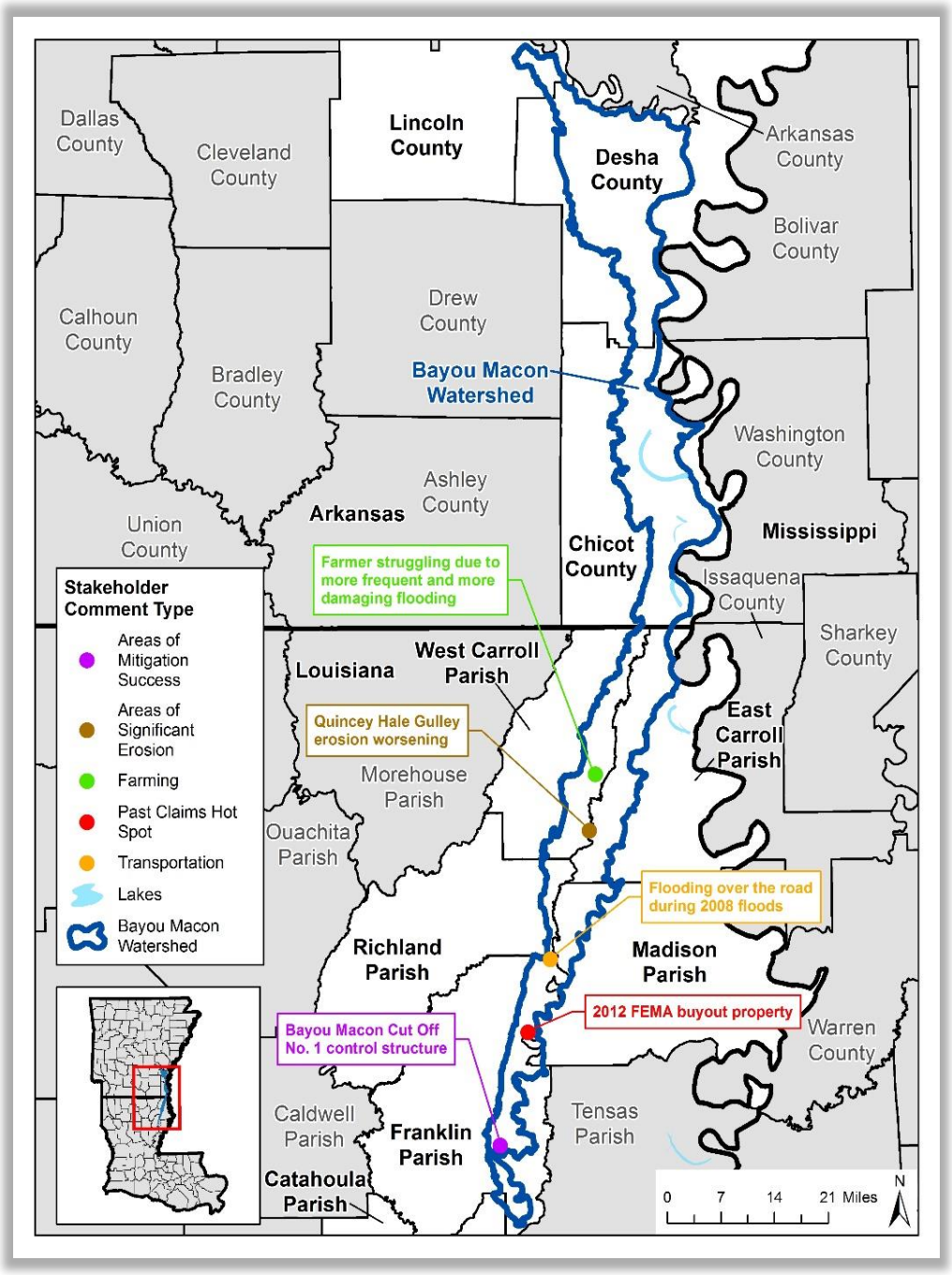


Figure 11: Stakeholder Comment Examples

Figure 12 demonstrates the differences in numbers per comment type. Thirty-seven comments were submitted for flood related concerns, such as roads overtopping during storm events or areas of significant erosion with no mitigation plans in place. Mapping concerns include one comment related to needs for updated mapping, such as older effective maps which do not match the current drainage patterns. There were seven areas of successful mitigation areas reported. No new or completed mitigation actions were reported.

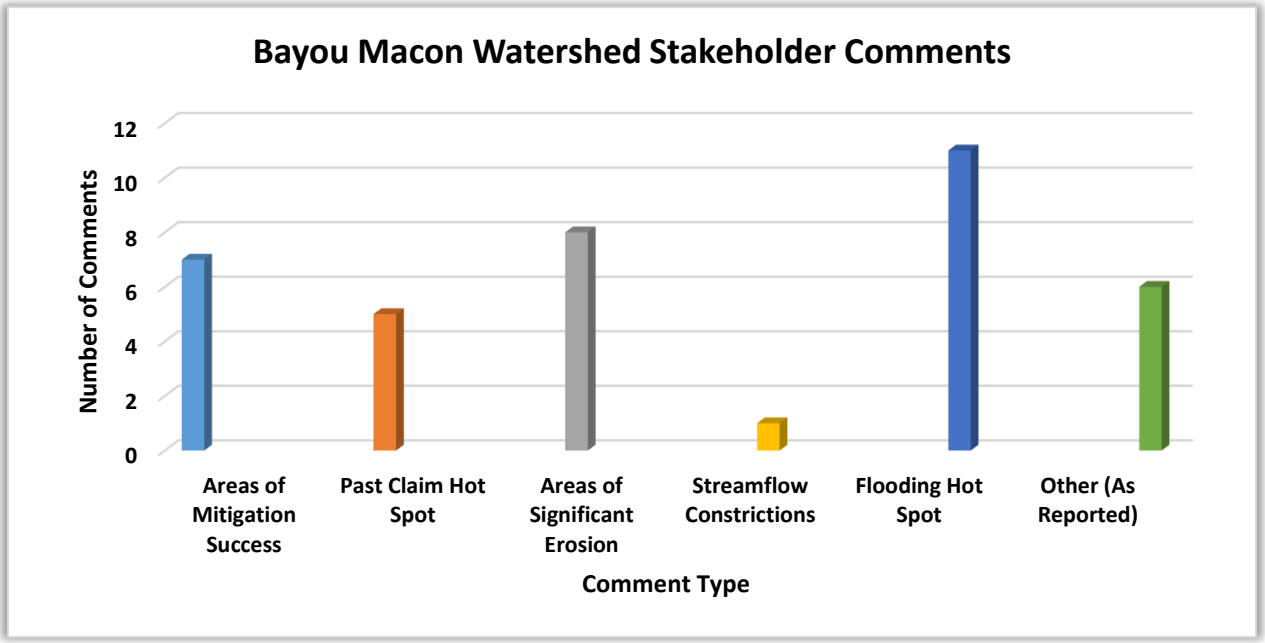


Figure 12: Stakeholder Comment Totals

Project Selection and Prioritization

Because of the presence of approximately 590 unverified CNMS stream miles in either Zone A or AE in the rural communities of this HUC-8 watershed, it is recommended that mapping updates be performed at a parish-wide level, rather than at the level of the individual flooding sources. This recommended approach to mapping updates would bring the number of modernized parishes from four to six (Catahoula Parish and East Carroll Parishes are not yet modernized). Table 6 gives a more in-depth review of the parish CNMS data for all six parishes that intersect the Bayou Macon watershed.

Table 6: CNMS Data by Parish

CNMS Data by Parish							
Parish	Total Area (mi^2)	Oldest Effective FIRM Date	Total Stream Miles	Total Streams Unverified			Percent Unverified by Mileage
				Zone	Count	Miles	
Catahoula	739	4/5/1988	760	A	63	117	25%
				AE	12	73	
East Carroll	442	10/16/1979	680	A	706	373	55%
				AE	-	-	
Franklin	635	9/2/2011	922	A	71	115	12%
				AE	1	< 1	
Madison	651	6/19/2012	767	A	386	336	47%
				AE	4	23	
Richland	565	9/18/2013	936	A	252	604	68%
				AE	8	30	
West Carroll	359	10/5/2018	695	A	114	112	16%
				AE	-	-	

Using the age of the oldest effective FIRM in the parish in conjunction with the percentage of unverified CNMS stream mileage, these parishes' needs for FIRM updates were prioritized from a low to moderate to high ranking with East Carroll Parish rated as the highest priority. In addition to the CNMS data listed above, additional information such as partial update coverage and dates, DFIRM status, and stakeholder comments and requests were considered for this ranking. The outcome of this exercise can be seen in Table 7.

Table 7: Mapping Needs Prioritization by Parish

Mapping Needs Prioritization by Parish		
Parish	Priority	Reason
East Carroll	Highest	More than 55% of the stream miles are unverified, and the oldest effective date exceeds the last 40 years. No DFIRM.
Richland	High	More than 65% of the stream miles are unverified, but the oldest effective date is within the last 10 years. DFIRM available.
Catahoula	Moderate	25% of the stream miles are unverified, and the oldest effective date exceeds the last 30 years. No DFIRM.
Madison	Moderate	More than 40% of the stream miles are unverified, but the oldest effective date is within the last 15 years. DFIRM available.
Franklin	Low	Less than 20% of the stream miles are unverified, and the oldest effective date is within the last 15 years. DFIRM available.
West Carroll	Low	Less than 20% of the stream miles are unverified, and the oldest effective date is within the last 5 years. DFIRM available.

Franklin and West Carroll Parishes received a “Low” ranking due to relatively new FIRM data, DFIRM availability, and a lower percentage of unverified stream miles. A total of 12 general mapping comments from stakeholders in Franklin Parish and 24 general mapping comments in West Carroll Parish show the community’s desire for erosion control measures and farmland flooding to be addressed are of highest concern. Available data for these mitigation measures has been recently updated as most panels (43 of 48) were updated 10/5/2018 for Franklin Parish and in 2018, West Carroll Parish updated parish-wide which gives this data an even more recent average FIRM date. Catahoula and Madison Parishes received a “Moderate” ranking though for different reasons. Catahoula Parish has just over 25% of its stream miles classified as unverified, but their data is much older than Franklin Parish which elevated their priority ranking. Catahoula Parish did receive a partial update in 2000 and 2005 and was the only parish that received comments on levee accreditation and insufficient pump capacity. Madison Parish has had much more recent DFIRM updates, but there is still some concern for stream accuracy with over 40% of the CNMS stream miles being unverified. Richland Parish raises similar concerns to Madison Parish given that updates were made within a similar timeframe, but this area receives a higher ranking due to the over 60% CNMS stream miles that remain unverified. Still, East Carroll Parish ranks as the top selection for updates given the substantial unverified stream miles and additional years since the oldest FIRM in the parish. A heatmap outlining the parishes’ ranks and unverified CNMS Zone A and AE streams can be seen in Figure 13.

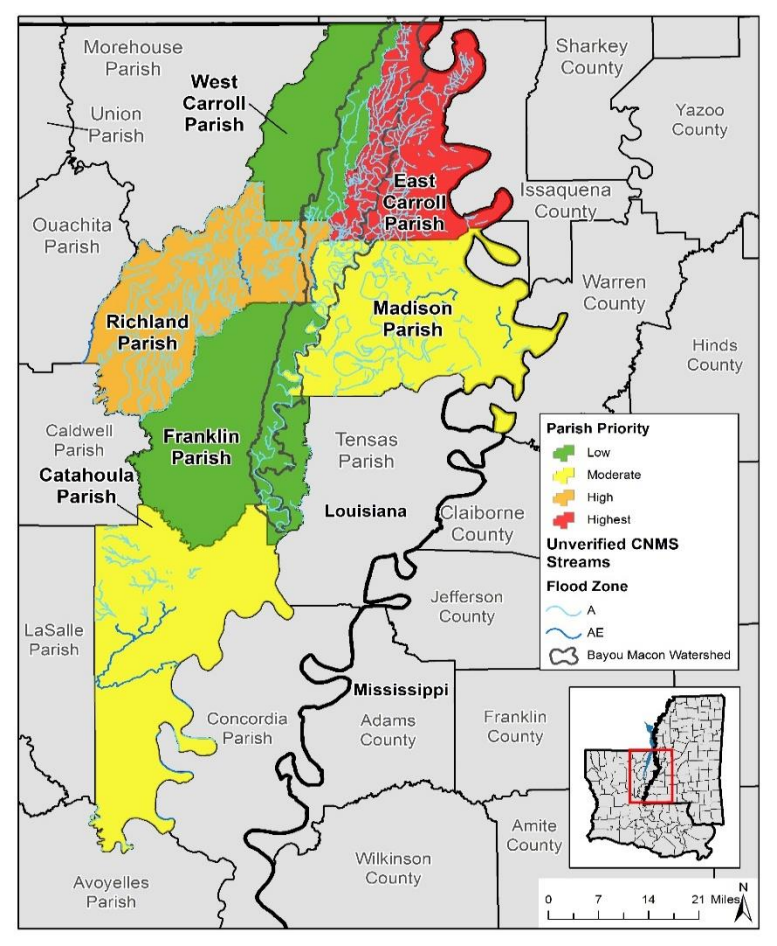


Figure 13: Parish Prioritization with Unverified CNMS Zone A and AE Streams

When considering these projects, effort and cost associated with that effort must be weighed. The bulk of stream miles in need of update for all six of these parishes fall under Zone A. Given the BLE availability and recent practices of adopting BLE for FIRM map creation, it is expected that these miles will incur a reduced cost from previous Zone A modeling and mapping tasks. Catahoula, Franklin, Madison, and Richland Parishes do have unverified Zone AE streams as well. These will require enhancement of the BLE models with structure survey and further refinement before being used for any FIRM production. The additional confidence in the BLE results after refinement and updated survey data in the AE flood zones will provide communities with better models for mitigation considerations such as channel widening or hardening, pump resizing, and other approaches that might be considered to address the concerns given through the Discovery process. This parish-wide mapping approach will maximize the value received from the improved models and mapping updates.

Data availability for enhancement and limiting factors, such as lack of levee accreditation, must also be weighed when considering parishes for updates and modernization. For parishes with non-accredited levee systems, further discussions on the status and schedule of accreditation should happen before the investment in the enhancement of BLE. Table 8 and Table 9 below outline the data availability and limitations as described.

*Table 8: Parish Levee Accreditation Status**

Parish	Modernized	Levee Accreditation	
		Levee	Accreditation
Catahoula	N	Jonesville Local Protection Larto-Jonesvilla LA Louisiana Delta Plantation Red River BW LA Sicily Island LA	Accredited Accredited Non-Accredited Accredited Accredited
East Carroll	N	AR-LA MS River Wilson Point System	Provisionally Accredited Non-Accredited
Franklin	Y	Sicily Island	Accredited
Madison	Y	AR-LA MS River MS East	Provisionally Accredited Accredited
Richland	Y	-	-
West Carroll	Y	-	-

*Includes all levees in the parishes affected by the watershed

Table 9: Parish BLE Status

Parish	Additional Intersecting BLE Models		
	Watershed Name	Status	Level of Study
Catahoula	Boeuf	In progress	-
	Little	Published	2D
	Tensas	Published	2D
	Black	Published	2D
	Lower Red	Published	2D
	Lower Ouachita	Published	2D
East Carroll	Tensas	Published	2D
Franklin	Boeuf	In progress	-
	Tensas	Published	2D
Madison	Tensas	Published	2D
Richland	Boeuf	In progress	-
West Carroll	Boeuf	In progress	-

Flood Risk Assessments Results

HAZUS is a risk assessment software program for analyzing potential losses in dollars from floods, hurricane winds, and earthquakes. The BLE flood data developed for this project was used as input data for the HAZUS-based flood risk assessment. The Bayou Macon watershed has an estimated $1.7 billion dollars worth of vulnerable assets, including residential, commercial, and other asset types. If a 100-year storm event were to occur throughout the watershed, HAZUS estimated nearly three percent of the assets will be damaged, with losses estimated at nearly $47 million dollars to physical assets. There will also be economic losses, including lost wages, inventory losses, losses in production, and economic opportunity losses, valued at over $61 million dollars. Figure 14 and Figure 15 show the capital stock inventory within the study watershed and the corresponding 100-year event losses. Figure 11 in Appendix I shows a more detailed potential loss risk map for the watershed.

Because the parishes in the Bayou Macon watershed have land in other watersheds, these HAZUS-based 100-year flood loss estimates are not indicative of their total potential loss estimates. Hence, the losses shown in this report do not necessarily represent community-wide totals.

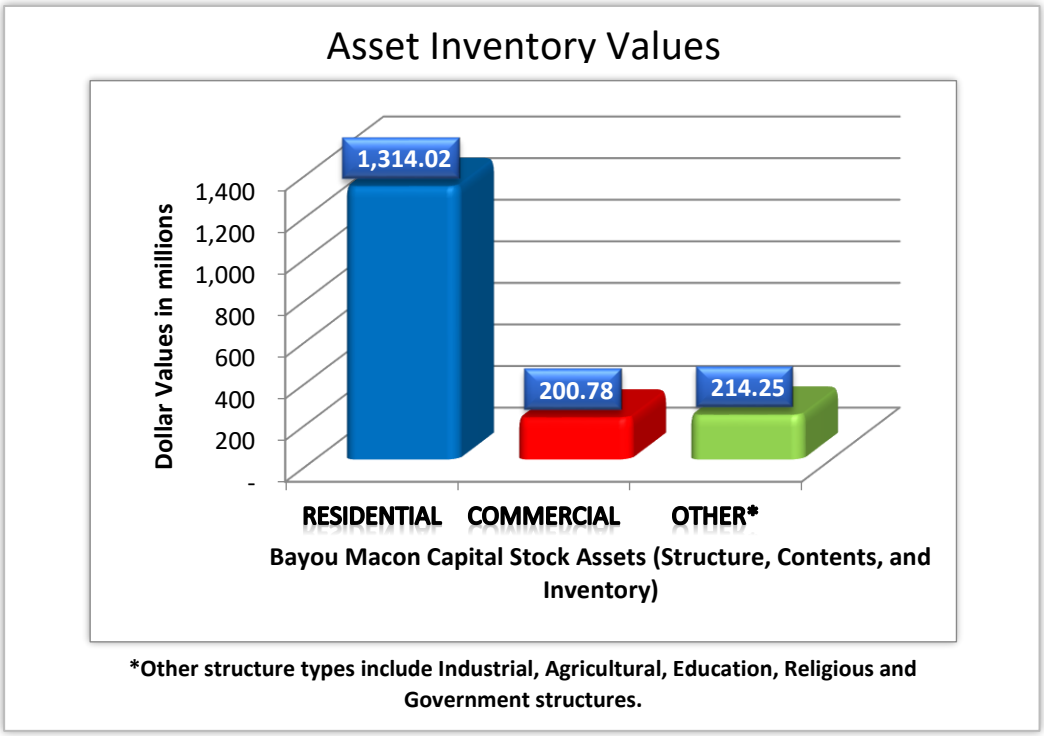


Figure 14: Asset Inventory Value Totals

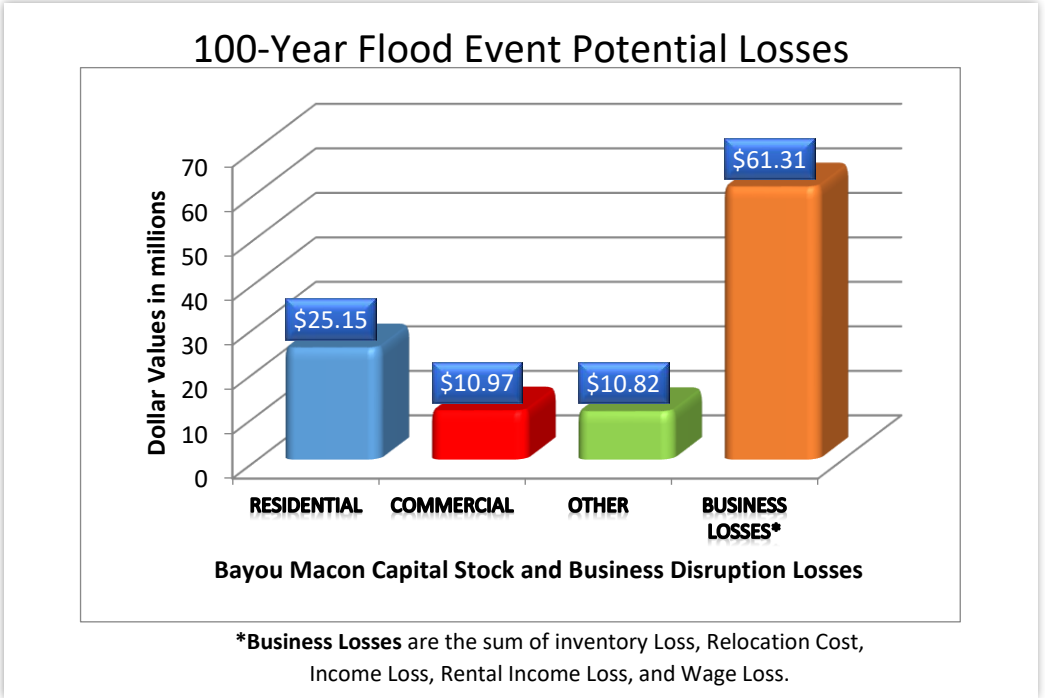


Figure 15: 100-Year Flood Event Potential Loss Totals

Aggregating the HAZUS-based 100-year flood loss estimates to parishes provides another method to prioritize new studies and hazard mitigation projects in the watershed. Figure 16 ranks the HUC-12s by estimated flood losses. Most of the watershed is at risk for $1 million dollars to $30 million dollars in potential loss if there is a 100-year flood event. The southernmost tip of the watershed, located in Franklin Parish, risks $800,000 dollars to $1 million dollars in potential losses based on the 100-year flood loss estimates.

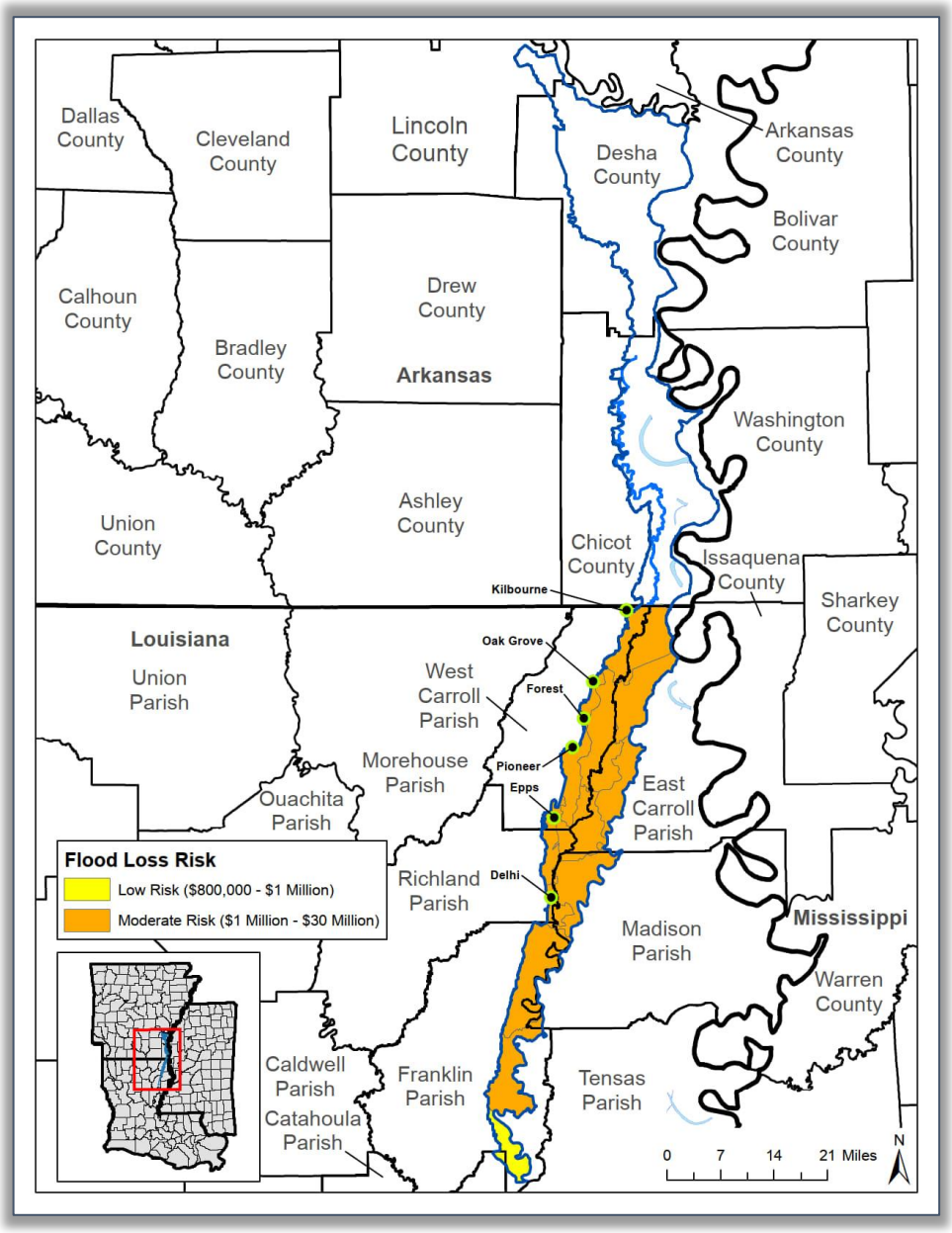


Figure 16: HAZUS-based 1% Annual Chance Loss Estimates by HUC-12s

Project Recommendations

Based on the needs of the communities, the availability of the data, and the current FEMA investment process, the proposed projects were prioritized for FEMA investment based on the following criteria.

First, non-digital parishes with no levees are recommended as primary considerations for immediate investment. The projects would enhance the BLE data in areas with effective Zone AE streams and advance BLE data to FIRMs. The next tier is the non-digital parishes with Accredited levees. These projects would enhance and advance BLE while incorporating the results of the levee accreditation. The next tier is the non-digital parishes with non-accredited levees. These projects require additional coordination with the levee owners to determine accreditation status and schedule before BLE enhancement and advancement can occur. The readiness of the community to provide support can also be considered in the project prioritization.

From the outlined criteria for consideration and available data for reference, the following projects are recommended.

- **East Carroll Parish Regulatory Update –** East Carroll Parish is non-digital with 472 miles of a combination of model-backed and non-model-backed effective Zone A. The study would leverage the Bayou Macon and Tensas BLE data to modernize the parish FIRMs. Prior to funding the study, the levee accreditation status of the AR-LA MS River system and the Wilson Point System would be confirmed. If there are any proposed changes to the accreditation status, then the levee information would be confirmed prior to initiating the regulatory process. The Parish Social Vulnerability Index Score is 0.9176.
- **Catahoula Parish BLE Enhancement and Regulatory Update** – Catahoula Parish is non-digital with 153 miles of a combination of model-backed and non-model-backed effective Zone A and 356 miles of Zone AE. The study would leverage the seven BLE datasets and enhance the 356 miles through the effective Zone AE. The enhanced data would be combined with the BLE data to update the parish regulatory data. Prior to funding the study, the levee accreditation status of the five systems would be confirmed. If there are any proposed changes to the accreditation status, then the levee information would be confirmed prior to initiating the regulatory process. The Parish Social Vulnerability Index Score is 0.7909.
- **Richland Parish Partial BLE Enhancement and Regulatory Update** – Richland Parish FIRMs are digital and were updated in 2013. There are 630 miles of a combination of model-backed and non-model-backed Zone A and 71 miles of Zone AE. The study would leverage the Boeuf and Bayou Macon BLE datasets and enhance the 7 miles through the effective Zone AE. The enhanced data would be combined with the BLE data to update the parish regulatory data. The Parish Social Vulnerability Index Score is 0.888.
- **West Carroll Parish Partial Regulatory Update** – West Carroll Parish FIRMs are digital and were updated in 2018. There are 390 miles of a combination of model-backed and non-model backed Zone A and 14 miles of Zone AE. The study would leverage the Boeuf and Bayou Macon BLE datasets and partially update the regulatory Zone A data. The Parish Social Vulnerability Index Score is 0.888.
- **Madison Parish BLE Enhancement and Regulatory Update** - Madison Parish FIRMs are digital and were updated in 2012 but no new engineering analysis was performed. There are 544 miles of a combination of model-backed and non-model backed Zone A and 79 miles of Zone AE. The study would leverage the Bayou Macon and Tensas BLE datasets and enhance the 79 miles through the effective Zone AE. The enhanced data would be combined with the BLE data to update the parish regulatory data. Prior to funding the study, the levee accreditation status of the two systems would be confirmed. If there are any proposed changes to the accreditation status, then the levee information would be confirmed prior to initiating the regulatory process. The Parish Social Vulnerability Index Score is 0.9959.

- **Franklin Parish Partial BLE Enhancement and Regulatory Update** – Franklin Parish FIRMs are digital and were updated in 2011 and 2018. There are 434 miles of a combination of model-backed and non-model-backed Zone A and 71 miles of Zone AE. The engineering data was updated in 2011 and 2014 using 1D modeling techniques. The BLE mapping data indicate that a 2D analysis of the area is more appropriate for portions of the watershed geography. The project would identify areas where the BLE can be enhanced and moved through the regulatory process. Prior to funding the study, the levee accreditation status of the Sicily Island levee system would be confirmed. If there are any proposed changes to the accreditation status, then the levee information would be confirmed prior to initiating the regulatory process. The Parish Social Vulnerability Index Score is 0.8609.

Follow-Up On Phase Project Decisions

The BLE results and the effective DFIRM floodplains were compared to identify any areas of significant change. If the results show large areas of change (expansions and contractions of the floodplain, increases and decreases of the computed BFEs, and increases in expected flow values) FEMA will continue to coordinate with the communities to identify the streams that should be considered for FIRM updates. These updates could be Letter of Map Revisions for small project areas, or a Physical Map Revision for large areas with mapping changes.

To identify other streams for future refinement, community growth patterns and potential growth corridors should be discussed with FEMA. These areas of expected community growth and development may benefit from updated flood hazard information. BLE can be further refined to provide detailed study information for a Flood Risk Identification Study and a FIRM update.

Areas of communities that were developed prior to 1970 (pre-FIRM areas) may include repetitive and severe repetitive loss properties. They may also be areas where re-development is likely to occur. Having updated flood hazard information before re-development and reconstruction activities take place may benefit communities by providing guidance to mitigate future risk.



The Discovery process aims to identify a subset of the BLE stream studies to be updated and included on the FIRMs. Communities may wish to review these possible areas and provide feedback once the BLE data has been received. Local communities can also refine BLE information and submit it through the Letter of Map Revision (LOMR) process to revise the existing flood hazard information and maintain the FIRMs throughout their community.

Post-Discovery Findings Meeting

LADOTD held one virtual Post-Discovery Meeting on March 14, 2023, for stakeholders in the watershed. A copy of the presentation is available in Appendix I.

The Post-Discovery informational webinar was held to discuss the results of the Discovery process and findings, including a review of comments received, preliminary HAZUS results, and BLE data. The FEMA Estimated BFE viewer, which can be used for reporting and downloading data, was presented and demonstrated to community stakeholders. The goals of the Post-Discovery Meeting were to:

- Recap FEMA's Risk MAP program's benefits and the Discovery process
- Discuss comments received by stakeholders
- Explain watershed prioritization and stream study requests
- Review HAZUS results
- Demonstrate the permanent FEMA BFE viewer
- Release a draft report to the communities prior to the release of the final report

Future Investments Decisions

FEMA will work closely with communities to identify additional areas for model refinement and FIRM panel updates. Communities will be provided information and training to support the use of BLE for planning, floodplain management, permitting, and risk communication activities. FEMA will work with communities to review, interpret, and incorporate the BLE information into their daily and future community management and planning activities.

Next Steps

Once the Discovery process is completed, FEMA will review project recommendations and determine if a project will move forward to update the regulatory products (FIS report, FIRM, and DFIRM database). A cursory review of the modeling results indicates that this study area has significant changes in floodplain width and depth.

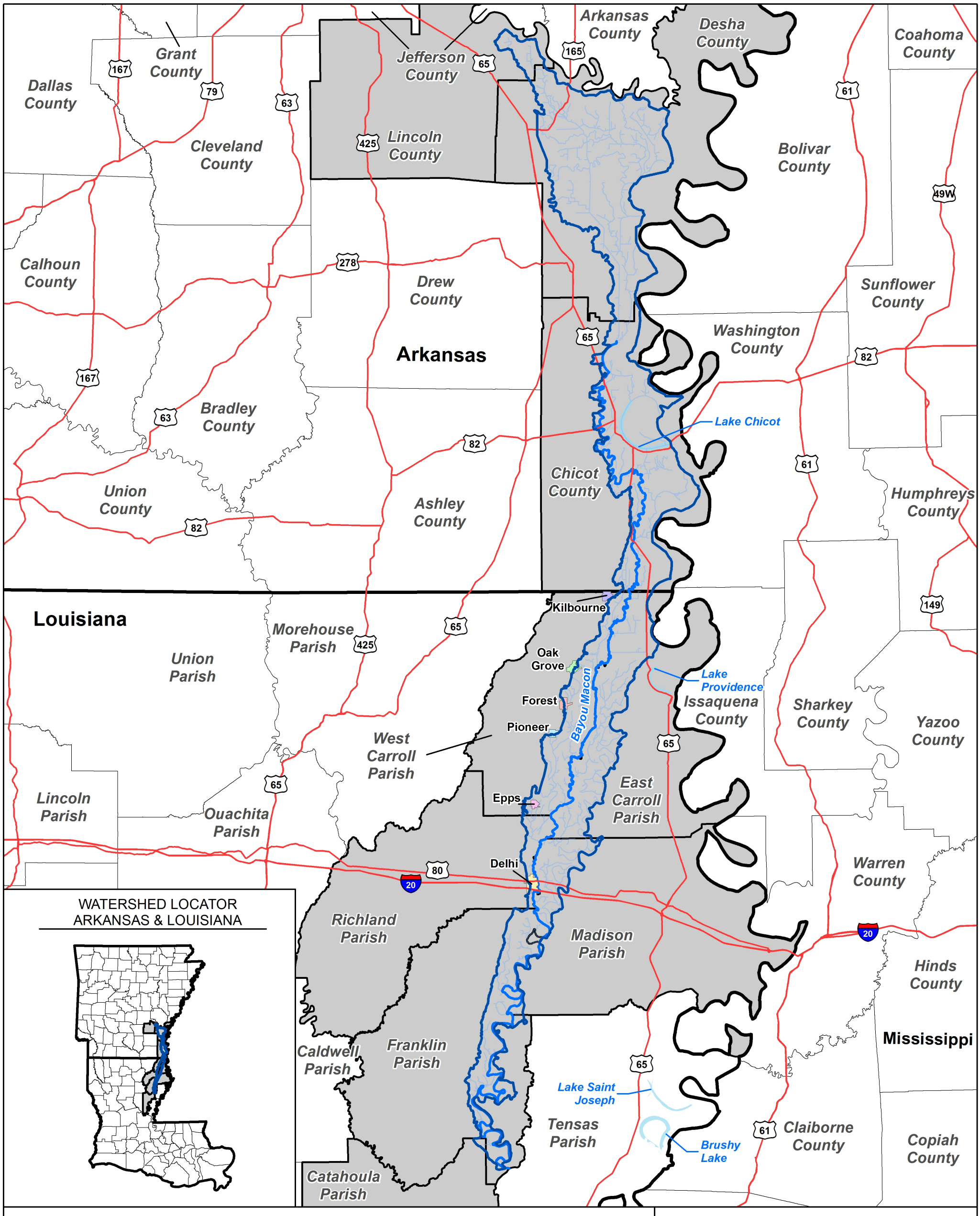


FEMA will work with communities to collect any outstanding technical inquiries within the study area after delivering the hydrologic and hydraulic analysis and floodplain work maps. After coordinating with communities, FEMA will likely initiate the Phase Three effort to update the regulatory products.

Appendix I: Additional Data

Appendix Figures

Figure 01: Watershed (HUC-8) Location
Figure 02: U.S. Congressional Districts
Figure 03: Arkansas & Louisiana State House Districts
Figure 04: Arkansas & Louisiana State Senate Districts
Figure 05: Population Density
Figure 06: Land Cover
Figure 07: Population Change
Figure 08: Effective Floodplains
Figure 09: Topographic Data Source
Figure 10: NFIP Flood Losses
Figure 11: Flood Risk – Potential Losses
Figure 12: Social Vulnerability Index
Figure 13: Resilience Rating
Figure 14: Riverine Flood Risk Rating
Figure 15: Flood Risk Population Exposure
Figure 16: Community Rating System (CRS) Participating Communities



Map Symbology

- Bayou Macon
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Name

- Delhi
- Epps
- Forest
- Kilbourne
- Oak Grove
- Pioneer

Figure 1:

Watershed (HUC-8) Location

BAYOU MACON WATERSHED

September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 12 24 Miles

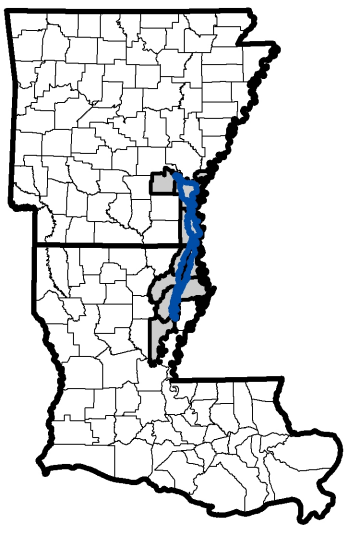
N

Arkansas County
Desha County
Coahoma County
Jefferson County
Grant County
Dallas County
Cleveland County
Lincoln County
Bolivar County
Calhoun County
Drew County
Sunflower County
Arkansas
Washington County
Bradley County
Lake Chicot
Union County
Ashley County
Chicot County
Humphreys County
Louisiana
Morehouse Parish
Union Parish
Oak Grove
Lake Providence
Bayou Macon
West Carroll Parish
Issaquena County
Sharkey County
Yazoo County
Louisiana District 5
East Carroll Parish
Warren County
Richland Parish
Madison Parish
Hinds County
Mississippi
Caldwell Parish
Franklin Parish
Lake Saint Joseph
Tensas Parish
Claiborne County
Brushy Lake
Copiah County
Catahoula Parish

U.S. House of Representatives
Louisiana District 5: Rep. Julia Letlow (R)

U.S. Senators
Louisiana
Sen. Bill Cassidy (R)
Sen. John Kennedy (R)

WATERSHED LOCATOR
ARKANSAS & LOUISIANA



Map Symbology

- Parish/County Seat
- Bayou Macon
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish Boundary
- Other Parish Boundary

U.S. Congressional Districts
- Louisiana, 5

Figure 2:

U.S. Congressional Districts

BAYOU MACON WATERSHED

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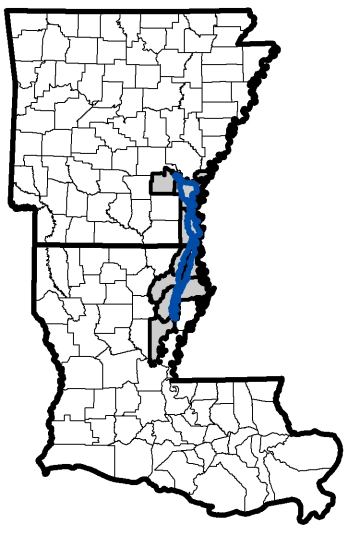
Arkansas County
Desha County
Coahoma County
Jefferson County
Grant County
Dallas County
Cleveland County
Lincoln County
Bolivar County
Calhoun County
Drew County
Sunflower County
Arkansas
Washington County
Bradley County
Lake Chicot
Union County
Ashley County
Chicot County
Humphreys County
Louisiana
Louisiana District 21
Morehouse Parish
Union Parish
Oak Grove
Lake Providence
Bayou Macon
Issaquena County
Sharkey County
Yazoo County
West Carroll Parish
East Carroll Parish
Louisiana District 19
Warren County
Richland Parish
Madison Parish
Hinds County
Caldwell Parish
Franklin Parish
Louisiana District 20
Mississippi
Lake Saint Joseph
Tensas Parish
Claiborne County
Brushy Lake
Copiah County
Catahoula Parish

Louisiana State House Representitives

District 19: Rep. Francis Thompson (D)
District 20: Rep. Neil Riser (R)
District 21: Rep. C. Travis Johnson (D)

WATERSHED LOCATOR
ARKANSAS & LOUISIANA



Map Symbology

- Parish/County Seat
- Bayou Macon
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish Boundary
- Other Parish Boundary

Louisiana State House Districts (2020)

- House District 19
- House District 20
- House District 21

Figure 3:
Arkansas & Louisiana State House Districts

BAYOU MACON WATERSHED
September 16, 2022

FEMA
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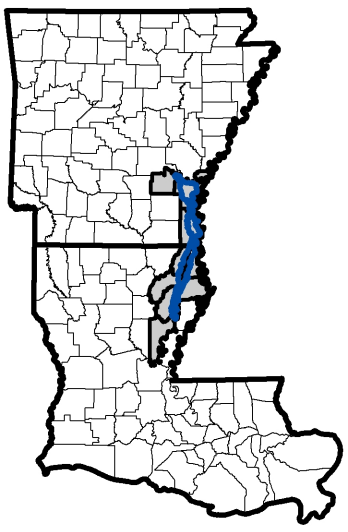
N

Arkansas County
Desha County
Coahoma County
Jefferson County
Grant County
Dallas County
Cleveland County
Lincoln County
Bolivar County
Calhoun County
Drew County
Sunflower County
Arkansas
Washington County
Bradley County
Lake Chicot
Union County
Ashley County
Chicot County
Humphreys County
Louisiana
Morehouse Parish
Union Parish
Oak Grove
Lake Providence
Louisiana District 33
Issaquena County
Sharkey County
Yazoo County
West Carroll Parish
East Carroll Parish
Louisiana District 34
Warren County
Richland Parish
Madison Parish
Louisiana District 32
Hinds County
Caldwell Parish
Franklin Parish
Mississippi
Lake Saint Joseph
Tensas Parish
Claiborne County
Brushy Lake
Copiah County
Catahoula Parish

Louisiana StateSenators
District 32: Sen. Glen Womack (R)
District 33: Sen. Stewart Cathey (R)
District 34: Sen. Katrina Jackson (D)

WATERSHED LOCATOR
ARKANSAS & LOUISIANA



Map Symbology

- Parish/County Seat
- Major Highways
- Other Streams
- Watershed Boundary: HUC-8
- Lake
- Discovery Parish Boundary
- Other Parish Boundary

Louisiana State Senate Districts (2020)

- Senate District 32
- Senate District 33
- Senate District 34

Figure 4:
Arkansas & Louisiana State Senate Districts

BAYOU MACON WATERSHED
September 16, 2022

FEMA
DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 12 24 Miles N

Arkansas
Louisiana
Dallas County
Grant County
Cleveland County
Jefferson County
Lincoln County
Arkansas County
Desha County
Coahoma County
Bolivar County
Calhoun County
Drew County
Sunflower County
Washington County
Bradley County
Union County
Ashley County
Chicot County
Lake Chicot
Humphreys County
Morehouse Parish
Union Parish
West Carroll Parish
Lincoln Parish
Ouachita Parish
Kilbourne
Oak Grove
Forest
Pioneer
Bayou Macon
Epps
Delhi
Lake Providence
Issaquena County
Sharkey County
Yazoo County
East Carroll Parish
Warren County
Richland Parish
Madison Parish
Hinds County
Mississippi
Caldwell Parish
Franklin Parish
Catahoula Parish
Tensas Parish
Lake Saint Joseph
Brushy Lake
Claiborne County
Copiah County
WATERSHED LOCATOR
ARKANSAS & LOUISIANA
Map Symbology
- Cities
- Bayou Macon
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
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- Discovery Parish/County Boundary
- Other Parish/County Boundary

Population Density (2020*)
- Very Low
- Low
- Medium
- High

*Source: 2020 U.S. Census

Figure 5:

Population Density

BAYOU MACON WATERSHED

September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 12 24 Miles

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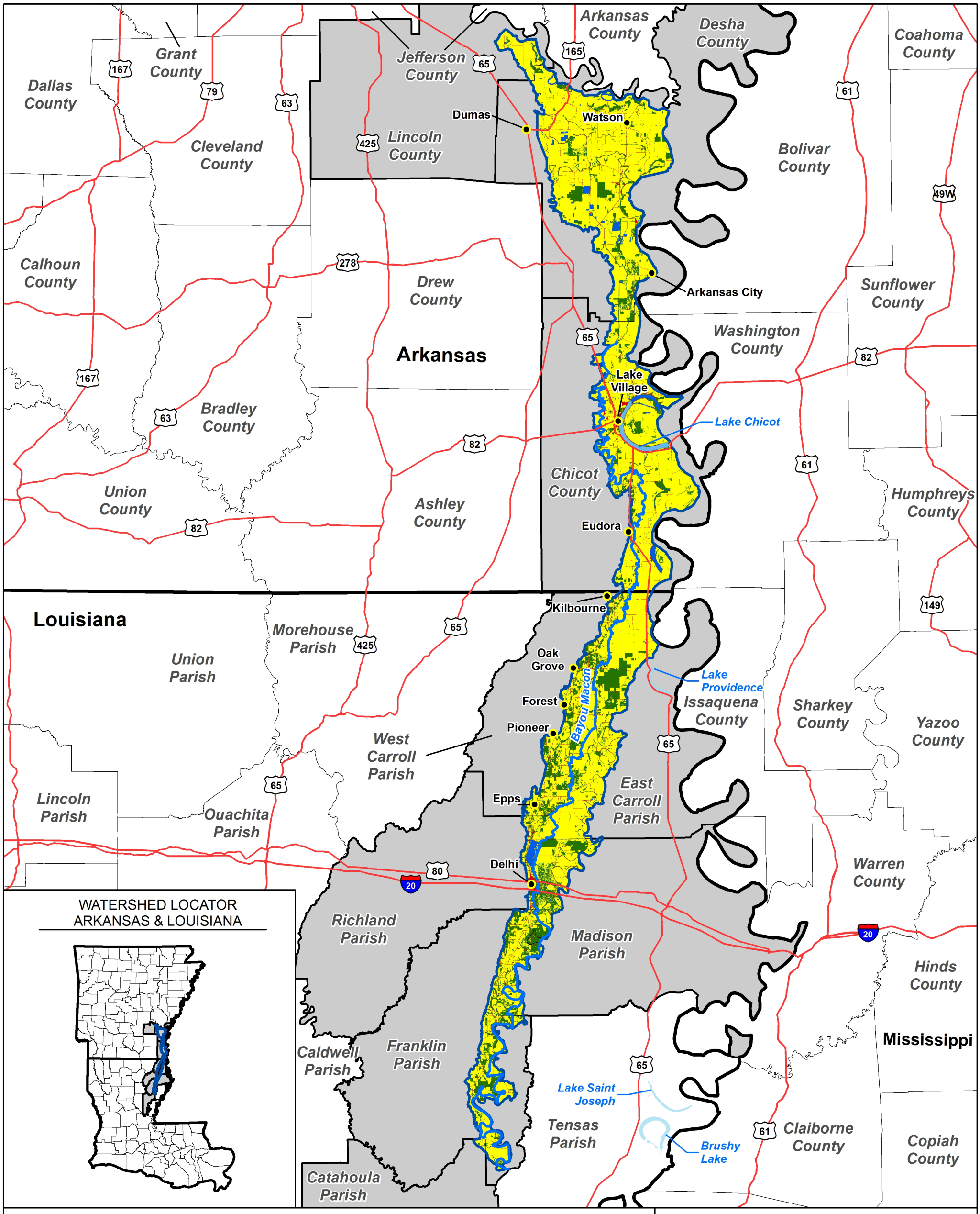

Map Symbology

- Cities
- Bayou Macon
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish Boundary
- Other Parish Boundary

Land Cover (USDA 2021*)

- Farming
- Forestry
- Open Water
- Urban Development

United States Department of Agriculture (USDA) Cropland Data Layer

Figure 6:

Land Cover

BAYOU MACON WATERSHED

September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 12 24 Miles

N

Arkansas County
Desha County
Coahoma County
Grant County
Jefferson County
Dallas County
Lincoln County
Cleveland County
Bolivar County
Calhoun County
Drew County
Sunflower County
Arkansas
Washington County
Lake Chicot
Bradley County
Chicot County
Union County
Ashley County
Humphreys County
Louisiana
Kilbourne
Morehouse Parish
Union Parish
Oak Grove
Lake Providence
Forest
Bayou Macon
Issaquena County
Sharkey County
Yazoo County
Pioneer
West Carroll Parish
East Carroll Parish
Lincoln Parish
Ouachita Parish
Epps
Delhi
Warren County
Richland Parish
Madison Parish
Hinds County
Mississippi
Caldwell Parish
Franklin Parish
Lake Saint Joseph
Tensas Parish
Claiborne County
Brushy Lake
Copiah County
Catahoula Parish

WATERSHED LOCATOR
ARKANSAS & LOUISIANA

Map Symbology

- Cities
- Bayou Macon
- Other Streams
- Major Highways
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- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Percent Population Change (2010-2020*)

- Less than -20%
- -10% to -20%
- -5% to -10%
- 0 to -5%
- No Change
- 0 to 5%

*Source: 2010, 2020 U.S. Census

Figure 7:

Population Change

BAYOU MACON WATERSHED

September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 12 24 Miles

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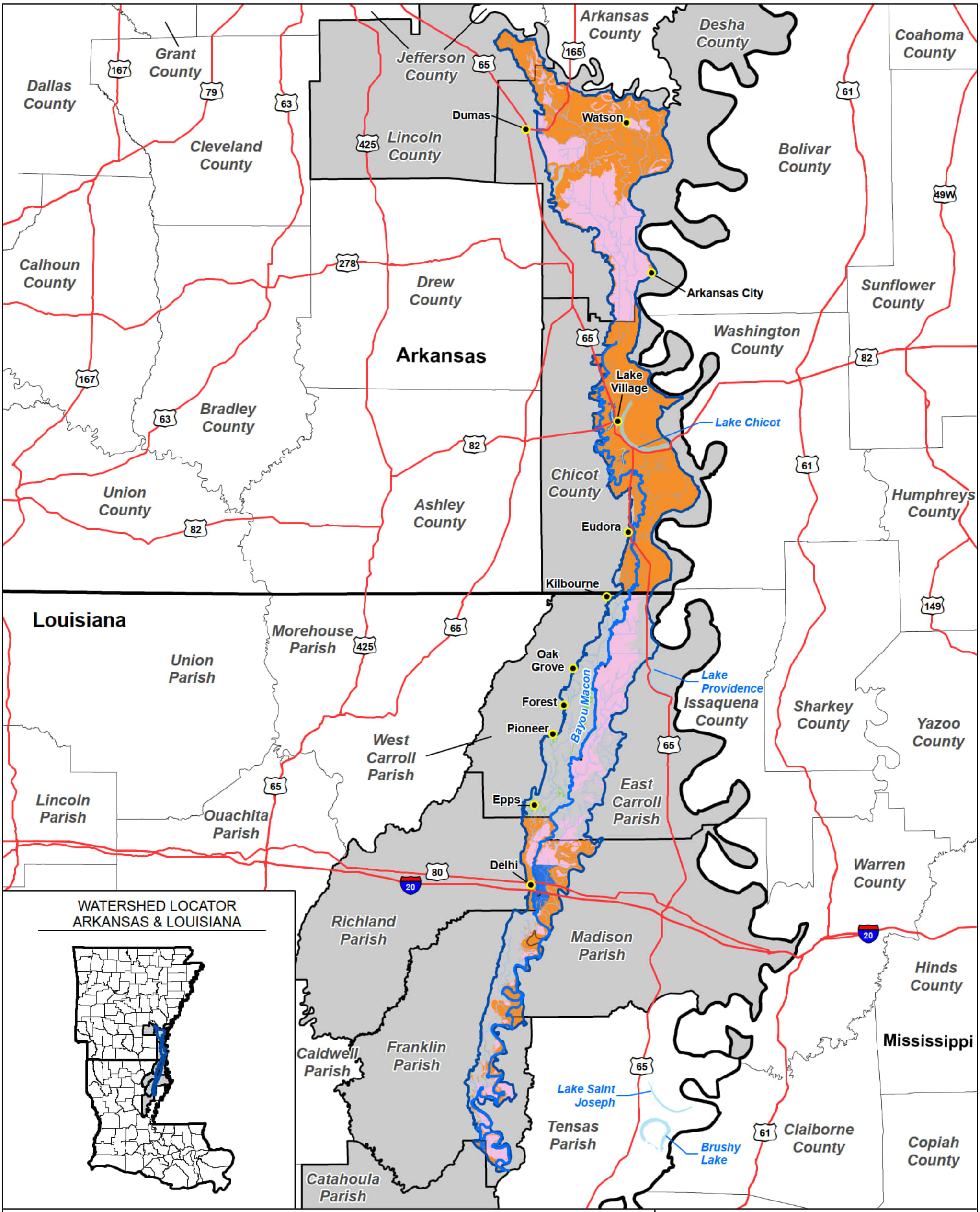


Map Symbology

- Cities
- Bayou Macon
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Effective FEMA Floodplains (2021)

- Zone AE, Floodway (100-Year, Detailed)
- Zone AE (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zones X (100-Year Depth <1 Foot; 500-Year, Detailed)
- Zone X (Protected by Levee)

Figure 8:

Effective Floodplains

BAYOU MACON WATERSHED

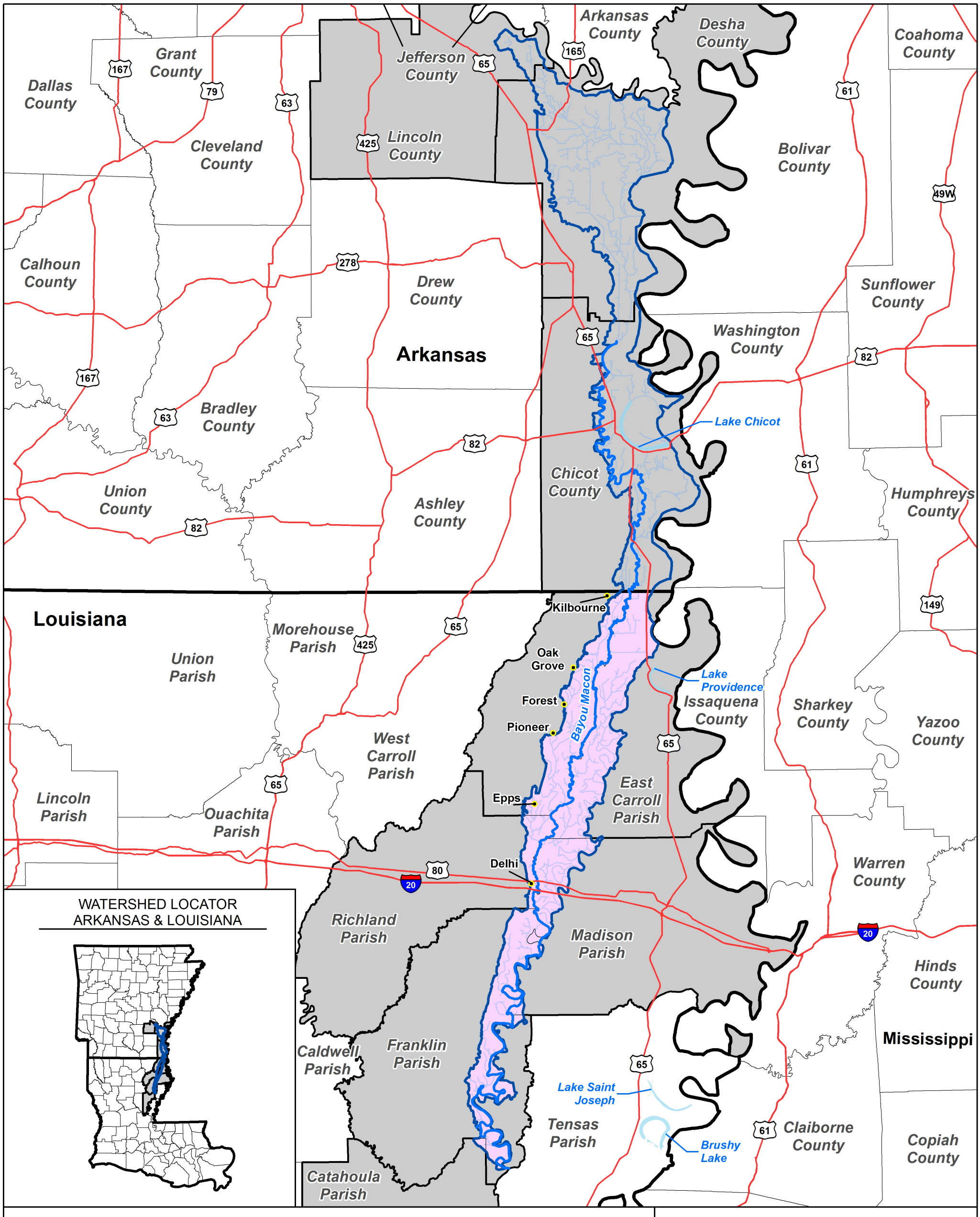
September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 12 24 Miles

N



Map Symbology

- Cities
- Bayou Macon
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Available Topographic Data

- 2008 Louisiana Statewide LIDAR

Figure 9:

Topographic Data Source

BAYOU MACON WATERSHED

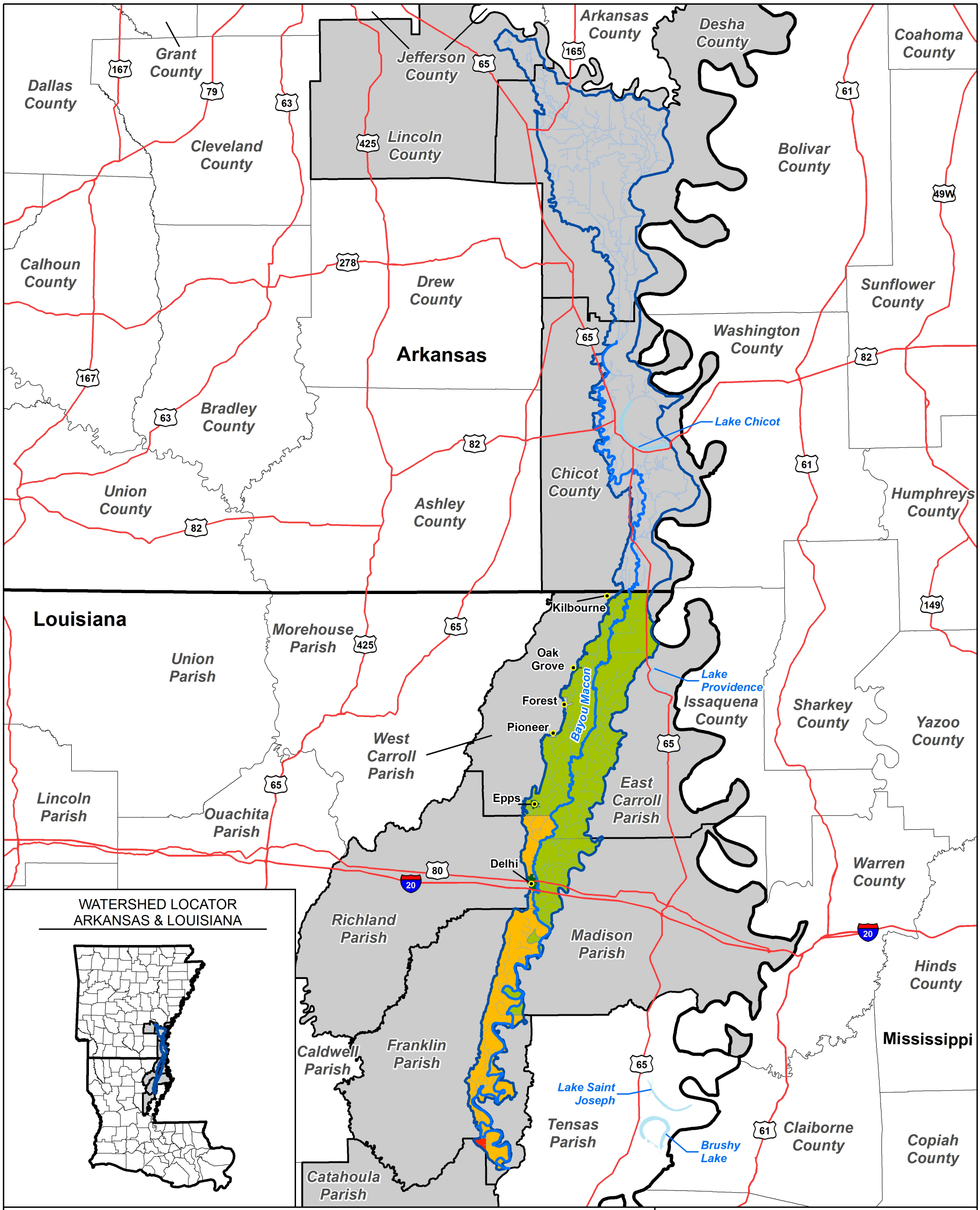
September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 12 24 Miles

N



Map Symbology

- Bayou Macon
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Community Total NFIP Claims*

- 4 - 29
- 30 - 88
- 89 - 195
- 196 - 1349

* Data only includes Louisiana communities

Figure 10:

NFIP Flood Losses

BAYOU MACON WATERSHED

September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 12 24 Miles N

Arkansas
Louisiana
Arkansas County
Desha County
Coahoma County
Grant County
Jefferson County
Dallas County
Cleveland County
Lincoln County
Dumas
Watson
Bolivar County
Calhoun County
Drew County
Arkansas City
Sunflower County
Washington County
Lake Village
Lake Chicot
Bradley County
Union County
Ashley County
Chicot County
Eudora
Humphreys County
Kilbourne
Morehouse Parish
Union Parish
Oak Grove
Lake Providence
Forest
Bayou Macon
Pioneer
Issaquena County
Sharkey County
Yazoo County
West Carroll Parish
Lincoln Parish
Ouachita Parish
Epps
East Carroll Parish
Delhi
Warren County
Richland Parish
Madison Parish
Hinds County
Mississippi
Caldwell Parish
Franklin Parish
Lake Saint Joseph
Tensas Parish
Brushy Lake
Claiborne County
Copiah County
Catahoula Parish
167
79
63
425
65
165
61
49W
278
82
149
20
80

WATERSHED LOCATOR
ARKANSAS & LOUISIANA

Map Symbology

- Cities
- Bayou Macon
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Hazus 1%-Annual-Chance Loss Study*

- Very Low
- Low
- Medium
- High
- Very High

*Flood risk data obtained from the FEMA Base Level Engineering study

Figure 11: Flood Risk - Potential Losses

BAYOU MACON WATERSHED

September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 12 24 Miles

N

Arkansas County
Desha County
Coahoma County
Jefferson County
Grant County
Dallas County
Cleveland County
Lincoln County
Bolivar County
Calhoun County
Drew County
Sunflower County
Arkansas
Washington County
Bradley County
Lake Chicot
Union County
Ashley County
Chicot County
Humphreys County
Louisiana
Morehouse Parish
Union Parish
Kilbourne
Oak Grove
Lake Providence
Forest
Bayou Macon
Pioneer
Issaquena County
Sharkey County
Yazoo County
West Carroll Parish
Lincoln Parish
Ouachita Parish
Epps
East Carroll Parish
Delhi
Warren County
Richland Parish
Madison Parish
Hinds County
Mississippi
Caldwell Parish
Franklin Parish
Lake Saint Joseph
Tensas Parish
Brushy Lake
Claiborne County
Copiah County
Catahoula Parish

WATERSHED LOCATOR
ARKANSAS & LOUISIANA

Map Symbology

- Bayou Macon
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- Discovery Parish/County Boundary
- Other Parish/County Boundary
- States Boundary

Social Vulnerability Index (NRI 2021*)

- Very High
- Relatively High
- Relatively Moderate
- Relatively Low
- Very Low

*NRI is the National Risk Index, created by the Federal Emergency Management Agency

Figure 12:

Social Vulnerability Index

BAYOU MACON WATERSHED

September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 12 24 Miles

N

Arkansas
Louisiana
Dallas County
Grant County
Cleveland County
Jefferson County
Lincoln County
Arkansas County
Desha County
Coahoma County
Bolivar County
Calhoun County
Drew County
Sunflower County
Washington County
Bradley County
Union County
Ashley County
Chicot County
Lake Chicot
Humphreys County
Morehouse Parish
Union Parish
West Carroll Parish
Lincoln Parish
Ouachita Parish
Kilbourne
Oak Grove
Forest
Pioneer
Epps
Delhi
Bayou Macon
Lake Providence
Issaquena County
Sharkey County
Yazoo County
East Carroll Parish
Warren County
Richland Parish
Madison Parish
Hinds County
Mississippi
Caldwell Parish
Franklin Parish
Tensas Parish
Lake Saint Joseph
Brushy Lake
Claiborne County
Copiah County
Catahoula Parish
167
79
63
425
65
165
61
49W
278
82
20
80
149

WATERSHED LOCATOR
ARKANSAS & LOUISIANA

Map Symbology

- Bayou Macon
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- Discovery Parish/County Boundary
- Other Parish/County Boundary
- States Boundary

Resilience Rating (NRI 2021*)

- Very High
- Relatively High
- Relatively Moderate
- Relatively Low
- Very Low

*NRI is the National Risk Index, created by the Federal Emergency Management Agency

Figure 13:

Resilience Rating

BAYOU MACON WATERSHED

September 16, 2022

FEMA

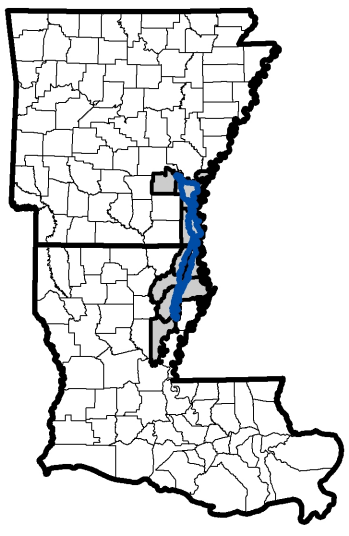
DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 12 24 Miles

N

Arkansas County
Desha County
Coahoma County
Grant County
Jefferson County
Dallas County
Cleveland County
Lincoln County
Bolivar County
Calhoun County
Drew County
Sunflower County
Arkansas
Washington County
Bradley County
Lake Chicot
Union County
Ashley County
Chicot County
Humphreys County
Louisiana
Morehouse Parish
Kilbourne
Union Parish
Oak Grove
Lake Providence
Forest
Bayou Macon
Issaquena County
Sharkey County
Yazoo County
Pioneer
West Carroll Parish
Lincoln Parish
Ouachita Parish
Epps
East Carroll Parish
Delhi
Warren County
Richland Parish
Madison Parish
Hinds County
Mississippi
Caldwell Parish
Franklin Parish
Lake Saint Joseph
Tensas Parish
Claiborne County
Brushy Lake
Copiah County
Catahoula Parish

WATERSHED LOCATOR
ARKANSAS & LOUISIANA



Map Symbology

- Bayou Macon
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- Discovery Parish/County Boundary
- Other Parish/County Boundary
- States Boundary

Riverine Flooding Risk Rating (NRI 2021*)

- Very High
- Relatively High
- Relatively Moderate
- Relatively Low
- Very Low

*NRI is the National Risk Index, created by the Federal Emergency Management Agency

Figure 14:

Riverine Flood Risk Rating

BAYOU MACON WATERSHED

September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 12 24 Miles

N

Arkansas County
Desha County
Coahoma County
Jefferson County
Grant County
Dallas County
Cleveland County
Lincoln County
Bolivar County
Calhoun County
Drew County
Sunflower County
Arkansas
Washington County
Bradley County
Lake Chicot
Union County
Ashley County
Chicot County
Humphreys County
Louisiana
Morehouse Parish
Union Parish
Kilbourne
Oak Grove
Lake Providence
Forest
Bayou Macon
Pioneer
Issaquena County
Sharkey County
Yazoo County
West Carroll Parish
Lincoln Parish
Ouachita Parish
Epps
East Carroll Parish
Delhi
Warren County
Richland Parish
Madison Parish
Hinds County
Mississippi
Caldwell Parish
Franklin Parish
Lake Saint Joseph
Tensas Parish
Brushy Lake
Claiborne County
Copiah County
Catahoula Parish

WATERSHED LOCATOR
ARKANSAS & LOUISIANA

Map Symbology

- Bayou Macon
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- Discovery Parish/County Boundary
- Other Parish/County Boundary
- States Boundary

Population Exposed to Flooding (NRI 2021*)

- 0 - 800
- 801 - 1600
- 1601 - 2400
- 2401 - 3200
- 3201 - 4000

*NRI is the National Risk Index, created by the Federal Emergency Management Agency

Figure 15:
Flood Risk
Population Exposure

BAYOU MACON WATERSHED

September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 12 24 Miles

N

Arkansas County
Desha County
Coahoma County
Jefferson County
Grant County
Dallas County
Lincoln County
Cleveland County
Bolivar County
Calhoun County
Drew County
Sunflower County
Arkansas
Washington County
Lake Chicot
Bradley County
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Ashley County
Humphreys County
Louisiana
Kilbourne
Morehouse Parish
Union Parish
Oak Grove
Lake Providence
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Issaquena County
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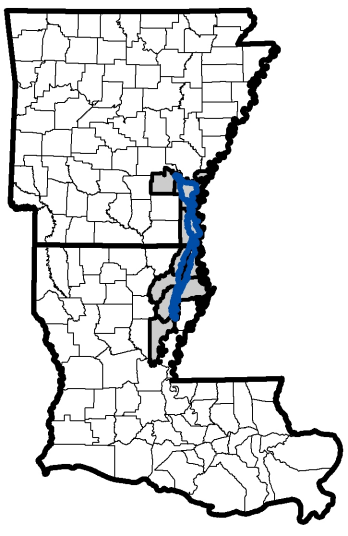
East Carroll Parish
Lincoln Parish
Ouachita Parish
Epps
Delhi
Warren County
Richland Parish
Madison Parish
Hinds County
Mississippi
Caldwell Parish
Franklin Parish
Lake Saint Joseph
Tensas Parish
Claiborne County
Brushy Lake
Copiah County
Catahoula Parish

WATERSHED LOCATOR
ARKANSAS & LOUISIANA



Map Symbology

- Cities
- Bayou Macon
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

CRS Class

- Not Participating

Figure 16:
Community Rating System (CRS) Participating Communities

BAYOU MACON WATERSHED

September 16, 2022

FEMA

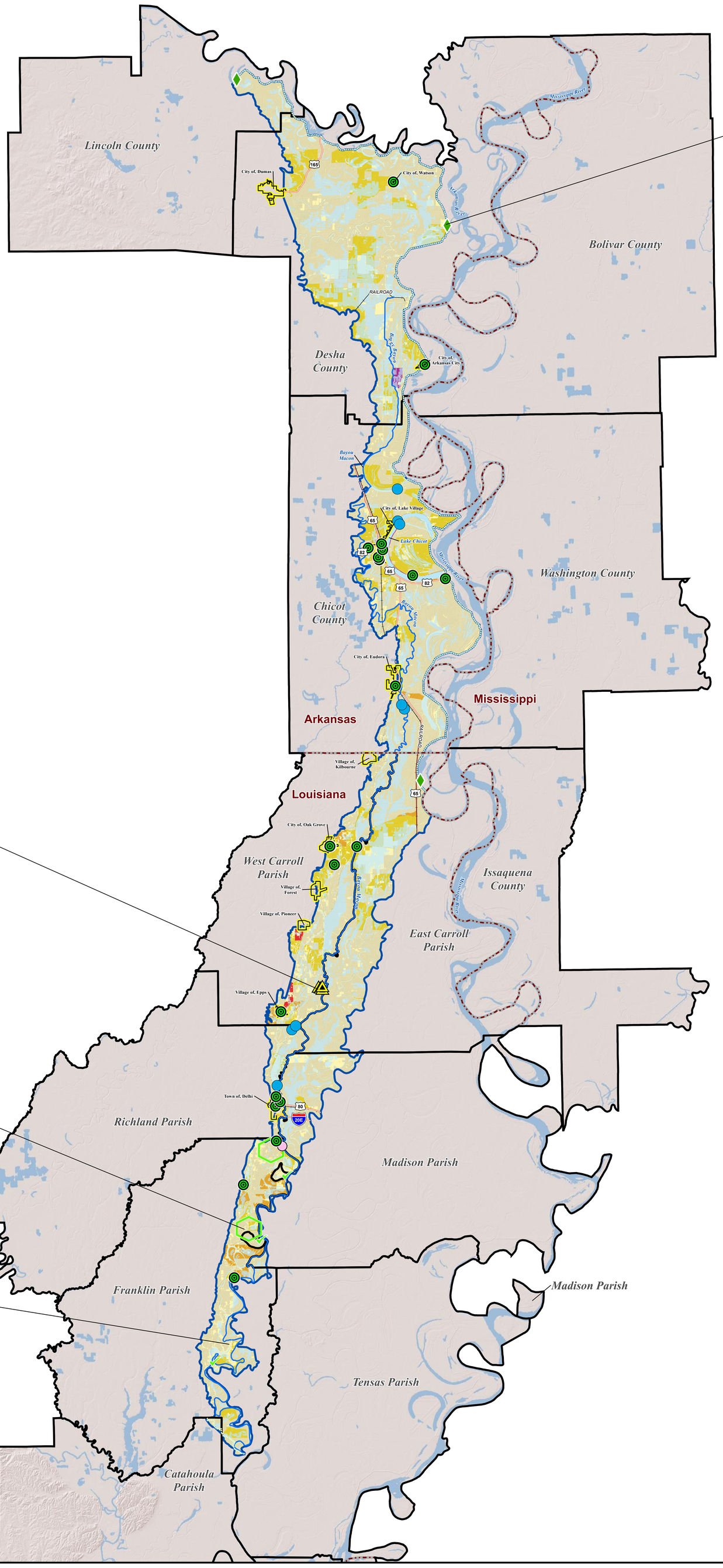
DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 12 24 Miles

N

Flood Risk Map

Flood Risk Map: *Bayou Macon HUC-8 Watershed*

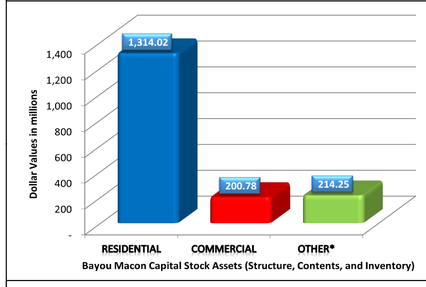


AR-LA MS River Levee



AR-LA MS River Levee - The AR-LA MS River Levee is a Provisionally Accredited Levee located on the West bank of the Mississippi River. The levee has a total length of 359 miles with a floodwall length of .24 miles, protecting approximately 6900 square miles of mostly agricultural land. The segment of MS River Levee, West Bank (Arkansas) was constructed in 1930 with a total length of 75.74 miles. The segment protects the Cities of Arkansas City, Dumas, Eudora and others. The total levee system protects an estimated population of 227,280 people with a property value of $20.9 Billion.

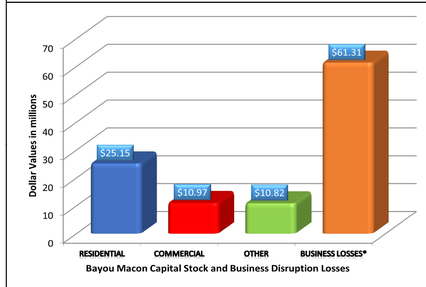
ASSET INVENTORY VALUES - BAYOU MACON



Bayou Macon Capital Stock Assets (Structure, Contents, and Inventory)

***Other** structure types include Industrial, Agricultural, Education, Religious, and Government structures

100-YEAR EVENT LOSSES - BAYOU MACON



Bayou Macon Capital Stock and Business Disruption Losses

***Business Losses** are the sum of Inventory Loss, Relocation Cost, Income Loss, Rental Income Loss, and Wage Loss.

West Carroll Parish



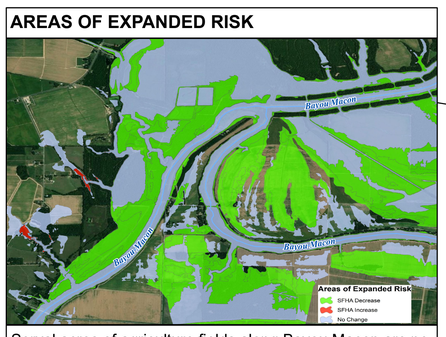
In West Carroll Parish, Poverty Point Park was flooded and experienced severe issues from flooding along the Harlan Bayou and Bayou Macon in 2016. A bridge and a culvert along Harlan Bayou were destroyed, and channel banks swelled. Agricultural runoff from the surrounding area washed out the several acres of land, leading to damage estimated at $1 million. The Parish received a $100,000 grant to repair the structures, but further work is needed to prevent further erosion.

Flood Risk



Franklin Parish has had a few past flood claims. The Parish's hydrology was published in August 2009, and the HEC-HMS hydraulic modeling method could benefit from a modernization of modeling methods. Unverified Zone A streams could be updated using the 2019 Base Level Engineering Study and incorporated into the Flood Insurance Rate Maps (FIRMs) for a more accurate representation of the floodplain.

AREAS OF EXPANDED RISK



Serval acres of agriculture fields along Bayou Macon are no longer within the SFHA due to new BLE Mapping. The Areas of Expanded Risk captures horizontal extent changes in the mapped floodplain.This can serve as an outreach and communication tool in understanding changes in flood risk due to topography and other factors.

N

0 4.5 9

Miles

MAP SYMBOLOGY

Base Data
- Highways
- Levees
- Railroads
- State Boundary
- Watershed Boundary
- Waterbodies
- City Boundary
- County Boundary

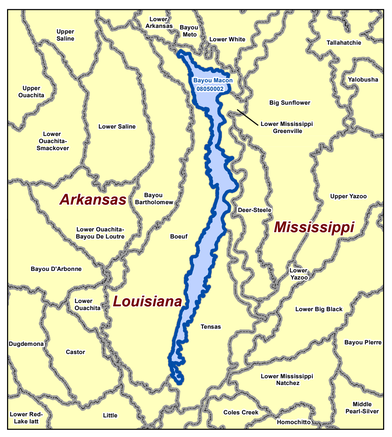
Flood Data
- Rivers and Streams
- New SFHA

Flood Risk*
- Very Low
- Low
- Medium
- High
- Very High

***Flood Risk Data Source:** Base Level Enginering (BLE) data and Hazus Level 1 Analysis.

Areas of Mitigation Interest
- Individual Assistance (IA) or Public Assistance (PA)
- Dams
- Areas of Significant Riverine Erosion
- Past Claims Hot Spot
- Areas of Mitigation Success
- At-Risk Essential Facilities
- Accredited Levees

WATERSHED LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

FRM FLOOD RISK MAP

BAYOU MACON WATERSHED

FEMA

HUC-8 Code
08050002

RELEASE DATE
03/29/2023

For more information of data used for this map, please consult the Bayou Macon Watershed Flood Risk Database and Flood Risk Report.

Pre-Discovery Map

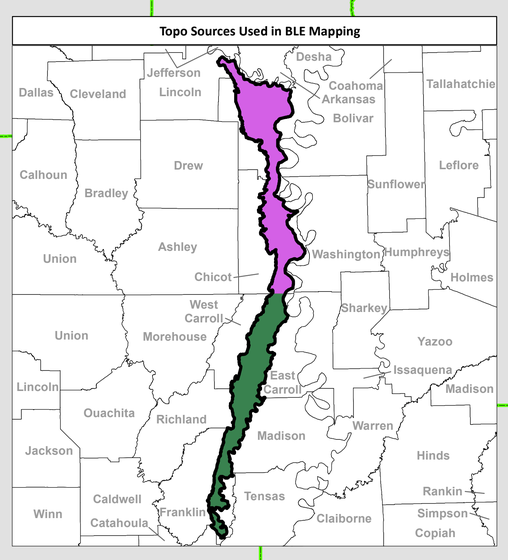
Discovery Communities			
Community	CID	Total Flood Area Sq. Mi.	Percent of Community Floodplain within Bayou Macon Watershed
Catahoula Parish*	220047	570.8	0.3%
Chicot County	050025	671.5	35.4%
Eudora	050027	1.7	28.5%
Lake Village	050028	2.2	100.0%
Desha County	050065	774.5	39.3%
Arkansas City	050066	0.5	99.6%
Dumas	050067	0.1	100.0%
Watson	050072	0.2	100.0%
East Carroll Parish*	220062	228.0	36.1%
Franklin Parish	220071	609.8	20.0%
Lincoln County	050045	261.6	7.1%
Madison Parish	220122	639.0	9.5%
Richland Parish	220154	561.4	3.7%
Delhi	220155	2.6	79.8%
West Carroll Parish	220243	238.0	11.8%
Epps	220283	0.5	100.0%
Forest	220286	0.2	44.3%
Oak Grove	220342	0.2	32.6%
Pioneer	220244	0.3	10.3%

*No Digital National Flood Hazard Layers Available. Floodplain in watershed taken from Q3.

Grant
Jefferson
Jefferson
Arkansas
Quitman
Dallas
Cleveland
Lincoln
Desha
Bolivar
Calhoun
Drew
Leflore
Bradley
Sunflower
Ashley
Washington
Union
Chicot
Humphreys
Holmes
Union
Morehouse
West Carroll
Issaquena
Sharkey
Yazoo
Lincoln
East Carroll
Madison
Richland
Warren
Hinds
Franklin
Madison
Rankin
Caldwell
Tensas
Claiborne
Simpson
Winn
Catahoula
Copiah

Bayou Macon

Dumas
Watson
Arkansas City
Lake Village
Eudora
Kilbourne
Oak Grove
Forest
Pioneer
Epps
Delhi



Topo Sources Used in BLE Mapping

Elevation Data	*Location*
2008 Louisiana Statewide LIDAR - Louisiana	
2016 NRCS Ouachita LIDAR - Arkansas	

N
0 4 8 16 24 Miles

Map Symbology

- USGS Gage
- LOMC
- High Water Mark
- Low Water Mark
- Dam
- Lake
- City Boundary
- County Boundary
- Watershed Boundary

SHIELD

- Interstate Highway
- US Highway
- State Highway
- Railroad

Effective FEMA Floodplains*

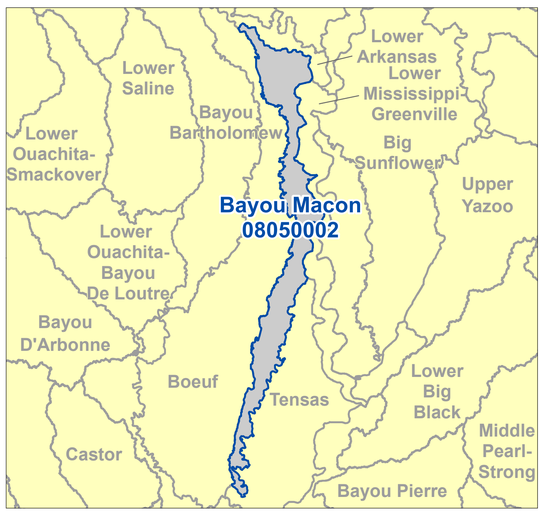
- Floodway
- Zone AE (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zones X 100-Year Depth <1 Foot; X500 (500-Year, Detailed)
- Zone X, Reduced Flood Risk Due to Levee

Effective Streams Study Type*

- Zone AE (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zone X (Unshaded X, Areas of Minimal Flood Risk)

***Data as of January 2022**

WATERSHEDS LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Pre-Discovery Map

BAYOU MACON WATERSHED,
ARKANSAS AND LOUISIANA

Stream Miles:	1,668
Zone AE Miles:	66
Zone A Miles:	1,031
Zone X Miles:	571
Population:	15,722

HUC-8 Codes
08050002

FEMA

Discovery Map

Parish	CID	Population [1]	Number of Policies	Total Coverage	Total Losses [2]	Total Payments [2]	Current FEMA DFIRM Status	Oldest Effective Date
Catahoula Parish	220047	6,535	530	$ 71,045,500	2,853	$ 22,119,321.00	Not Modernized	4/5/1988
East Carroll Parish	220062	3,872	124	$ 31,502,100	139	$ 2,100,595.00	Not Modernized	10/16/1979
Franklin Parish	220071	13,482	238	$ 56,081,300	238	$ 3,927,227.00	Modernized	9/2/2011
Madison Parish	220122	2,976	179	$ 49,231,000	96	$ 1,429,197.00	Modernized	6/19/2012
Richland Parish	220154	13,450	345	$ 73,319,200	216	$ 6,105,344.00	Modernized	9/18/2013
West Carroll Parish	220243	7,148	100	$ 26,391,800	40	$ 1,424,853.00	Modernized	10/5/2018

[1] Total community population based on 2020 Decennial Census data

[2] Based on available NFIP claims data as of February 2022

Total Losses - All losses submitted regardless of the status.

Total Payments - Total amount paid on losses.

Discovery Communities			
Community	CID	Total Flood Area Sq. Mi.	Percent of Community Floodplain within Bayou Macon Watershed
Catahoula Parish*	220047	570.8	0.3%
Chicot County	050025	671.5	35.4%
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Delhi	220155	2.6	79.8%
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Epps	220283	0.5	100.0%
Forest	220286	0.2	44.3%
Oak Grove	220342	0.2	32.6%
Pioneer	220244	0.3	10.3%
*No Digital National Flood Hazard Layers Available. Floodplain in watershed taken from Q3.			

Topo Sources Used in BLE Mapping

Topo Sources Used in BLE Mapping

Elevation Data	*Location*
2008 Louisiana Statewide LIDAR - Louisiana	
2016 NRCS Ouachita LIDAR - Arkansas	

N

0 4 8 16 24 Miles

Map Symbology

- USGS Gage
- LOMC
- Dam
- Lake
- City Boundary
- County Boundary
- Watershed Boundary

Major Roads

- Interstate Highway
- US Highway
- Other Major Road; State Highway and Route
- Railroad

Effective FEMA Floodplains*

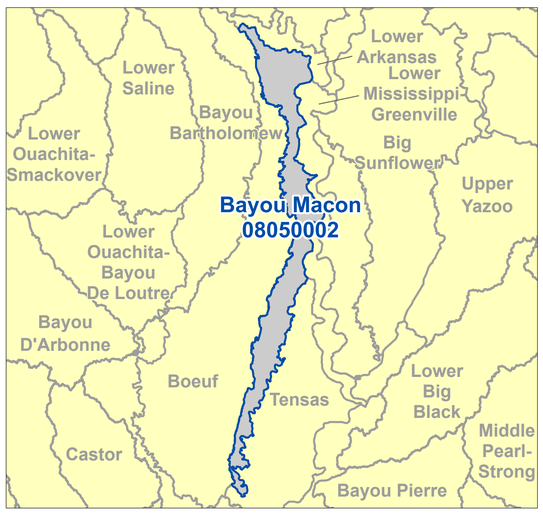
- Floodway
- Zone AE (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zones X 100-Year Depth <1 Foot; X500 (500-Year, Detailed)
- Zone X, Reduced Flood Risk Due to Levee

Effective Streams Study Type*

- Zone AE (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zone X (Unshaded X, Areas of Minimal Flood Risk)

***Data as of January 2022**

WATERSHEDS LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Discovery Map

BAYOU MACON WATERSHED, ARKANSAS AND LOUISIANA

Stream Miles:	1,668
Zone AE Miles:	66
Zone A Miles:	1,031
Zone X Miles:	571
Population:	15,722

HUC-8 Codes
08050002

FEMA

Post-Discovery Map

CNMS Validation Status Definitions	
Assessed	Unmapped Streams or streams not part of FEMA's SFHA inventory that have been investigated and considered for study in current and/or future Fiscal Years (FYs).
Unverified	Stream has not passed the Critical and Secondary Element checks (At least one critical or four or more secondary change conditions flagged) and may either be assigned resources for restudy in current and/or future FYs.
Valid	Streams considered New, Validated, or Updated Engineering (NVUE) compliant (zero critical and fewer than four secondary elements flagged).
To Be Studied	Mapped streams that need to be studied and are planned for a future FY or unmapped streams prioritized to be mapped with a SFHA.

Grant
Jefferson
Jefferson
Arkansas
Quitman
Coahoma
Lincoln
Tallahatchie
Dallas
Cleveland
Desha
Bolivar
Calhoun
Drew
Leflore
Sunflower
Bradley
Ashley
Washington
Bayou Macon
Humphreys
Holmes
Union
Chicot
Sharkey
Union
Morehouse
West Carroll
Issaquena
Yazoo
East Carroll
Lincoln
Ouachita
Madison
Richland
Warren
Jackson
Hinds
Rankin
Madison
Franklin
Caldwell
Tensas
Claiborne
Simpson
Winn
Copiah
Catahoula

N
0 4 8 16 24 Miles

Map Symbology

- USGS Gage
- LOMC
- Dam
- Lake
- City Boundary
- County Boundary
- Watershed Boundary

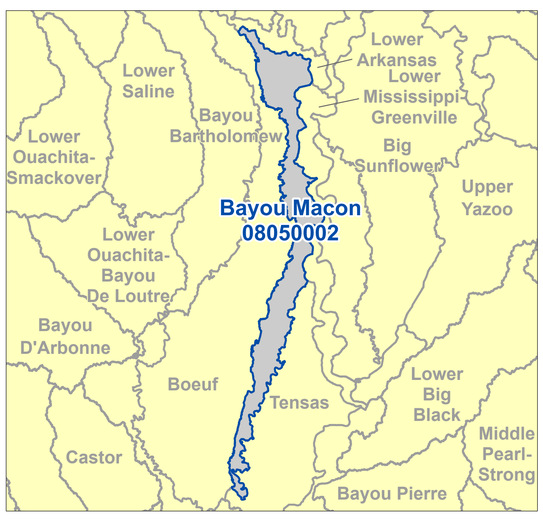
Transportation
- Interstate Highway
- US Highway
- Other Major Road; State Highway and Route
- Railroad

Effective FEMA Floodplains*
- Floodway
- Zone AE (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zones X 100-Year Depth <1 Foot; X500 (500-Year, Detailed)
- Zone X, Reduced Flood Risk Due to Levee

VALIDATION STATUS, STATUS TYPE**
- Unverified, Being Studied
- Unverified, To Be Studied
- Assessed, Being Studied
- Valid, Being Studied
- Valid, NVUE Compliant

***Data as of January 2022**

WATERSHEDS LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Post-Discovery Map

BAYOU MACON WATERSHED, ARKANSAS AND LOUISIANA

Stream Miles:	1,668
Zone AE Miles:	66
Zone A Miles:	1,031
Zone X Miles:	571
Population:	15,722

HUC-8 Codes
08050002

FEMA

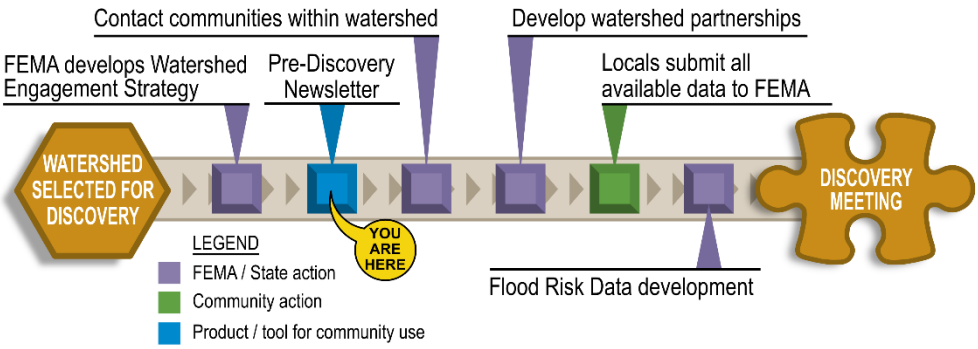
Pre-Discovery Newsletter

Pre-Discovery Newsletter
Bayou Macon and Tensas Watersheds

"Capturing a More Complete Picture of Your Community and Your Watershed" *January 2022*

Risk MAP Process and Discovery

Risk Mapping, Assessment, and Planning (Risk MAP) is the Federal Emergency Management Agency (FEMA) Program that assists communities with flood information and tools they can use to enhance their mitigation plans and better protect their citizens. Discovery is the first phase of an overall process to achieve mitigation actions for reducing risks. The Louisiana Department of Transportation & Development (DOTD) has been awarded a FEMA grant to conduct Discovery in the Bayou Macon and Tensas Watersheds in 2022.



The Goal: To work closely with communities to better understand local flood risk, mitigation efforts, and other topics to spark watershed-wide discussions about increasing resilience to flooding.

Pre-Discovery Meeting	Online invitations for Webex Meeting to be sent out soon
January 19th, 2022	
10:00 AM	

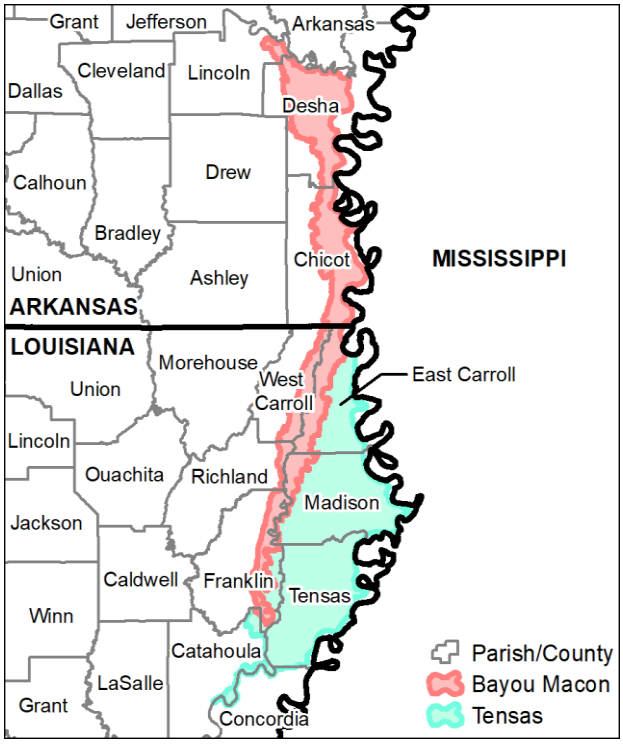
Pre-Discovery Meeting

In preparation for the upcoming Discovery Meetings, DOTD will be hosting one Pre-Discovery meeting via Webex call. This meeting will introduce you to flood risk data being developed in the watershed, inform you about what to expect at the Discovery Meeting, describe who should attend, and communicate the data we need to collect from your community. Invitations to the meeting are currently being sent out. The meeting will be recorded and posted online should your community be unable to join the Webex call.

Requested Data from Communities

- Areas of recurring flooding
- Historical local flooding locations
- High water marks or flood photos documented from historical flood events
- Infrastructure information, especially for levees and new bridges, dams, culverts and road improvements
- Mitigation activities and grant projects (ongoing or planned)
- Local development and floodplain management plans
- Stormwater management activities
- Regional watershed plans
- Flood study needs

Customize Discovery:
After the meeting, enter your community's data at:
https://dotd.discovery.halff.com
Password: DOTD_FY20!



Discovery Data Collection

The section to the left lists some of the types of data requested from each community within the watershed. We would greatly appreciate your participation in providing mapping needs and flood risk data for your community.

DOTD requests communities share whatever data they have, to provide as complete a picture as possible.

The Louisiana Department of Transportation & Development is a FEMA Cooperating Technical Partner (CTP), which allows them to collaborate with FEMA to help maintain current flood hazard information. The results from Base Level Engineering (BLE) studies served as a reference for the Mapping Activity Statement (MAS) of the FEMA CTP grant. FEMA awarded a CTP grant to DOTD to perform Discovery in these watersheds. The current MAS is included in the Risk MAP program. **Please contact Susan Veillon (Susan.Veillon@la.gov) if you have questions about Discovery.**

Pre-Discovery Meeting Slides

FEMA

RiskMAP
Increasing Resilience Together

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

LOUISIANA DISCOVERY

"CAPTURING A MORE COMPLETE PICTURE OF YOUR WATERSHED"

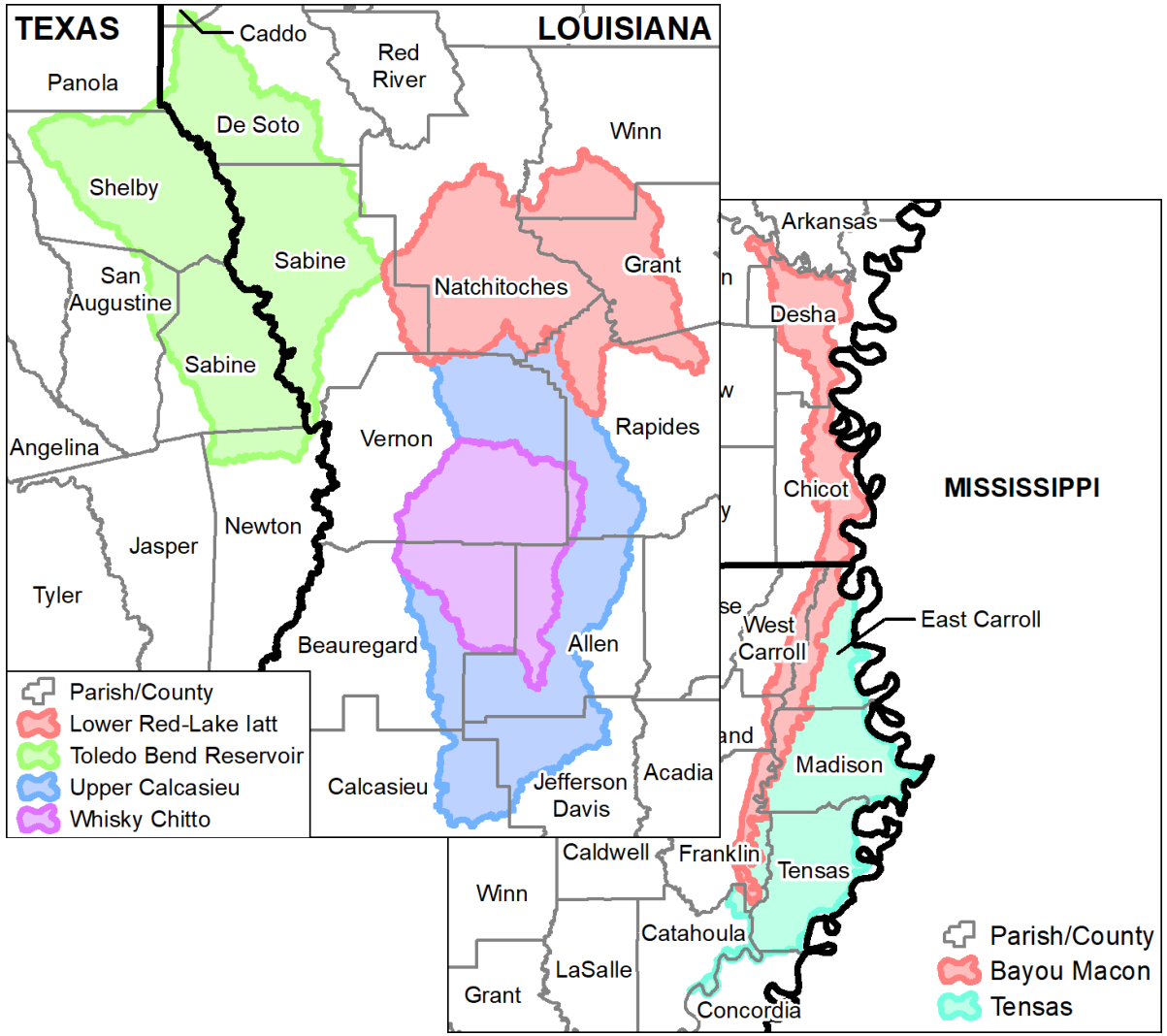
PRE-DISCOVERY MEETING

JANUARY 19, 2022

HALFF

AGENDA

- Overview of Risk MAP
- Discovery Overview
- LaDOTD Discovery Activities
  - Pre-Discovery Activities
  - Discovery Activities
  - Post-Discovery Activities
- 2022 LaDOTD Discovery Watersheds
  - Northeast Watersheds: Tensas & Bayou Macon
  - Southwest Watersheds: Toledo Bend Reservoir, Lower Red-Lake Iatt, Upper Calcasieu & Whisky Chitto
- Data Gathering Website and Walk-through



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DISCOVERY OVERVIEW

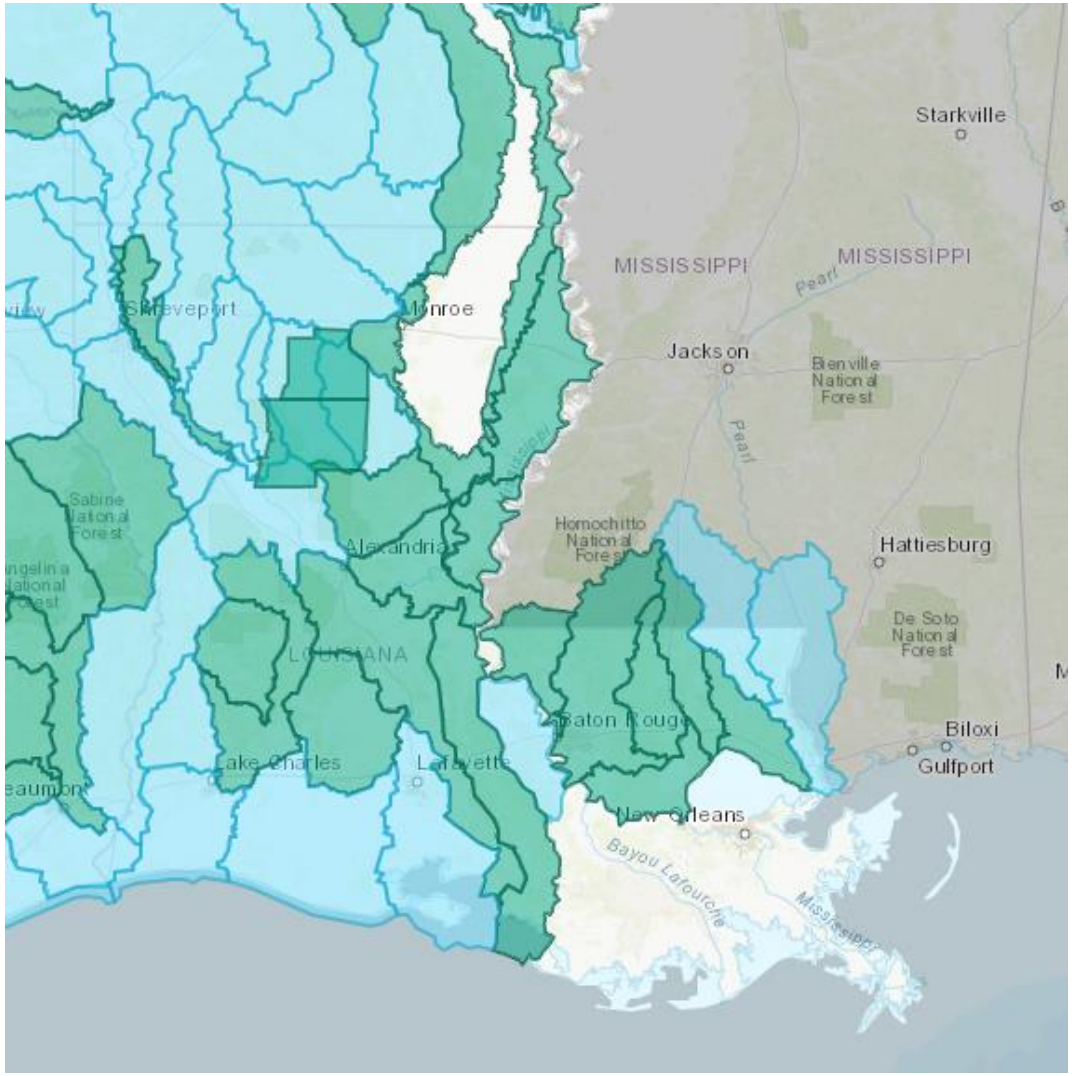
Discovery is FEMA's process for identifying and accessing flood risk to better prepare a list of needs and projects to address those needs within communities.

- Heighten community involvement and understanding
- Gather all flood-related information available
  - Knowledge of Flood Risks and Past Flooding in your community
  - Hazard Mitigation Projects – ongoing, planned or completed
  - Master Drainage Plans and floodplain studies – ongoing, planned or completed
  - Current flood risk communication process
  - GIS data

DISCOVERY OVERVIEW

- Request needs in the community
  - Questions and concerns for DFIRM maps
  - All questions and concerns for dams and levees
  - Study request in areas of repetitive loss
  - Areas of new development or other causes of concern for the future
  - Funding needs for identified flood risk projects

FEMA'S RISK MAP PROGRAM





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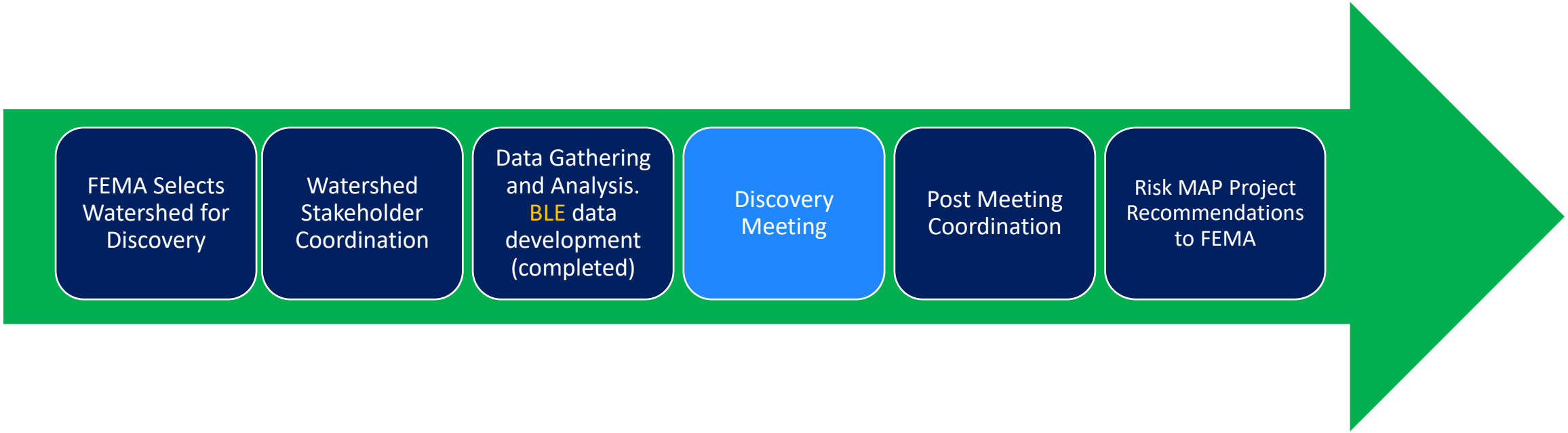
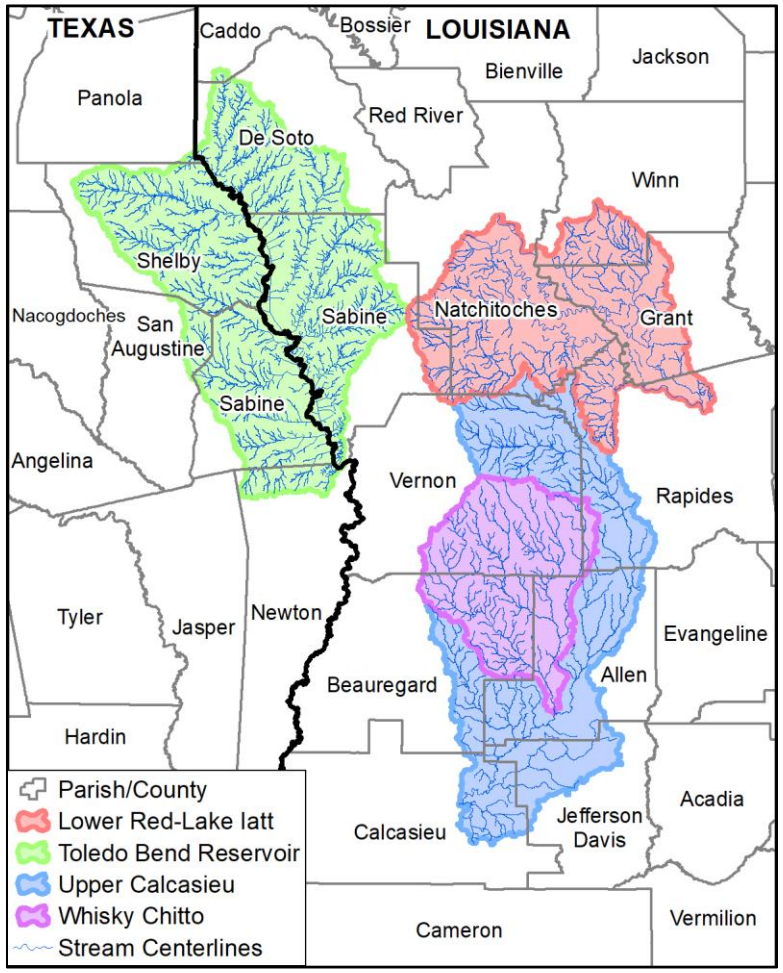
DISCOVERY STEPS

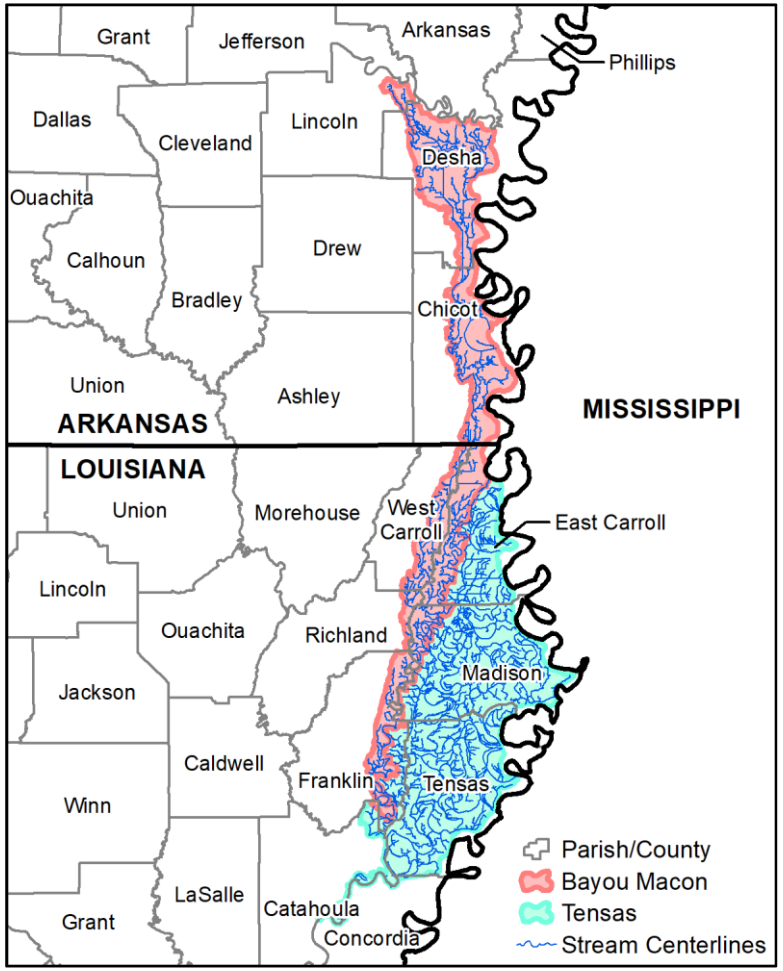
- ***Capture a more complete picture of your watershed by working closely with local communities…***



Louisiana Watersheds Discovery

- Goals
  - Inform Community of Present Flood Risk
  - Gather local data to supplement National, Regional and State data
  - Present FEMA with areas of highest concern and need for additional study





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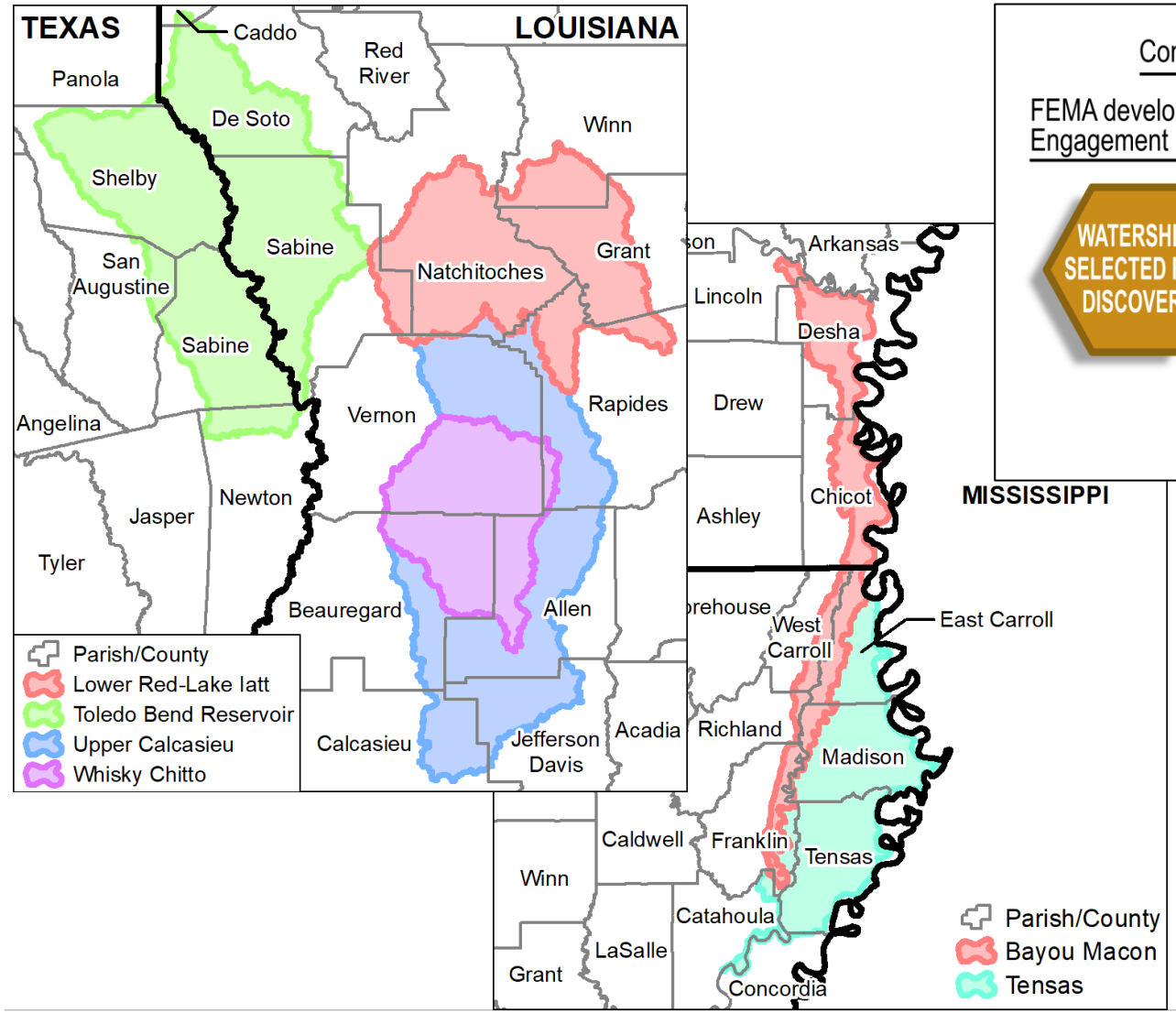
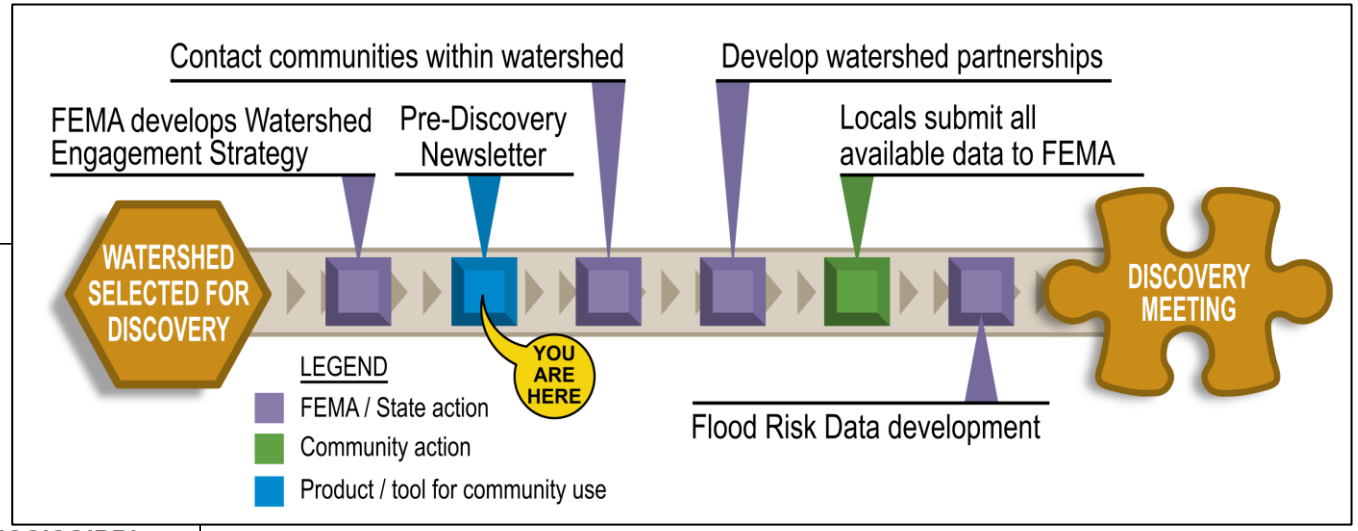
DISCOVERY NEWSLETTER





Pre-Discovery Meeting
January 19th, 2022
10:00 AM

Online invitations for Webex Meeting to be sent out soon

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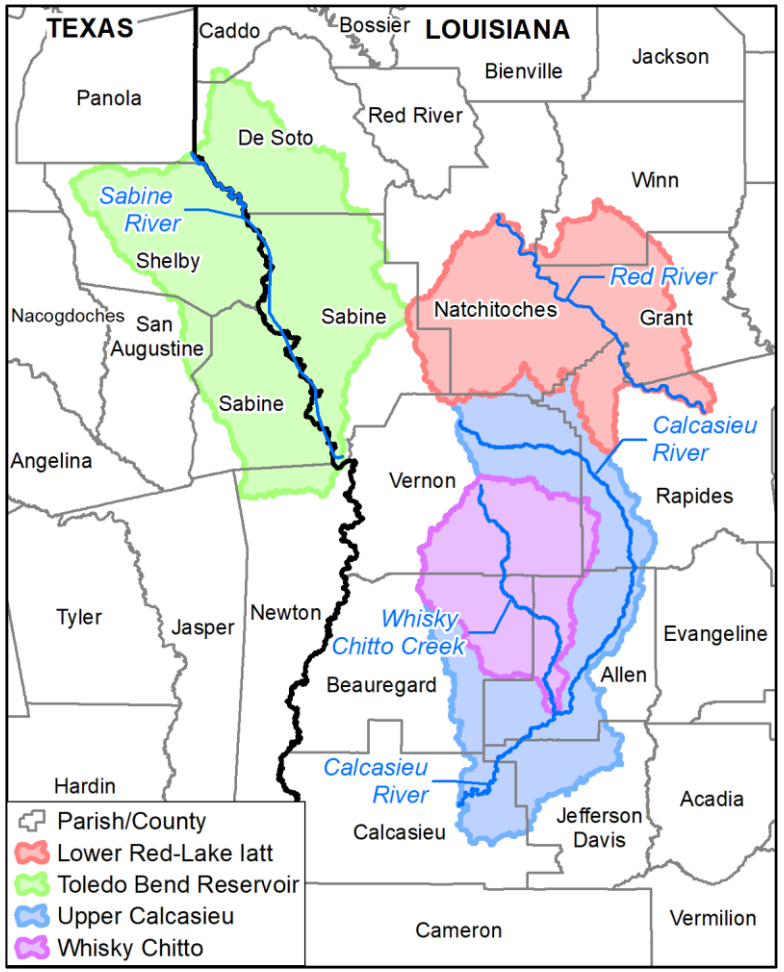
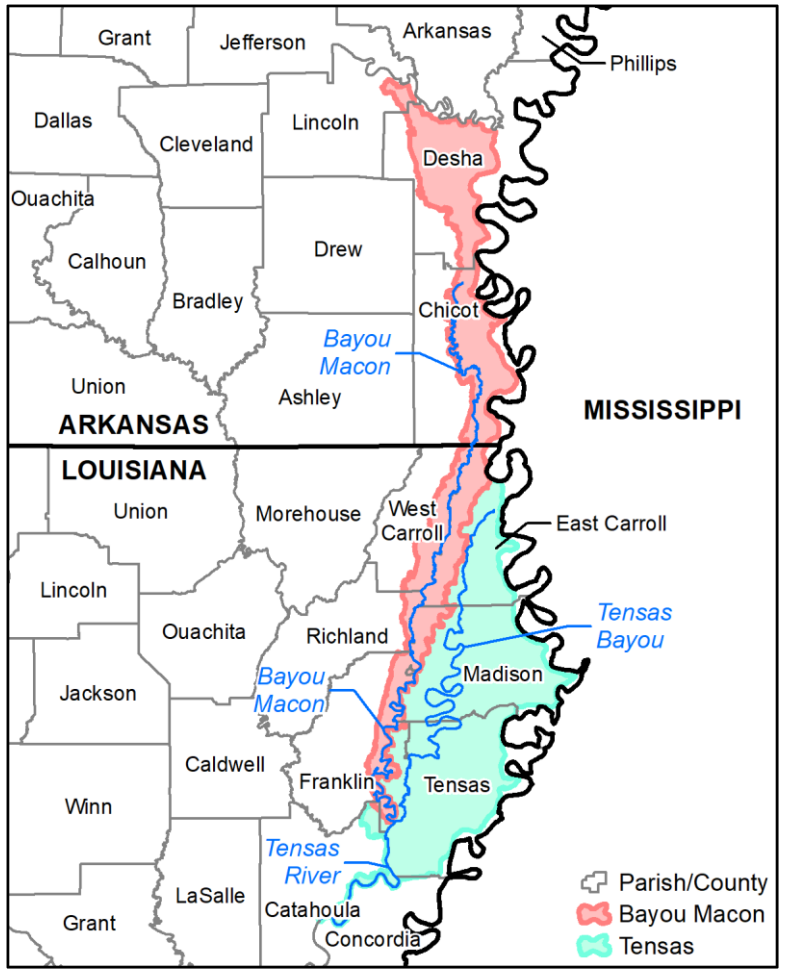
What information are we interested in?



BASE LEVEL ENGINEERING (BLE)

- BLE is developed at a larger scale (HUC8)
- LiDAR must be available
- Steps of Hydrology, Hydraulics & Terrain
- Model review and adjustments
- Gage review included in hydrology
- Used to assess flood risk





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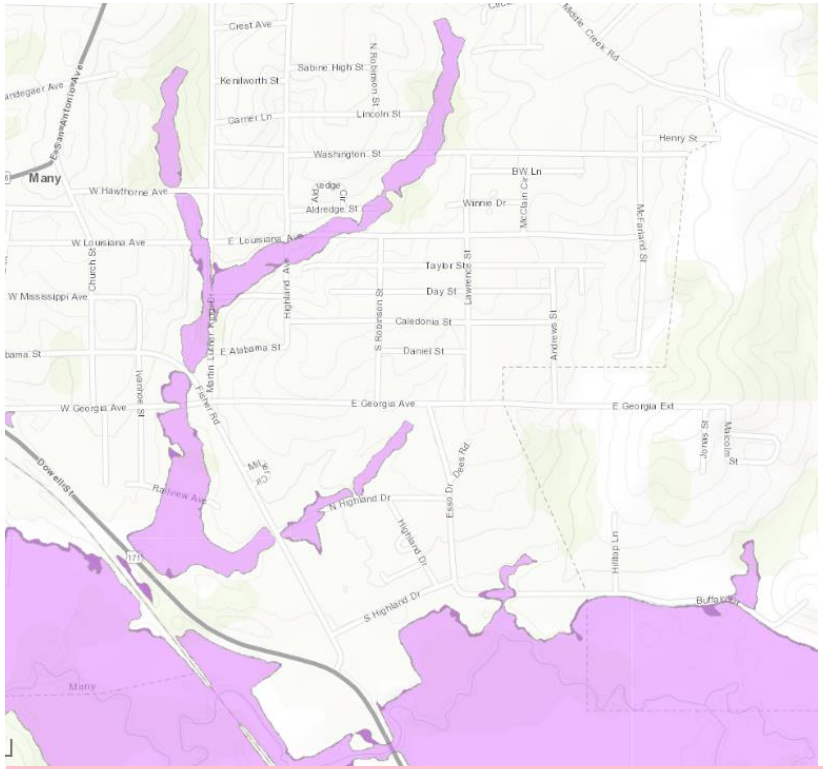
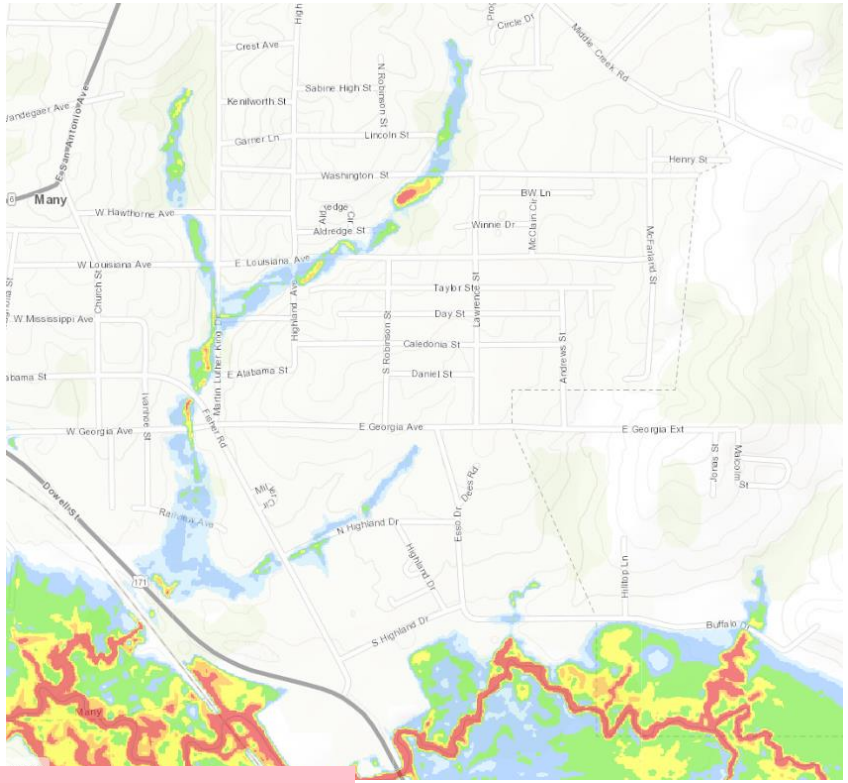
BASE LEVEL ENGINEERING (BLE)





High risk (1% flood zone)

Low to moderate risk (0.2% flood zone)

≤ 1 foot	> 3 to 4 feet
> 1 to 2 feet	> 4 to 5 feet
> 2 to 3 feet	> 5 feet

OUTPUTS

- Hydrology modeling (Regression) flows w/gage analysis
- Hydraulic modeling (HEC-RAS) for 10%, 4%, 2%, 1% and 0.2% storm events
- 10%, 1% and 0.2% floodplain boundaries

Non-Regulatory

- Areas of Expanded Flood Risk
- Depth and Analysis Grids
- Flood Risk Assessment

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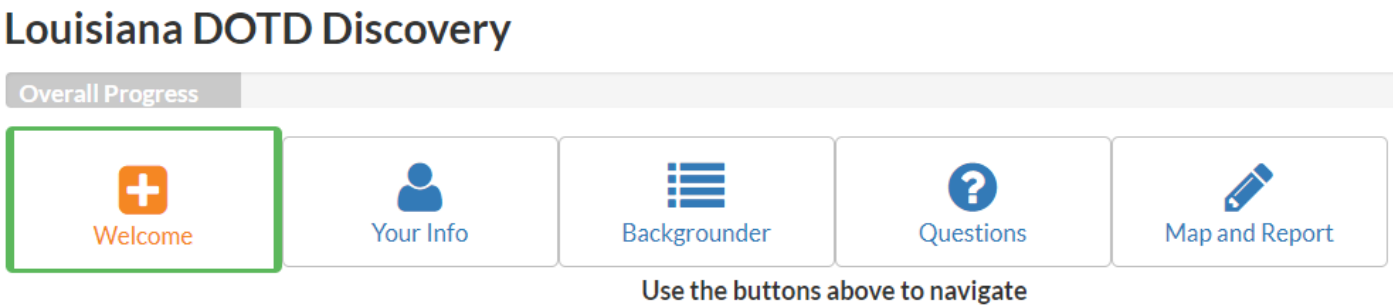
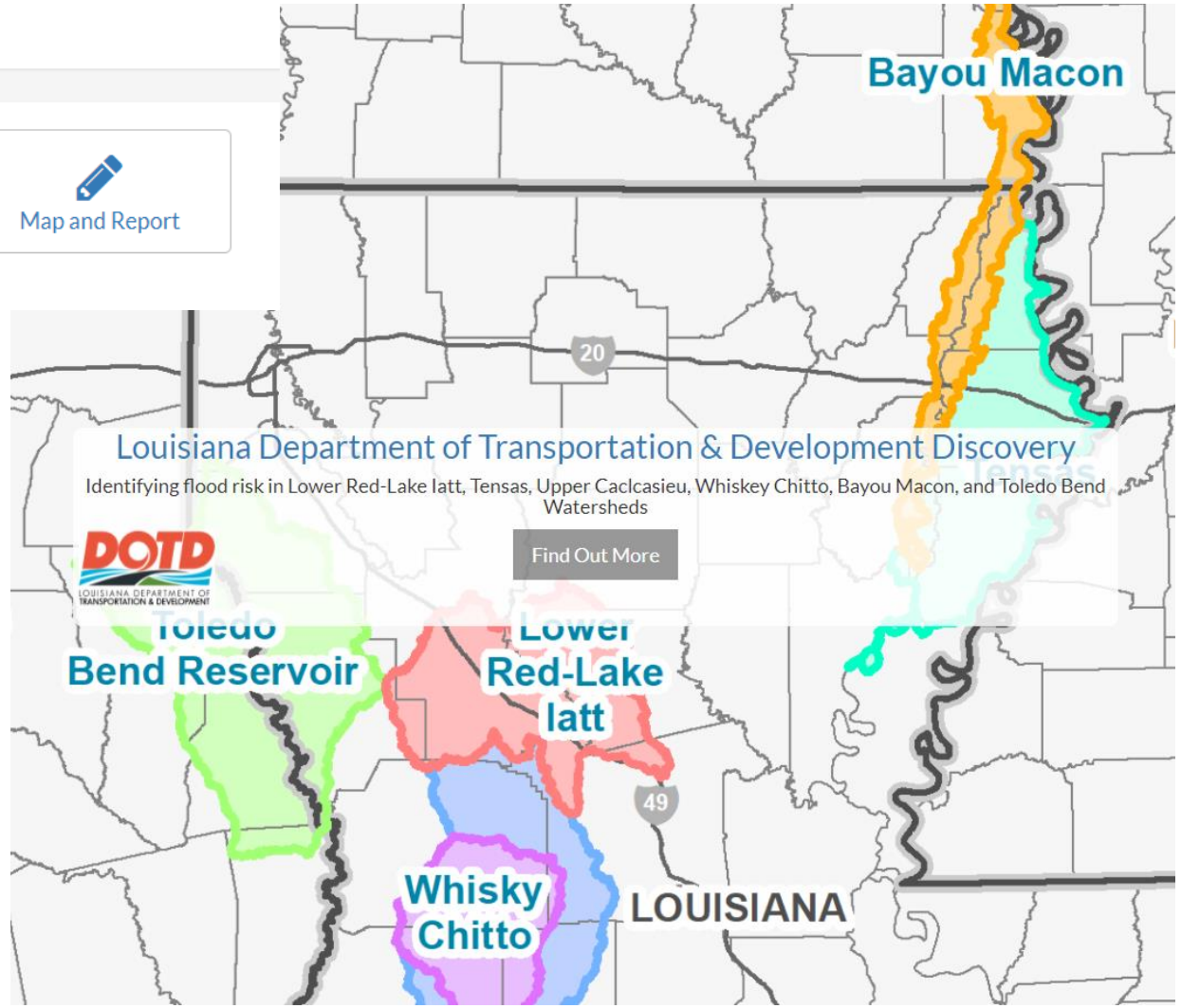
DISCOVERY MEETINGS – PREPARATION



- Enter your data online before the meeting
- Discovery meetings in March
- All community stakeholders are encouraged to attend



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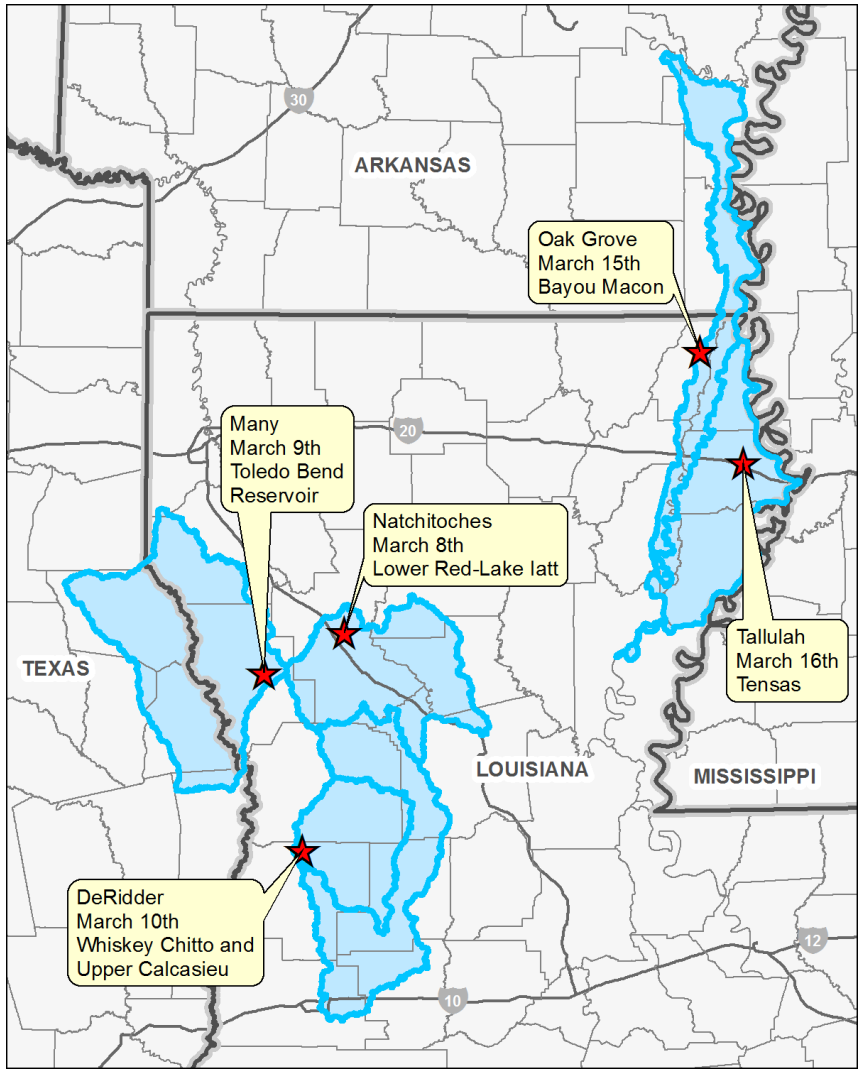
DISCOVERY MEETINGS – LOCATIONS

- Southwest Watersheds
  - March 8th – Natchitoches
  - March 9th – Many
  - March 10th – DeRidder
- Northeast Watersheds
  - March 15th – Oak Grove
  - March 16th – Tallulah



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DISCOVERY MEETINGS – WHAT TO EXPECT

- "Come and Go" format
- Open conversation
- Serves as additional meeting point beyond the webmap
- Groups present:
  - Federal, State, and Regional Agencies
  - Community Officials and other local stakeholders

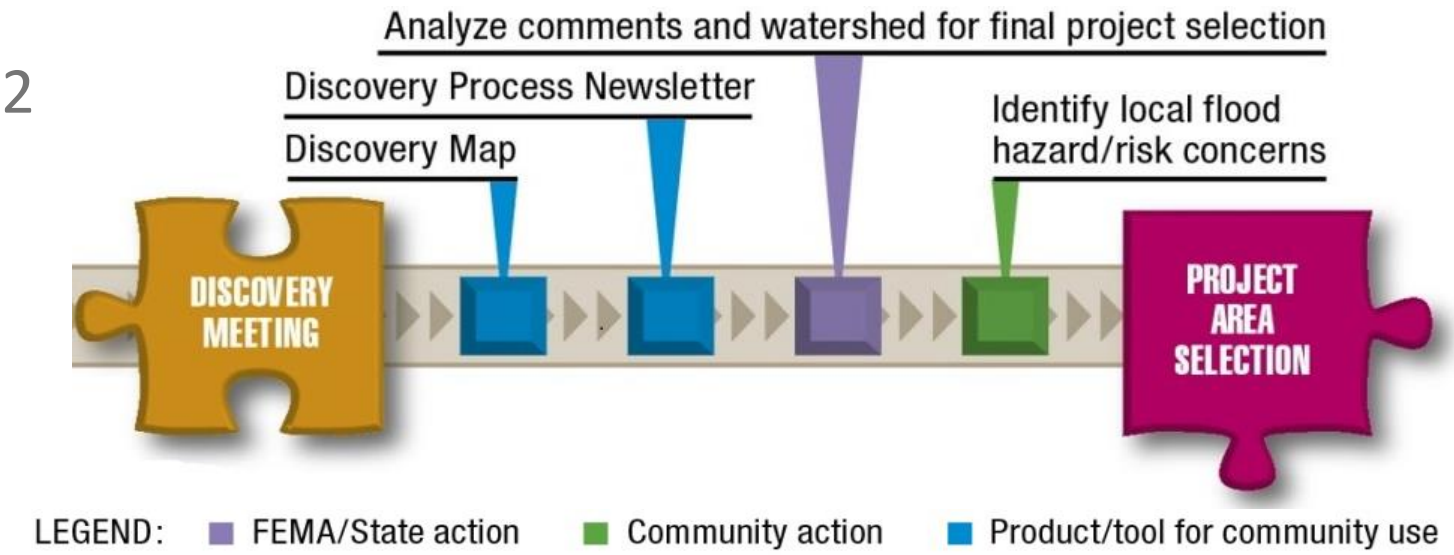


DISCOVERY MEETINGS – WHAT YOU SHOULD BRING

- Knowledge of Flood Risks and Past Flooding in your community
- Hazard Mitigation Projects – Identified, In Progress, or Complete?
- Master Drainage Plan(s), floodplain studies – completed or identified as needs
- Questions or Concerns regarding your current Digital Flood Insurance Rate Maps – Flood Study Needs
- Current Flood Risk Communication Process
- Dams and Levees – Questions or Concerns
- GIS data

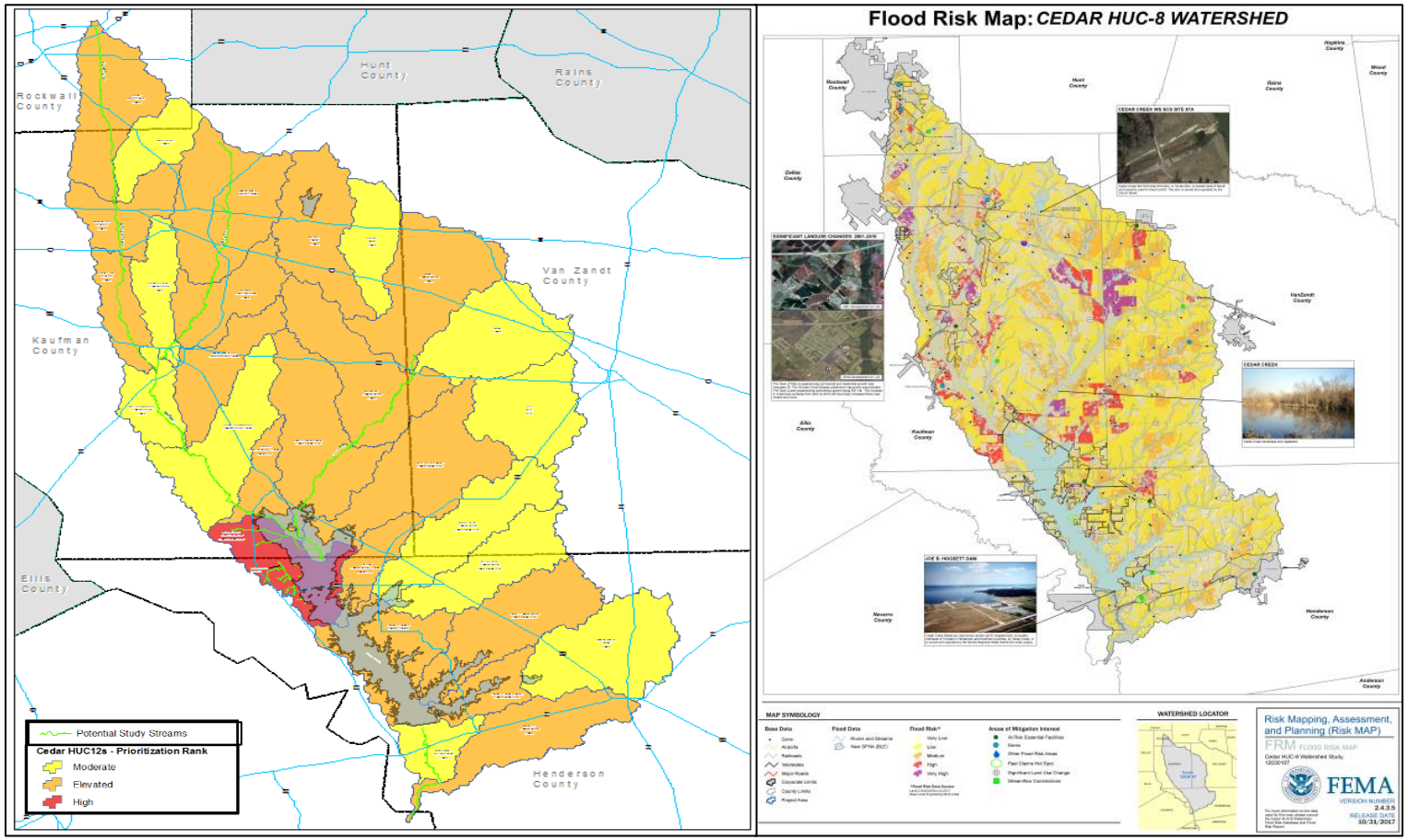
POST-DISCOVERY ACTIONS

- Post-Discovery Actions
  - -Analyze data collected
  - -Review findings with LaDOTD
  - -Preliminary project selections provided to communities
  - -Evaluate community input
  - -Discovery Report
- Findings Meetings – Fall 2022



POST-DISCOVERY RESULTS

- Population density and change
- Predicted population growth
- Historical flood events and claims
- Number of Letters of Map Change (LOMR/LOMA)
- Available current topography
- Age of technical data – hydrology and hydraulics
- Ability to leverage current studies
- Potential for local funding and "work in kind"
- Previous contribution to FEMA studies
- Stakeholder mapping requests



The primary result of Discovery is a list of projects to be considered for funding!

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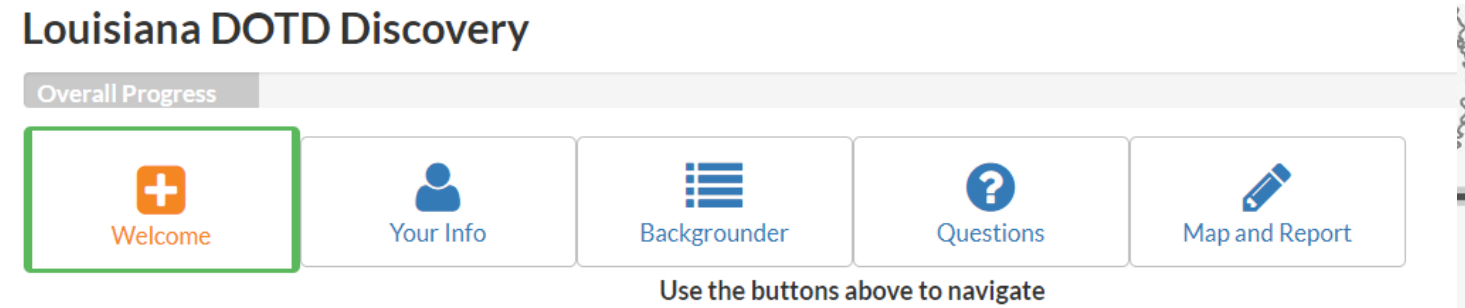
DISCOVERY SUMMARY

- Heighten community involvement and understanding
- Gather all flood-related information available
  - Knowledge of Flood Risks and Past Flooding in your community
  - Hazard Mitigation Projects – ongoing, planned or completed
  - Master Drainage Plans and floodplain studies – ongoing, planned or completed
  - Current flood risk communication process
  - GIS data
- Request needs in the community
  - Questions and concerns for DFIRM maps
  - All questions and concerns for dams and levees
  - Study request in areas of repetitive loss
  - Areas of new development or other causes of concern for the future
  - Funding needs for identified flood risk projects

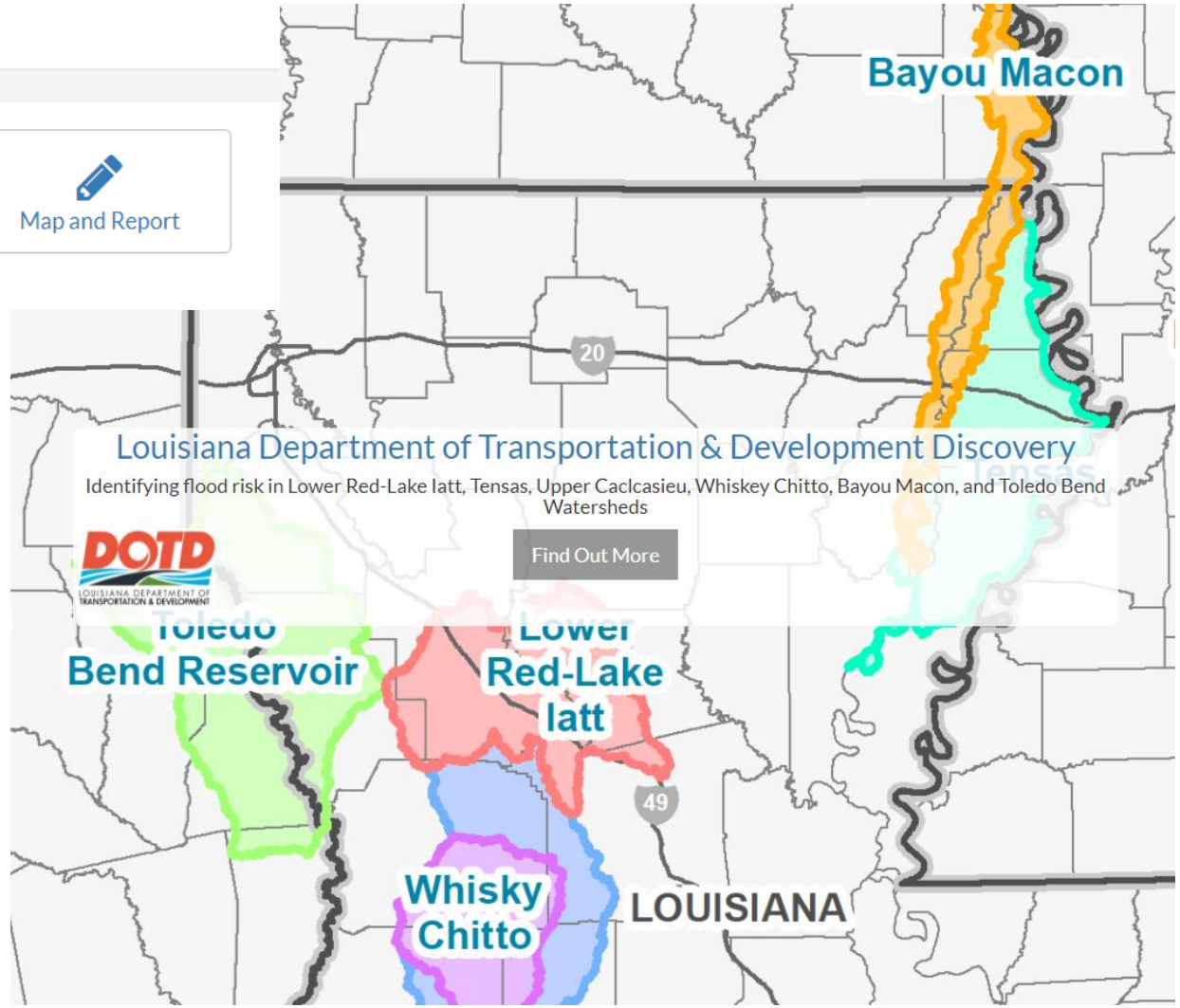
DISCOVERY SUMMARY

- Next steps
  - Involve other people in your office, team and community
  - Go to the website and add all information you gather
  - Call or email with questions
  - Join us in March for the Discovery meeting for any additional conversation
  - Get funding for your area!

PLEASE ENTER YOUR INFORMATION ON THE WEBSITE – LIVE AFTER THIS MEETING



Customize Discovery:
After the meeting, enter your community's data at:
https://dotd.discovery.halff.com
Password: DOTD_FY20!



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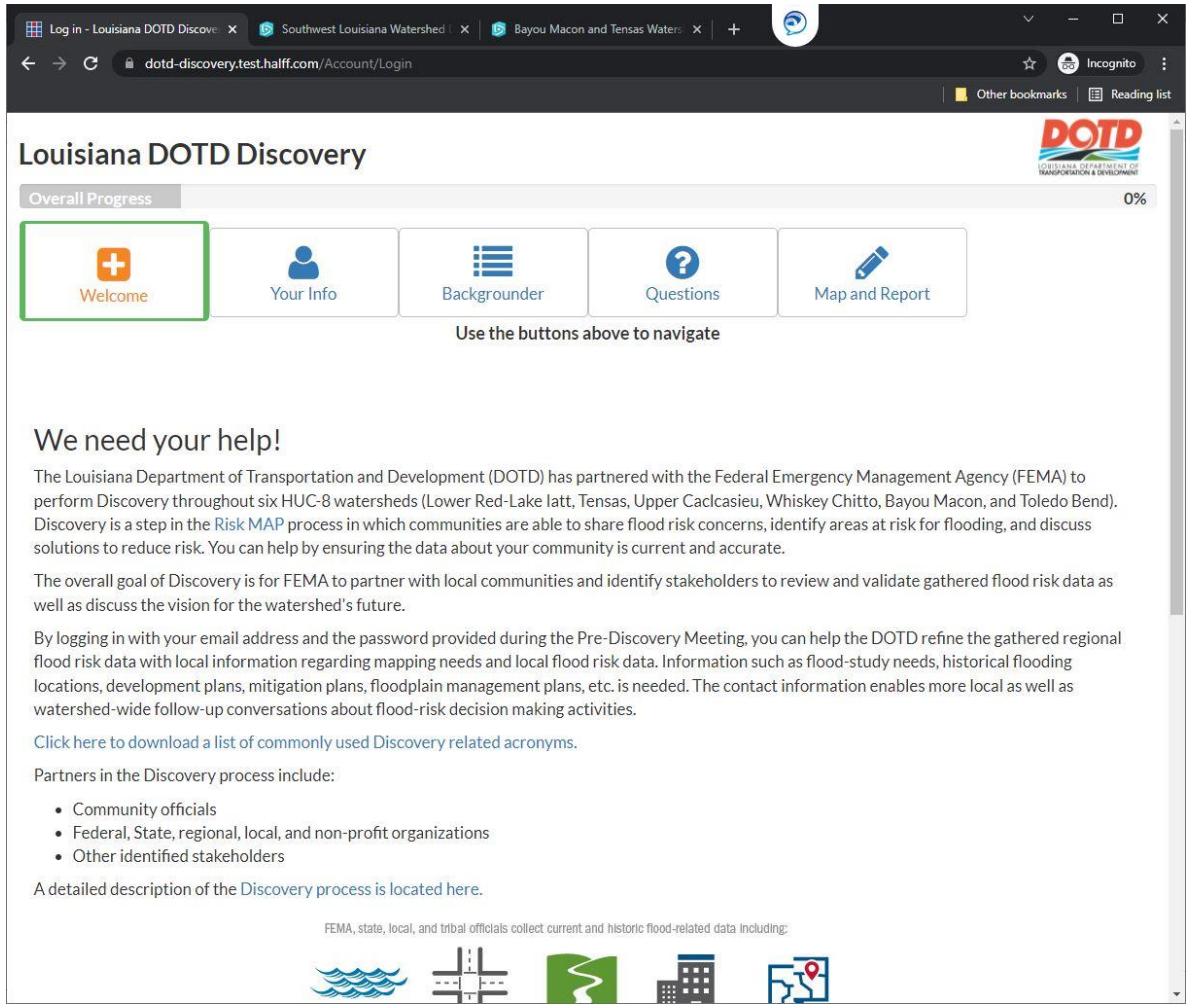
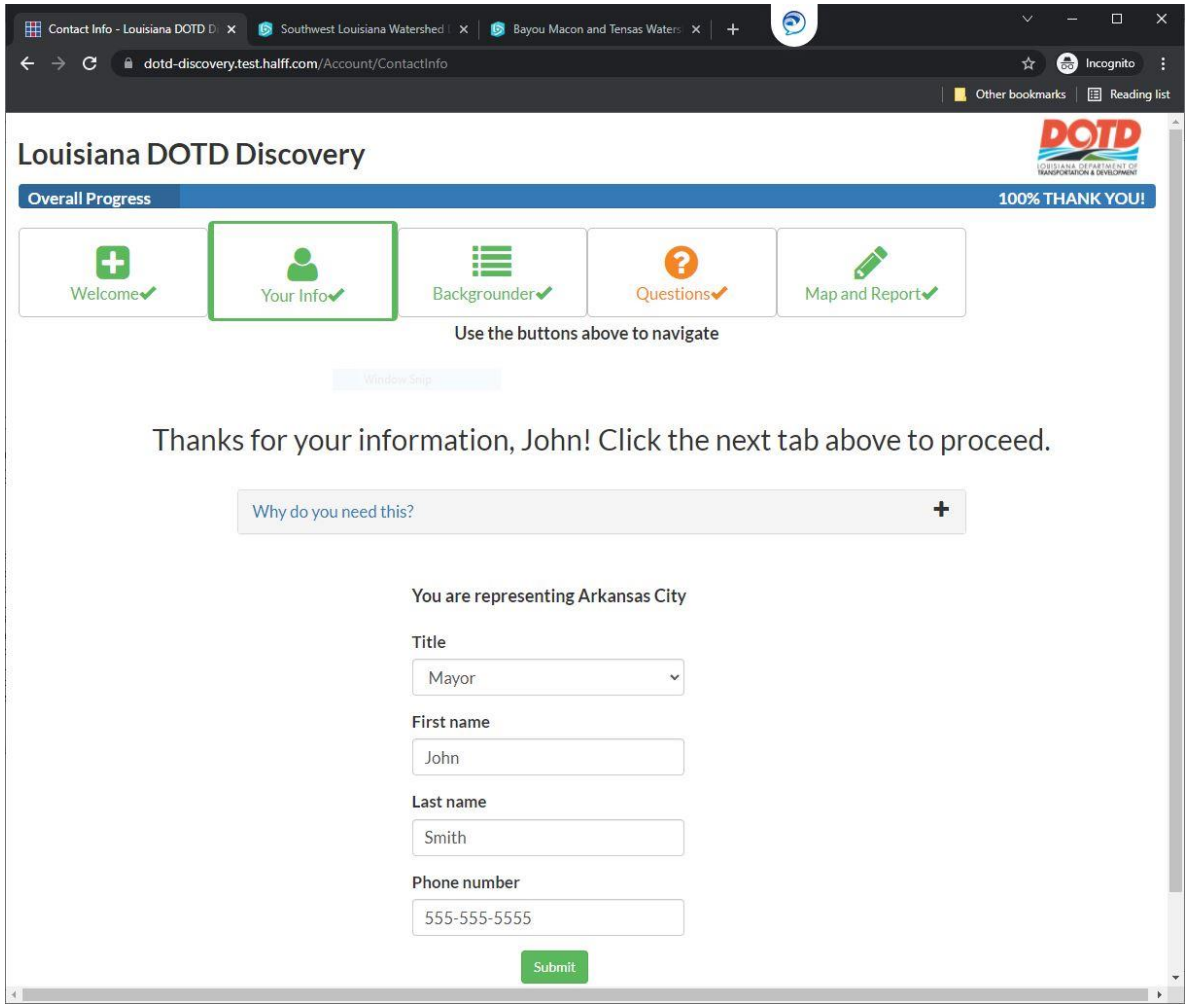
WEBSITE OVERVIEW





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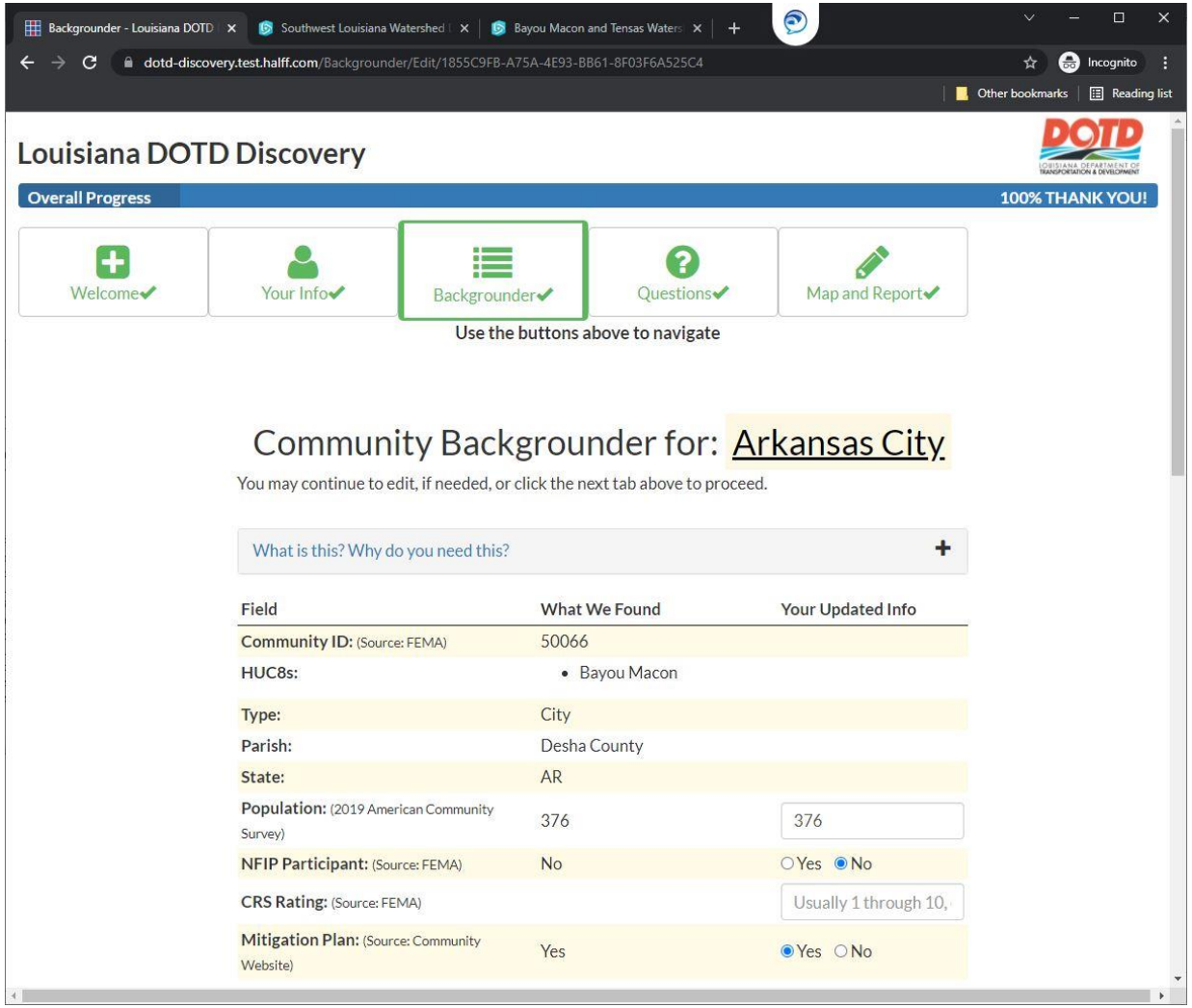
WEBSITE OVERVIEW

Community Backgrounder

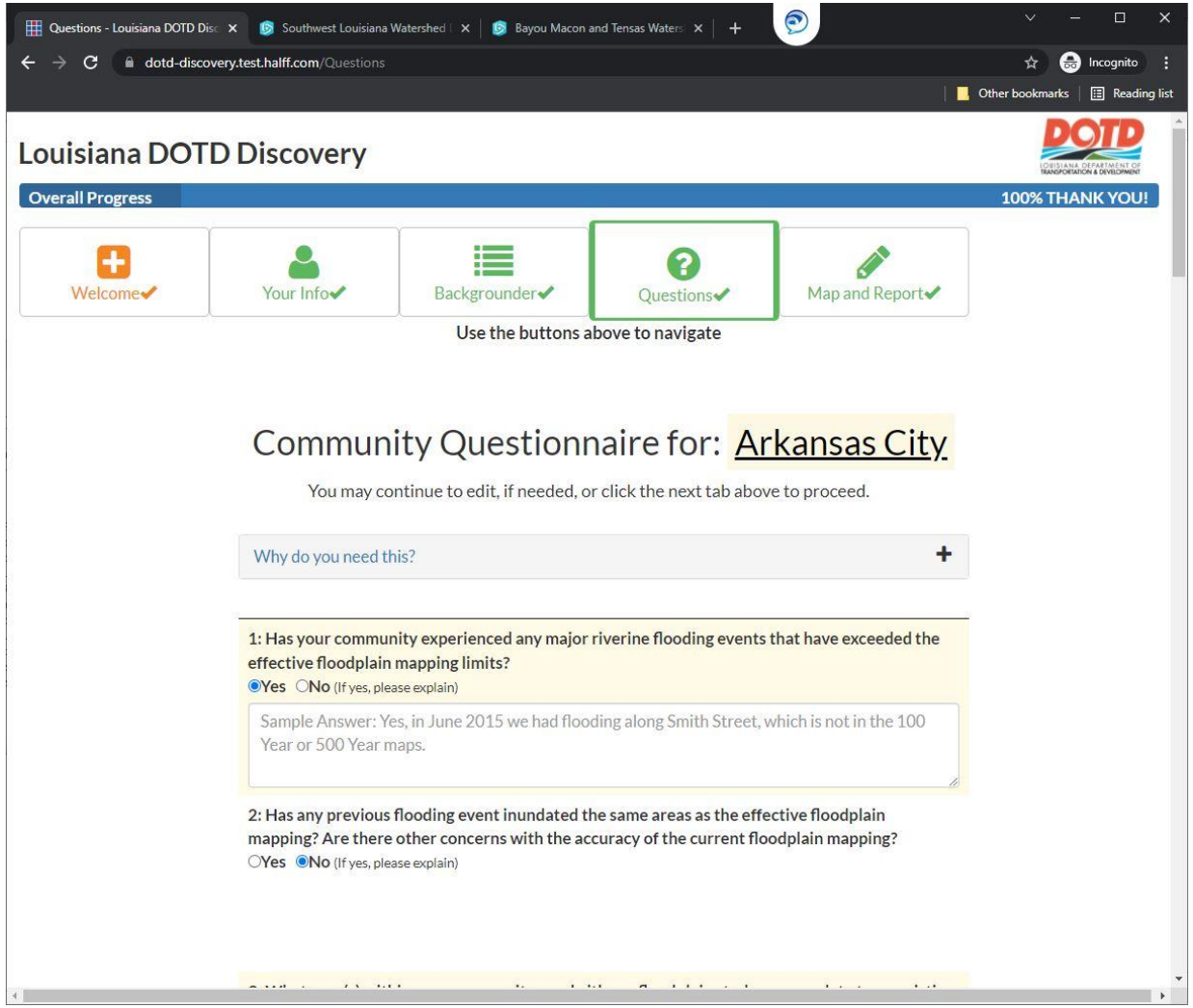
- Snapshot of existing data
- Open for review and verification
  - Key items for verification:
    - Number of NFIP claims
    - Financial cost of losses
    - Mitigation Plan standing (outdated, existing, proposed, etc.)
    - Number of high-water marks
    - Number of low-water crossings



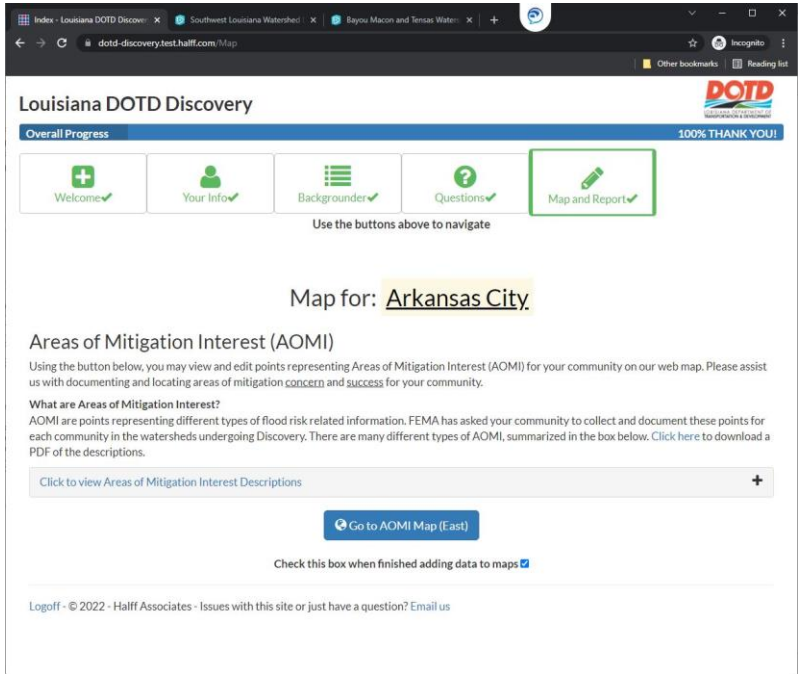
WEBSITE OVERVIEW

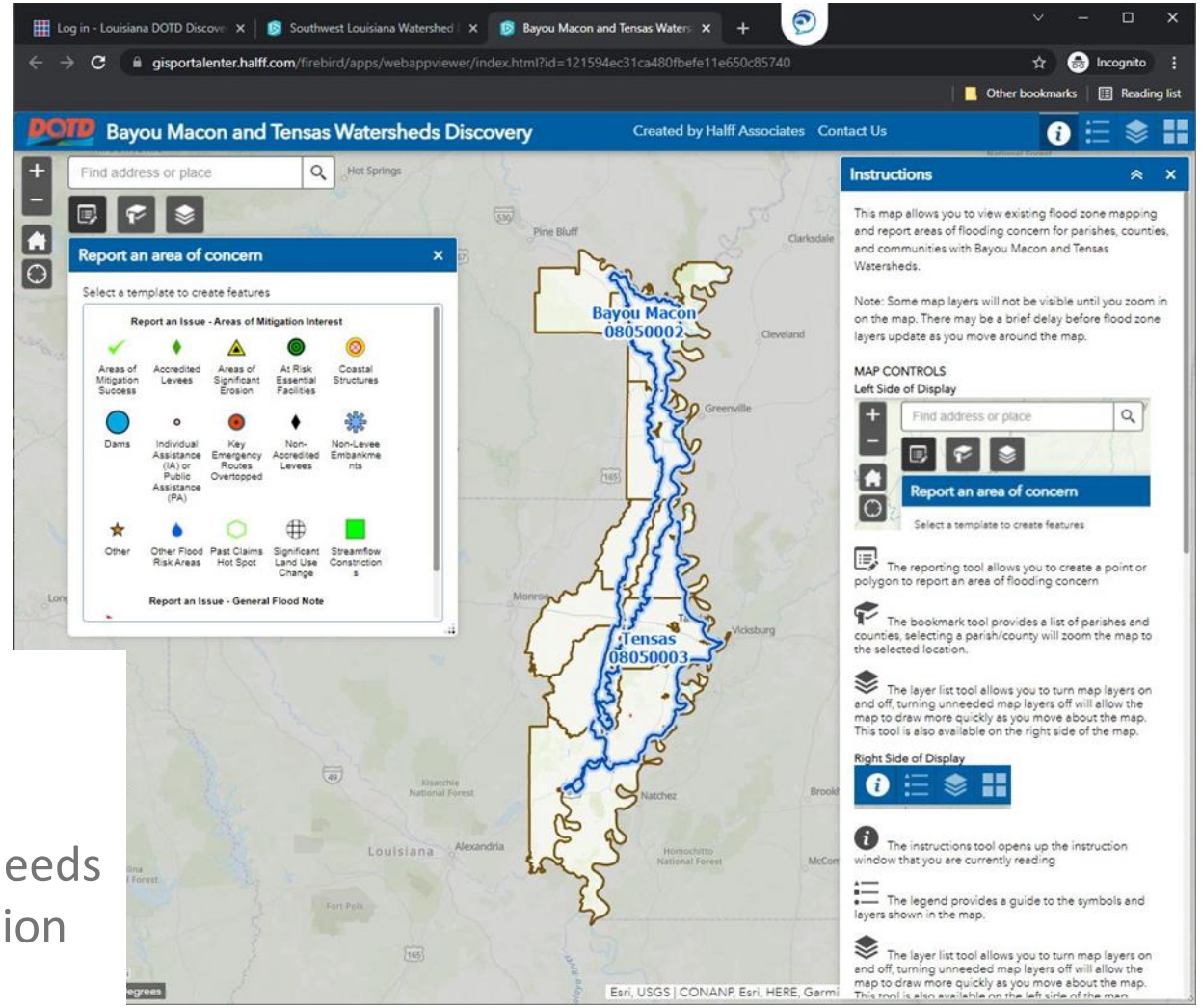
Community Questionnaire

- 26 questions to guide flood risk conversation and data gathering/mapping
- Sample responses provided



WEBSITE OVERVIEW





Interactive Webmap

- Areas of Mitigation Interest (AOMI)
- Gathering information on mitigation success and needs
- Place for all additional data and mapping risk location
- Tutorial available online

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QUESTIONS?



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QUESTIONS

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Discovery Findings Webinar Slides

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LOUISIANA DISCOVERY

"CAPTURING A MORE COMPLETE PICTURE OF YOUR WATERSHED"

POST-DISCOVERY MEETING

HALFF

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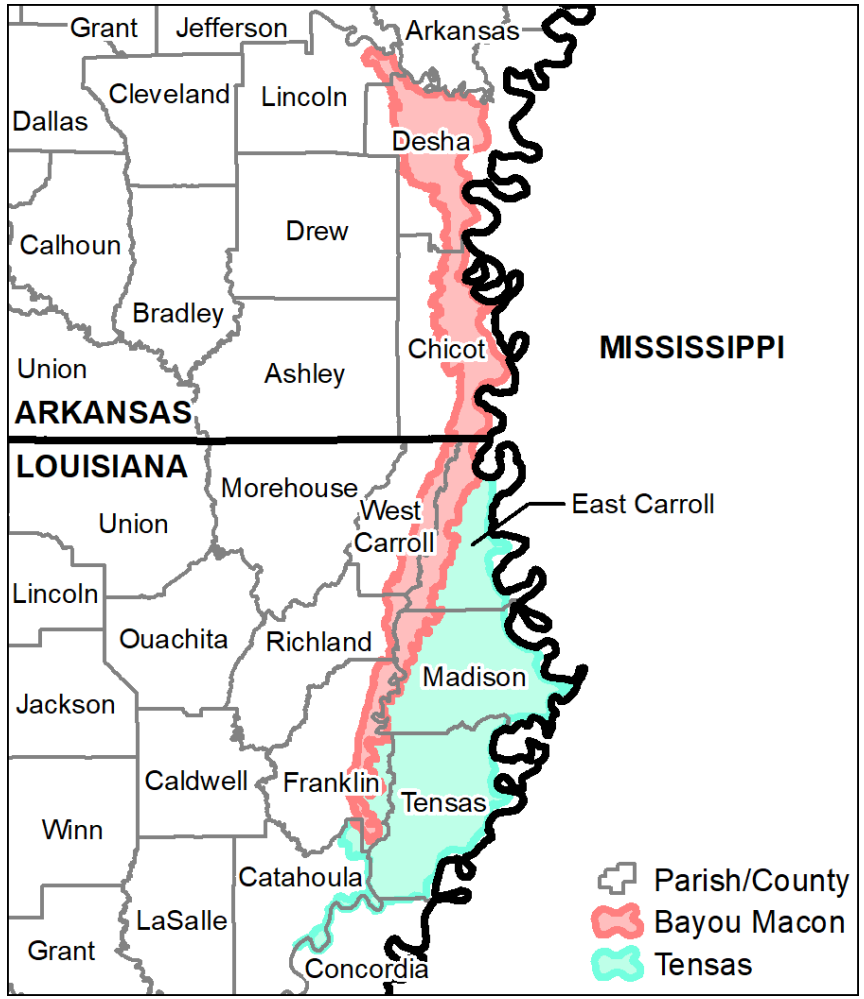
(501) 801-2683
dskultety@Halff.com

AGENDA

- Discovery Overview
- Risk MAP Overview
- LaDOTD Discovery Activities
  - Activities
  - Findings
- BFE Overview
- Post Meeting Coordination
- Project Recommendations to FEMA



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DISCOVERY OVERVIEW

Discovery is FEMA's process for identifying and accessing flood risk to better prepare a list of needs and projects to address those needs within communities.

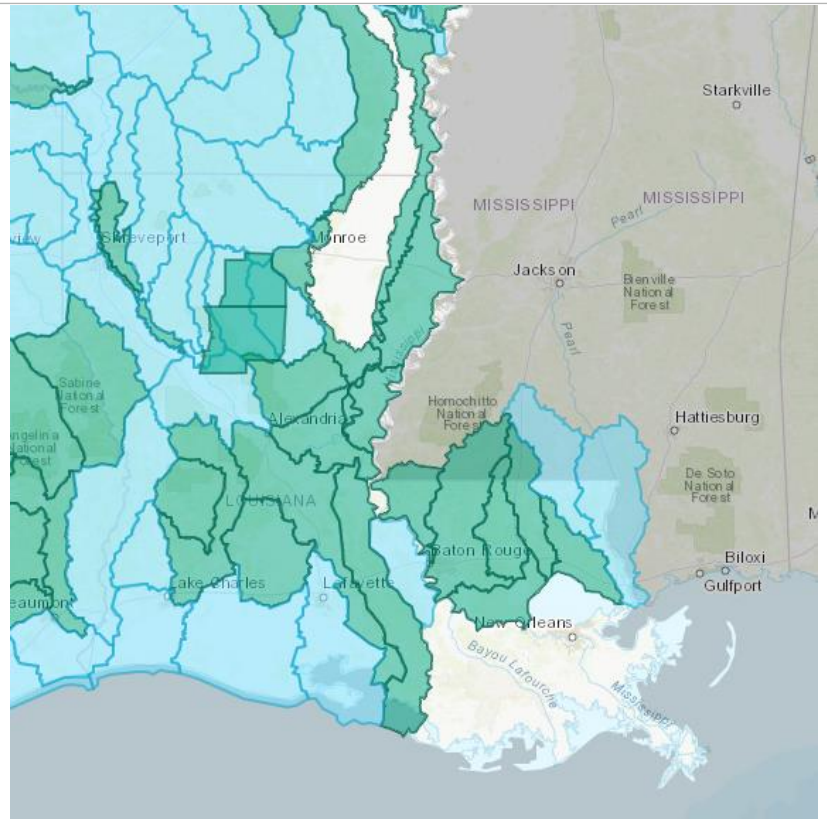
- Heighten community involvement and understanding
- Gather all flood-related information available
  - Knowledge of Flood Risks and Past Flooding in your community
  - Hazard Mitigation Projects – ongoing, planned or completed
  - Master Drainage Plans and floodplain studies – ongoing, planned or completed
  - Current flood risk communication process
  - GIS data

DISCOVERY OVERVIEW

- Request needs in the community
  - Questions and concerns for DFIRM maps
  - All questions and concerns for dams and levees
  - Study request in areas of repetitive loss
  - Areas of new development or other causes of concern for the future
  - Funding needs for identified flood risk projects

- Present Projects for Consideration
  - Modeling and Mapping needs
  - Structural improvements listed in the Flood Risk Map

FEMA'S RISK MAP PROGRAM OVERVIEW



- Provide flood information and tools for better **protection**
- **Action-Driven** through local understanding and ownership of risk



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FEMA'S RISK MAP PROGRAM OVERVIEW

FEMA'S RISK MAPPING, ASSESSMENT, AND PLANNING (MAP) PROGRAM



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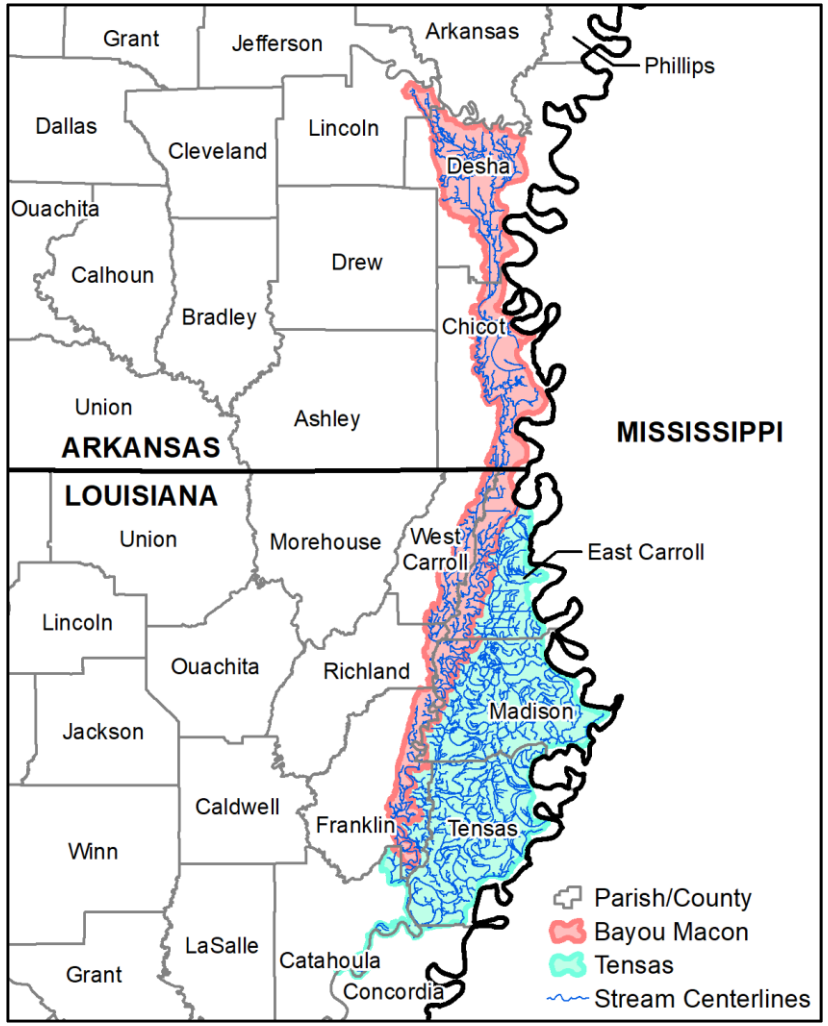
LOUISIANA DOTD DISCOVERY GOALS

Louisiana Watersheds Discovery

- Goals
  - Inform Community of Present Flood Risk
  - Gather local data to supplement National, Regional and State data
  - Present FEMA with areas of highest concern and need for additional study



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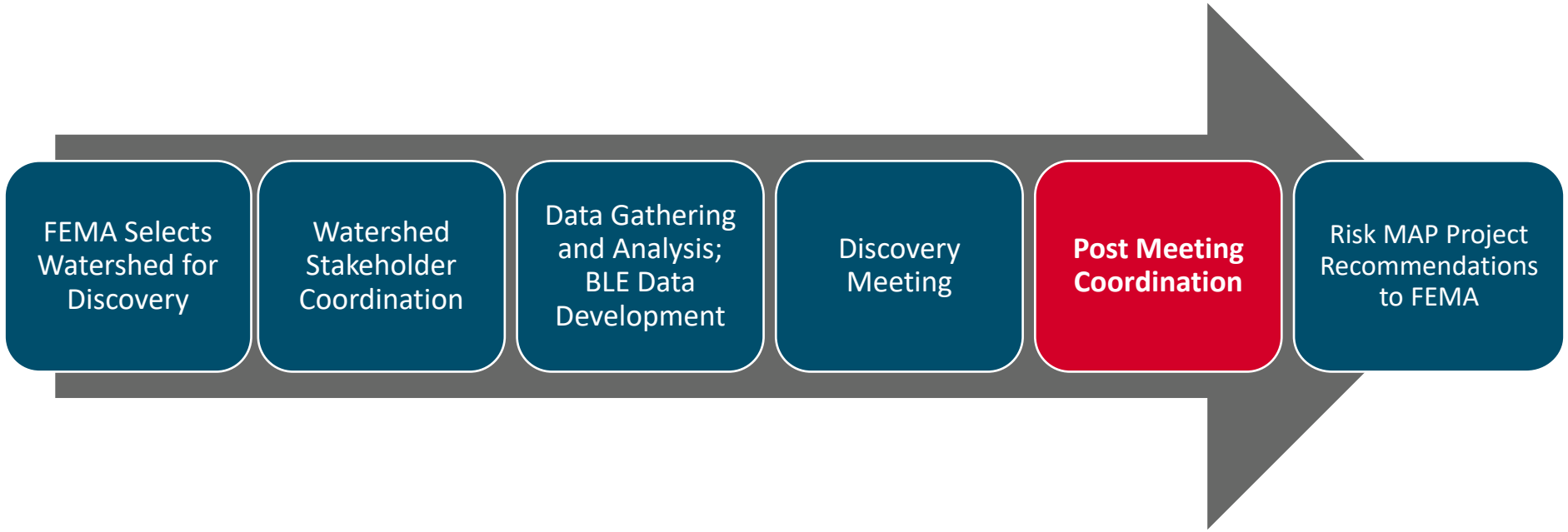
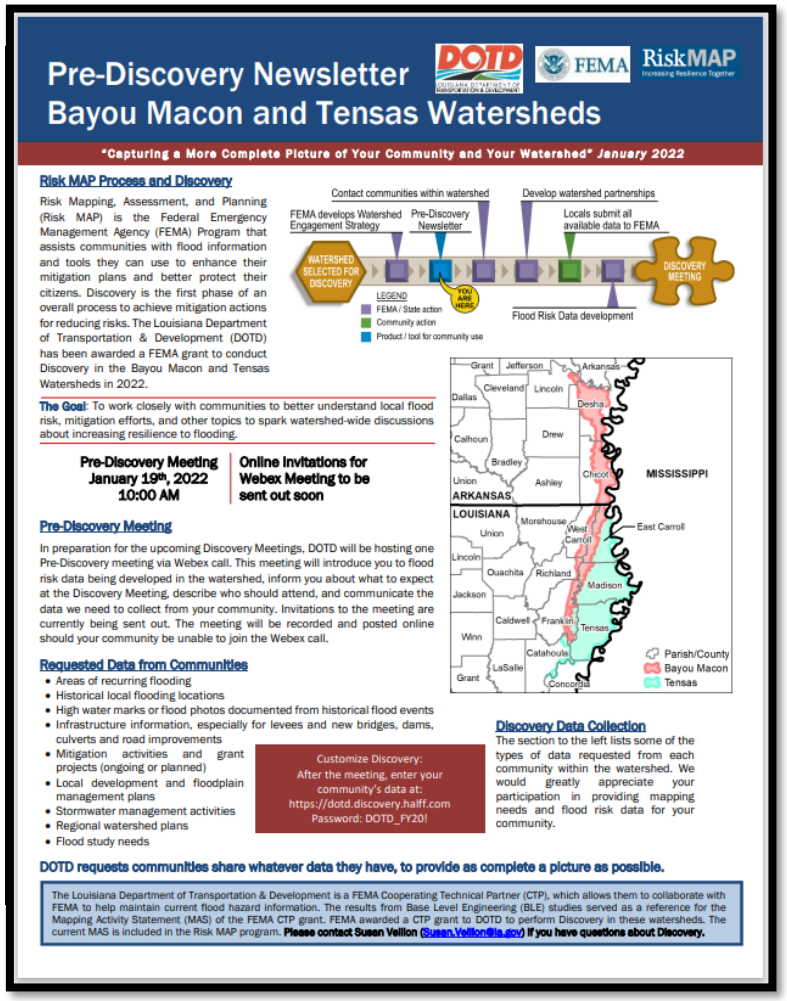
DISCOVERY PROCESS

- ***Capture a more complete picture of your watershed by working closely with local communities…***



PRE-DISCOVERY ACTIVITIES



Pre-Discovery Newsletter
Bayou Macon and Tensas Watersheds

DOTD | FEMA | RiskMAP Increasing Resilience Together

"Capturing a More Complete Picture of Your Community and Your Watershed" January 2022

Risk MAP Process and Discovery

Risk Mapping, Assessment, and Planning (Risk MAP) is the Federal Emergency Management Agency (FEMA) Program that assists communities with flood information and tools they can use to enhance their mitigation plans and better protect their citizens. Discovery is the first phase of an overall process to achieve mitigation actions for reducing risks. The Louisiana Department of Transportation & Development (DOTD) has been awarded a FEMA grant to conduct Discovery in the Bayou Macon and Tensas Watersheds in 2022.

Contact communities within watershed | Develop watershed partnerships
FEMA develops Watershed Engagement Strategy | Pre-Discovery Newsletter | Locals submit all available data to FEMA
WATERSHED SELECTED FOR DISCOVERY → YOU ARE HERE → Flood Risk Data development → DISCOVERY MEETING
LEGEND: FEMA / State action; Community action; Product / tool for community use

The Goal: To work closely with communities to better understand local flood risk, mitigation efforts, and other topics to spark watershed-wide discussions about increasing resilience to flooding.

Pre-Discovery Meeting
January 19th, 2022
10:00 AM

Online invitations for Webex Meeting to be sent out soon

Pre-Discovery Meeting

In preparation for the upcoming Discovery Meetings, DOTD will be hosting one Pre-Discovery meeting via Webex call. This meeting will introduce you to flood risk data being developed in the watershed, inform you about what to expect at the Discovery Meeting, describe who should attend, and communicate the data we need to collect from your community. Invitations to the meeting are currently being sent out. The meeting will be recorded and posted online should your community be unable to join the Webex call.

Requested Data from Communities

- Areas of recurring flooding
- Historical local flooding locations
- High water marks or flood photos documented from historical flood events
- Infrastructure information, especially for levees and new bridges, dams, culverts and road improvements
- Mitigation activities and grant projects (ongoing or planned)
- Local development and floodplain management plans
- Stormwater management activities
- Regional watershed plans
- Flood study needs

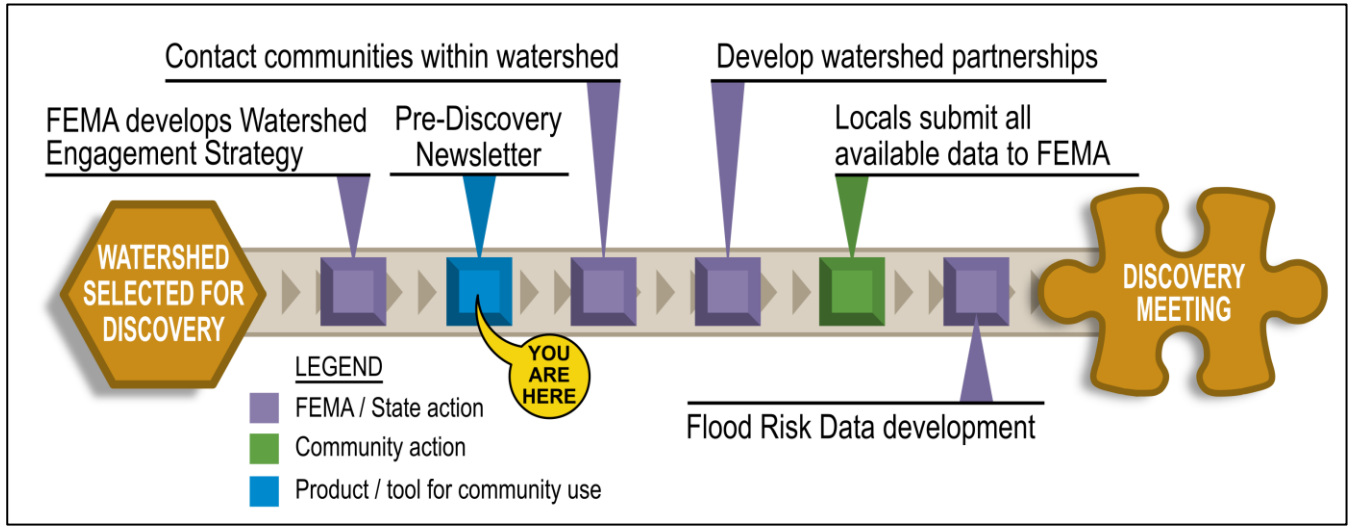
Customize Discovery:
After the meeting, enter your community's data at:
https://dotd.discovery.halff.com
Password: DOTD_FY20!

Discovery Data Collection

The section to the left lists some of the types of data requested from each community within the watershed. We would greatly appreciate your participation in providing mapping needs and flood risk data for your community.

DOTD requests communities share whatever data they have, to provide as complete a picture as possible.

The Louisiana Department of Transportation & Development is a FEMA Cooperating Technical Partner (CTP), which allows them to collaborate with FEMA to help maintain current flood hazard information. The results from Base Level Engineering (BLE) studies served as a reference for the Mapping Activity Statement (MAS) of the FEMA CTP grant. FEMA awarded a CTP grant to DOTD to perform Discovery in these watersheds. The current MAS is included in the Risk MAP program. **Please contact Susan Veillon (Susan.Veillon@la.gov) if you have questions about Discovery.**



Pre-Discovery Meeting
January 19th, 2022
10:00 AM

Online invitations for Webex Meeting to be sent out soon

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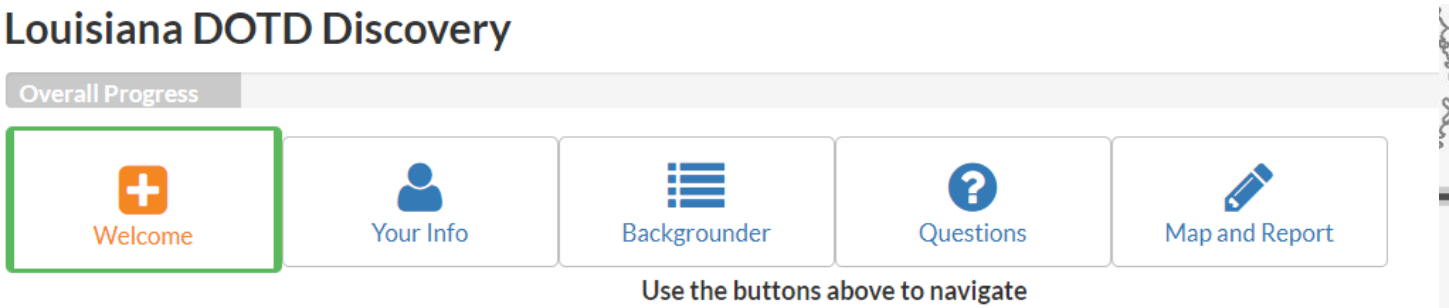
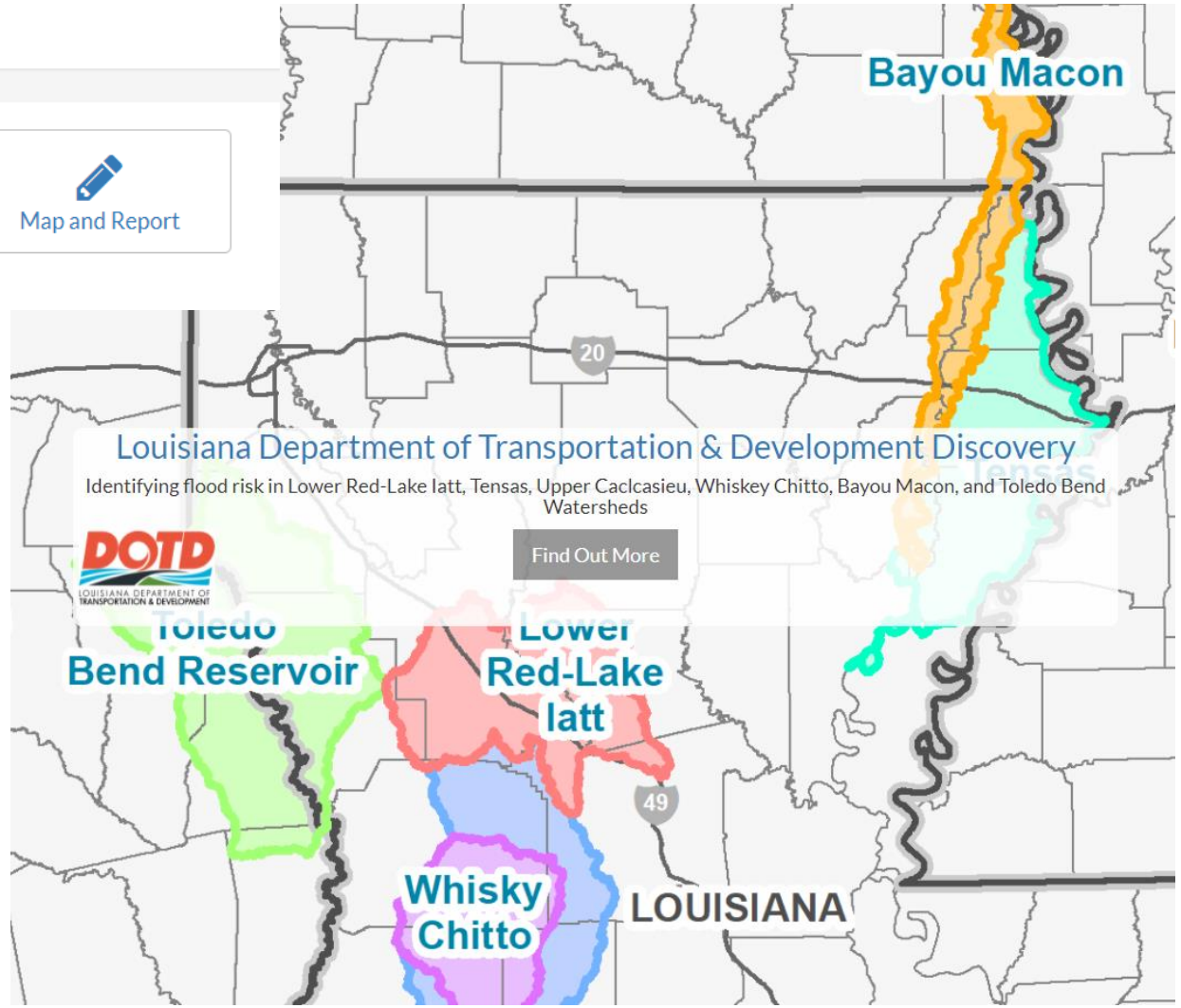
DISCOVERY ACTIVITIES – WEBSITE



- Enter your communities' data online
- Discovery meetings were conducted in March
- All community stakeholders were encouraged to attend



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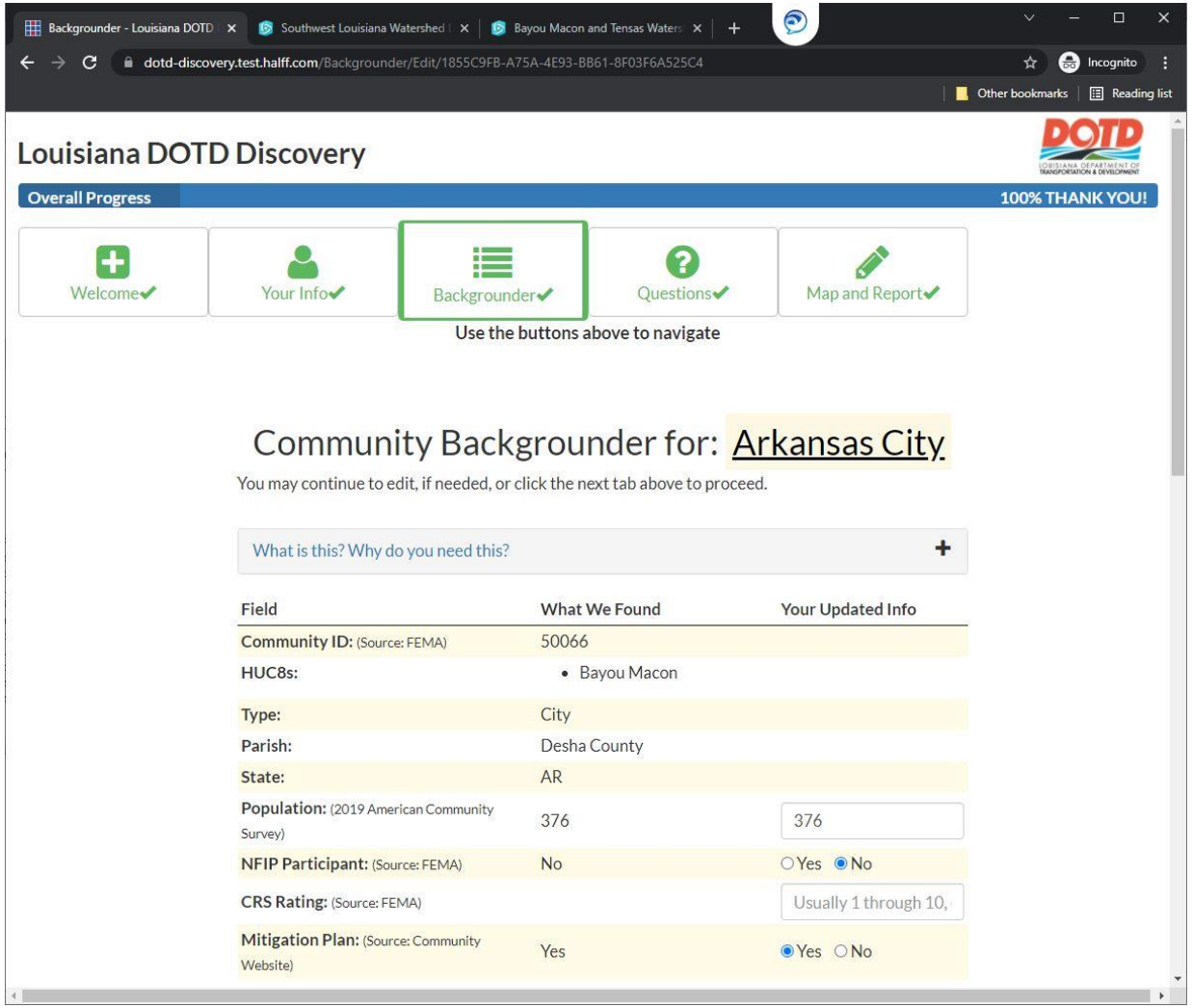
DISCOVERY ACTIVITIES – WEBSITE

Community Backgrounder

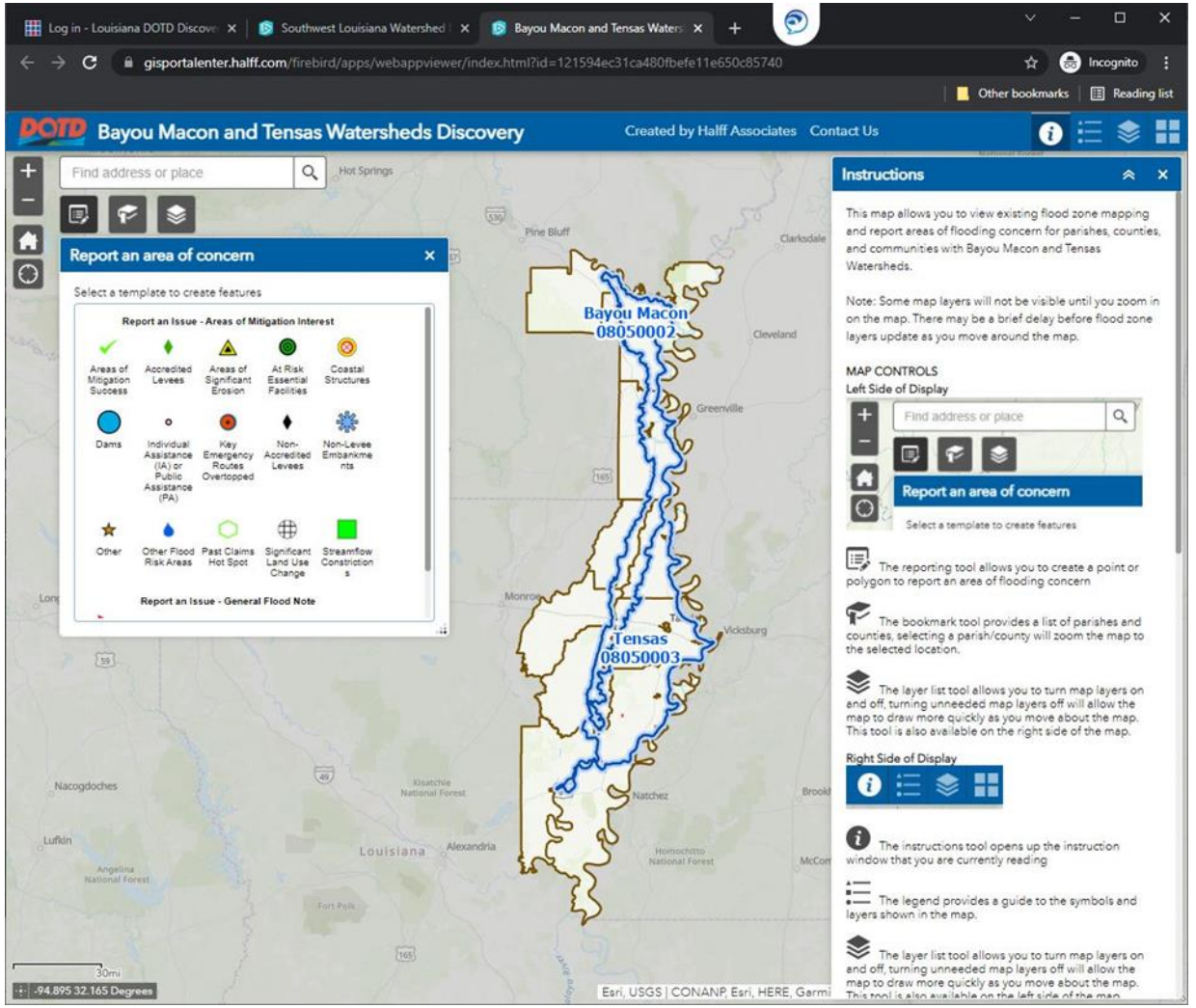
- Key items for verification:
  - Number of NFIP claims
  - Financial cost of losses
  - Mitigation Plan standing (outdated, existing, proposed, etc.)
  - Number of high-water marks
  - Number of low-water crossings
  - Significant Land Use Changes
  - Issues with Effective Mapping



DISCOVERY ACTIVITIES – WEBSITE

Interactive Webmap

- Areas of Mitigation Interest (AOMI)
- Gathering information on mitigation success and needs, significant erosion areas, past claim hotspots, and other flood risk areas
- Place for all additional data and mapping risk location



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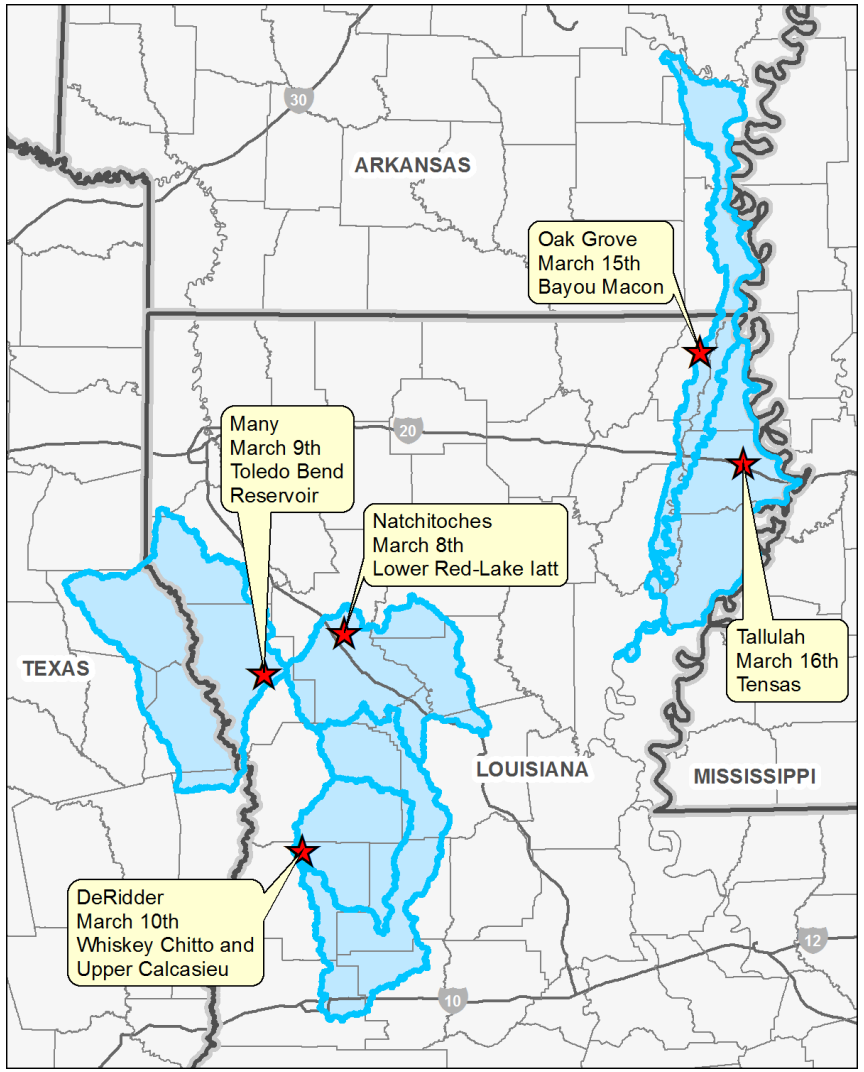
DISCOVERY ACTIVITIES – MEETINGS

- Northeast Watersheds
  - March 15th – Oak Grove
  - March 16th – Tallulah
- Southwest Watersheds
  - March 8th – Natchitoches
  - March 9th – Many
  - March 10th – DeRidder



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DISCOVERY ACTIVITIES – MEETINGS

- "Come and Go" format
- Open conversation
- Served as additional meeting point beyond the webmap
- Facilitated discussion among stakeholders
- Received flooding issues
- Groups present:
  - Federal, State, and Regional Agencies
  - Community Officials and other local stakeholders









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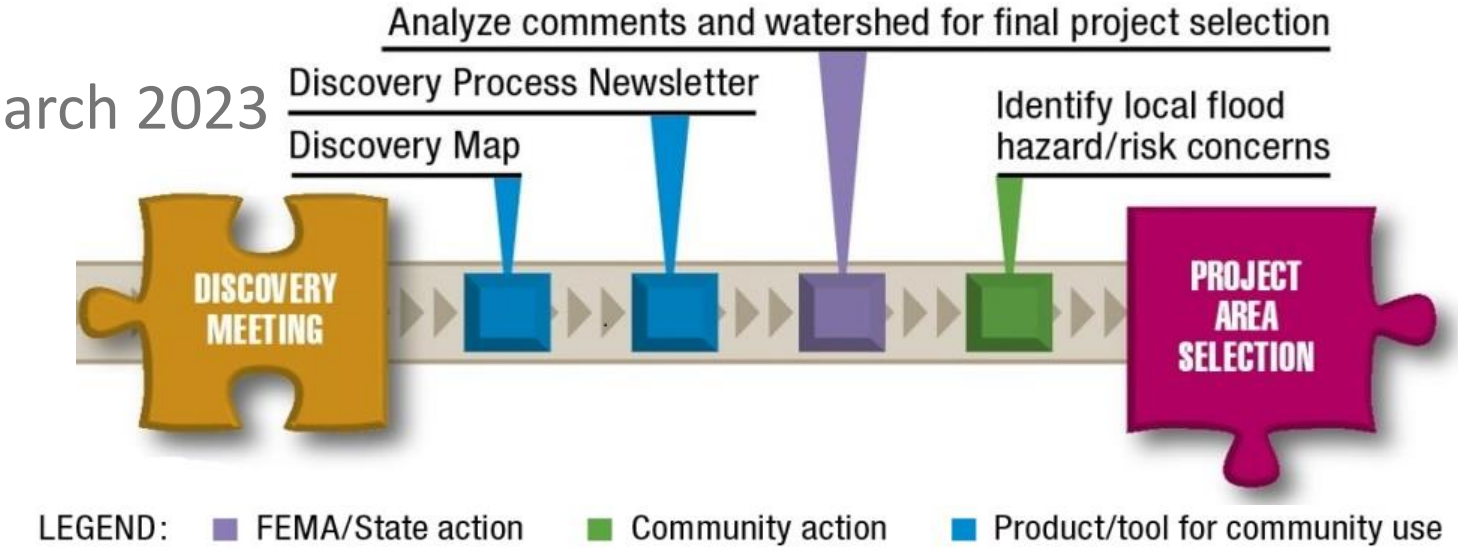
POST-DISCOVERY ACTIVITIES

- Post-Discovery Actions
  -Analyze data collected
  -Review findings with LaDOTD
  -Preliminary project selections provided to communities
  -Evaluate community input
  -Discovery Report
- Post-Discovery Meeting – March 2023

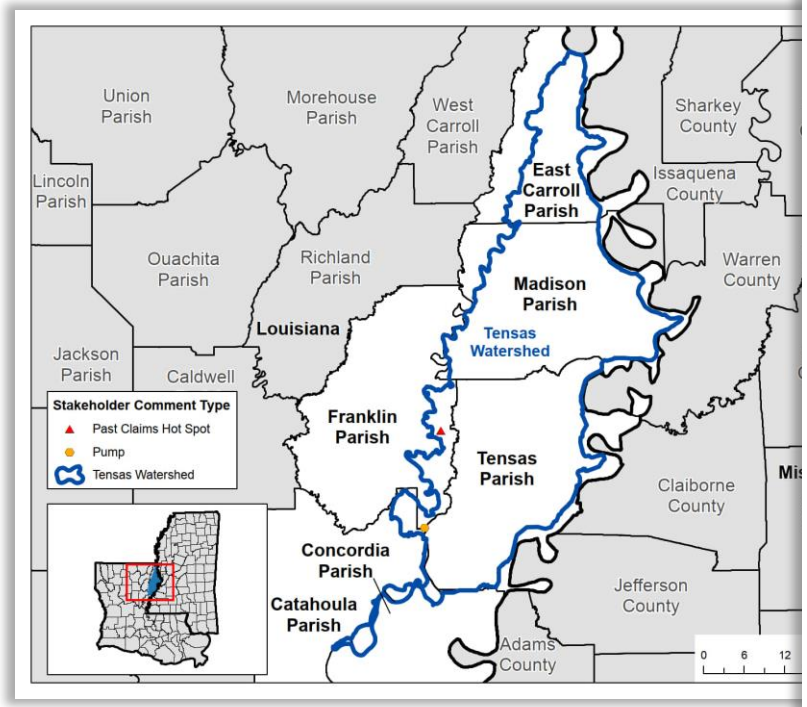


FINDINGS

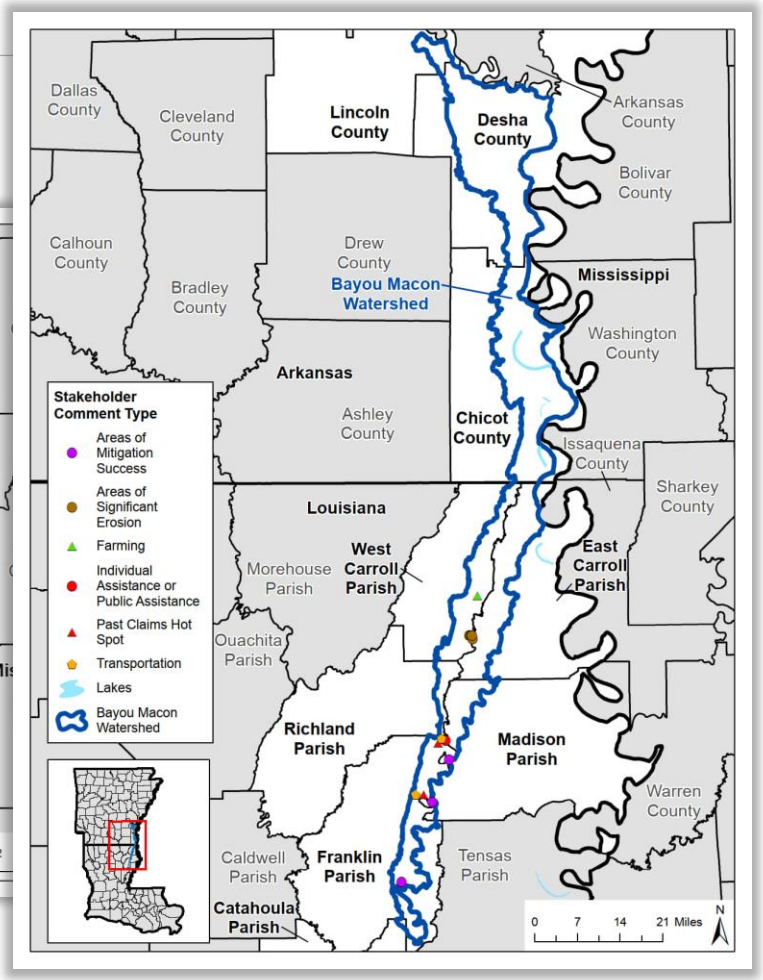
49 STAKEHOLDER MAP COMMENTS

Number of Comments	Parish
2	Catahoula
1	Concordia
0	East Carroll
14	Franklin
8	Madison
0	Richland
0	Tensas
24	West Carroll

Tensas Watershed



Bayou Macon Watershed



The primary result of Discovery is a list of projects to be considered for funding!

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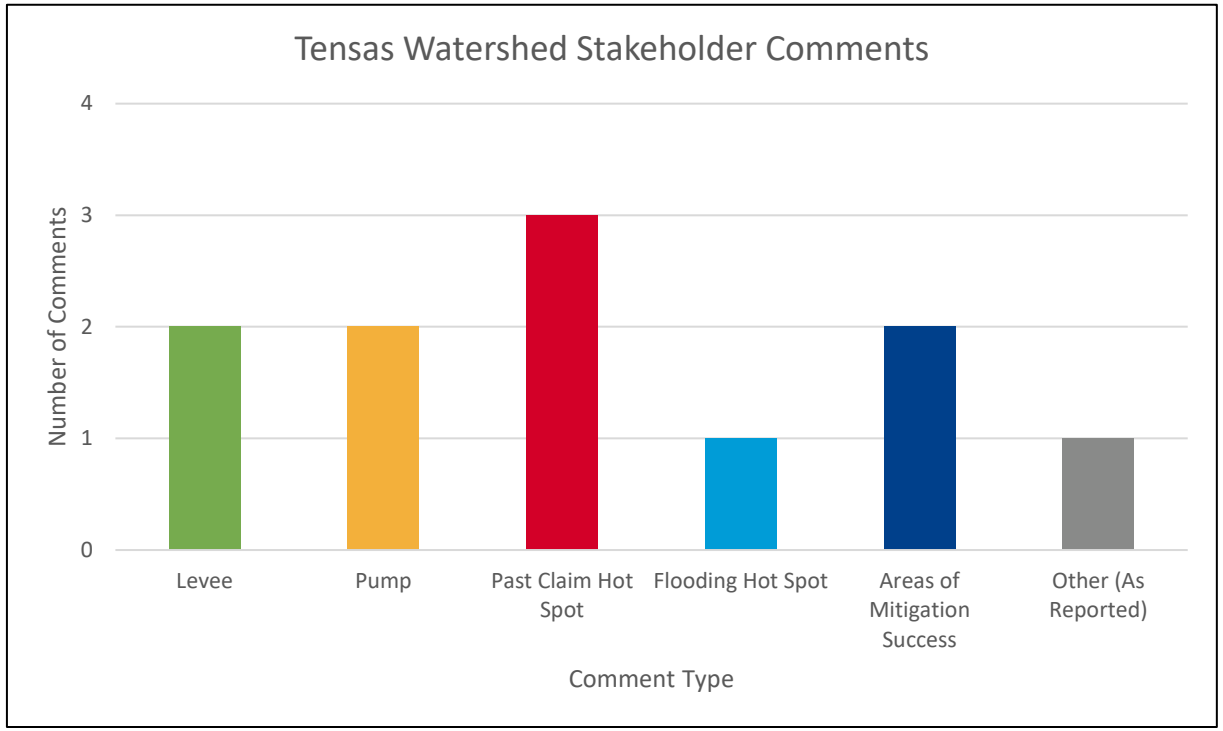
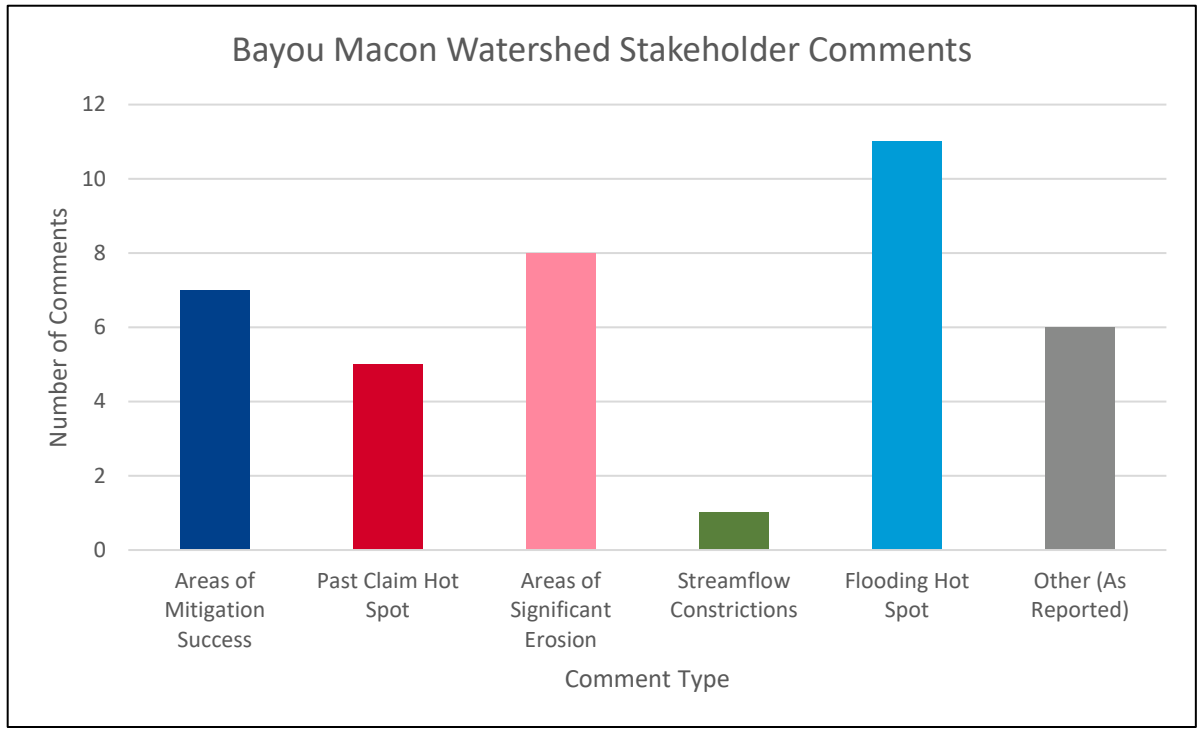
FINDINGS

STAKEHOLDER COMMENTS BY TYPE





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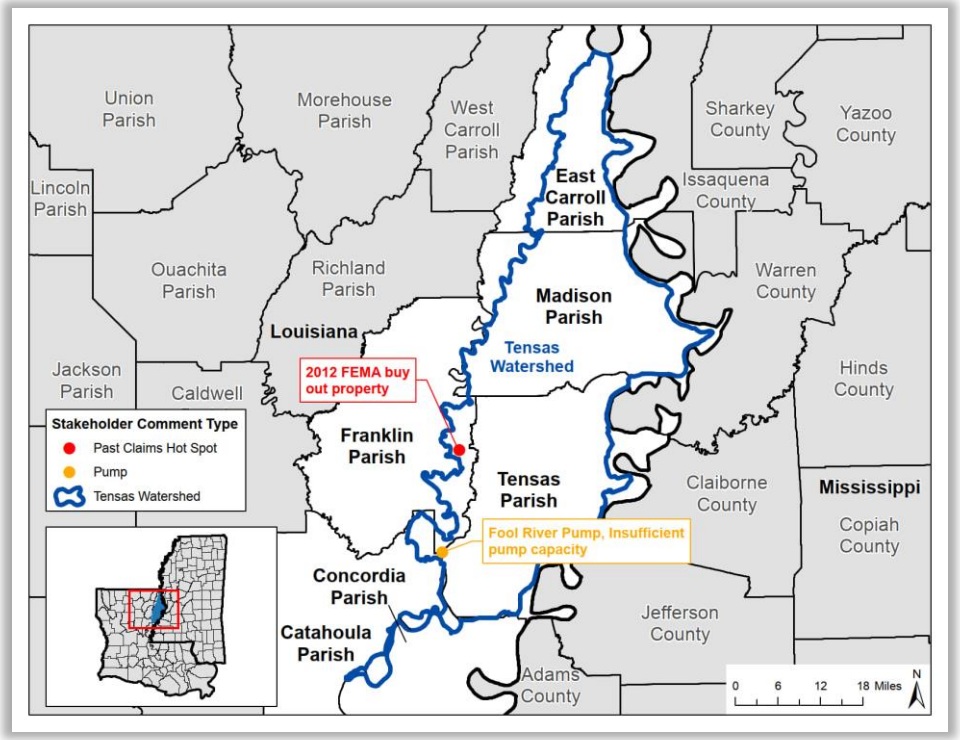
FINDINGS

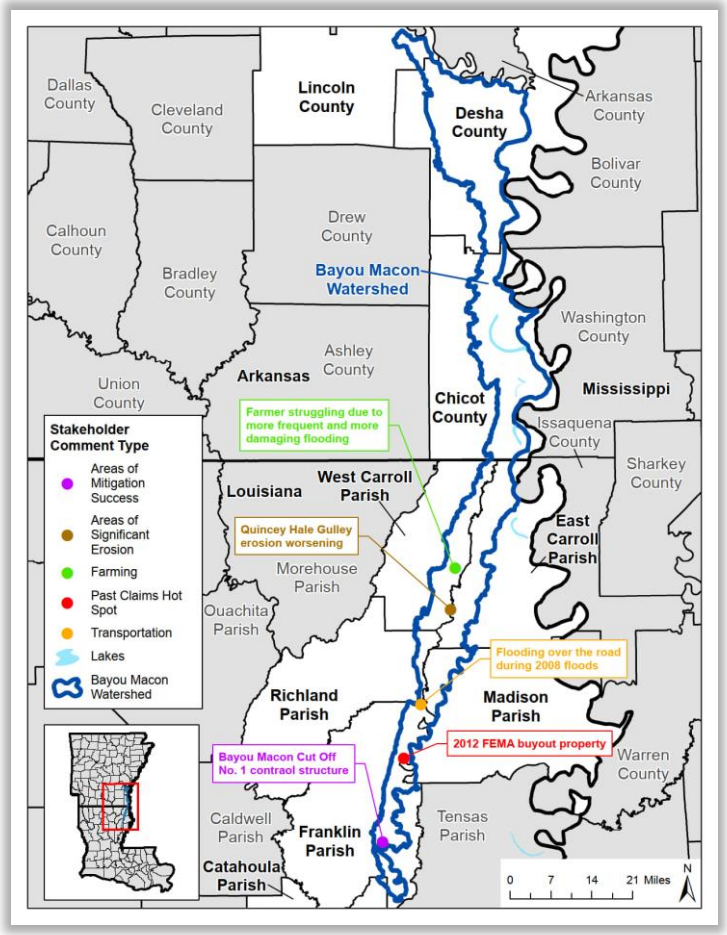
SAMPLE COMMENTS SUBMITTED

Tensas Watershed



SAMPLE COMMENTS SUBMITTED

Bayou Macon Watershed



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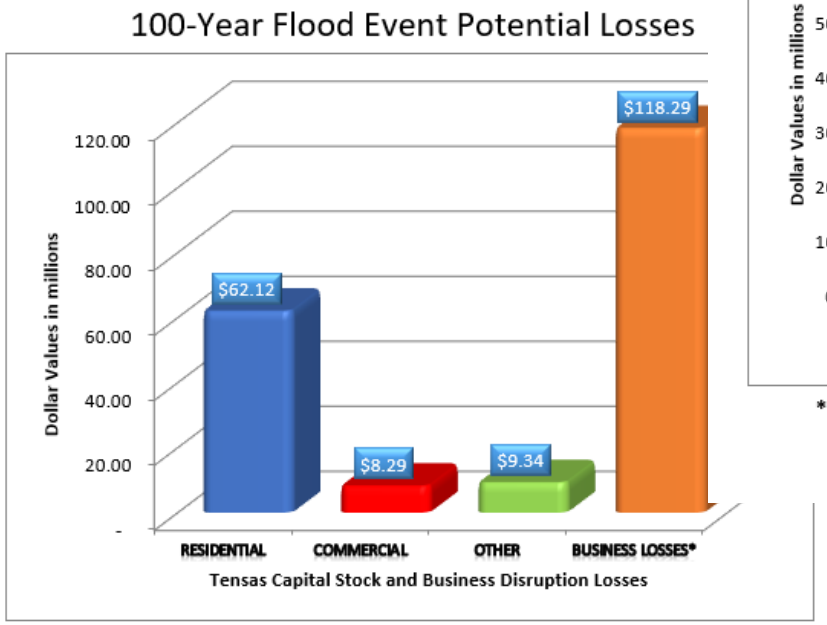
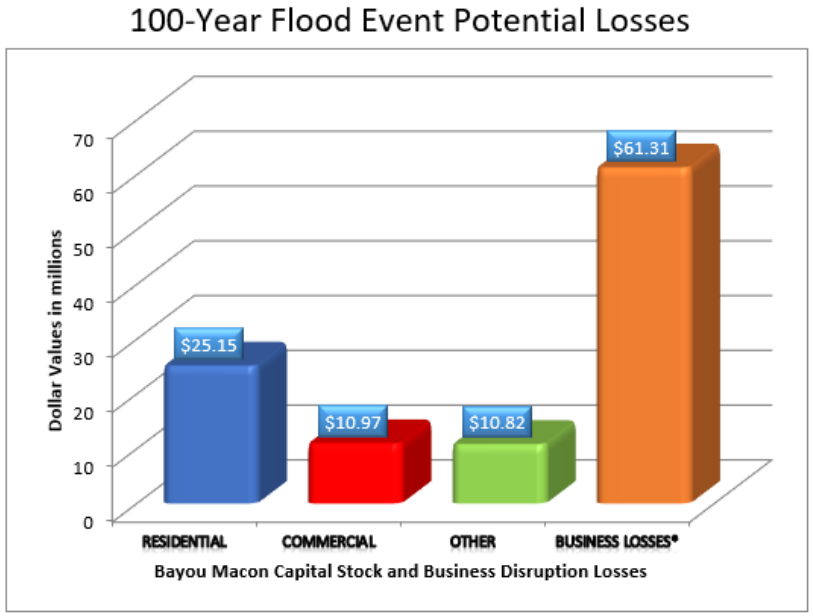
FINDINGS

HAZUS-BASED 100-YEAR POTENTIAL LOSS ESTIMATES

- Identify flooding consequences in damages and other losses
- Based on 100 Year Depth Grids and at-risk assets
- Can be further refined



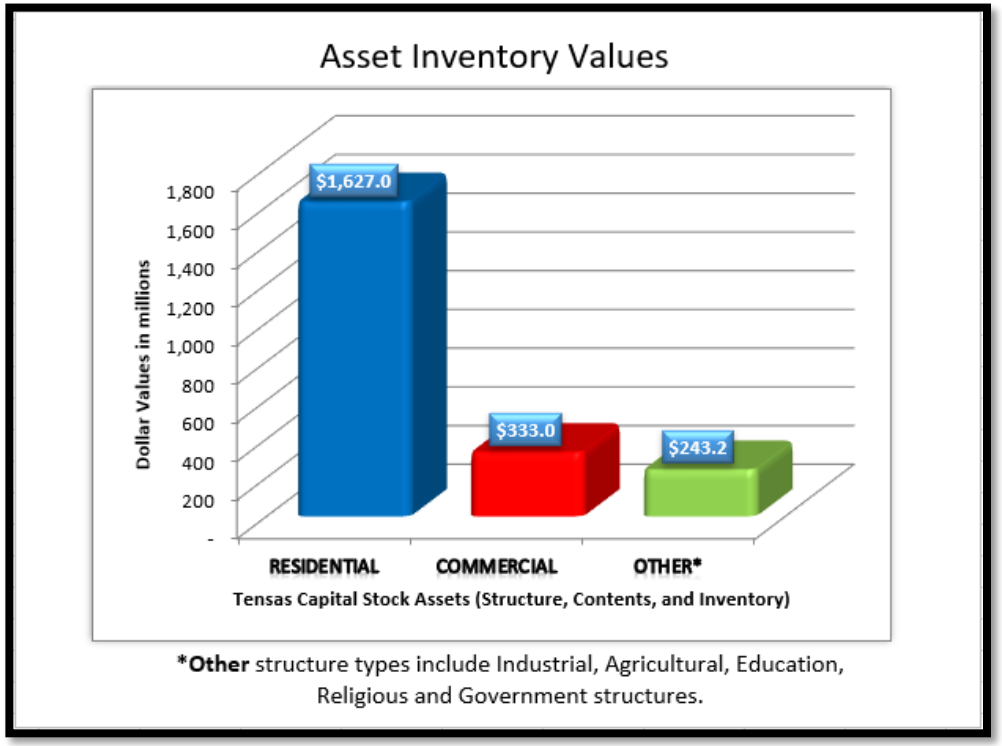
***Business Losses** are the sum of inventory Loss, Relocation Cost, Income Loss, Rental Income Loss, and Wage Loss.



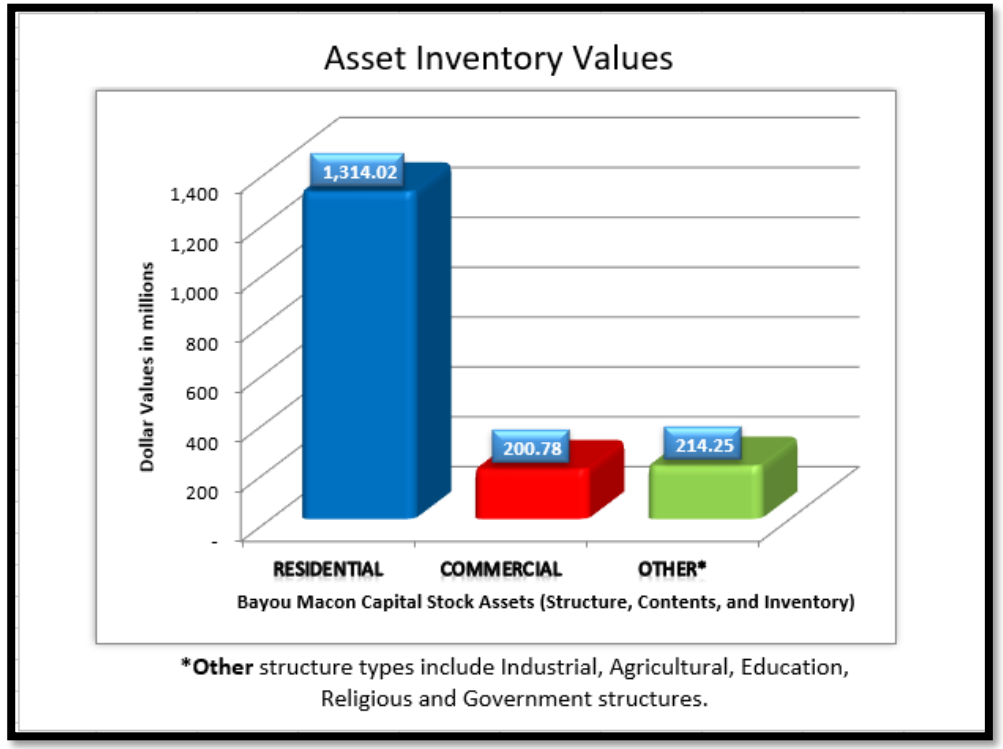
***Business Losses** are the sum of inventory Loss, Relocation Cost, Income Loss, Rental Income Loss, and Wage Loss.

FINDINGS

HAZUS-BASED ASSET INVENTORY VALUES



***Other** structure types include Industrial, Agricultural, Education, Religious and Government structures.



***Other** structure types include Industrial, Agricultural, Education, Religious and Government structures.

FINDINGS

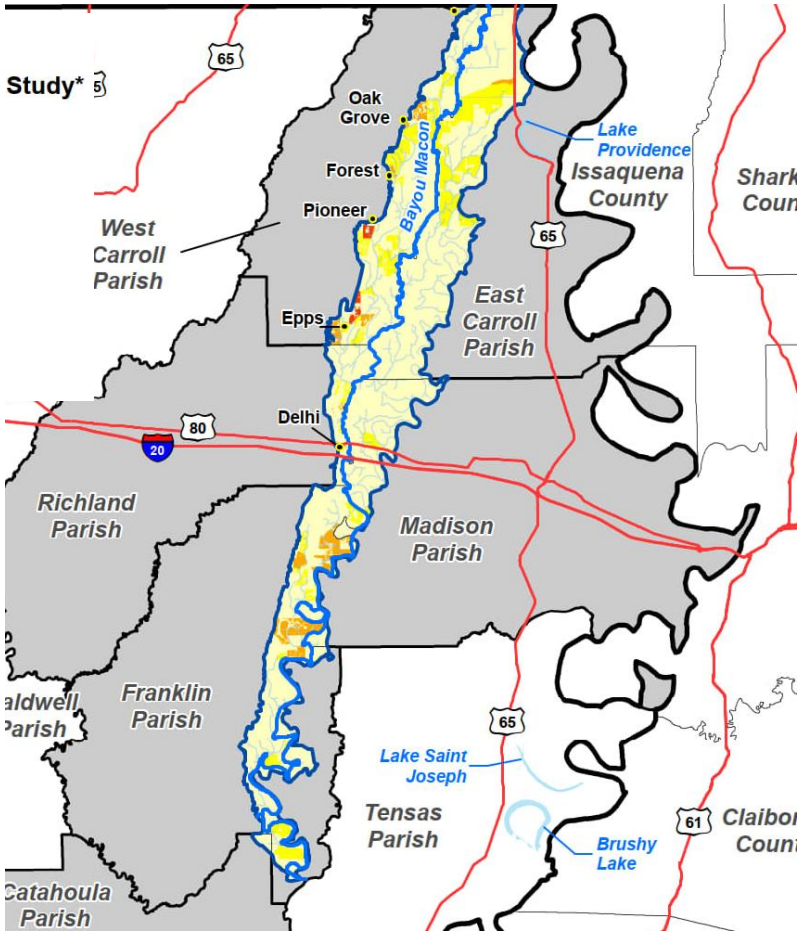
HAZUS-BASED 1% ANNUAL CHANCE LOSS ESTIMATES

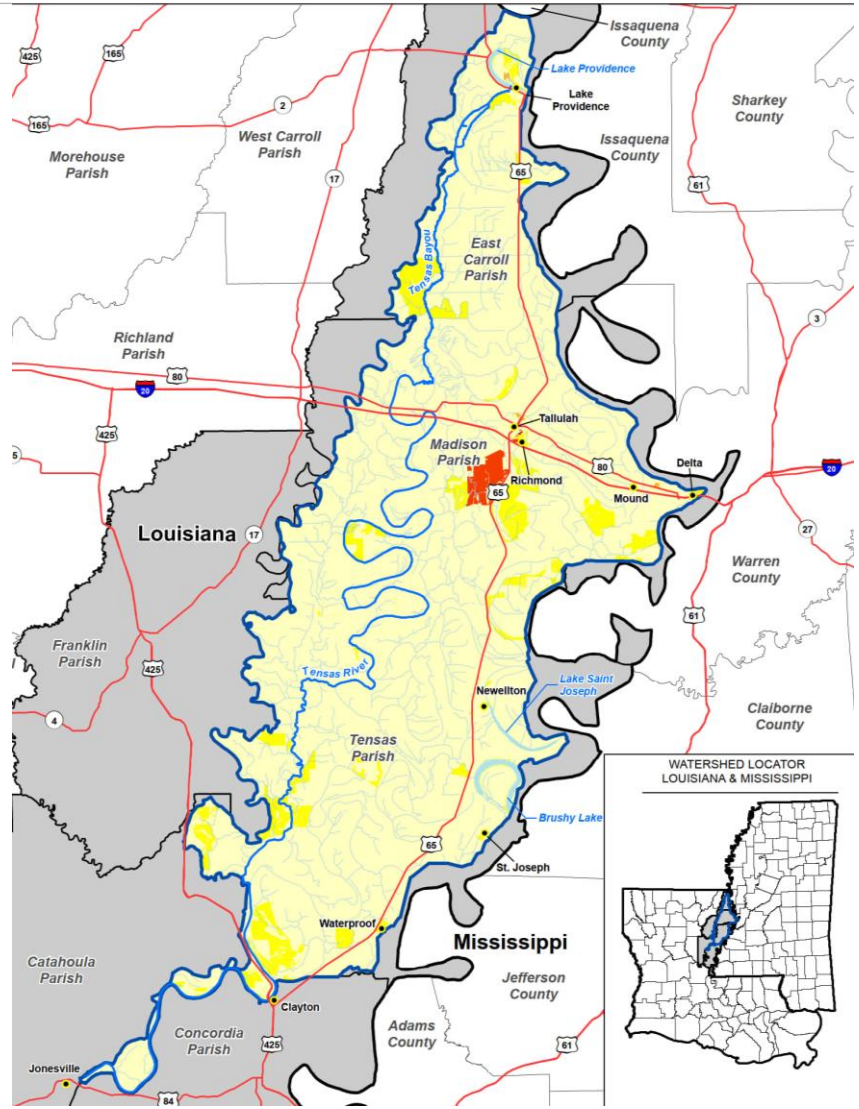
Map Symbology

- Cities
- Tensas Bayou & Tensas River
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish Boundary
- Other Parish/County Boundary

Hazus 1%-Annual-Chance Loss Study*

- Very Low
- Low
- Medium
- High
- Very High





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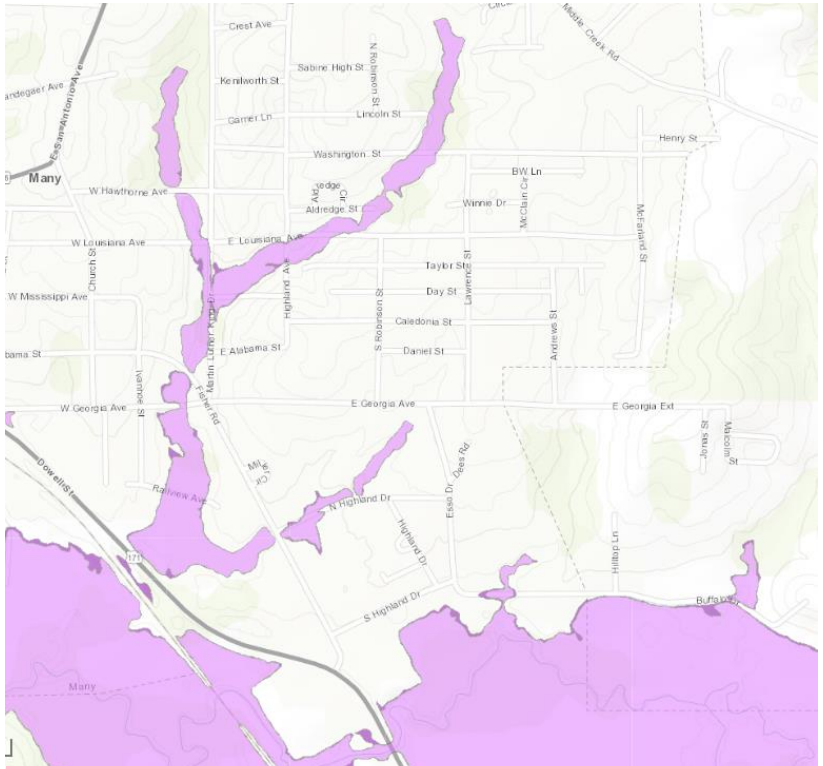
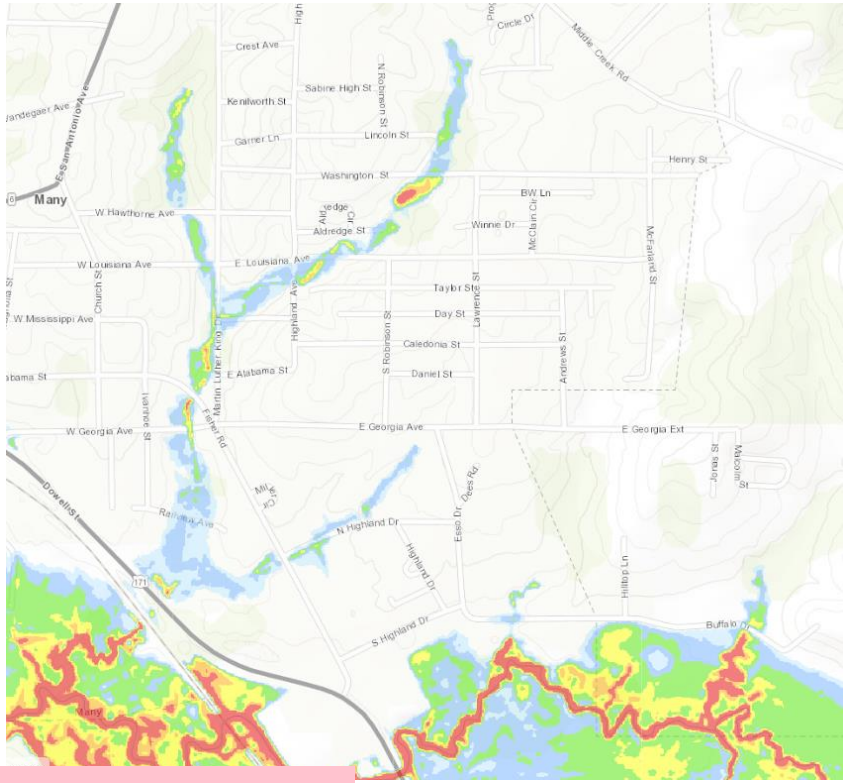
BASE LEVEL ENGINEERING (BLE)

- BLE is developed at a larger scale (HUC8)
- LiDAR must be available
- Steps of Hydrology, Hydraulics & Terrain
- Model review and adjustments
- Gage review included in hydrology
- Used to assess flood risk



BASE LEVEL ENGINEERING (BLE)





High risk (1% flood zone)

Low to moderate risk (0.2% flood zone)

≤ 1 foot	> 3 to 4 feet
> 1 to 2 feet	> 4 to 5 feet
> 2 to 3 feet	> 5 feet

OUTPUTS

- Hydrology modeling (Regression) flows w/gage analysis
- Hydraulic modeling (HEC-RAS) for 10%, 4%, 2%, 1% and 0.2% storm events
- 10%, 1% and 0.2% floodplain boundaries

Non-Regulatory

- Areas of Expanded Flood Risk
- Depth and Analysis Grids
- Flood Risk Assessment

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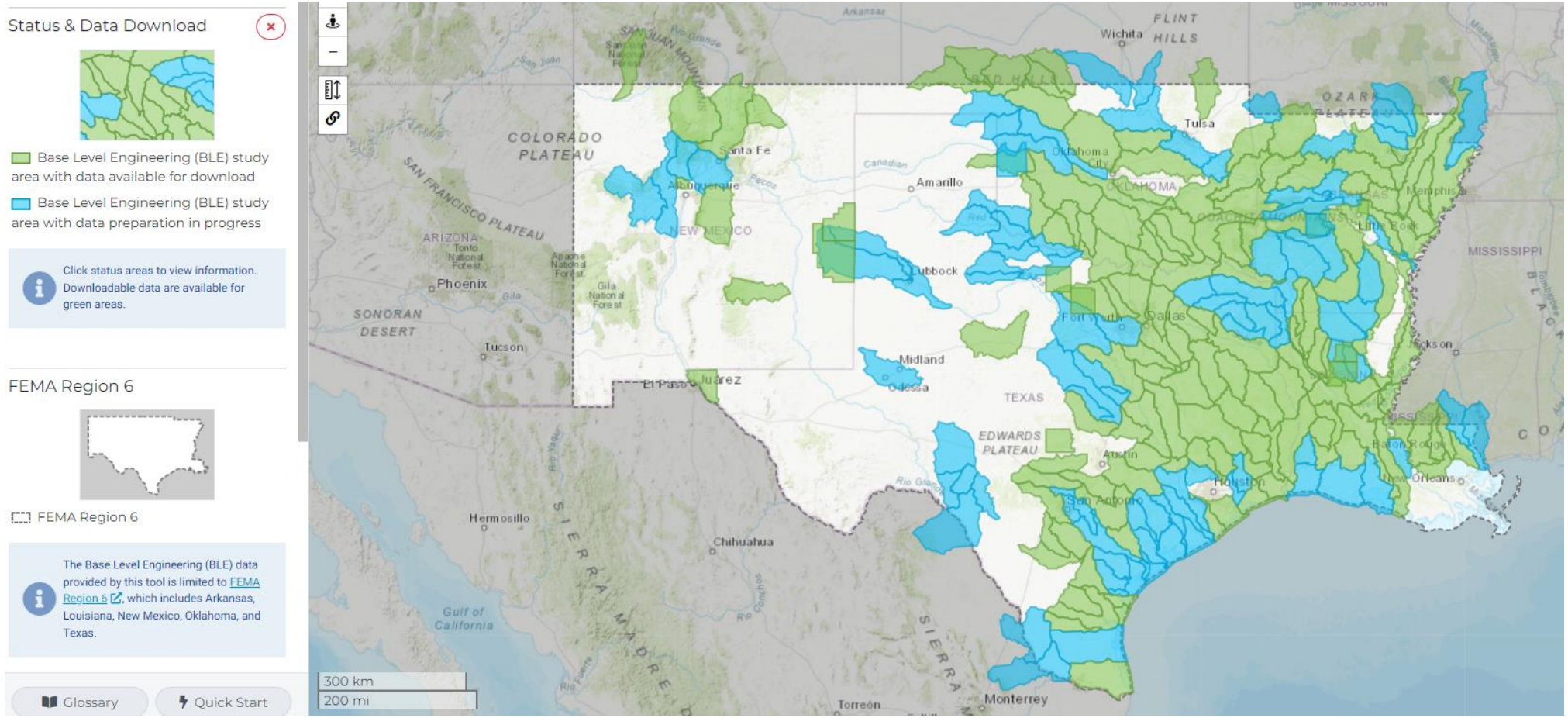
BASE LEVEL ENGINEERING (BLE)

- View and download completed BLE data
- Useful for determining BFEs for development

https://webapps.usgs.gov/infrm/estBFE/



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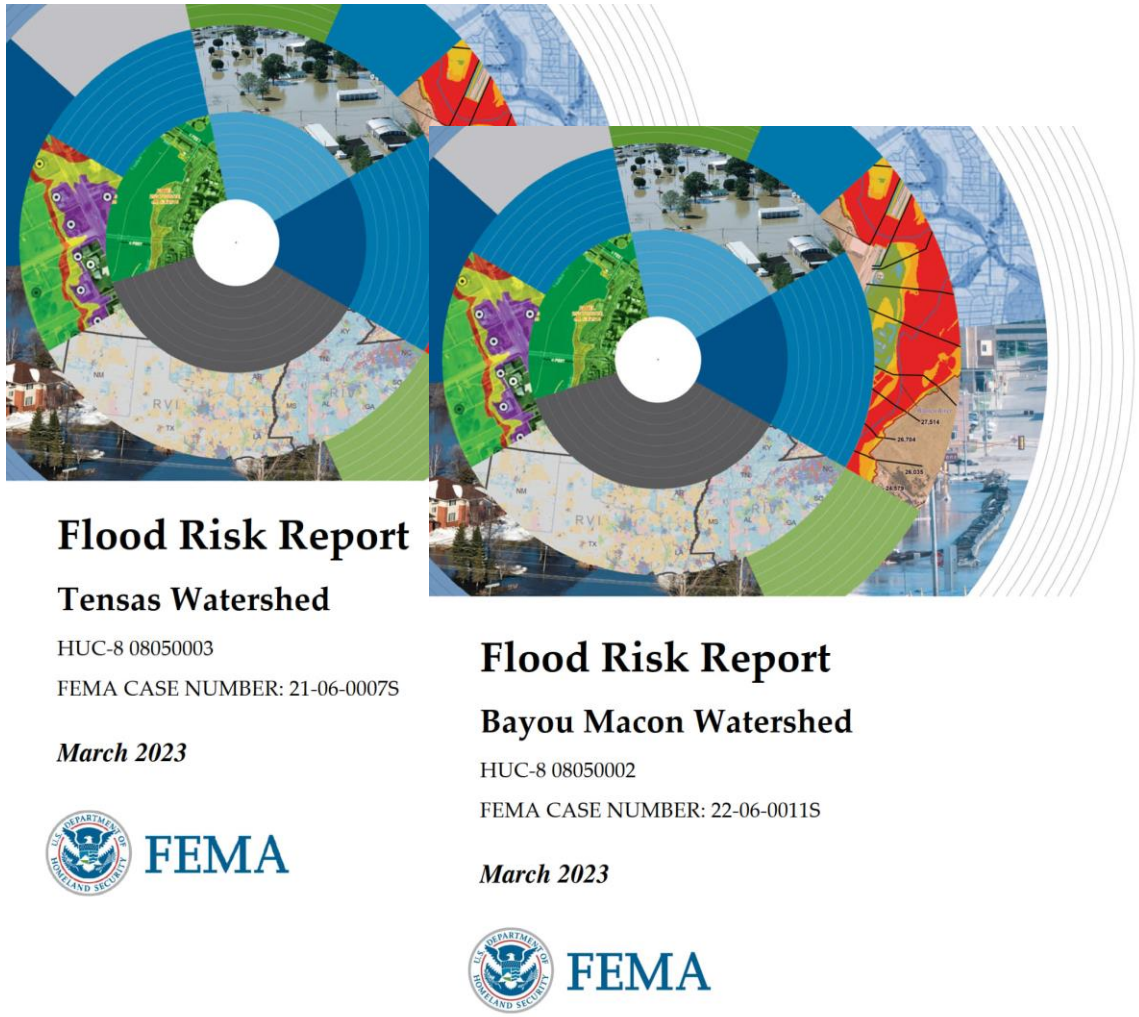
POST-DISCOVERY MEETING COORDINATION



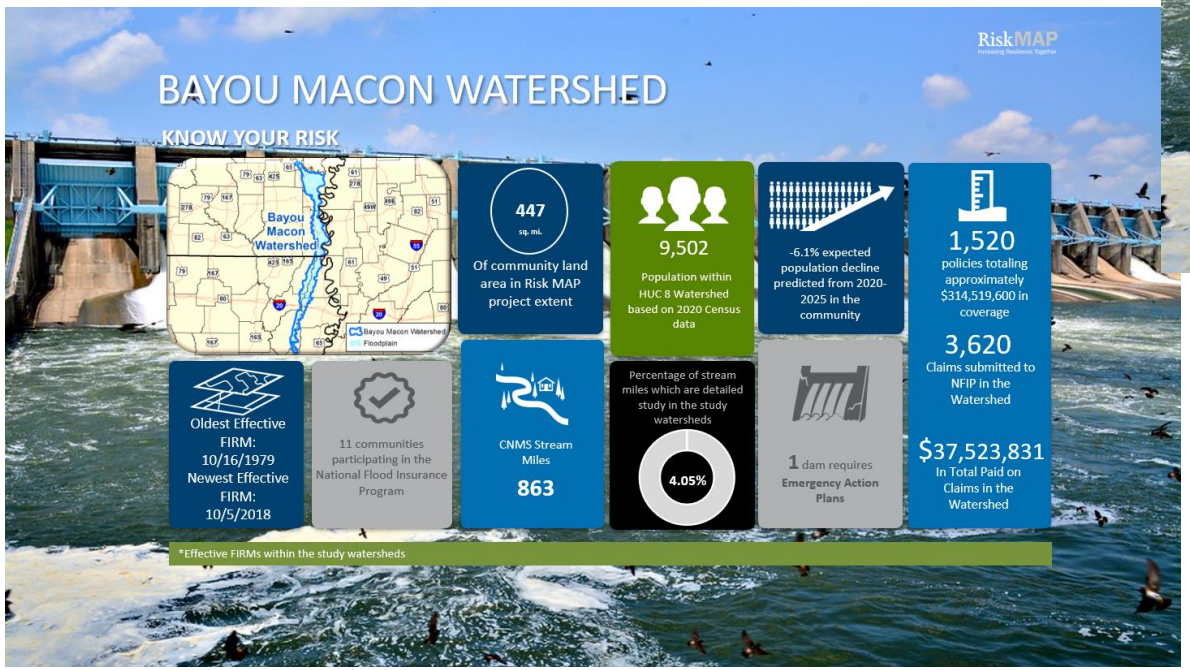
FLOOD RISK REPORT

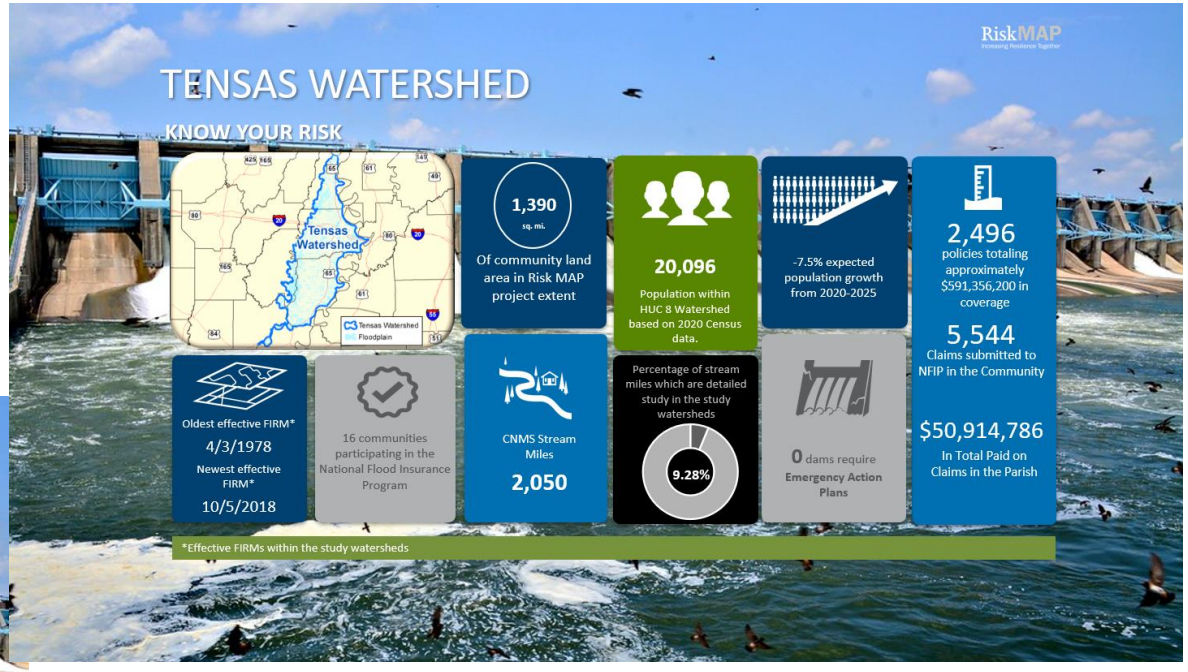
- Prioritization Results
- Summary of Discovery Activities
- Historical Flooding
- Figures and Maps
- Community Snapshots
- Stakeholder Comments

POST-DISCOVERY MEETING COORDINATION

FLOOD RISK REPORT

- Stakeholder Comments
- Community Snapshots
- BLE Report





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POST-DISCOVERY MEETING COORDINATION

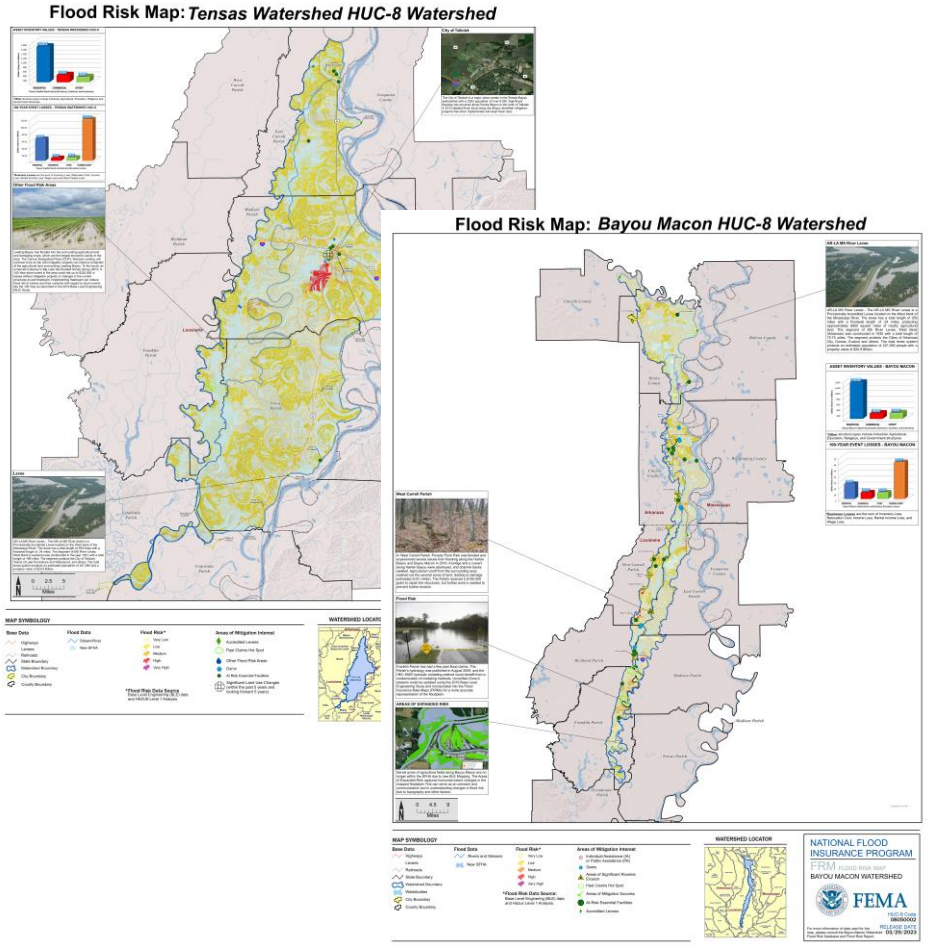
BLE DATASET AND REVIEW



FLOOD RISK REPORT



FLOOD RISK MAP



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RISK MAP PROJECT RECOMMENDATIONS TO FEMA

MAPPING NEEDS PRIORITIZATION BY PARISH

Tensas Watershed

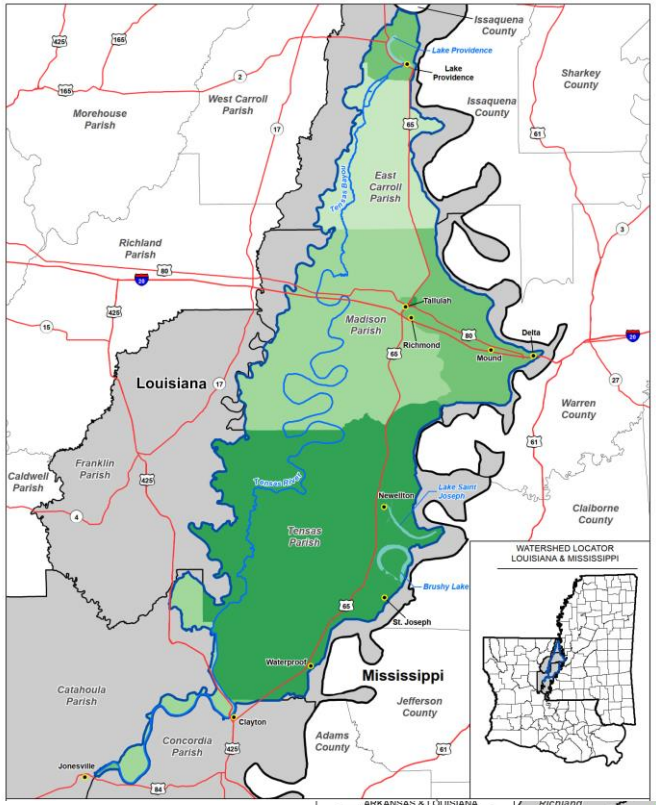
Mapping Needs Prioritization by Parish		
Parish	**Priority**	**Reason**
Catahoula	Moderate	25% of the stream miles are unverified, and the oldest effective date exceeds the last 30 years.
Concordia	High	More than 55% of the stream miles are unverified, and the oldest effective date exceeds the last 25 years.
East Carroll	Highest	More than 55% of the stream miles are unverified, and the oldest effective date exceeds the last 40 years.
Franklin	Low	Less than 20% of the stream miles are unverified, and the oldest effective date is within the last 15 years.
Madison	Moderate	More than 40% of the stream miles are unverified, but the oldest effective date is within the last 10 years.
Tensas	Moderate	Less than 20% of the stream miles are unverified, but the oldest effective date exceeds the last 40 years.

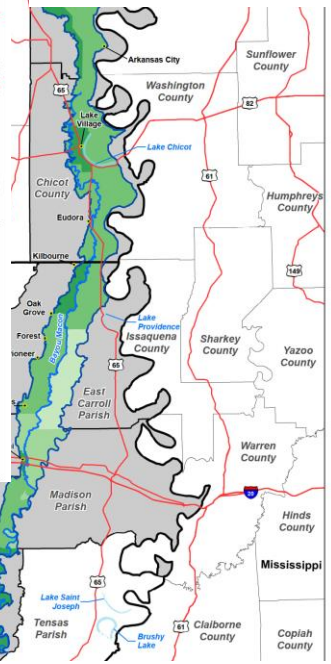
Bayou Macon Watershed

Mapping Needs Prioritization by Parish		
Parish	**Priority**	**Reason**
Catahoula	Moderate	25% of the stream miles are unverified, and the oldest effective date exceeds the last 30 years.
East Carroll	Highest	More than 55% of the stream miles are unverified, and the oldest effective date exceeds the last 40 years.
Franklin	Low	Less than 20% of the stream miles are unverified, and the oldest effective date is within the last 15 years.
Madison	Moderate	More than 40% of the stream miles are unverified, but the oldest effective date is within the last 10 years.
Richland	High	More than 90% of the stream miles are unverified, but the oldest effective date is within the last 10 years.
West Carroll	Low	Less than 20% of the stream miles are unverified, and the oldest effective date is within the last 5 years.

RISK MAP PROJECT RECOMMENDATIONS TO FEMA

OTHER CONSIDERATIONS FOR MAPPING UPDATES



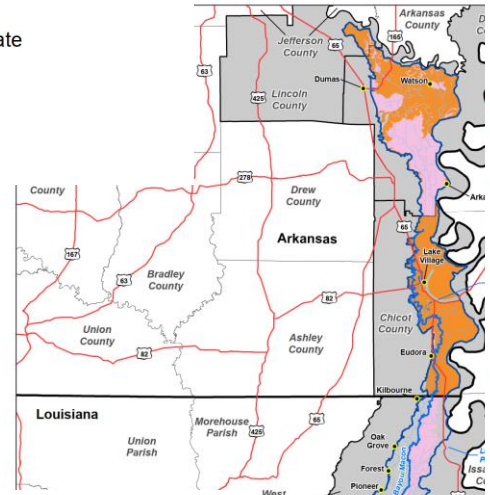


Map Symbology

- Major Highways
- Tensas Bayou & Tensas River
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish Boundary
- Other Parish/County Boundary

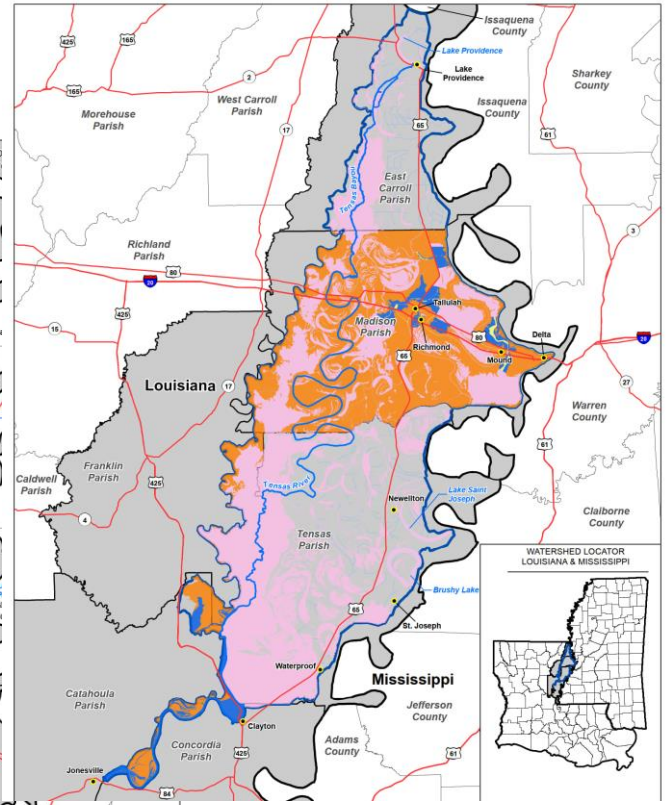
Social Vulnerability Index (NRI 2021*)

- Very High
- Relatively High
- Relatively Moderate
- Relatively Low
- Very Low



Effective FEMA Floodplains (2021)

- Zone AE, Floodway (100-Year, Detailed)
- Zone AE (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zones X (100-Year Depth <1 Foot; 500-Year, Detailed)
- Zone X (Protected by Levee)



HALFF

FEMA

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DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

DISCOVERY OVERVIEW

FEMA'S RISK MAPPING, ASSESSMENT, AND PLANNING (MAP) PROGRAM



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QUESTIONS?



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THANK YOU!

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Discovery GIS Lead
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dskultety@Halff.com

Appendix II: Community-Specific Reports

Snapshots

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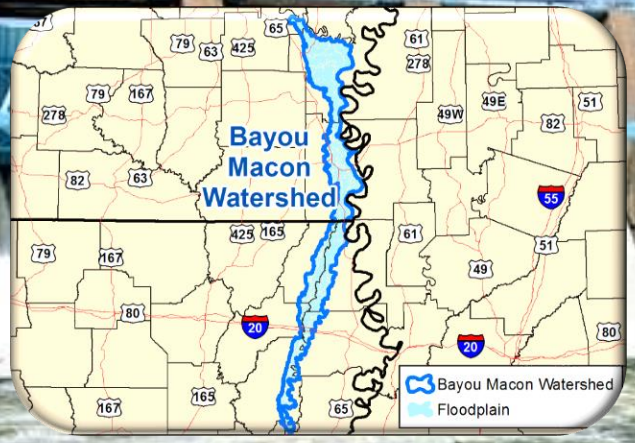
BAYOU MACON WATERSHED

KNOW YOUR RISK



447 sq. mi.
Of community land area in Risk MAP project extent

9,502
Population within HUC 8 Watershed based on 2020 Census data

-6.1% expected population decline predicted from 2020-2025 in the community

1,520
policies totaling approximately $314,519,600 in coverage

3,620
Claims submitted to NFIP in the Watershed

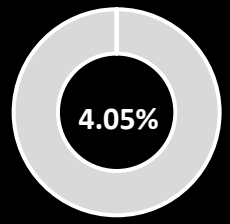
$37,523,831
In Total Paid on Claims in the Watershed

Oldest Effective FIRM: 10/16/1979
Newest Effective FIRM: 10/5/2018

11 communities participating in the National Flood Insurance Program

CNMS Stream Miles
1,667

Percentage of stream miles which are detailed study in the study watersheds



1 dam requires **Emergency Action Plans**

*Effective FIRMs within the study watersheds

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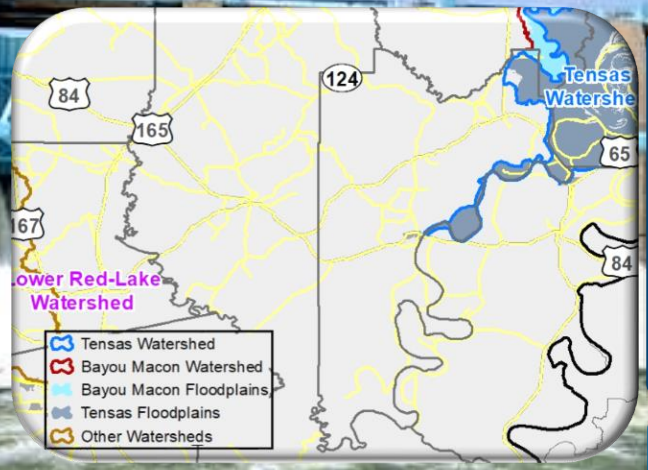
CATAHOULA PARISH

KNOW YOUR RISK



1.70 sq. mi.

of the community's land area is in the study watershed

0

Population within HUC 8 Watershed based on 2020 Census data

0% expected population growth predicted from 2020-2025 in the community

530

Policies totaling approximately $71,045,500 in coverage

2,853

Claims submitted to NFIP in the Community

$22,119,321

In Total Paid on Claims in the Parish

1%

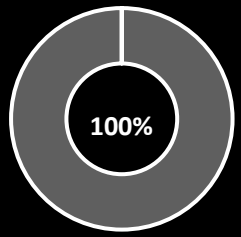
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Bayou Macon Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

1.16

Percentage of stream miles which are detailed study in the study watersheds



17

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

CATAHOULA PARISH

TAKE ACTION: Potential Next Step



Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Reduce the impact of future flooding
- Ensure the delivery of critical services to the community in the case of a hazard event
- Improve the ability of structures to withstand high wind and storm events
- Engage and inform the community on the subject of hazard mitigation

FEMA's Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and GOHSEP's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP)[2] website. The State Hazard Mitigation Officer may be contacted for additional information. Participation in FEMA's Community Rating System[3] (CRS) reduces insurance premiums up to 45%, and FEMA will provide free technical assistance in designing and implementing programs designed to reduce flood damage. The State Hazard Mitigation Officer may be contacted for additional information.

The Louisiana Watershed Initiative (LWI) provides funding for local governments for flood risk reduction projects and project development capacity building through CDBG-Mitigation dollars. These funds are distributed through three rounds of competitive funding opportunities focused on projects that result in demonstrable flood mitigation[4].

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1. https://www.fema.gov/hazard-mitigation-assistance.
2. https://gohsep.la.gov/GRANTS/RECOVERY-GRANTS/Hazard-Mitigation-Assistance/Hazard-Mitigation-Overview
3. https://www.fema.gov/national-flood-insurance-program-community-rating-system
4. https://watershed.la.gov/local-regional-projects-programs

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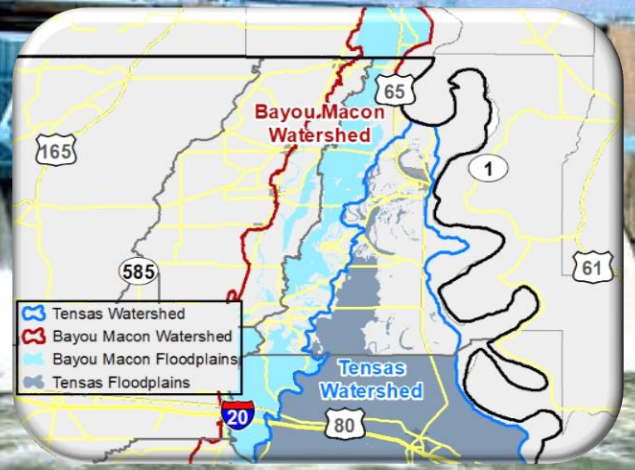
EAST CARROLL PARISH

KNOW YOUR RISK



143.02 sq. mi.

of the community's land area is in the study watershed

1,262

Population within HUC 8 Watershed based on 2020 Census data

1.3% expected population growth predicted from 2020-2025 in the community

124

Policies totaling approximately $31,502,100 in coverage

139

Claims submitted to NFIP in the Community

$2,100,595

In Total Paid on Claims in the Parish

36%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Bayou Macon Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

269.72

The are no detailed study stream miles in the study watershed

NA

5

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

EAST CARROLL PARISH

TAKE ACTION: Potential Next Step



Your Hazard Mitigation Plan expiration date is **October 2021*.**

The hazard mitigation goals identified projects for:

- Protect life and property
- Ensure emergency management services
- Increase public preparedness
- Establish and strengthen partnerships for implementation
- Preserve or restore natural resources
- Promote a sustainable economy
- Improve data collection, sue, and sharing to reduce the risk from disasters

FEMA's Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and GOHSEP's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP)[2] website. The State Hazard Mitigation Officer may be contacted for additional information. Participation in FEMA's Community Rating System[3] (CRS) reduces insurance premiums up to 45%, and FEMA will provide free technical assistance in designing and implementing programs designed to reduce flood damage. The State Hazard Mitigation Officer may be contacted for additional information.

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1. https://www.fema.gov/hazard-mitigation-assistance.
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3. https://www.fema.gov/national-flood-insurance-program-community-rating-system
4. https://watershed.la.gov/local-regional-projects-programs

*East Carroll Parish held a kick-off meeting to begin the Hazard Mitigation Plan update process in January 2022.

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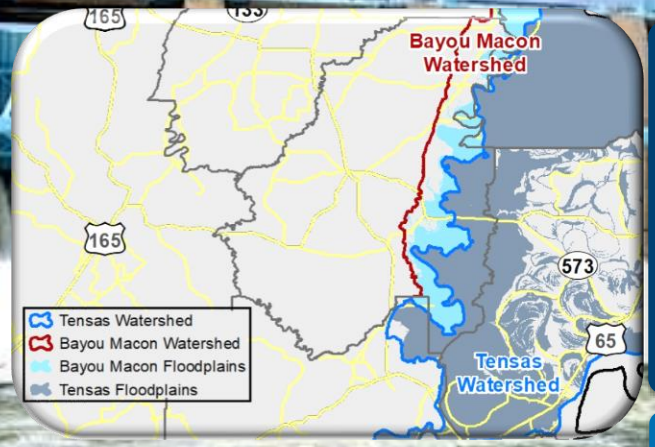
FRANKLIN PARISH

KNOW YOUR RISK



112.31 sq. mi.

of the community's land area is in the study watershed

2,386

Population within HUC 8 Watershed based on 2020 Census data

-2.3% expected population decline predicted from 2020-2025 in the community

238

Policies totaling approximately $56,081,300 in coverage

238

Claims submitted to NFIP in the Community

$3,927,227

In Total Paid on Claims in the Parish

20%

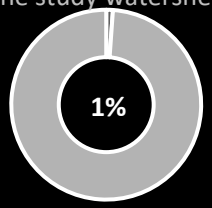
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Bayou Macon and Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

128.34

Percentage of detailed study stream miles in the study watershed



11

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

FRANKLIN PARISH

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **November 2021*.**

The hazard mitigation goals identified projects for:

- Identify and pursue preventative measures that will reduce future damages from hazards
- Enhance public awareness and understanding of disaster preparedness
- Reduce repetitive flood losses in the parish and municipalities
- Facilitate sound development in the parish and municipalities so as to reduce or eliminate the potential impact of hazards

FEMA's Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and GOHSEP's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP)[2] website. The State Hazard Mitigation Officer may be contacted for additional information. Participation in FEMA's Community Rating System[3] (CRS) reduces insurance premiums up to 45%, and FEMA will provide free technical assistance in designing and implementing programs designed to reduce flood damage. The State Hazard Mitigation Officer may be contacted for additional information.

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2. https://gohsep.la.gov/GRANTS/RECOVERY-GRANTS/Hazard-Mitigation-Assistance/Hazard-Mitigation-Overview
3. https://www.fema.gov/national-flood-insurance-program-community-rating-system
4. https://watershed.la.gov/local-regional-projects-programs

* FEMA began a review of Franklin Parish's Hazard Mitigation Plan update in August 2022.

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MADISON PARISH

KNOW YOUR RISK



60.78 sq. mi.

of the community's land area is in the study watershed

283

Population within HUC 8 Watershed based on 2020 Census data

-12.4% expected population decline predicted from 2020-2025 in the community

179

policies totaling approximately $49,231,000 in coverage

96

Claims submitted to NFIP in the Community

$1,429,197

In Total Paid on Claims in the Parish

10%

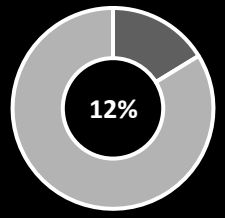
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Bayou Macon Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

132.99

Percentage of detailed study stream miles in the study watershed



8

Flood-related presidential disaster declarations in your Discovery study county

*National Flood Hazard Layer (NFHL)

MADISON PARISH

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **August 2024.**

The hazard mitigation goals identified projects for:

- Identify and pursue preventative measures that will reduce further damages from hazards
- Enhance public awareness and understanding of disaster preparedness
- Reduce repetitive flood losses in the parish
- Facilitate sound development in the parish to reduce or eliminate potential impacts of hazards

FEMA's Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and GOHSEP's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP)[2] website. The State Hazard Mitigation Officer may be contacted for additional information. Participation in FEMA's Community Rating System[3] (CRS) reduces insurance premiums up to 45%, and FEMA will provide free technical assistance in designing and implementing programs designed to reduce flood damage. The State Hazard Mitigation Officer may be contacted for additional information.

The Louisiana Watershed Initiative (LWI) provides funding for local governments for flood risk reduction projects and project development capacity building through CDBG-Mitigation dollars. These funds are distributed through three rounds of competitive funding opportunities focused on projects that result in demonstrable flood mitigation[4].

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1. https://www.fema.gov/hazard-mitigation-assistance.
2. https://gohsep.la.gov/GRANTS/RECOVERY-GRANTS/Hazard-Mitigation-Assistance/Hazard-Mitigation-Overview
3. https://www.fema.gov/national-flood-insurance-program-community-rating-system
4. https://watershed.la.gov/local-regional-projects-programs

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RICHLAND PARISH

KNOW YOUR RISK



21.42 sq. mi.

of the community's land area is in the study watersheds

513

Population within HUC 8 Watershed based on 2020 Census data

0.1% expected population growth predicted from 2020-2025 in the community

345

Policies totaling approximately $73,319,200 in coverage

216

Claims submitted to NFIP in the Community

$6,105,344

In Total Paid on Claims in the Parish

4%

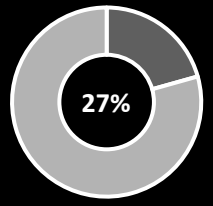
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Bayou Macon Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watersheds

50.46

Percentage of stream miles which are detailed study in the study watersheds



7

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

RICHLAND PARISH

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **January 2022.**

The hazard mitigation goals identified projects for:

- Identify and pursue preventative measures that will reduce future damages from hazards
- Enhance public awareness and understanding of disaster preparedness
- Reduce repetitive flood losses in the parish and towns
- Facilitate sound development in the parish and towns to reduce or eliminate hazard damages.
- Improve data collection, use, and sharing

FEMA's Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and GOHSEP's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP)[2] website. The State Hazard Mitigation Officer may be contacted for additional information. Participation in FEMA's Community Rating System[3] (CRS) reduces insurance premiums up to 45%, and FEMA will provide free technical assistance in designing and implementing programs designed to reduce flood damage. The State Hazard Mitigation Officer may be contacted for additional information.

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TOWN OF DELHI

KNOW YOUR RISK



2.23 sq. mi.

of the community's land area is in the study watershed

1991

Population within HUC 8 Watershed based on 2020 Census data

-5.2% expected population decline predicted from 2020-2025 in the community

17

Policies totaling approximately $5,373,700 in coverage

29

Claims submitted to NFIP in the Community

$189,021

In Total Paid on Claims in the Community

80%

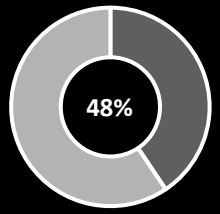
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Bayou Macon Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

4.60

Percentage of stream miles which are detailed study in the study watersheds



7

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

TOWN OF DELHI

TAKE ACTION: Potential Next Step



Your Hazard Mitigation Plan expiration date is **January 2022.**

The hazard mitigation goals identified projects for:

- Identify and pursue preventative measures that will reduce future damages from hazards
- Enhance public awareness and understanding of disaster preparedness
- Reduce repetitive flood losses in the parish and towns
- Facilitate sound development in the parish and towns to reduce or eliminate hazard damages.
- Improve data collection, use, and sharing

FEMA's Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and GOHSEP's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP)[2] website. The State Hazard Mitigation Officer may be contacted for additional information. Participation in FEMA's Community Rating System[3] (CRS) reduces insurance premiums up to 45%, and FEMA will provide free technical assistance in designing and implementing programs designed to reduce flood damage. The State Hazard Mitigation Officer may be contacted for additional information.

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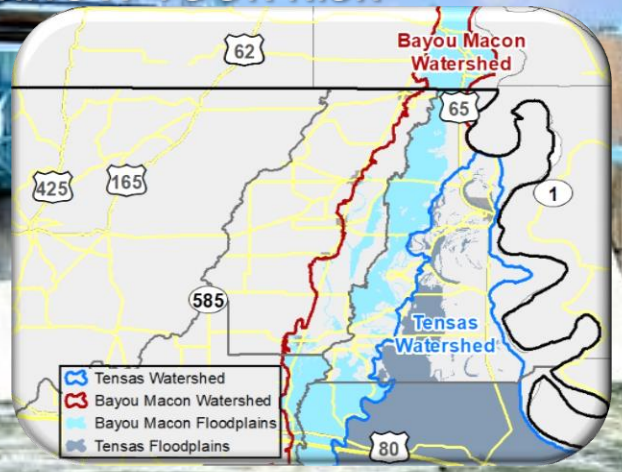
WEST CARROLL PARISH

KNOW YOUR RISK



103.17 sq. mi.

of the community's land area is in the study watershed

2085

Population within HUC 8 Watershed based on 2020 Census data

-6.0% expected population decline predicted from 2020-2025 in the community

100

Policies totaling approximately $26,391,800 in coverage

40

Claims submitted to NFIP in the Community

$1,424,853

In Total Paid on Claims in the Parish

12%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Bayou Macon Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

223.85

The are no detailed study stream miles in the study watershed

NA

4

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

WEST CARROLL PARISH

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **April 2027.**

The hazard mitigation goals identified projects for:

- Identify and pursue preventative measures that will reduce future damages from hazards
- Enhance public awareness and understanding of disaster preparedness and mitigation
- Reduce repetitive flood losses in the parish and municipalities
- Facilitate sound development in the parish and municipalities so as to reduce or eliminate the potential impact of hazards

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4. https://watershed.la.gov/local-regional-projects-programs

RiskMAP
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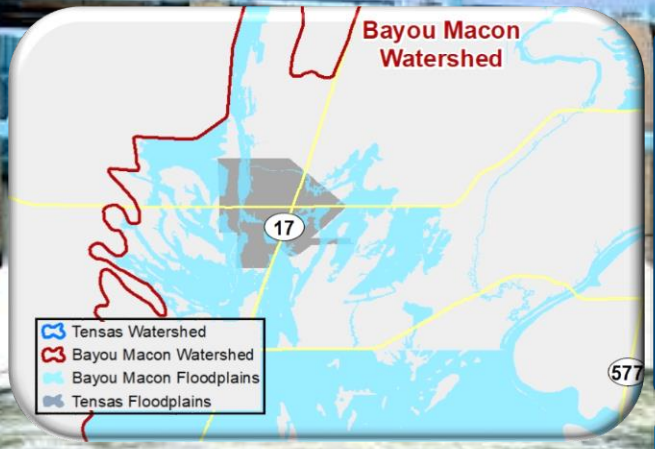
VILLAGE OF EPPS

KNOW YOUR RISK



0.97 sq. mi.

of the community's land area is in the study watershed

358

Population within HUC 8 Watershed based on 2020 Census data

-35.3% expected population decline predicted from 2020-2025 in the community

0

policies totaling approximately $0 in coverage

4

Claims submitted to NFIP in the Community

$36,629

In Total Paid on Claims in the Community

100%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Bayou Macon Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

2.57

The are no detailed study stream miles in the study watershed

NA

4

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

VILLAGE OF EPPS

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **April 2027.**

The hazard mitigation goals identified projects for:

- Identify and pursue preventative measures that will reduce future damages from hazards
- Enhance public awareness and understanding of disaster preparedness and mitigation
- Reduce repetitive flood losses in the parish and municipalities
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4. https://watershed.la.gov/local-regional-projects-programs

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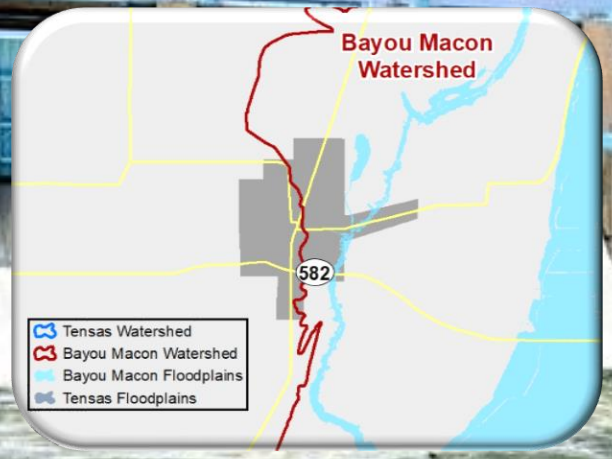
VILLAGE OF FOREST

KNOW YOUR RISK



0.87 sq. mi.

of the community's land area is in the study watershed

159

Population within HUC 8 Watershed based on 2020 Census data

-7.5% expected population decline predicted from 2020-2025 in the community

0

NFIP policies

0

Claims submitted to NFIP in the Community

0

In Total Paid on Claims in the Community

44%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Bayou Macon Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

2.17

The are no detailed study stream miles in the study watershed

NA

4

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

VILLAGE OF FOREST

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **April 2027.**

The hazard mitigation goals identified projects for:

- Identify and pursue preventative measures that will reduce future damages from hazards
- Enhance public awareness and understanding of disaster preparedness and mitigation
- Reduce repetitive flood losses in the parish and municipalities
- Facilitate sound development in the parish and municipalities so as to reduce or eliminate the potential impact of hazards

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RiskMAP
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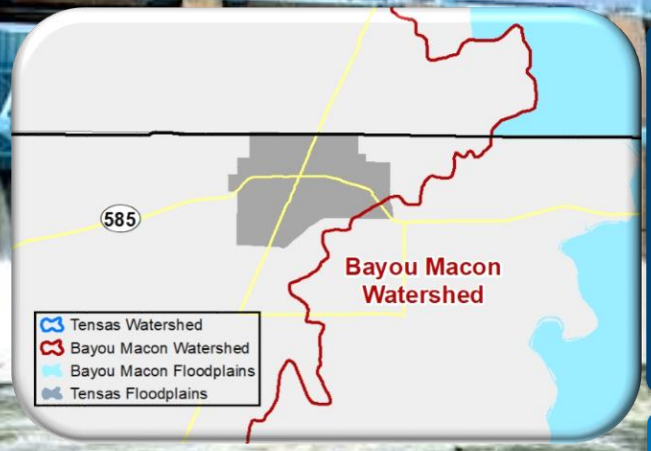
VILLAGE OF KILBOURNE

KNOW YOUR RISK



0.04 sq. mi.

of the community's land area is in the study watershed

11

Population within HUC 8 Watershed based on 2020 Census data

-8.0% expected population decline predicted from 2020-2025 in the community

0

policies totaling approximately $0 in coverage

0

Claims submitted to NFIP in the Community

0

In Total Paid on Claims in the Community

0%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Bayou Macon Watershed

X

Not participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

0.0

The are no detailed study stream miles in the study watershed

NA

4

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

VILLAGE OF KILBOURNE

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **April 2027.**

The hazard mitigation goals identified projects for:

- Identify and pursue preventative measures that will reduce future damages from hazards
- Enhance public awareness and understanding of disaster preparedness and mitigation
- Reduce repetitive flood losses in the parish and municipalities
- Facilitate sound development in the parish and municipalities so as to reduce or eliminate the potential impact of hazards

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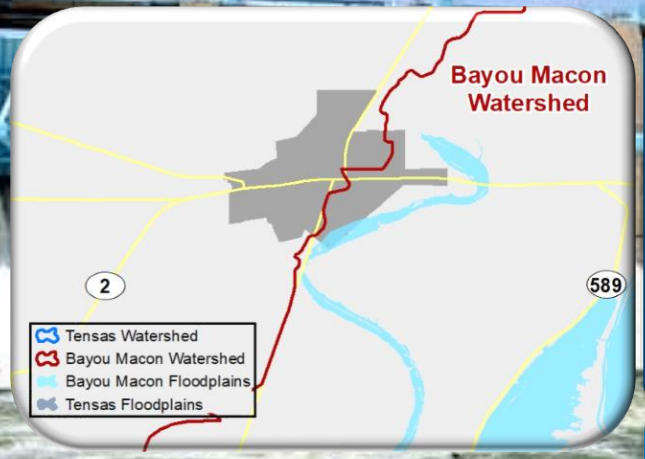
TOWN OF OAK GROVE

KNOW YOUR RISK



0.49 sq. mi.

of the community's land area is in the study watershed

408

Population within HUC 8 Watershed based on 2020 Census data

-8.6% expected population decline predicted from 2020-2025 in the community

6

Policies totaling approximately $1,575,000 in coverage

5

Claims submitted to NFIP in the Community

$191,644

In Total Paid on Claims in the Community

33%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Bayou Macon Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

0.21

The are no detailed study stream miles in the study watershed

NA

4

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

TOWN OF OAK GROVE

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **April 2027.**

The hazard mitigation goals identified projects for:

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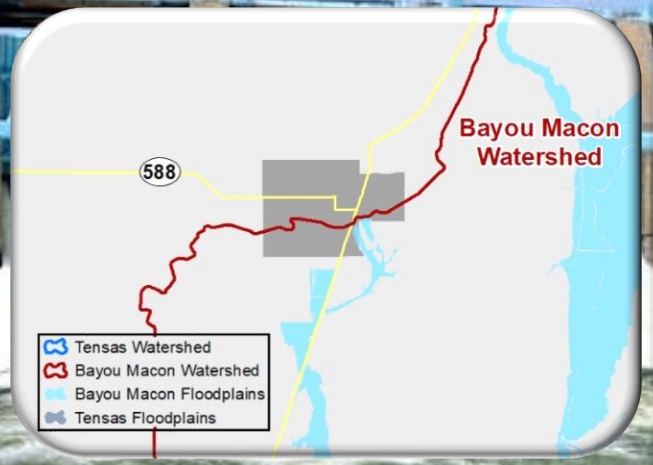
VILLAGE OF PIONEER

KNOW YOUR RISK



0.34 sq. mi.

of the community's land area is in the study watershed

46

Population within HUC 8 Watershed based on 2020 Census data

-2.1% expected population decline predicted from 2020-2025 in the community

1

NFIP policy

0

Claims submitted to NFIP in the Community

10%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Bayou Macon Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

0.05

The are no detailed study stream miles in the study watershed

NA

4

Flood-related presidential disaster declarations in your Discovery study parish

0

In Total Paid on Claims in the Community

*National Flood Hazard Layer (NFHL)

VILLAGE OF PIONEER

TAKE ACTION: Potential Next Step



Your Hazard Mitigation Plan expiration date is **April 2027.**

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4. https://watershed.la.gov/local-regional-projects-programs

Table 10: Bayou Macon Watershed Community Overview

CID	Community	*Total Community Population*[1]	Percent of Population in Study watershed	Total Community Land Area (sq. mi)	Percent of Land Area in Study watershed	NFIP Participant
220047	**Catahoula Parish**	6,635	0%	737.3	0.2%	Y
220062	**East Carroll Parish**	3,872	32.6%	438.7	32.6%	Y
220071	**Franklin Parish**	13,482	17.7%	634.6	17.7%	Y
220122	**Madison Parish**	2,976	9.5%	639.3	9.5%	Y
220154	**Richland Parish**	13,450	3.8%	561.8	3.8%	Y
220155	**Town of Delhi**	2,622	75.9%	2.9	76.0%	Y
220243	**West Carroll Parish**	7,148	29.2%	353.7	29.8%	Y
220283	**Village of Epps**	358	100%	1.0	100%	Y
220286	**Village of Forest**	304	52.3%	1.7	52.4%	Y
220298	**Village of Kilbourne**	351	3.2%	1.4	3.2%	N
220342	**Town of Oak Grove**	1,441	28.3%	1.7	28.3%	Y
220244	**Village of Pioneer**	149	31.0%	1.1	31.0%	Y

[1]*2020 United States Census Bureau Population Estimate*

Appendix III: Base Level Engineering Report

Compass
Identify, Interpret, Integrate

Bayou Macon Watershed, Arkansas/Louisiana
2D Base Level Engineering Methods and Results

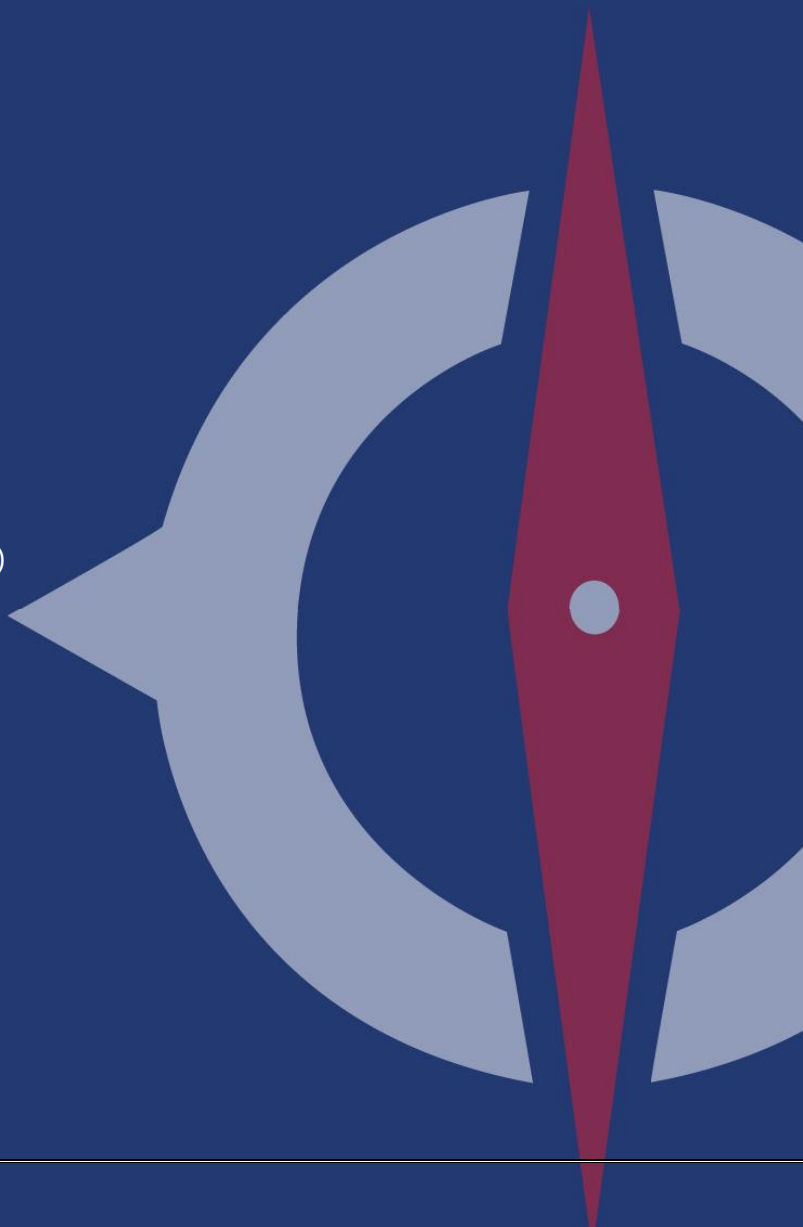
Contract# HSFE60-15-D-0003
Task Order 70FA6019F00000035
August 2020

Prepared for:

DHS/FEMA (Federal Emergency Management Agency)
FEMA Region VI
FRC 800 North Loop 288
Denton, TX 76209-3698

Submitted by:

Compass PTS JV
3101 Wilson Boulevard, Suite 900
Arlington, VA 22201



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DOCUMENT HISTORY

DOCUMENT LOCATION

K:/FY2020/20-06-0045S/HYDRAULICS - HYDRAULICS|BAYOU MACON AR-LA|BLE 03

REVISION HISTORY

Version Number	Version Date	Summary Changes	Team/Author
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APPROVALS

This document requires the approval of the following persons:

Role	Name	Phone	Title (CLIN/RMC)	Review Date	Approved Date
Project Manager	April Smith	512.457.7818	Project Manager	8/31/2020	8/31/2020

CLIENT DISTRIBUTION

Name	Title/Organization	Location
FEMA's MIP	Region VI	See path above

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01 Introduction

Recent innovations and efficiencies in floodplain mapping have allowed the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) to develop a process formerly known as First Order Approximation (FOA), now labeled Base Level Engineering (BLE), which can be used to address current program challenges, including the validation of Zone A studies and the availability of flood risk data in the early stages of a Flood Risk Project. The BLE process involves using best available data and automated techniques to produce estimates of flood hazard boundaries for multiple recurrence intervals. The Bayou Macon Watershed BLE documented here was designed to use 2-dimensional (2D) modeling efforts with enhancements and calibration to develop products intended to be transitioned into regulatory data development workflows.

As described in Title 42 of the Code of Federal Regulations, Chapter III, Section 4101(e), once every five years, FEMA must evaluate whether the information on Flood Insurance Rate Maps (FIRMs) reflects the current risks in flood prone areas. FEMA makes this determination of flood hazard data validity by examining flood study attributes and change characteristics, as specified in the Validation Checklist of the Coordinated Needs Management Strategy (CNMS) Technical Reference. The CNMS Validation Checklist provides a series of critical and secondary checks to determine the validity of flood hazard areas studied by detailed methods (e.g., Zone AE, AH, or AO). While the critical and secondary elements in CNMS provide a comprehensive method of evaluating the validity of Zone AE studies, a cost-effective approach for evaluating Zone A studies has been lacking.

In addition to the need for Zone A validation guidance, FEMA standards require flood risk data to be provided in the early stages of a Flood Risk Project. FEMA Program Standard Identification (SID) #29 requires that during Discovery, data must be identified that illustrates potential changes in flood elevation and mapping which may result from the proposed project scope. If available data does not clearly illustrate the likely changes, an analysis is required that estimates the likely changes. This data and any associated analyses should be shared and results should be discussed with stakeholders.

An important goal of the BLE process is the scalability of the results. Scalability means that the results of a BLE should not only be used for CNMS evaluations of Zone A studies, but can also be leveraged throughout the Risk Mapping, Assessment and Planning (Risk MAP) program. The large volume of data resulting from a BLE can be updated as needed and used for the eventual production of regulatory and non-regulatory products, outreach and risk communication, and MT-1 processing. Leveraging this data outside the Risk MAP program may also be valuable to external stakeholders.

In an effort to increase and enhance the flood risk products in Louisiana and Arkansas, FEMA Region VI contracted the Compass PTS JV to perform a BLE analysis for the Bayou Macon Watershed. This report documents the BLE process, products, and results for this watershed. Figure 1 depicts the Bayou Macon Watershed footprint.

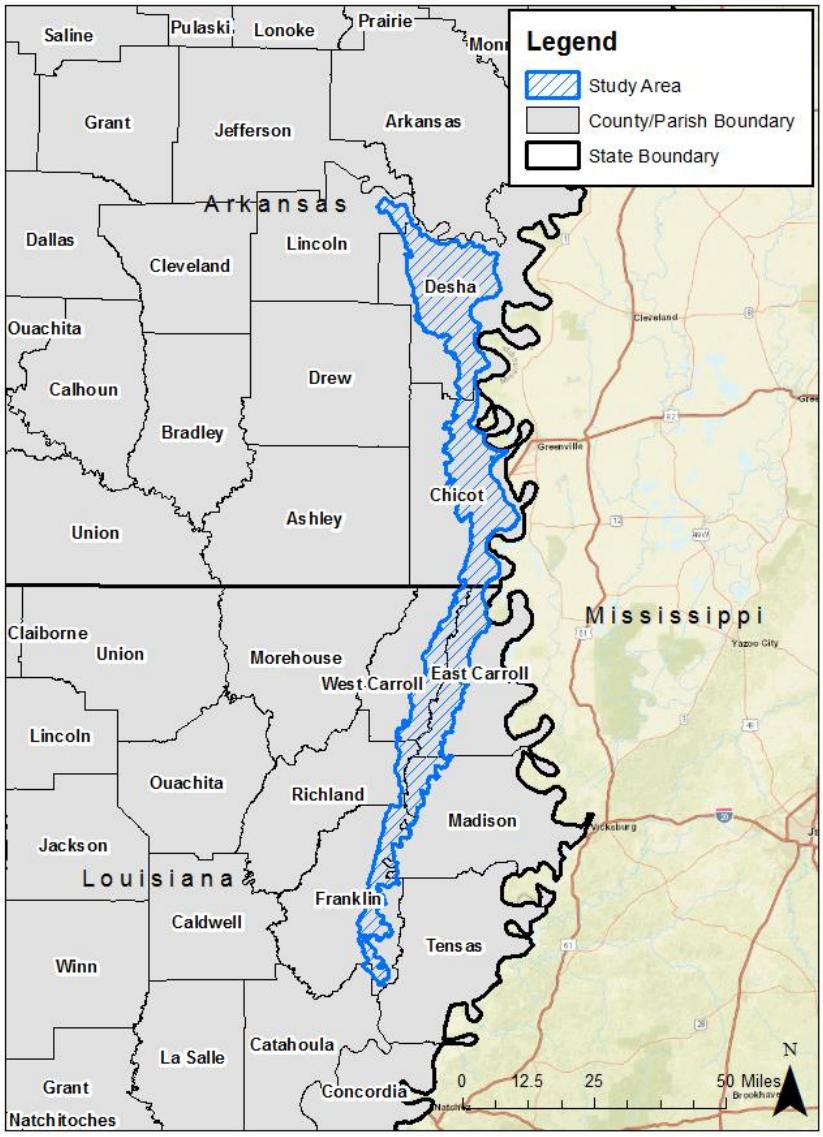

Figure 1: Bayou Macon Watershed

02 2D BLE Modeling Inputs and Controls

Section 2 presents fundamental components required to execute a 2-dimensional (2D) hydraulic engineering analysis for the Bayou Macon Watershed. Inputs such as elevation data, hydrology from rain-on-grid and inflow hydrographs, and hydraulic analyses and variables are defined herein. HEC-RAS 5.0.7 rain-on-grid utility was applied in the production of the 2D BLE products produced for this watershed.

2.1 Topographic Data

A high resolution Digital Elevation Model (DEM) is a fundamental component for two-dimensional engineering analyses by providing a detailed representation of the surface for hydraulic routing through the model area. As such, DEMs were developed for the Bayou Macon BLE project by leveraging available high resolution gridded elevation data derived from Light Detection and Ranging (LiDAR) collections throughout the States of Louisiana and Arkansas. The 10-foot DEM developed to support the 2D BLE modeling and analysis, within the Bayou Macon Watershed, was executed using the following steps:

1. Available elevation data for the project area were inventoried and collected.
2. Leveraged elevation data were evaluated and prioritized based on source vertical accuracy, year of collection, and resolution.
3. Seamless DEMs were processed using GIS.
4. Quality was assured using quantitative and qualitative assessment.

Documentation regarding leveraged data including coverage, accuracy, acquisition dates, and source contact/agency are presented in the figures, tables and text within Section 2.1. All vertical accuracy specifications were obtained from the metadata or survey reports provided with the leverage datasets. All available metadata, survey reports, and other leverage documentation are included in the FEMA Data Capture Technical Reference compliant submittal content for the Bayou Macon Watershed.

2.1.1 Inventory

An inventory of existing topographic data was conducted for the Bayou Macon BLE project footprint. Figure 2 depicts the datasets identified and leveraged across the project area. FEMA, National Oceanic and Atmospheric Administration (NOAA), United States Geological Survey (USGS), and other State and Federal agencies were queried to build the inventory with the most current and available data sources.

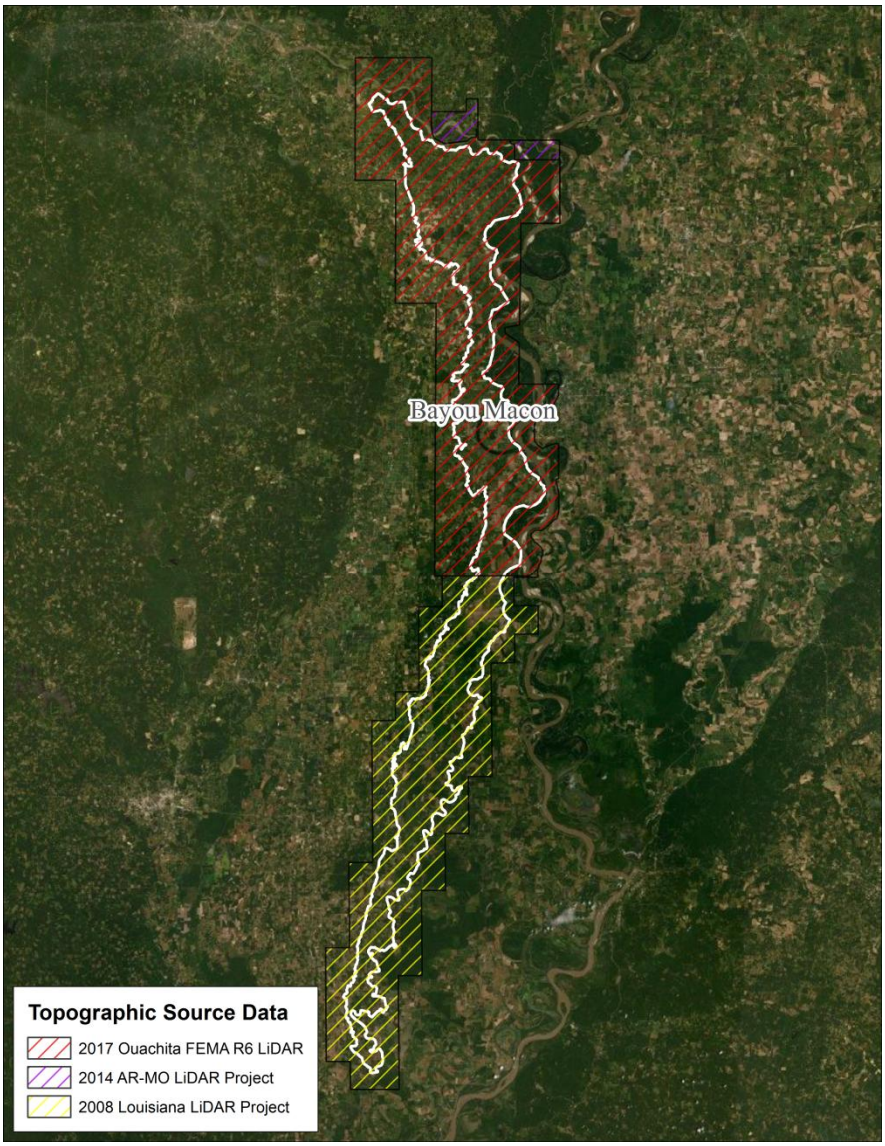

Figure 2: Bayou Macon Watershed BLE Source Terrain Data

2.1.2 Evaluation

A data coverage assessment was conducted to check for data gaps, extent, accuracy, and completeness. A review of related documentation, reports, indexes, and metadata associated with the leveraged datasets ensured each dataset meets FEMA accuracy requirements for topographic data. Decisions to leverage or exclude a dataset (or portion of it), were based generally on the following criteria coupled with engineering judgment:

- Data meet FEMA vertical accuracy standards (Table 1)
- Date of origination
- Data density and coverage

Table 1 depicts the Risk MAP SID #43 vertical accuracy requirements based on flood risk and terrain slope within the floodplain being mapped.

Table 1: FEMA Vertical Accuracy Requirements for Leveraged Data

Level of Flood Risk	Typical Slopes	Specification Level	Vertical Accuracy*	LiDAR Nominal Pulse Spacing (NPS)
High (Deciles 1,2,3)	Flattest	Highest	24.5 cm / 36.3 cm	≤ 2 meters
High (Deciles 1,2,3)	Rolling or Hilly	High	49.0 cm / 72.6 cm	≤ 2 meters
High (Deciles 2,3,4,5)	Hilly	Medium	98.0 cm / 145 cm	≤ 3.5 meters
Medium (Deciles 3,4,5,6,7)	Flattest	High	49.0 cm / 72.6 cm	≤ 2 meters
Medium (Deciles 3,4,5,6,7)	Rolling	Medium	98.0 cm / 145 cm	≤ 3.5 meters
Medium (Deciles 3,4,5,6,7)	Hilly	Low	147 cm / 218 cm	≤ 5 meters
Low (Deciles 7,8,9,10)	All	Low	147 cm / 218 cm	≤ 5 meters

*Vertical Accuracy at 95% Confidence Level (FVA or NVA)/(CVA or VVA)

Table 2 depicts the complete list of source elevation data and attributes leveraged for the Bayou Macon Watershed BLE project. All datasets used for hydraulic analyses and mapping meet the highest specification level defined in Table 1. Further explanation of the Table 2 datasets can be referenced in section 2.1.2.1.

Table 2: Source Topographic Data Available for the Bayou Macon Watershed

Year	Description	Data Type	Source/Owner
2017	2017 Ouachita LiDAR	Airborne LiDAR	USGS/FEMA
2014	AR-MO LiDAR	Airborne LiDAR	NRCS
2008	Louisiana Statewide LiDAR	Airborne LiDAR	LSU/USGS

2.1.2.1 Bayou Macon Watershed Source Terrain Data

The source elevation data for the Bayou Macon Watershed are DEMs derived from the 2017 Ouachita FEMA Region 6 LiDAR, the 2014 AR-MO LiDAR Project and the 2008 Louisiana LiDAR Project. Only points classified as "ground" points (i.e., bare earth) were imported from the LiDAR and used for development of the project DEMs. Bare-earth LiDAR data are typically made by filtering non-ground returns (e.g. buildings, vegetation, etc.) from the raw laser returns. Figure 2 depicts the extent of the data defined in Table 2.

2.1.2.1.1 2017 Ouachita LiDAR

The 2017 Quachita FEMA R6 LiDAR was acquired for the United States Geological Survey (USGS). The LiDAR data was collected from January 20th to March 26th of 2016. This task order requires LiDAR data to be acquired over approximately 20,386 square miles of LiDAR, for the Area of Interest (AOI) collected at a nominal pulse spacing (NPS) of 0.7 meters. The LiDAR data was acquired and processed in compliance with USGS National Geospatial Program LiDAR Base Specification version 1.2. The NPS assessment is made against single swath, first return data located within the geometrically usable center portion (typically ~90%) of each swath.

2.1.2.1.2 2014 AR-MO LiDAR

This project combines the varied interests of the National Resources Conservation Service (NRCS), USGS, Missouri Department of Natural Resources (MO-DNR), United States Army Corps of Engineers (USACE) & Arkansas Game & Fish to collect detailed ground elevation data from Aerial LiDAR Sensors for approximately 10,008 Square Miles into a unified collection and processing project to benefit the US

Government. These partners require 0.7-meter nominal point spacing (USGS Level 2) high-resolution digital elevation data developed from Aerial LiDAR collection in the following Missouri and Arkansas Counties: Cape Girardeau, Stoddard, Mississippi, Lauderdale, New Madrid, Pemiscot, Poinsett, Craighead, Greene, Crittenden, Cross, St. Francis, Lee, Monroe, Phillips and Desha. The areas to be collected may only cover the portions of the counties without existing data. These data will then be used to generate digital elevation models and contours for use in hydraulic/hydrologic models and other purposes to include conservation planning activities and environmental assessments.

2.1.2.1.3 2008 Louisiana Statewide/FEMA LiDAR

Begun in 2000, Louisiana's statewide LiDAR project was initiated in response to the high per capita and repetitive flood loss rates experienced by the FEMA, National Flood Insurance Program and the private insurance industry in the state. LiDAR derived, high-resolution topographic information has been accepted by FEMA as a low cost means to update inaccurate and out of date flood maps. The state sponsor for the project, thus far, has been the Louisiana Oil Spill Coordinators Office (LOSCO), which has managed the project and arranged for state match through legislative action. Oil spill contingency planning and response issues plague all Louisiana parishes requiring critical high resolution topographic information. The Louisiana Office of Emergency Preparedness (OEP) has recently assumed administrative control of the project, largely because of OEP's direct, official connection with FEMA. The LiDAR systems being used in the Louisiana project are accurate to 15-30 cm RMSE, depending upon land cover, and will support contours of 1-2 foot vertical map accuracy standards. These accuracies meet FEMA standards for floodplain reevaluation studies and map modernization programs designed to update the FIRM.

2.1.3 Data Development Methodology

The source topographic data were processed for an area covering the Bayou Macon Watershed BLE modeling efforts. The topographic data for Bayou Macon Watershed was projected horizontally, as needed, to North American Datum of 1983 (NAD83), State Plane Lambert Conformal Conic Louisiana North in feet (1701). All topographic data were adjusted vertically, as needed, to North American Vertical Datum of 1988 (NAVD88) in feet. Compass used a combination of ArcGIS and other software tools to apply any vertical datum shifts and\or any horizontal projection transformations to the topographic data.

2.1.4 DEM QA/QC

DEMs developed for use in the Bayou Macon Watershed BLE analysis were developed and independently assured to meet quality standards of the project. The data were developed using a controlled process, were evaluated and assured by a topographic data development team, and were evaluated and assured by the engineering team. Quality assurance during the data development process includes, but is not limited to the following QC checks:

- Horizontal Projection Check
- Vertical Datum Check
- Resolution Check
- Format Check
- Seamless Data Check to ensure the DEM files are consistent and seamless along source data edges

The quality control after the development process by the DEM development team included visual observations using hillshade, contouring, color rendering, and/or other visual aids to review and identify potential impactful anomalies within the DEM surface. This QC step included, but were not limited to the following QC checks:

- Seamless Data Check to ensure no voids along the edges and between the prioritized datasets
- NoData Value Check to ensure no null values
- Manual Elevation Check using hillshade rasters to find erroneous elevation issues
- Unit Consistency Check
- Legacy Cell Value Anomalies

Quality assurance conducted after the seamless DEM development conducted by the engineering team included visual or automated assessments to identify potentially impactful anomalies or slope changes that may adversely impact hydraulic.

The final DEM data developed for the Bayou Macon Watershed is assured to meet FEMA standards and present a representative surface developed from leveraged elevation data for the purposes of this BLE project.

2.2 2D BLE Methods

The following sections describe the 2D computational mesh and program setting considerations, followed by discussion and tabulation of hydrologic and hydraulic engineering methods and model inputs.

2.2.1 2D Computational Mesh and Settings

The HEC-RAS 2D computational mesh defines the extents of the 2D flow and can affect the accuracy of the 2D calculations. A more dense mesh may provide more accurate results, but it can dramatically increase computation times. The 2D mesh for the models were set as evenly spaced cells at 200 feet. The mesh was further refined by placing breaklines along roads, berms, ridges, and other high ground that can influence the flow.

To ensure the entire Bayou Macon Watershed was represented, a 500 foot buffer was added to the Hydrologic Unit Code 8 (HUC-8) boundary.

The HEC-RAS 2D computational mesh was created for the Bayou Macon Watershed based on HUC boundaries using ArcGIS toolsets, such as smoothing and simplification routines; ultimately, significantly reducing the need for manual edits to mesh cells within HEC-RAS that happen to generate errors. The 2D mesh consists of 770,329 cells and a 200 foot nominal mesh cell size; there are factors that could result in either larger or smaller cell sizes including proximity to the edge of the 2D mesh or the presence of breaklines. A 30 second time step was used in the HEC-RAS model, applying the Diffusion Wave (simplified Full Momentum) equations.

2.2.2 Model and Boundary Condition Setup

Using HEC-RAS rain-on-grid modeling requires establishing a 2D computational mesh boundary. For the Bayou Macon Watershed, an excess precipitation was applied to the mesh. Figure 3 shows the 2D computational mesh for the Bayou Macon Watershed, along with USGS peak streamflow gages pertinent to the study.

The development of the excess precipitation hyetographs for the 2D mesh are described in Section 2.2.3.

Outflow boundary conditions (from the computational 2D mesh) were utilized along basin boundaries using normal depth. Unique outflow boundaries were established for obvious riverine outflows, while the remaining boundaries were defined as continuous boundaries to allow drainage from adjacent basins to leave the model area freely. Normal depth was used for all non-unique outflow boundary conditions using approximate energy grade-line slopes estimated from the LiDAR terrain data.

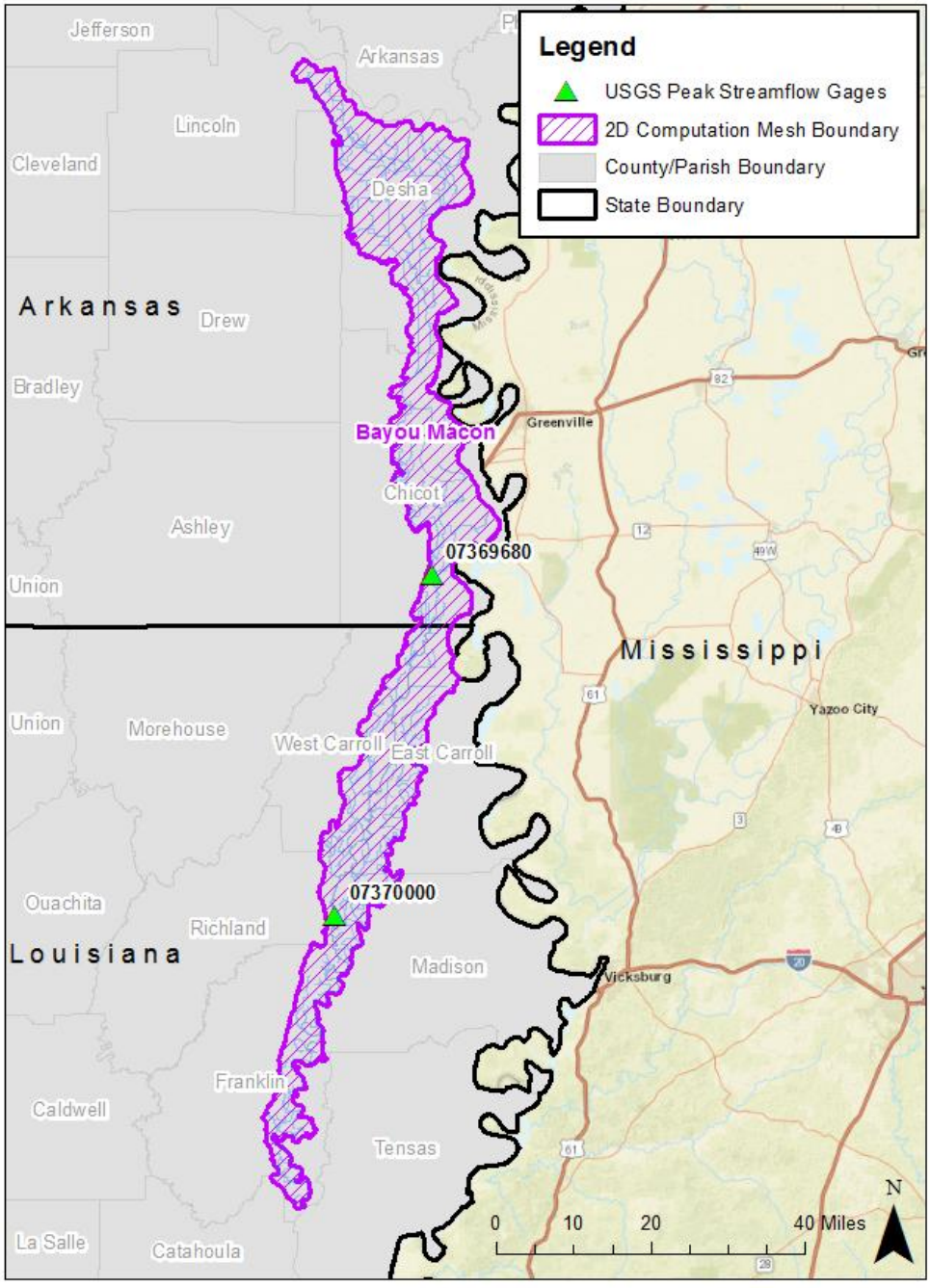

Figure 3: HEC-RAS 2D Computational Mesh and USGS Peak Streamflow Gages

2.2.3 Hydrology

Precipitation data for this study were referenced from NOAA's Precipitation Frequency Data Server, and appropriate values for all sub-basin elements were determined considering spatial variation and a representative total for Bayou Macon. Excess precipitation for the 2D mesh was developed as described in Section 2.2.3.1 USGS streamflow gage data were leveraged to estimate peak flows for downstream gages within each work area for calibration purposes, as discussed in Section 2.3.1.1.

Bayou Macon flows from Arkansas into Louisiana and eventually meets the Tensas Watershed at the downstream boundary. A statistical analysis was performed for the USGS gage 07370000 and USGS gage 07369680. The results from the analysis were compared with the HMS model results for the Bayou Macon Watershed. The HEC-HMS version 4.2 model was used solely for the development of excess precipitation hyetographs which were applied to the 2D mesh.

Precipitation frequency data published in NOAA Atlas 14, Volume 9 Version 2.0 (NOAA, 2013) were used for this study. These data were obtained from NOAA's Precipitation Frequency Data Server (PFDS) (http://hdsc.nws.noaa.gov/hdsc/pfds/index.html). The 10%, 4%, 2%, 1%, and 0.2% annual chance 24-hour precipitation depths for all sub-basin elements were determined by area-weighted intersection of gridded PFDS data with sub-basins. Excess precipitation for the 2D mesh was developed as described in Section 2.2.3.1. The gages utilized for this study are presented in Table 3.

Table 3: USGS Peak Streamflow Gages

Gage ID	Flooding Source and Location	Published Drainage Area (mi^2)	Period of Record
07369680	Bayou Macon at Eudora, AR	500	1931 – 2019
07370000	Bayou Macon nr Delhi, LA	782	1882 – 2019

Annual chance peak flows were calculated at each gage using USGS Bulletin 17B methodology. The 84% confidence interval was used to determine the 1% plus and minus chance events. Calculated discharges for the 1%, 1% plus, and 1% minus events are presented in Table 4 for each gage utilized in this study.

Table 4: USGS Peak Streamflow Gage Analysis Results

Gage ID	Flooding Source and Location	1% Peak Q (cfs)	1%- Peak Q (cfs)	1%+ Peak Q (cfs)
07369680	Bayou Macon at Eudora, AR	5,421	5,058	5,870
07370000	Bayou Macon nr Delhi, LA	12,620	11,780	13,640

2.2.3.1 Excess Precipitation for 2D Computational Mesh

HEC-HMS version 4.2 was used to apply the Soil Conservation Service (SCS) Curve Number method to calculate losses and define excess precipitation for this watershed. Temporal distributions of point rainfall totals were defined using 24-hour, SCS Type III storm distributions. The plus and minus standard error for the 1% annual chance precipitation depths were determined as the upper and lower 84% confidence limits on the nominal 1% depth, assuming a normal distribution of the logarithms for the precipitation depths.

In addition to recurrence interval precipitation estimates, NOAA Atlas 14 provides 90% confidence intervals of reported precipitation values. On a normal distribution curve, 90% confidence intervals (i.e. the upper and lower 95% confidence limits) correspond to +/- 1.645 standard deviations. The 1% plus and minus events are defined to be one standard deviation above and below the 1% event. It should be noted that the standard errors for the 1% rainfall depth were based on the depth used post-areal reduction.

Curve numbers were computed by intersecting the National Land Cover Dataset (NLCD) 2016 coverage and NRCS soils data based on the matrix presented in Table 5.

Table 5: Land Use-Soils-CN Matrix for Computing Initial Curve Numbers

LU_GridCode	NLCD LU Description	Hydrologic Soil Group			
		A	B	C	D
11	Open Water	99	99	99	99
21	Developed Open Space	49	69	79	84
22	Developed Low Intensity	61	75	83	87
23	Developed Medium Intensity	81	88	91	93
24	Developed High Intensity	89	92	94	95
31	Barren Land	39	61	74	80
41	Deciduous Forest	30	55	70	77
42	Evergreen Forest	30	55	70	77
43	Mixed Forest	30	55	70	77
52	Shrub Scrub	30	48	65	73
71	Herbaceous	49	62	74	85
81	Hay Pasture	39	61	74	84
82	Cultivated Crops	51	67	76	80
90	Woody Wetlands	72	80	87	93
95	Emergent Herbaceous Wetlands	72	80	87	93

A Curve Number (CN) can be considered a parameter, exhibiting variability that follows some frequency distribution. While Antecedent Runoff Condition (ARC) II CNs were used for a 1% event, the range between ARC I and ARC III for the ARC II CN was assumed to correspond to an 80% confidence interval of the ARC II CN. The CN loss method assumes a maximum potential retention parameter, S, is inversely related to a CN by S = 1000 / CN – 10; this relationship is based on a median value of S determined from plotting a large number of observations.

Chapter 5 of the NRCS National Engineering Handbook (NEH) Part 630 provides an example of computing a CN for a watershed based on annual peak gage observations. The example involves computing a CN and corresponding S value for each event, then taking the logarithms of the S values. Further, the logarithm of S is assumed to vary normally, and the mean of the logarithms corresponds to the arithmetic median. Therefore, 10% (S10) and 90% (S90) extremes of lognormally distributed S values can be assumed to correspond to ARC III and ARC I condition CN values, respectively. This range represents an 80% confidence interval, corresponding to +/- 1.282 standard deviations from the mean.

The following procedure was used to estimate one standard deviation of a given CN (in fact, one standard deviation of the logarithm of S) for the purposes of modeling 1% plus and minus events. First, ARC III (corresponding to S10) and ARC I (corresponding to S90) CN values can be estimated from a 1% CN (ARC II) by:

$$CNI = 4.2 * CNII / (10 - 0.058 * CNII)$$
$$CNIII = 23 * CNII / (10 + 0.13 * CNII)$$

Next, S90 and S10 can be computed by:

$$S10 = 1000 / CNIII - 10$$
$$S90 = 1000 / CNI - 10$$

The following relationship can then be used to compute one standard deviation of the logarithm of S:

$$\log (S10) = \text{mean} (\log S) + 1.282 \text{ std. dev.} (\log S)$$
$$\log (S90) = \text{mean} (\log S) - 1.282 \text{ std. dev.} (\log S)$$
$$1 \text{ std. dev.} (\log S) = (\log S10 - \log S90) / 1.282$$

Therefore, 1% plus and minus S values can be estimated by:

$$\log SPlus = \log S + [1 \text{ std. dev.} (\log S)]$$
$$\log SMinus = \log S - [1 \text{ std. dev.} (\log S)]$$

Finally, 1% plus and minus CNs can be computed by:

$$CNPlus = 1000 / (SPlus + 10)$$
$$CNMinus = 1000 / (SMinus + 10)$$

Since the 1% plus and minus events represent plus and minus one standard deviation of a 1% event, CNs used in a rainfall-runoff simulation for modeling 1% plus and minus events were developed, as described above.

Lag times for sub-basins were determined using the SCS lag equation, as well as engineering judgment.

During the calibration of the model, it was determined that a 10% increase in the curve number would be required to calibrate the model. The calibration is discussed in further detail below in 2.3.1.1. The table below shows the adjusted curve numbers and lag time values used in this study.

Table 6: Rainfall-Runoff Parameters (Calibrated Curve Number, Lag Time)

Sub-basin Description	Calibrated CN	CN 1% Minus	CN 1% Plus	Tlag (min)
Bayou Macon	88.8	80.4	93.9	12,800

NRCS rainfall-runoff methods were used to define excess precipitation applied to the 2D mesh, including curve numbers for defining rainfall losses and lag time for transforming the runoff temporally. No routing was considered in the rainfall-runoff modeling. NRCS Type III storm distributions were used for defining temporal distributions of point rainfall totals. An Areal Reduction Factor (ARF) of 0.91 was used on all recurrence interval total precipitation depths in order to determine the effective precipitation for the sub-basin representing the 2D mesh. Table 7 provides the precipitation totals used for determining excess precipitation.

Table 7: Precipitation Totals for HEC-RAS 2D Computational Mesh (post ARF)

Sub-basin Description	Percent Annual Chance Precipitation Total (in)						
	10	4	2	1	0.2	1% Minus	1% Plus
Bayou Macon	4.63	5.67	6.52	7.39	9.58	5.57	9.07

Figure 4 shows the hyetographs applied to the 2D computational mesh.

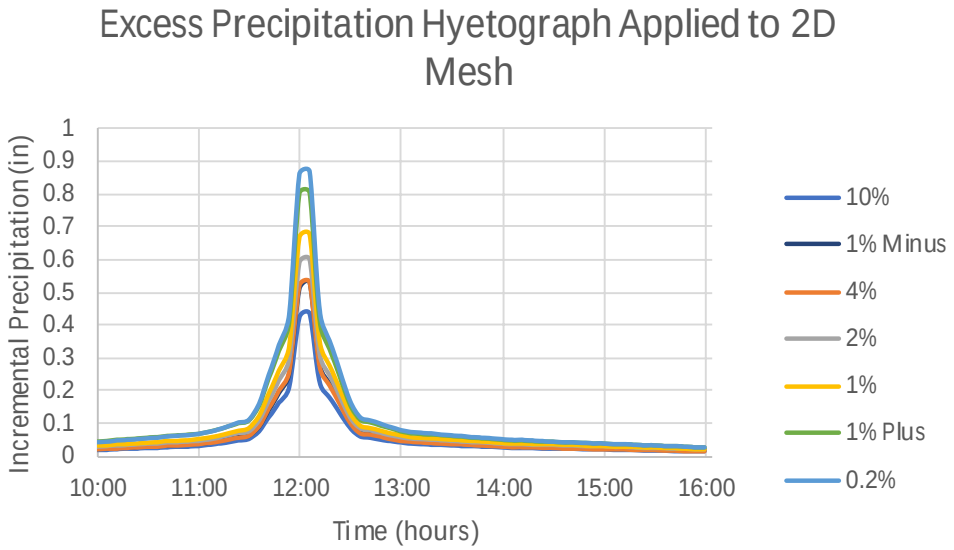

Figure 4: Precipitation Hyetographs (post ARF) applied to the Computational Mesh

2.2.4 Hydraulics

This section describes the remaining hydraulic modeling considerations, including implementation of Manning's roughness, breaklines, and hydraulic structures within the 2D computational mesh.

2.2.4.1 Roughness Coefficients

A Manning's n roughness coverage was developed for the 2D computational mesh using typical values for roughness for given NLCD land classifications. In several areas, the channel section land use indicated a Manning's n-value inappropriate for channel conveyance; for example, woody wetlands. A 200 foot buffer zone was created around each stream centerline to create a main channel roughness zone. The channel roughness zone was given a Manning's n value of 0.045 to ensure the channel 2D cells have appropriate conveyance with the value being taken from the HEC-RAS User's Manual. A

Manning's n value of 0.035 was used towards the downstream end of Bayou Macon based on assessment of aerial imagery and the Madison Parish, LA Flood Insurance Study. A higher roughness coefficient was utilized for developed areas to account for buildings. A higher roughness coefficient was also utilized for the Woody Wetland classification based on an assessment of the aerial imagery and features defined under this classification. The table below shows a typical land use-roughness matrix used in defining the roughness coverage for the study area.

Table 8: NLCD 2016-Manning's N Roughness Matrix

NLCD Classification	Selected Manning's N	Minimum	Normal	Maximum	Source
Open Water	0.03	0.025	0.03	0.033	Chow 1959
Developed, Open Space	0.04	0.01	0.013	0.016	Calenda, et al. 2005
Developed, Low Intensity	0.06	0.038	0.05	0.063	Calenda, et al. 2005
Developed, Medium Intensity	0.08	0.056	0.075	0.094	Calenda, et al. 2005
Developed, High Intensity	0.12	0.075	0.1	0.125	Calenda, et al. 2005
Barren Land	0.03	0.025	0.03	0.035	Chow 1959
Deciduous Forest	0.12	0.1	0.12	0.16	Chow 1959
Evergreen Forest	0.12	0.1	0.12	0.16	Chow 1959
Mixed Forest	0.12	0.1	0.12	0.16	Chow 1959
Scrub/Shrub	0.06	0.035	0.05	0.07	Chow 1959
Grassland/Herbaceous	0.03	0.025	0.03	0.035	Chow 1959
Pasture/Hay	0.04	0.03	0.04	0.05	Chow 1959
Cultivated Crops	0.045	0.025	0.035	0.045	Chow 1959
Woody Wetlands	0.15	0.08	0.1	0.12	Chow 1959
Emergent Herbaceous Wetland	0.075	0.075	0.1	0.15	Chow 1959
Main Channel[1]	0.045				HEC-RAS User's Manual

[1]Clean, winding, some pools and shoals, some weeds and stones, lower stages, more ineffective slopes and sections

2.2.4.2 Breaklines

Breaklines align grid cell faces and were used within the 2D mesh area to define prominent features including, road embankments and hydraulic structures as well as stream centerlines. Road embankments were identified in ArcGIS and imported into HEC-RAS as breaklines to ensure that water was not routed past roads until it was deep enough to overtop the road. Similarly, bridge/culvert crossings that were not processed out of the terrain data were modeled by offsetting breaklines adjacent to the road embankment to align grid cells around the embankment and allow water to be routed across the embankment without creating artificial backwater. This approach was used for most hydraulic structures because it could be implemented in ArcGIS on a large scale with much less effort than alternative methods. An example of the offset breakline approach is shown below.

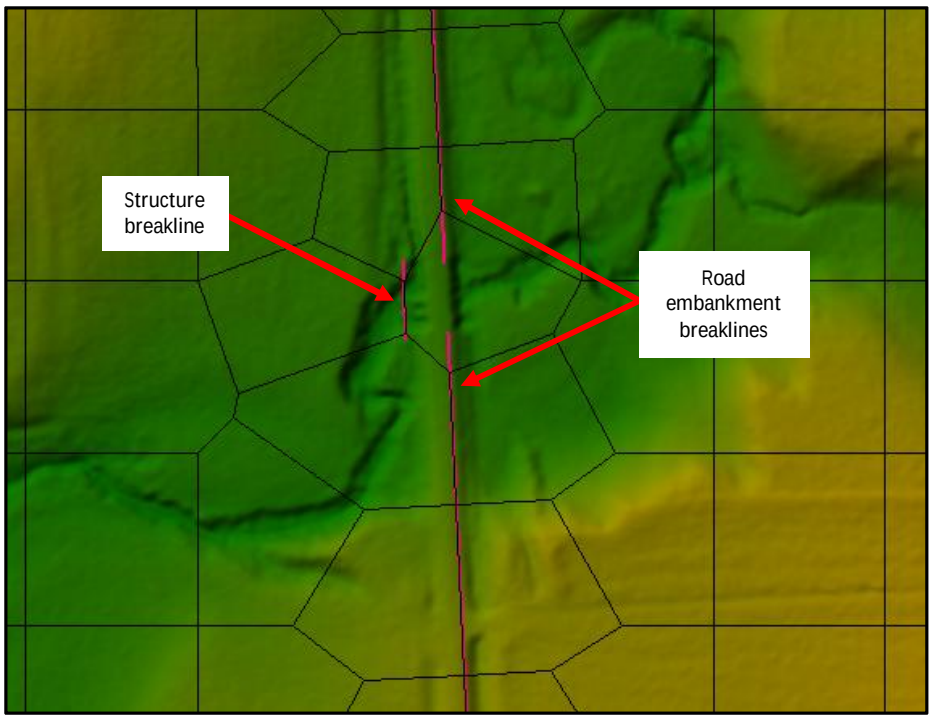

Figure 5: Offset Breakline Approach at Bridge Crossing

County/Parish, interstate, common name, state recognized, and U.S. roads were incorporated for road breaklines from the U.S. Census Bureau TIGER/Line road layer.

The stream centerlines were input as breaklines to ensure cells lined up perpendicular to the stream and to capture stream conveyance.

The study area included multiple levee systems. In order to represent the prominent features, breaklines were utilized for the provisionally accredited West Bank Mississippi River Levee System and the accredited Sicily Island Levee System. Although, the West Bank Mississippi River Levee System is provisionally accredited, it was assumed to provide protection as mapped on the effective FIRMs.

2.2.4.3 Initial Conditions

The Bayou Macon Watershed includes many areas of frequent standing water including Lake Chicot and the Poverty Point Reservoir. Initial wet conditions were considered and included in the final modeling. A broad scale simulation was performed to fill in depressions and establish an initial water surface and was used as a restart file for the refined simulations. The 10% storm event was selected to create the restart file.

2.3 Model Results

The 2D BLE results for the study produced a Special Flood Hazard Area (SFHA) that compared reasonably well in terms of water surface elevation with the effective SFHA in most cases, and provides additional estimated SFHA in areas that do not currently have an SFHA mapped. Table 9 shows a comparison of some the effective BFE data with the model results. While the results provide context for flood risk communication as part of the Discovery process, and are scalable, the results require further analysis to be used for regulatory purposes. The validity of the 2D BLE results should be verified through community work map meetings before being applied to a regulatory product.

Table 9: Effective and Model BFE Comparison

Stream	Comparison Point Effective Station	Effective BFE (feet)	Model BFE (feet)	Difference (feet)
Alligator Bayou	59,528	110.2	110.3	0.1
Bayou Macon	54,697	78.5	77.4	-1.1
Bayou Macon Trib 1	13,008	89.2	90.5	1.3
Bayou Macon Trib 2	7,128	91.6	92.1	0.5
Bogzack Creek	14,464	93.3	94.3	1.0
Little Lake Bayou	2.1	119.3	118.8	-0.5
Macon Bayou	157.25	107.7	106.9	-0.9
Main Ditch 6	5.18	116.6	116.6	0.0

2.3.1.1 Calibration & Sensitivity Analysis

Known USGS gages within the model area with more than 20 years of flow record were used for calibration and validation of the 1% annual chance event. Peak flows within the model were compared with a Bulletin 17B analysis of the gage data using PeakFQ. Final results of the flow comparisons are presented in Table 10.

Table 10: 1% Annual Chance Reasonability Comparisons

Flooding Source	USGS Gage Used for Verification	HEC-RAS 5.0.7 (2D)		Reference	
		WSEL (ft)	Discharge (cfs)	WSEL (ft)	Discharge (cfs)
Bayou Macon	07369680	107.0	4,859	110.0[1]	5,421
Bayou Macon	07370000	75.4	10,787	76.6[2]	12,620

[1] Water surface elevation is approximate based on USGS WaterWatch Rating Curve
[2] Water surface elevation is based on April 30, 1991 storm event (10,900 cfs)

To determine which factors were significantly impacting the model results, a sensitivity analysis was run at the USGS stream gages to evaluate the impact of five parameters including Manning's roughness values, breaklines, hydrologic losses, initial conditions, and boundary conditions. The Manning's n-values greatly impacted the results and was determined that a channel n-value needed to be set for the watershed. Further discussion of the roughness coefficients can be found in Section 2.2.4.1. It was determined that enforced breaklines at roads and centerlines were needed and are discussed further in Section 2.2.4.2. A 5% and 10% increase to the curve number were tested during the sensitivity analysis. A restart file was utilized as to replicate initial conditions in order to provide starting elevations for Lake Chicot, Poverty Point Reservoir, as well as other low-lying areas. The initial conditions are discussed in Section 2.2.4.3. Table 11 and Table 12 summarize the results of each sensitivity run at the stream gages.

Table 11: Sensitivity Analysis Results - Bayou Macon near Delhi, LA (USGS 07370000)

Iteration	Manning's N Zones	Breaklines[1]	Hydrologic Losses	Initial Conditions	Boundary Conditions	Peak Flow (cfs)	Peak Elevation (ft)
1	Original Landuse	None	Excess Precipitation	Dry	Only DS Outfall	4,497	75.22
2	Original Landuse	None	Excess Precipitation	Dry	Normal Depth	4,354	74.34
3	Land Use with Channel 0.045	None	Excess Precipitation	Dry	Normal Depth	7,528	74.52
4	Land Use with Channel 0.040	Primary/ Secondary Roads and centerlines	Excess Precipitation	Dry	Normal Depth	6,260	74.58
5	Original Landuse	Roads and centerlines	Excess Precipitation	Dry	Normal Depth	3,414	74.45
6	Land Use with Channel 0.040	Roads and centerlines	Excess Precipitation	Dry	Normal Depth	6,437	74.62
7	Land Use with Channel 0.040	Roads, centerlines, and offset breaklines	Excess Precipitation	10% restart	Normal Depth	8,536	75.28
8	Land Use with Channel 0.040	Roads, centerlines, and offset breaklines	Excess Precipitation w/ 10% CN increase	10% restart	Normal Depth	8,999	75.52
9	Land Use with Channel 0.045, Bayou Macon d/s 0.035	Roads, centerlines, and offset breaklines	Excess Precipitation	10% restart	Normal Depth	9,601	74.80
10	Land Use with Channel 0.045, Bayou Macon d/s 0.035	Roads, centerlines, and offset breaklines	Excess Precipitation w/ 5% CN increase	10% restart	Normal Depth	10,497	75.21
11	Land Use with Channel 0.045, Bayou Macon d/s 0.035	Roads, centerlines, and offset breaklines	Excess Precipitation w/ 10% CN increase	10% restart	Normal Depth	10,787	75.37
					Gage Analysis:	12,620	76.62[2]

[1] All iterations included breaklines for accredited and provisionally accredited levees.
[2] Water surface elevation is based on April 30, 1991 storm event (10,900 cfs)

Table 12: Sensitivity Analysis Results - Bayou Macon at Eudora, AR (USGS 07369680)

Iteration	Manning's N Zones	Breaklines[1]	Hydrologic Losses	Initial Conditions	Boundary Conditions	Peak Flow (cfs)	Peak Elevation (ft)
1	Original Landuse	None	Excess Precipitation	Dry	Only DS Outfall	2,819	107.04
2	Original Landuse	None	Excess Precipitation	Dry	Normal Depth	2,492	105.48
3	Land Use with Channel 0.045	None	Excess Precipitation	Dry	Normal Depth	2,987	105.39
4	Land Use with Channel 0.040	Primary/ Secondary Roads only and centerlines	Excess Precipitation	Dry	Normal Depth	3,082	104.89
5	Original Landuse	Roads and centerlines	Excess Precipitation	Dry	Normal Depth	1,701	105.02
6	Land Use with Channel 0.040	Roads and centerlines	Excess Precipitation	Dry	Normal Depth	2,777	104.58
7	Land Use with Channel 0.040	Roads, centerlines, and offset breaklines	Excess Precipitation	10% restart	Normal Depth	4,796	106.58
8	Land Use with Channel 0.040	Roads, centerlines, and offset breaklines	Excess Precipitation w/ 10% CN increase	10% restart	Normal Depth	5,378	106.89
9	Land Use with Channel 0.035-0.045	Roads, centerlines, and offset breaklines	Excess Precipitation	10% restart	Normal Depth	4,013	106.35
10	Land Use with Channel 0.035-0.045	Roads, centerlines, and offset breaklines	Excess Precipitation w/ 5% CN increase	10% restart	Normal Depth	4,627	106.78
11	Land Use with Channel 0.035-0.045	Roads, centerlines, and offset breaklines	Excess Precipitation w/ 10% CN increase	10% restart	Normal Depth	4,859	106.94
					Gage Analysis:	5,421	110.06[2]

[1] All iterations included breaklines for accredited and provisionally accredited levees.
[2] Water surface elevation is approximate based on USGS WaterWatch Rating Curve

2.4 Challenges

Major challenges included a lack of peak streamflow record, though sufficient data was available to provide confidence in the results. Within the watershed, there are several agriculture fields that appear to be trapping water which prevents runoff from reaching the channel in the model. If the runoff actually reaches the channel during a storm event through cross culverts or other conveyances, this may explain why the model results are lower than the gage analysis at certain areas of the watershed. The

watershed's proximity to the Mississippi River and low lying areas also often made it more difficult to determine the direction of flow.

2.5 Recommendations

This study provides significant information useful for flood identification and communication among those affected. The study is highly scalable, and stakeholder input and further analysis would enhance the product and inform implementation of regulatory flood hazard areas. In addition, the validity of the 2D BLE results should be verified through community work map meetings before being applied as a regulatory product.

03 Floodplain Mapping and Effective Zone A Validation

The following sections provide a synopsis of how raw modeled depths were translated into SFHAs. In addition to developing a new SFHA, the BLE model data was leveraged to validate the effective Zone A studies within the project footprint. The results of the validation effort can be found below in Section 3.2.

3.1 Special Flood Hazard Area

3.1.1 Model Outputs

The floodplains are derived from the raw modeled depth grids using the maximum value. These depth grids are exported from HEC-RAS as TIFF format rasters with an interpolated rendering that slope values at the center and along the faces/edges of the computational mesh cells. Using GIS, the TIFF rasters are post processed into 1% SFHA and 0.2% shaded X polygons.

3.1.2 Methodology

The use of 2D modeling methods results in water surface elevation values at every cell in the model's computational mesh. In order to represent the desired model results and eliminate extraneous disconnected cells, post processing of the depth grids is required. In order to decrease the "cupping effect" along the extent of the floodplain boundaries, an intermediate step was completed by taking the extents of the sloping raster from the model and placing points parallel to the boundary by 25 feet on either side every 50 feet along the line. Those points were then given a value from the horizontal model raster and combined with the mesh cell center points and a new interpolated raster was created for the floodplain mapping. For the purposes of the Bayou Macon BLE project, floodplain mapping delineation was completed using connected raster cells at the extent of the CNMS mapped and unmapped features in the project footprint with raster depths greater than 0.5 feet. Converting the raster data to polygon features enabled an intersection of modeled results to the CNMS and effective zones to create the SFHA and 0.2% shaded X features. Because the new mapping, based on gridded engineering, retains the blocky shape of a raster, a simplification process was applied using GIS to smooth the boundaries. These processes remove unnecessary points, bends, and angles while preserving the natural shape of the polygon. Furthermore, small voids, or "holes" inside of the floodplain were aggregated with the larger surrounding polygons to merge them and make the floodplain complete. These edits adhere to traditional and approved floodplain mapping approaches.

In addition to the SFHA, all other flooding associated with the 1% and 0.2% raw results were retained as "on the shelf" data that may be leveraged for future needs and analysis.

3.1.3 Flood Hazard Area Layer

Special Flood Hazard Areas, as noted above, were developed to the extent of the CNMS features or up to 0.5 square mile drainage area and effective Zone A study locations. The Regional CNMS database, National Flood Hazard Layer, and paper inventory were used as reference data to ensure extent of the BLE results represents appropriate flooding extent.

The 0.2% flood areas were produced for the entire watershed for all depths greater than 0. The methodology applied for the 1% to convert the raster to polygon, smooth and simplify the polygons were applied to the 0.2% boundaries. After both layers were developed, a union of the two products was performed to develop the deliverable format FLD_HAZ_AR.

3.2 Validation of Effective Zone A SFHA

The following summarizes the results of the CNMS validation assessments for the effective Zone A studies in the Bayou Macon HUC-8 Watershed.

3.2.1 Initial Assessment A1 – Significant Topography Update Check

The significant topography update check determines whether a topographic data source is available that is significantly better than what was used for the effective Zone A modeling and mapping. For the study area in the Bayou Macon Watershed the effective Zone A topographic data sources leveraged were lower quality than LiDAR sources, except for the studies in West Carroll Parish, LA. The topographic data sources discussed in Section 2.1.1 of this report represent a significant improvement for the areas that did not use LiDAR for their effective studies. Therefore, all reaches in the study area FAIL this check except for those in West Carroll Parish, LA.

3.2.2 Initial Assessment A2 – Check for Significant Hydrology Changes

The significant hydrology changes check determines whether new regression equations have become available from the USGS since the date of the effective Zone A study. If newer regression equations exist for the area of interest, then an engineer must determine whether these regression equations would significantly affect the 1% annual chance flow. Regression equations were only utilized for the effective analyses in West Carroll Parish, LA. New equations have not been issued since that time. For this reason, all reaches in the study area PASS this check.

3.2.3 Initial Assessment A3 – Check for Significant Development

The significant development check, using the National Urban Change Indicator (NUCI) dataset, assesses increased urbanization in the watershed. If the percentage of urban area within the HUC-12 watershed containing the effective Zone A study is 15 percent or more, and has increased by 50 percent or more since the effective analysis, the study would fail this check. The check for significant development in the Bayou Macon Watershed was completed by evaluating percentage of urban change at the HUC-12 level. None of the HUC-12 polygons within the study area met the threshold of 15% or more urban cover, therefore, all reaches were set to PASS this element.

Table 13 presents the summarized results of checks A1 through A3.

Table 13: A1-A3 Validation Results

Assessment Checks	Pass / Fail	Notes
A1 – Topography	Fail/Pass	Available LiDAR significantly better than effective topo source/LiDAR utilized in effective study
A2 – Hydrology	Pass	Regression equations not used in effective analysis OR New equations have not been published since the effective analysis
A3 – Development	Pass	Less than 15% of study area is under urban cover

3.2.4 Validation Check A4 – Check of Studies Backed by Technical Data

Zone A studies that pass all initial assessment checks described above may be categorized as “Valid” in the CNMS Inventory only if the effective Zone A study is supported by modeling or sound engineering judgment and all regulatory products are in agreement. If the effective Zone A study passes all initial assessment checks, but is not supported by modeling, or if the original engineering method used is

unsupported or undocumented, a comparison of the BLE results and effective Zone A's is performed. Due to lack of documentation of the original engineering methods in the Bayou Macon Watershed, check A4 has been marked as FAIL for all reaches in the study area except for those in Lincoln County, AR and West Carroll Parish, LA where effective studies are model-backed.

3.2.5 Validation Check A5 – Comparison of BLE and Effective Zone A

The effective Zone A comparison was performed at the full extent of the Bayou Macon Watershed. The validation of the effective Zone A boundaries using 2D flood hazard products differ from the standard 1D methods due to the lack of cross sections and their use with standard Floodplain Boundary Standards (FBS) methodology. For this 2D study, the effective A zone boundaries were compiled using the National Flood Hazard Layer and Core Logic effective digital uplift product. These data were dissolved to one continuous A-zone layer, which then had points placed along its perimeter every 500 feet.

For each test point, a 75-foot buffer was created. Using this buffer, the minimum and maximum values of the DEM were extracted, as a proxy for the effective base flood elevation. The minimum value of the 1% minus raster and the maximum value of the 1% plus raster are also extracted. These 1% plus maximum and 1% minus minimum values are products of the new 2D BLE study and act as the vertical tolerance. The test point passes if the DEM maximum value is less than or equal to the 1% plus maximum value and the DEM minimum value is greater than or equal to the 1% minus minimum value. This can be visualized as a short 75-foot radius cylinder, with a height of 1% plus maximum – 1% minus minimum. This test verifies that at least one point from the ground surface (i.e. proxy BFE) falls both vertically and horizontally within this range.

3.2.6 Validation Results

All 1,005.3 total miles of available CNMS features representing the effective Zone A studies were categorized as VALID – BEING STUDIED and UNVERIFIED – BEING STUDIED. Total miles in each of these categories are summarized in Table 14 and illustrated in Figure 6 below. Table 15 summarizes the validation results based on the individual HUC 12 watersheds within the Bayou Macon Watershed.

Table 14: Aggregated Zone A Validation Results

Validation Status	Status Type	Total Miles
VALID	BEING STUDIED	2.2
UNVERIFIED	BEING STUDIED	1,001.4

Table 15: HUC 12 Zone A Validation Results

HUC-12 Watershed		Total FBS points	Fail	Pass	%Pass	BLE Comparison Pass? (>90%)	Priority Score
Watershed Name	Watershed Number						
Bayou Macon	All Streams	57,311	29,499	27,812	48.5%	Fail	
Alligator Bayou	080500020503	3454	1629	1825	52.8%	Fail	40.2
Atkins Slough-Oak Log Bayou	080500020101	2944	1308	1636	55.6%	Fail	38.9
Baxter Bayou	080500020501	1333	716	617	46.3%	Fail	46.0
Boggy Bayou	080500020202	633	298	335	52.9%	Fail	38.3
Bogzack Creek	080500020504	2947	890	2057	69.8%	Fail	27.2
Canal No. 43	080500020201	3168	1690	1478	46.7%	Fail	46.1
Canal No. 43-Clay Bayou	080500020203	1168	570	598	51.2%	Fail	43.5
Canal No. 81-Lake Isaacs	080500020104	1615	910	705	43.7%	Fail	45.1
Clarks Bayou-Bayou Macon	080500020703	2913	1410	1503	51.6%	Fail	38.7
Cypress Bayou-Bayou Macon	080500020505	5681	2786	2895	51.0%	Fail	41.5
Grand Lake	080500020402	128	94	34	26.6%	Fail	76.0
Hill Bayou-Bayou Macon	080500020403	2647	1909	738	27.9%	Fail	65.7
Hurricane Bayou-Bayou Macon	080500020701	5502	2392	3110	56.5%	Fail	33.5
Little Lake Bayou-Bayou Macon	080500020301	33	19	14	42.4%	Fail	51.8
Long Lake Bayou-Bayou Macon	080500020502	6493	5034	1459	22.5%	Fail	67.1
Lower Joes Bayou	080500020602	3983	876	3107	78.0%	Fail	20.4
Oak Log Bayou-Cypress Bayou	080500020102	2355	1517	838	35.6%	Fail	43.7
Paps Slough-Bayou Macon	080500020303	165	110	55	33.3%	Fail	60.0
Red Fork Bayou	080500020103	2484	1426	1058	42.6%	Fail	26.3
Stillhouse Creek-Bayou Macon	080500020702	4583	2083	2500	54.5%	Fail	34.3
Upper Joes Bayou	080500020601	3082	1832	1250	40.6%	Fail	53.5

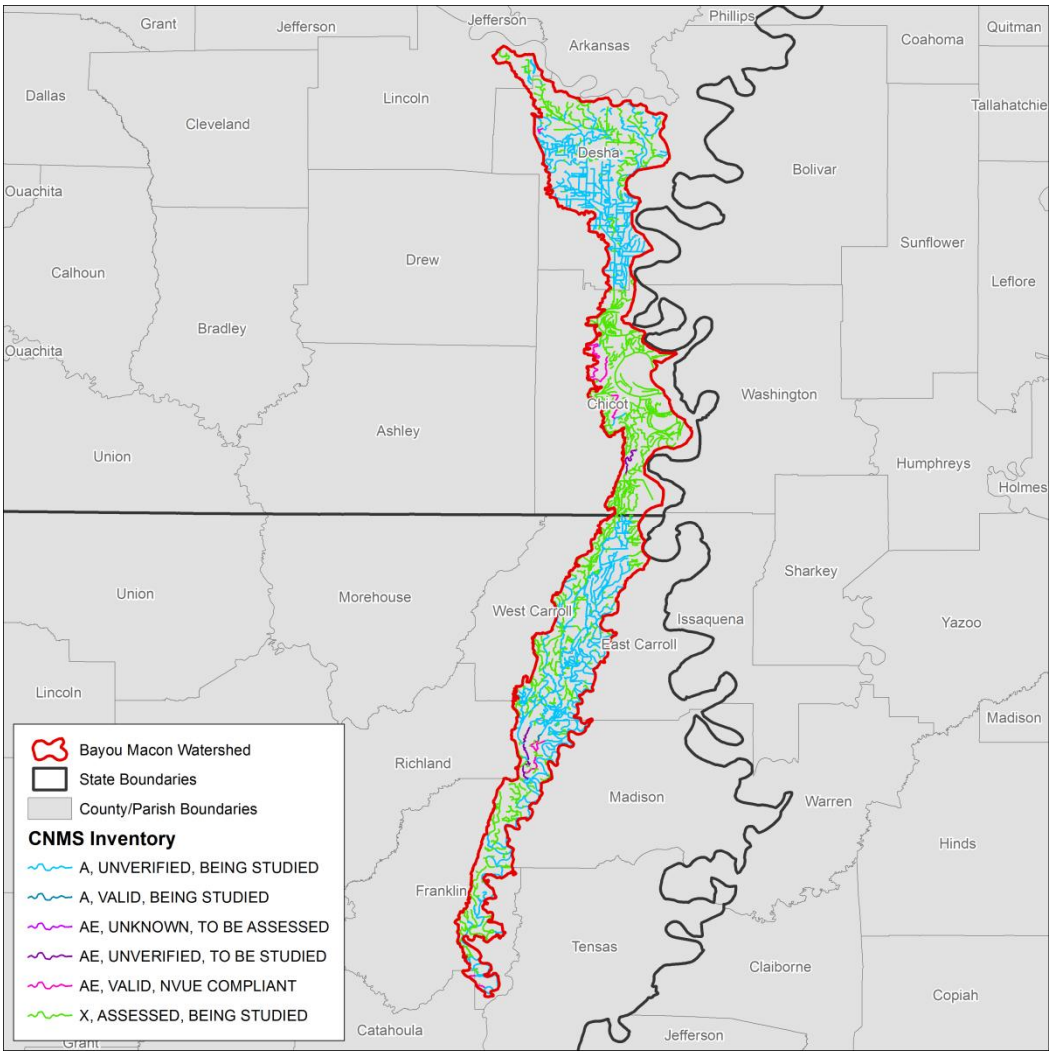

Figure 6: Bayou Macon Watershed CNMS Validation Results

An overall risk for each HUC-12 watershed was calculated using the National Flood Risk Percentages Dataset and its proportional area. The weighted risk was multiplied by the percentage of points in the watershed that failed the CNMS comparison to effective to determine the priority score. Figure 7 below shows the range of the Bayou Macon HUC-12 priority scores which can be used to initiate discussions during the Discovery phase. Little Choctaw Bayou-Big Choctaw Bayou HUC-12 was determined to have the highest priority score and the most need while Black Bayou-Bayou Macon River HUC-12 has the lowest score.

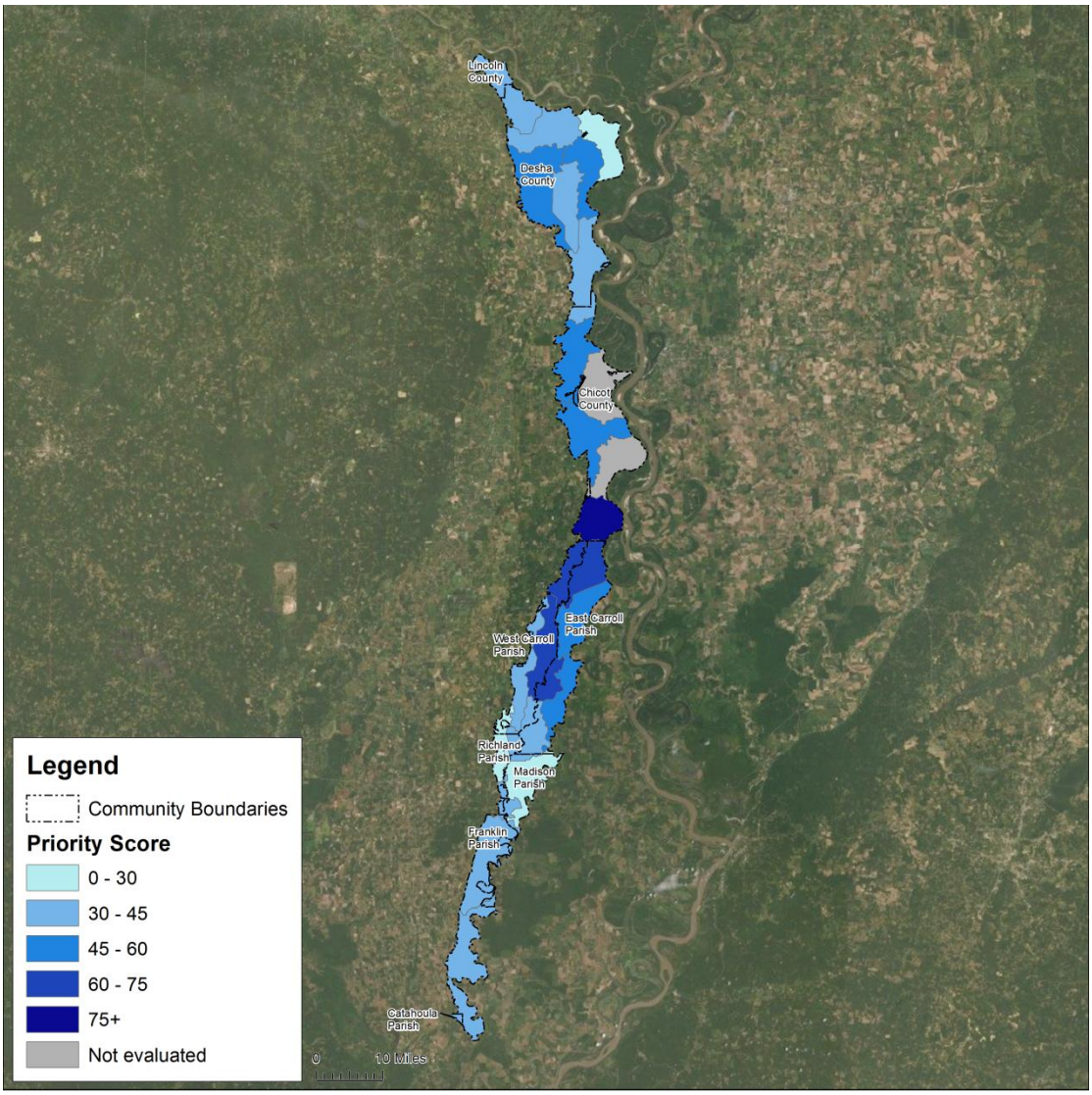

Figure 7: Ranking of Bayou Macon Watershed HUC-12s

3.3 Flood Risk Analysis

A flood risk analysis was performed for this project. The updated 1% annual chance and 0.2% annual chance depth grids were used to calculate the potential flood losses. The loss results are stored in the S_FRAC_AR spatial file within the FRD geodatabase. All results are reported in whole dollar values.

Hazus version 4.2 (SP03) was used for the basic and refined loss analysis.

The losses are reported via census blocks. It is important to note that Hazus version 4.2 (SP03) uses dasymetric census blocks. Dasymetric mapping removes undeveloped areas (such as areas covered by other bodies of water, wetlands, or forests) from the census blocks, changing their shape and reducing their size in these areas. For more information on dasymetric data visit FEMA's Media Library for the Hazus-MH Data Inventories: Dasymetric vs. Homogenous, or Hazus 3.0 Dasymetric Data Overview.

Hazus analysis was performed by county/parish within the project watershed extends for each return period to ensure proper model processing. A summary of results per county/parish for the 1% annual chance event scenarios are shown in Table 16.

Table 16: Hazus 4.2 (SP02) Results for 1-percent-annual-chance (100 year) scenario for Bayou Macon Watershed, Arkansas and Louisiana

County/Parish	Full Replacement - Total Loss	Dollar Exposure (Replacement Value) - Buildings	Dollar Exposure (Replacement Value) - Contents
Catahoula Parish	$57,000	$1,670,000	$1,121,000
Chicot County	$39,023,000	$326,233,000	$233,374,000
Desha County	$17,621,000	$166,454,000	$92,607,000
East Carroll Parish	$4,885,000	$71,506,000	$43,742,000
Franklin Parish	$7,850,000	$217,056,000	$126,940,000
Lincoln County	$40,000	$3,368,000	$1,691,000
Madison Parish	$3,575,000	$60,614,000	$31,570,000
Richland Parish	$2,515,000	$116,923,000	$73,187,000
West Carroll Parish	$21,747,000	$256,767,000	$159,682,000
Total	$97,313,000	$1,220,591,000	$763,914,000

04 References

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4. NOAA, “NOAA Atlas 14 Precipitation-Frequency Atlas of the United States”, 2013. Volume 9, Version 2.0. (https://www.nws.noaa.gov/oh/hdsc/PF_documents/Atlas14_Volume9.pdf).
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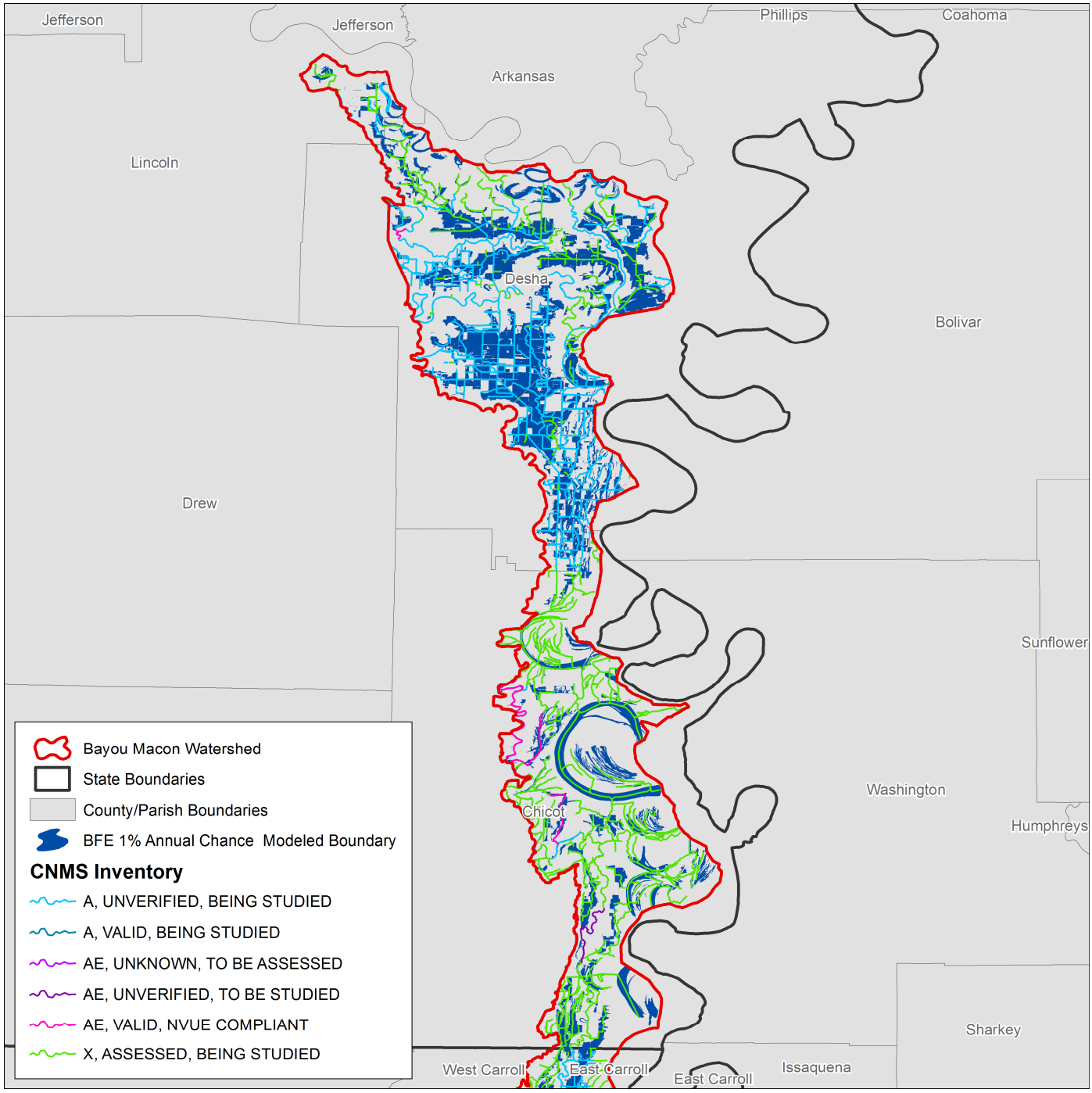
APPENDIX A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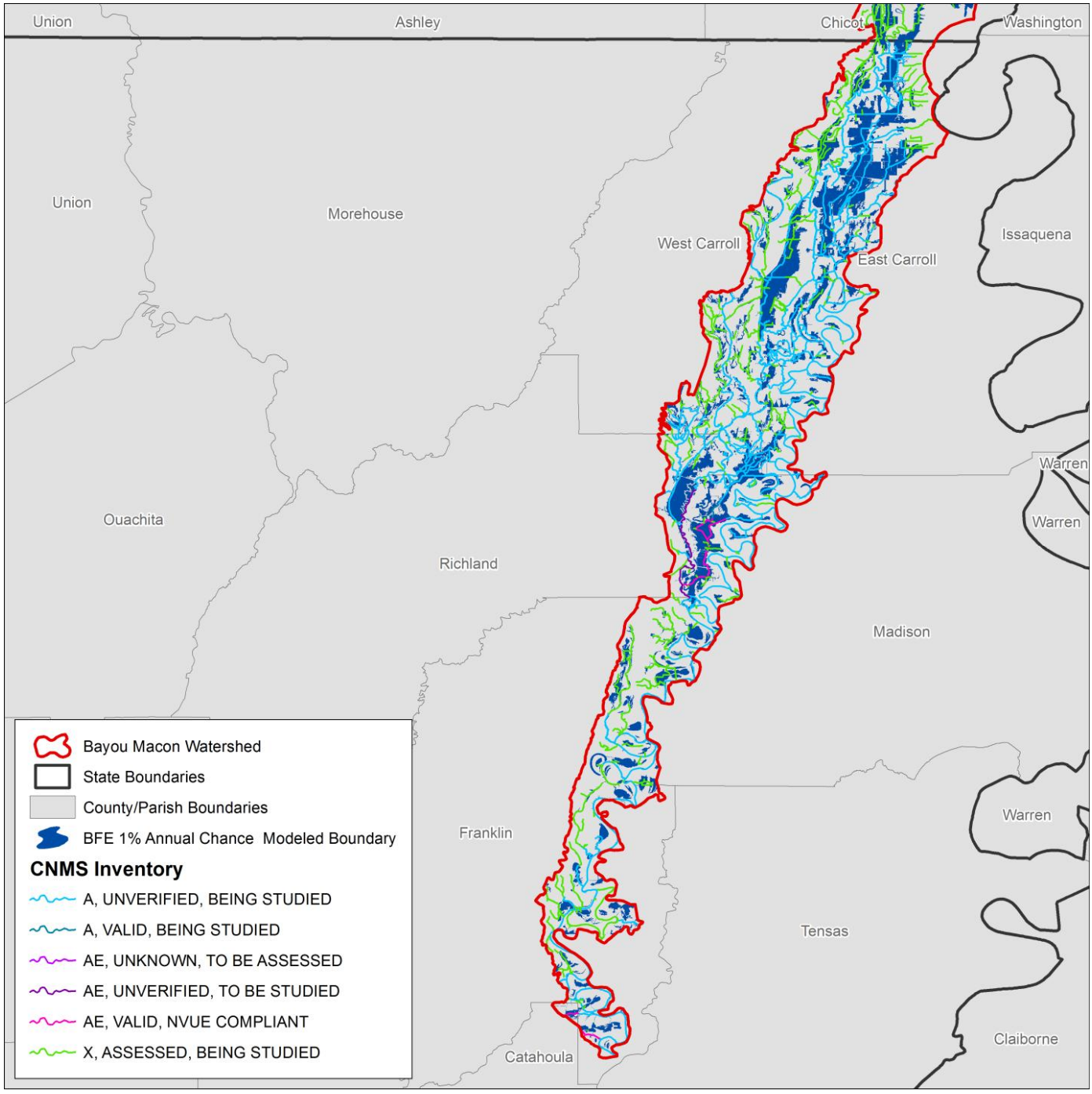
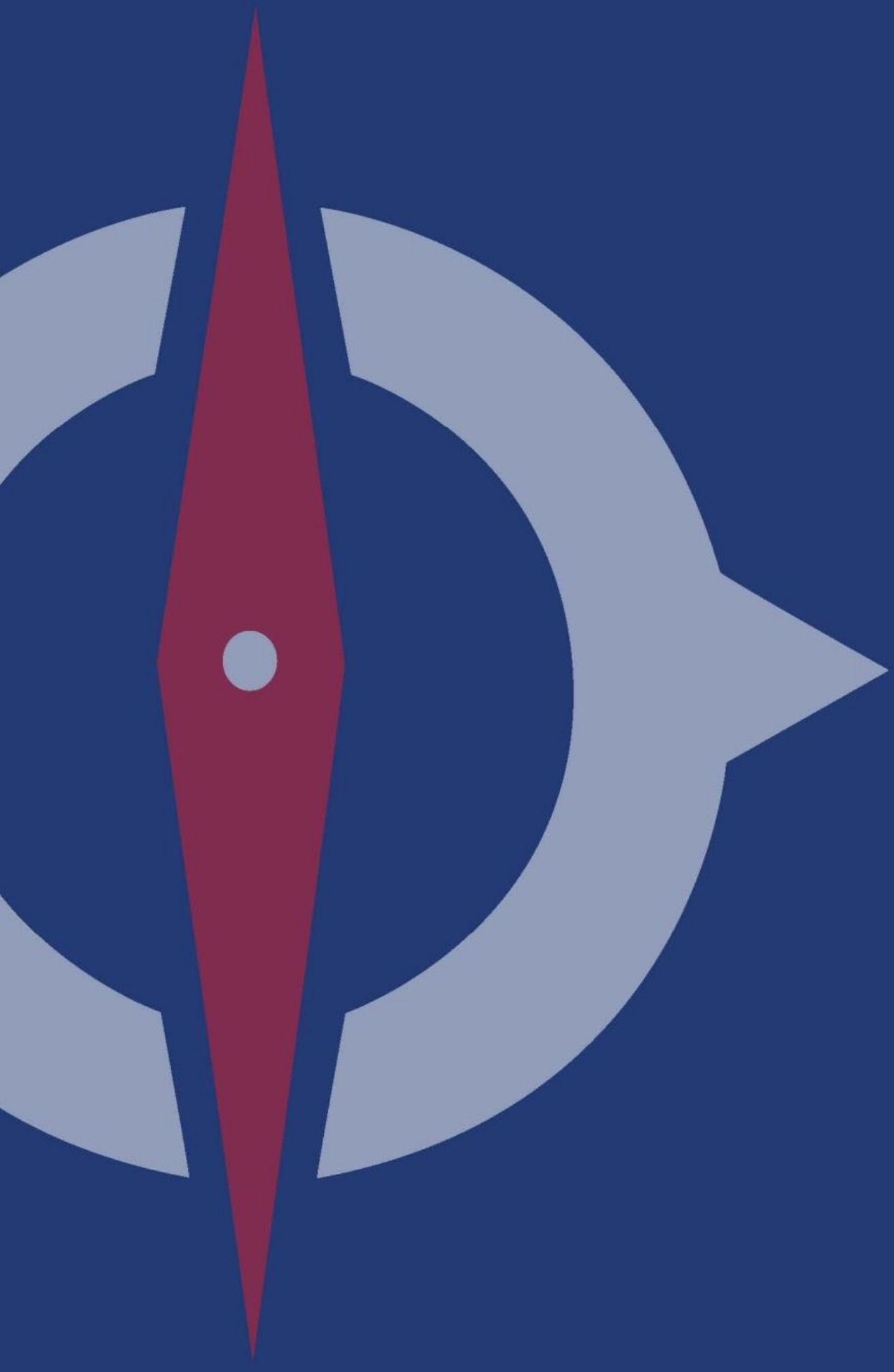
Jefferson
Phillips
Coahoma
Arkansas
Lincoln
Desha
Bolivar
Drew
Sunflower
Washington
Chicot
Humphreys
Sharkey
West Carroll
East Carroll
East Carroll
Issaquena
Bayou Macon Watershed
State Boundaries
County/Parish Boundaries
BFE 1% Annual Chance Modeled Boundary
CNMS Inventory
A, UNVERIFIED, BEING STUDIED
A, VALID, BEING STUDIED
AE, UNKNOWN, TO BE ASSESSED
AE, UNVERIFIED, TO BE STUDIED
AE, VALID, NVUE COMPLIANT
X, ASSESSED, BEING STUDIED


Union
Ashley
Chicot
Washington
Union
Morehouse
West Carroll
East Carroll
Issaquena
Warren
Ouachita
Warren
Richland
Madison
Warren
Franklin
Tensas
Claiborne
Catahoula
Bayou Macon Watershed
State Boundaries
County/Parish Boundaries
BFE 1% Annual Chance Modeled Boundary
CNMS Inventory
A, UNVERIFIED, BEING STUDIED
A, VALID, BEING STUDIED
AE, UNKNOWN, TO BE ASSESSED
AE, UNVERIFIED, TO BE STUDIED
AE, VALID, NVUE COMPLIANT
X, ASSESSED, BEING STUDIED



Appendix IV: Resources

FEMA Points of Contact

Subject/Topic of Interest	Name	Contact Information
FEMA Region 6 Risk MAP Lead *Project Outreach*	Diane Howe Risk Analysis Branch FEMA Region 6	Phone: (940) 898 5171 Email: diane.howe@fema.dhs.gov
FEMA Technical Monitor	Dustin Busse Risk Analysis Branch FEMA Region 6	Phone: (940) 383 7214 Email: dustin.busse@fema.dhs.gov
• How to find and read FIRMs • Letters of Map Change and Elevation Certificates • Flood zone disputes • Mandatory insurance purchase guidelines • Map Service Center (MSC) and National Food Hazard Layer	FEMA Map Information eXchange (FMIX)	Phone: 877-FEMA-MAP (336-2627) Email: FEMAMapSpecialist@Risk MAPcds.com Live Chat: https://www.floodmaps.fema.gov/fhm/fmx_main.html
FEMA Project Monitor Project Outreach	Diane Howe, CFM	Phone: (940) 898 5171 Email: diane.howe@fema.dhs.gov

State Partners

Organization/Title	Name	Partner Location	Contact Information
Louisiana Water Resources Development Program *Deputy Assistant Secretary, OPW*	Patrick J Landry, P.E. Edward M. Knight, P.E.	P.O. Box 94245 Baton Rouge, LA 70804-9245	Phone: (225) 379 3000 Email: patrick.landry@la.gov Email: Edward.knight@la.gov Web Page: Water Resources Program (la.gov)
Louisiana State NFIP Coordinator	Cindy O'Neal, CFM Susan Veillon, CFM	P.O. Box 94245 Baton Rouge, LA 70804-9245	Phone: (225) 379 3005 Email: cindy.oneal@la.gov Email: susan.veillon@la.gov Web Page: National Flood Insurance Program (NFIP) (la.gov)
DOTD CTP & CRS Program Manager	Pamela Lightfoot, CFM	P.O. Box 94245 Baton Rouge, LA 70804-9245	Phone: (225) 379 3005 Email: pam.lightfoot@la.gov Web Page: La DOTD - Floodplain Management Contacts
State Hazard Mitigation Officer	Jeffrey Giering	7667 Independence Blvd. Baton Rouge, Louisiana 70806	Phone: (225) 267 2516 Email: jeffrey.giering@la.gov Web Page: Governor's Office of Homeland Security & Emergency Preparedness

Organization/Title	Name	Partner Location	Contact Information
LADOTD *Statewide Flood Control Program Manager*	William J Williamson, P.E.	Public Works & Water Resources 1201 Capital Access Rd. Baton Rouge, LA 70802	Phone: (225) 379 3023 Email: billy.williamson@la.gov Web Page: Statewide Flood Control Program (la.gov)
Louisiana Department of Transportation and Development *Communications Director*	Rodney Mallett		Phone: (225) 379 1275 Email: rodney.mallett@la.gov Web Page: Administration Contacts (la.gov)

Governor's Office of Homeland Security and Emergency Preparedness

GOHSEP (la.gov)

Louisiana is a high-risk state for emergency events and disasters. The Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) is the agency responsible for coordinating the state's efforts throughout the emergency management cycle to prepare for, prevent where possible, respond to, recover from, and mitigate against hazards to lessen the effects of man-made or natural disasters that threaten the state. GOHSEP can save lives and reduce property damage by understanding risks and taking action to address those risks, as well as minimizing disaster impacts and increasing the resiliency in our communities, environment, and economy.

Louisiana Department of Transportation and Development (LADOTD)

Risk MAP / CTP (la.gov)

On March 11, 2015, the Louisiana Department of Transportation and Development (LADOTD) signed a partnership agreement with FEMA Region 6 to become a Cooperating Technical Partner (CTP) in FEMA's Risk MAP Program. Since becoming a CTP, LADOTD has been diligently planning and working toward the release of updated flood risk information for Louisiana. The hope is that in the future, other stakeholders will become involved in the program to make good and efficient use of the data for floodplain management decisions and mitigation actions.

Louisiana Floodplain Management Association (LFMA)

The Louisiana Floodplain Management Association serves as a forum for parish and municipal employees, state and federal officials, and the private sector to meet and share experiences, ideas, and solutions to common flooding problems. As a grassroots effort, we assist and support each other when confronted by flooding. Flood damage reduction can best be achieved through floodplain management, that is, a balanced combination of structural and nonstructural measures. Structural measures include levees, pumps, dams, channelization, diversions, and detention/retention ponds. Of equal importance are nonstructural measures, which encompass flood insurance, federal and state legislation, voluntary relocation, local codes, emergency preparedness, floodproofing, and mitigation plans and activities.

Organization	Contact Information	Website
Louisiana Floodplain Management Association (Chairman)	Phone: 504-736-6653	lfma.memberclicks.net

Certified Floodplain Manager (CFM) Certification

The Association of State Floodplain Managers (ASFPM) established a national program for certifying floodplain managers. This program recognizes continuing education and professional development that enhances the knowledge and performance of local, state, federal, and private-sector floodplain management professionals.

The role of the nation's floodplain managers is expanding due to increases in disaster losses, the emphasis on mitigation to alleviate the cycle of damage-rebuild-damage, and a recognized need for professionals to adequately address these issues. This certification program will lay the foundation for ensuring that highly qualified individuals are available to meet the challenge of breaking the damage cycle and stopping its negative drain on the nation's human, financial, and natural resources.

CFM® is a registered trademark and available only to individuals certified and in good standing under the ASFPM Certified Floodplain Manager Program.
For more information, you may want to review these available CFM Awareness Videos:

- What is the CFM Program?
- Becoming a CFM
- What are the Benefits of a CFM?

Study materials for those interested in applying for the CFM certification can be found on the ASFPM Website at: Getting Certified (floods.org)
Check the Training & Education | Association of State Floodplain Management (floods.org) for in-person training sessions near you.
For information on becoming a member and the exam application process in the State of Louisiana visit Getting Certified (floods.org)

Interactive Preliminary Data Viewer

Risk Mapping, Assessment and Planning (Risk MAP) | FEMA.gov
To support community review of the study information and promote risk communication efforts, FEMA launched an interactive web tool accessible on-line at ArcGIS - Mapping Information Platform Studies Tracker for the project areas.

For more information on the Interactive Preliminary Data Viewer in the Region 6 area: [KS2]
Region 6 | FEMA.gov
FEMA's Flood Map Changes Viewer
Flood Map Changes Viewer (arcgis.com)

Estimated Base Flood Elevation (BFE) Viewer

As a part of the Risk MAP process, FEMA is completing **BLE** to provide a complete picture of flood hazard throughout a watershed. The BLE analysis uses high resolution ground elevation data, flood flow calculations, and fundamental engineering modeling techniques to define flood extents for streams.

To provide a look at BLE data availability and relative engineering analysis, FEMA developed the **Estimated BFE Viewer** for community officials, property owners, and land developers to identify the flood risk (high, moderate, low), expected flood elevation, and estimated flood depth near any property or structure within watersheds where BLE has been prepared.

Visit the Estimated BFE Viewer FEMA's Estimated Base Flood Elevation (BFE) Viewer (usgs.gov) application to learn the status of BLE in your area of interest or surrounding communities, to view the flood hazard data developed, or to utilize the tool's flood risk reporting features for a location where BLE has been made available.

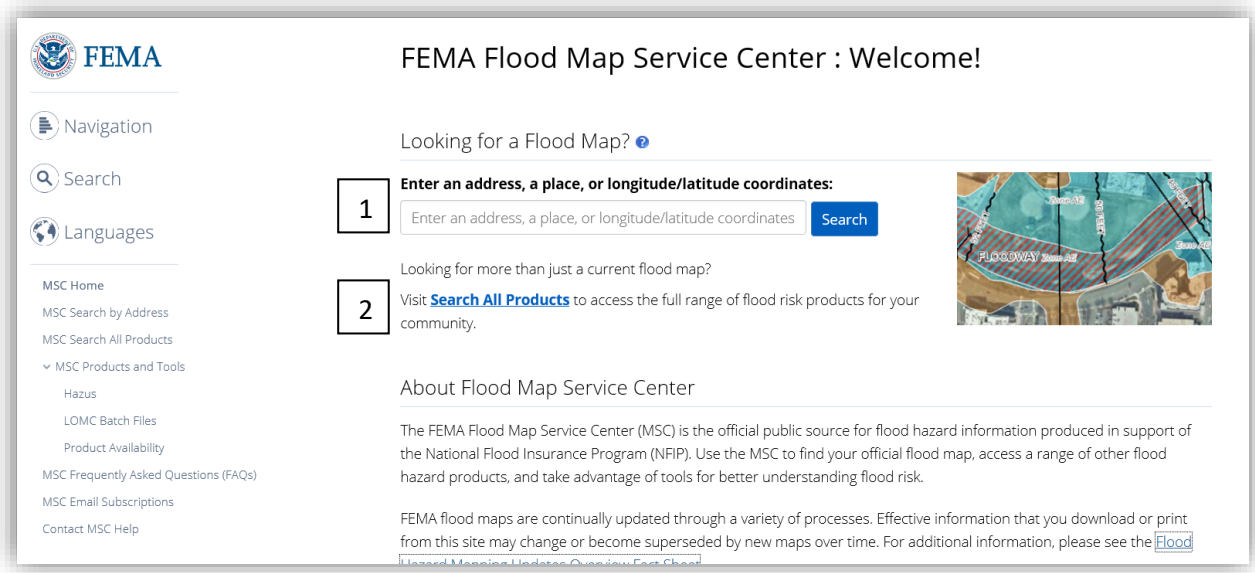
Map Service Center – Available Map Data

The FEMA Flood Map Service Center (MSC) is the official public source for flood hazard information produced in support of the NFIP. Use the MSC to find your official effective flood map, preliminary flood maps, and access a range of other flood hazard products.

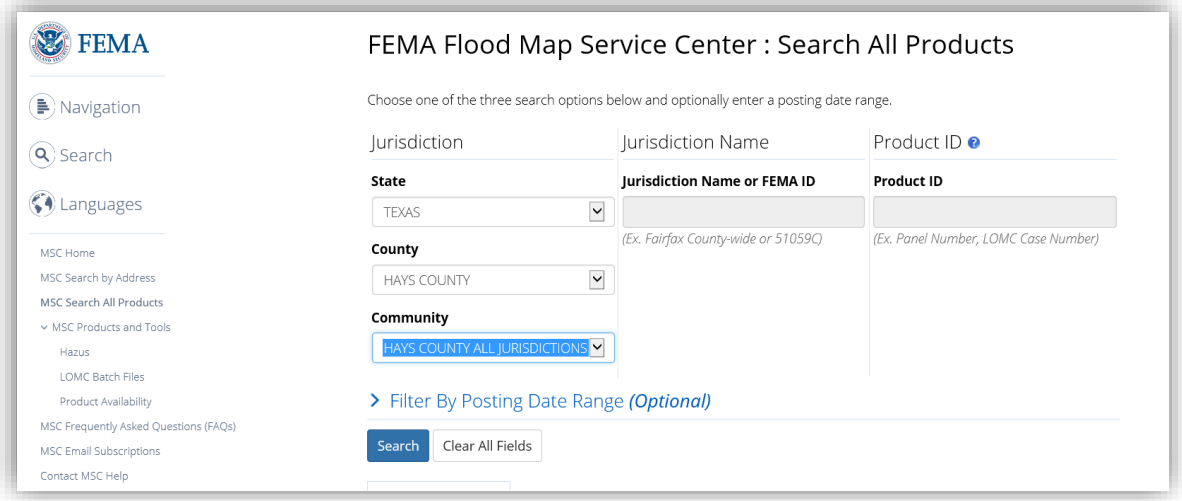
FEMA flood maps are continually updated through a variety of processes. Effective information that you download or print from this site may change or become superseded by new maps over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet.

At the MSC, there are two ways to locate flood maps in your vicinity.

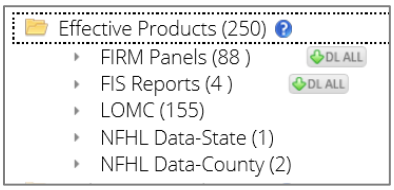
1. Enter an address, place name, or latitude/longitude coordinates and click search. This will provide the current effective FIRM panel where the location is shown.
2. Or Search All Products, which will provide access to the full range of flood risk information available.



By using the more advanced search option, "Search All Products," users may access current, preliminary, pending, and historic flood maps. Additionally, GIS data and flood risk products may be accessed through the site with these few steps.

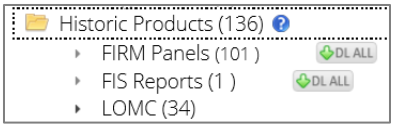


Using the pull down menus, select your state, county, and community of interest. For this example, we selected Hays County - All Jurisdictions. After the search button is selected, the MSC will return all items in the area. There are five types of data available.



Effective Products. The current effective FIS, FIRM, and DFIRM database (if available) is available through the MSC. If users click on the available effective products, they are presented a breakdown of the available products. FIRM panels, FIS reports, LOMRs, statewide National Flood Hazard Layer (NFHL) data, and parish-wide NFHL data may be available, as indicated in the breakdown on the right of the page.

Historic Products. A range of historic flood hazard maps, FIS texts, and LOMCs are available through the MSC.



Flood Risk Products. The Flood Risk Report, Flood Risk Map, and Flood Risk Database will be made available through the MSC once they have been compiled and completed. These products are made available after the flood study analysis and mapping have been reviewed and community comments incorporated.