

Keys to the River Report

*Tools and A Vision for Long Term Planning for
Managing Floods, Droughts, and Sediment*

Acknowledgements

This UMRBA-led collaborative report is shaped by, and builds upon, a tremendous and complex history of Upper Mississippi River management. It reflects the region's deeply rooted partnership among federal, state, local, and nongovernmental interests as well as community leaders.

The Upper Mississippi River's partnership has long recognized that no one agency or program can solely manage this multi-use ecosystem successfully. Rather, the Upper Mississippi River requires thoughtful and meaningful coordination among numerous agencies and organizations with varying mandates and missions. Continuing that principle forward into this project, the enclosed report reflects the ideas and information available in 2020. Its useful life may be short as we continue to move forward together and advance the recommendations.

UMRBA would like to take this opportunity to express appreciation to our stakeholder community who have worked tirelessly on behalf of the Upper Mississippi River and its communities. Thank you for the attention you have placed on the river and in showcasing the investment needs and opportunities at the national level. Your support and involvement in UMRBA's effort is invaluable.

UMRBA is also thankful for the partnership with the U.S. Army Corps of Engineers for its partnership through a Planning Assistance to the States (PAS) partnership.

Keys to the River 2020

Table of Contents

Our Collective Charge

Chapter 1 – Communications and Engagement Strategy

Chapter 2 – High-Impact Actions

Chapter 3 – Long Term Strategies

Chapter 4 – Other Alternatives Considered

Appendix 1 – Geographic Setting

Appendix 2 – Sociopolitical Context

Appendix 3 – Upper Mississippi and Illinois Rivers Flood Risk and Sediment Management Summit Outcomes

Appendix 4 – Section 729 Planning Bulletin

Our Collective Charge

Substantial changes in land use throughout the Upper Mississippi River watershed compounded with climate-driven shifts in precipitation are testing the safety and economic resilience of communities, industries, and agriculture; impeding the safety and reliability of commercial navigation; and degrading fish and wildlife habitat in the river floodplain. Managing floods, droughts, and sediment on the Upper Mississippi River System, with its vast geographic scale, tremendous economic productivity, and globally significant resources, presents extraordinary challenges and opportunities. The complex nature of the river system and array of human uses requires thoughtful and inclusive dialogue among the diverse suite of stakeholder representatives throughout the region.

The consequences of flood and drought response, recovery, and mitigation decisions and sedimentation can be profound. Many floodplain farmers, communities, and businesses that are suffering from major floods every year are simultaneously at risk of water shortages during prolonged droughts as well as the associated sediment movement and deposition. Underserved communities (low income communities, communities of color, and other disadvantaged communities) in the Upper Mississippi River floodplain are often both more disproportionately impacted by, and vulnerable to, floods, droughts, and degraded water quality. Many of the levee systems experience recurring damages over consecutive years, collectively requiring tens of millions of taxpayer dollars for repairs following each major flood event. Non-leveed areas use costly and less resilient temporary flood barriers to prevent damages. The economic consequences associated with disruptions to the navigation channel showcased publicly in recent years have been building for decades. High and low water levels and sediment accumulation in the navigation channel are forcing closures or restrictions nearly every year and sometimes multiple times within one year.

The potential for extended dry periods and limited water availability threatens economic and ecological harm to the Upper Midwest. The Upper Mississippi River watershed has historically had abundant water resources and precipitation is expected to continue to increase in the Midwest. However, consequential droughts still occur in a wetter climate. The recent occurrences of rapid change between flood and drought conditions demonstrate the unique challenges facing the Upper Mississippi River. Major droughts in 1988, 2005, 2012, and 2018 demonstrated the need for coordinated and integrated planning for both drought and heavy precipitation events, including the implications of rapid shifts between those two conditions.

Tied with climate change and land use practices, surface water runoff throughout the watershed is affecting sediment movement and its placement in the navigation channel and backwaters. Increasingly in recent years, the U.S. Army Corps of Engineers (Corps) has undertaken emergency measures to reopen or maintain the navigation channel as a result of channel conditions. Emergency situations are costly to industry and the public, and place the states in difficult, reactive positions of having to expedite environmental reviews. Emergency dredging situations have required Corps Districts to reprioritize scheduled maintenance dredging, quickly relocate dredges, remove rock pinnacles, and adjust navigation traffic to a one-way pilot channel with limited draft depth. The dynamic nature of these events causes significant economic burden to those who depend on the Mississippi River as a domestic and international transportation route, such as American farmers, local communities, miners, and manufacturers.

In 2019 alone, the greatest volume of water flowed on the Upper Mississippi River through St. Louis in recorded history. Damages occurred from levees overtopping, uncontrolled underseepage (i.e., sand boils), interior flooding behind levees, and saturated soils reducing yields. Prolonged flooding conditions shortened the 2019 shipping season and subsequent sediment deposition constricted the navigation channel, resulting in a reduction of approximately 30 percent in tonnage shipped on the river compared to 2018 and of 25 percent compared to the 10-year average.

It is unknown whether the volume and rate of water and sediment moving through the Upper Mississippi River will continue on an upward trajectory or whether high and low water events will become more episodic. Uncertainties associated with global climate modeling and hydrologic modeling contribute to the current lack of scientific consensus. However, there is scientific consensus that the Upper Mississippi River basin will experience increased precipitation and more intense precipitation events with the largest increases in precipitation in winter and spring. The impacts of increased precipitation are observed locally on rivers in the Upper Mississippi River basin. There was a dramatic shift in the length of time the river spends above flood stage in the 2010s. At several sites, the Mississippi River was above flood stage approximately five times to 10 times longer in the 2010s than on average over the preceding 80 years. Based on historical trends, it is anticipated that the increased precipitation will lead to flood events that are more intense and that hold for a longer duration. The ability to effectively respond to such situations will likely be tested in the near- and long-term. The factors affecting these challenges are interconnected as will be the strategies necessary to address them.

The health, function, and viability of the mainstem Mississippi River reflects the dynamics inside the floodplain and the performance of the watershed as a whole. It is widely acknowledged that actions must be taken in the watershed to reduce the challenges in the river. However, it will take time for those efforts to be realized in the Upper Mississippi River. Working under assumptions about future tributary influences, we need to work together to build resilience in the river floodplain through immediate actions and long-term planning.

We need to work together to better understand risk, improve forecasting capabilities, and develop a detailed understanding of how the existing system of flood protection, damage reduction and recovery, and conveyance and storage areas (including backwaters, wetlands, and floodplain forests) perform during major flood events. This will help answer questions about where the existing system currently provides adequate protection and where it does not provide adequate protection. We need to develop a shared assessment of the unique causes of drought onset, magnitude, and duration in the Upper Mississippi River watershed as well as how various drought scenarios might drive low water conditions in the river. This includes how and when drought impacts different water users and uses, such as agriculture, manufacturing, and local communities, and how that affects social and economic vulnerabilities more broadly.

The fundamental question pertaining to sediment management is whether, over the long term, sediment can be removed from the river main stem and backwaters at the pace needed to maintain the navigation channel, allow for sufficient flood conveyance, and provide for a healthy riverine ecosystem. Sedimentation and erosion are natural processes that are important to a healthy river floodplain ecosystem but that have been substantially changed by actions to manage floods and the 9-foot navigation channel.

Report Purpose and Structure

Through UMRBA, the Governors' joint interstate collaborative, the states of Illinois, Iowa, Minnesota, Missouri, and Wisconsin are bringing together those who live and work in the floodplain to improve disaster preparedness, economic growth and resilience, and ecological health. The purposes being to a) increase the economic, ecological, and social resilience of the Upper Mississippi River to major flood events, prolonged drought, and excessive sediment; and b) foster dynamic, balanced, objective, and adaptive approaches to flood, drought, and sediment management in a multi-purpose management context.

Objectives for UMRBA's long term resilience planning are to:

- 1) Develop an integrated, comprehensive, and systems-based approach to minimize the threat to health and safety resulting from flooding by using structural and nonstructural floodplain management measures
- 2) Develop new, or renew existing, comprehensive long-term channel maintenance and management strategies that are sustainable, cost-effective, and ecologically sensitive
- 3) Develop mitigation strategies for multi-year drought events that would increase the resilience of communities and economies adjacent to, or dependent on, the river
- 4) Seek opportunities to support environmental sustainability, restoration, and water quality goals for the Upper Mississippi and Illinois Rivers
- 5) Accelerate efforts in the watershed that reduce the volume and rate of runoff to the Mississippi River

When organizing the scope and development process for this report, UMRBA recognized that developing a long term resilience plan will take time and that there are important things we know we need to do to build resilience in the system that do not require additional study or deliberation among stakeholders. Therefore, UMRBA entered into a Planning Assistance to the States (PAS) agreement with the Corps to 1) develop a more detailed vision and scope of work for exploring complex issues through the Corps' Section 729 study while 2) exploring solutions for which federal, state, local, and private partners can take immediate action.

Chapter 1 describes the approach for developing informed consent among affected interests that will be essential to ensuring that long term strategies are regionally acceptable, particularly by those who will be directly affected by the outcomes. Chapter 2 provides high-impact actions that will result in significant positive change, offering practical and effective solutions for building resilience in the river floodplain. Many of the actions will inform the resilience planning as described in Chapter 3. That chapter offers a broader context and direction for setting planning objectives and developing systemic approaches for building resilience related to flood, drought, and sediment management. Appendices 1 and 2 provide the geographic setting and sociopolitical context regarding today's challenges relating to flood, drought, and sediment. Appendix 3 is a summary of the 2017 UMRBA's Flood and Sediment Management Summit. Appendix 4 is the Corps' Section 729 planning authority bulletin.

The report's use of the term "we," represents the shared ownership of the problems and solutions. The recommendations included in this report involve lead and supporting roles and responsibilities for UMRBA, the five Upper Mississippi River states, the Corps, other federal agencies with responsibilities in the watershed and river, and all those directly and indirectly affected by the work. State and federal agencies involved in the report development offered their technical and policy expertise as stewards of the river. Implementation of the actions will require appropriations and ongoing support from elected leaders, federal and state administrations, and agency leadership.

Chapter 1: Communications and Engagement

The goal of systematic development of informed consent is to create a commonly-held vision with shared goals, objectives, and implementation strategies that are regionally supported. This requires a collaborative, consent-based planning process to:

- a) Build understanding and mutual acceptance and empathy of the challenges affected interests face living and working in a highly dynamic river-floodplain and ideas for addressing local and regional issues
- b) Guide deliberations that foster productive discourse among affected interests and state and federal government agencies in the development of solutions and prioritization of investments
- c) Improve, leverage, and better utilize knowledge that is used to inform the deliberation of solutions
- d) Establish and maintain the legitimacy of the planning process, outcomes (including decisions and assumptions), and public and private agencies/entities that will work to advance the outcomes
- e) Motivate productive action that advances the path forward following the plan's acceptance

UMRBA is committed to providing a fair, objective, and inclusive forum for people, communities, and businesses in the Upper Mississippi River floodplain affected by floods, droughts, and sediment to learn from one another and seek opportunities to collaborate.

Principles for Fostering Collaboration

The Systematic Development of Informed Consent (SDIC) methodology ensures that those affected by the work are knowledgeable of, and consent to, the selected plan and the resulting impacts to them. This SDIC methodology requires that the affected interests are involved in deliberations throughout the planning process and have ample opportunity to provide their perspectives and opinions. It also requires that the project planners listen to, and reflect on, stakeholder input. People, communities, and businesses that would be affected by this work were engaged throughout this report's development, building trust and creating outcomes that benefit the various uses and purposes of the Upper Mississippi River floodplain. These efforts established a foundation for ongoing conversations.

An effective communications strategy will require consistent, concise, relatable, and relevant explanations of the problem statement for today and the foreseeable future; the goals and objectives for the planning process and outcomes; what solutions are being deliberated and the resulting impacts; and who the key players are and why they are the right entities to advance solutions. Over time and through ongoing deliberations, we strive to build empathy, trust, and a sense of togetherness among the river's many stakeholders.

An overarching storyline will be used in all engagement opportunities that follows three key messages: 1) the problems associated with floods, droughts, and sedimentation are important to resolve, 2) there are practical solutions and a logical way to address the more complex challenges, and 3) UMRBA is working towards to a robust, inclusive engagement strategy to develop these solutions. A relatable explanation of why this federal-state partnership is organized and is seeking the participation of individuals and organizations will build trust in the process and encourage them to invest their time and energy.

The first step is to provide clarity about the problem statement. Together, Appendices 1 and 2 describe how the existing infrastructure and supporting policies are resulting in unsustainable conditions for people and communities given today's watershed conditions. As we go forward, we will continue to build a collective understanding of how

land use and climate change will shape future tributary influences on the river floodplain. This will include building awareness and appreciation for how the different river-floodplain stakeholders are affected given today's watershed and weather dynamics, river-floodplain infrastructure, and management policies.

UMRBA will strive to instill a new sense of trust and transparency among federal, state, and local public entities. UMRBA will build a systemic and integrated information network, bridging connections among various people, monitoring, modeling tools, and other information sources. We will leverage science-based information with experiences to develop and evaluate solutions. The intent is to build trust in solutions and the decision makers.

We recognize that people of color have been vastly underrepresented in river management conversations historically, including in this work to date. We need to get to know the many racially, ethnically, and culturally diverse communities who reside and work in the river floodplain and who experience unique challenges associated with floods, droughts, and sediment. We will be as specific as possible with respect to elevating voices that have been missing from river management discussions; building trust, legitimacy, and participation from all affected interests; and continuing to turn communications strategy around. Through the SDIC methodology, we will build from the work over the past few years. We will connect and listen first, find out what people think is happening, learn what they want us to do, and support their capacity to participate.

Process To-Date

The process of identifying and developing the river system's longer term needs and strategies (potentially through a UMRBA's Section 729 proposal), as described in Chapter 3, has evolved in many ways since 2016 in large part due to input received from those who live and work in the floodplain community. The recommendations provided in this report are robust and deliberate because of the thoughtful feedback received. We fully intend to continue robust stakeholder conversations as this work progresses.

2017 UMRBA Flood Risk and Sediment Management Summit

On July 25-26, 2017, UMRBA brought together people who live and work in the floodplain to begin discussions of how we can work together to improve disaster preparedness, economic growth and resilience, and ecological health. The summit uncovered that the floodplain community shares very similar experiences living and working on the river, particularly in relation to the changing flooding and sediment flow dynamics, from the Twin Cities of Minnesota to the confluence of the Ohio River in Cairo, Illinois and throughout the Illinois River. Participants resoundingly pointed to land use in the watershed and floodplain as well as changing weather patterns as causing the watershed to behave differently.

To the surprise of many participants, the floodplain community also shares many of the same perspectives for improving preparedness and reducing impacts of major flood and sediment-related events. This includes employing a collaborative and science-based process to develop a systemic flood risk and sediment management plan, convening the river-floodplain community more frequently and formally to discuss issues and collaborate on solutions, addressing specific policy impediments, securing resource needs, and improving and better utilizing knowledge. The findings from the July 2017 Upper Mississippi and Illinois Rivers Flood Risk and Sediment Management Summit are provided in Appendix 3.

2018 Communications Workshop

In August 2018, the Corps secured resources through its Integrated Water Resources Management pilot program that supported a workshop to explore how to engage and communicate with stakeholders and interested citizens

during the development of this report. The workshop explored how to use the Systematic Development of Informed Consent (SDIC) method to engage people, communities, and businesses who are directly and indirectly affected by the solutions in this report and the outcomes of the proposed long term planning effort (see Chapter 3) as well as the those who are interested in this work and those who will become decision makers to implement the recommendations – e.g., Congress, the Administration, state legislatures.

As an outcome, it became even more apparent that this process will require a unique and robust communications strategy that is ongoing. Instead of asking stakeholders to provide reactionary input, they need to be involved in the process as the issues unfold and the solutions are developed.

2019 Local Listening Sessions

Before beginning to organize around a set of problems and issues and drafting solutions, we needed to organize conversations and create relationships with and among those who work and live in the river floodplain. UMRBA and the Corps held local conversations in six communities along the Upper Mississippi River, as follows:

- July 13 — Hannibal, Missouri
- July 20 — Muscatine, Iowa
- July 27 — Dubuque, Iowa
- August 3 — Winona, Minnesota
- August 24 — Godfrey, Illinois
- September 7 — Cape Girardeau, Missouri

These meetings focused on how local residents through local action can address flooding, sedimentation, and droughts. They were very different from most other public meetings. The people who came to these events set the agenda and led the discussions. These sessions provided us with a unique opportunity to learn about what local residents and local leaders think needs to be done to address important issues and learn how to incorporate local ideas and local actions into a future regional resilience plan for the river.

These meetings were held for three primary reasons:

1. To bring together residents and local leaders to talk with each other about how local actions can address important river issues, such as flooding, sediment management, and long term drought
2. To learn what residents and local leaders think needs to be done near-term and longer-term to address important issues the river poses to local communities and the probable entity(ies) responsible to implement the actions – e.g., federal, state, local, private
3. To be able to incorporate local ideas and local actions into the development of a regional resilience plan for the river

Common themes of the conversations were:

- During the last five years, the river has behaved differently than in the past
- The status quo of river management is not acceptable and new systemic management approaches (or a plan) are needed for managing the river corridor given changing watershed influences

- Solutions will be complex, requiring consideration of the many uses and values of the river system
- Flooding, low water/drought, and sedimentation are interrelated – i.e., sedimentation filling in backwaters affects conveyance of flood waters and flooding increases sedimentation rates – and all affect habitat quality and quantity
- The most impactful solutions will reside in the watershed and efforts must be focused there to slow water and sediment movement to the river

It was widely recognized that the velocity of water and sediment moving through the system is fast and that solutions should “slow the water” or “make room for the river.” But there were mixed recommendations for doing that, including creating spillways, restoring floodplain forests, investing in agriculture conservation practices in the watershed, setting back levees, and more.

Many participants questioned who is responsible for managing the river and for what purposes. Are separate entities responsible for different areas of management? How is the river regulated? Why and by whom? There were some common misunderstandings about the lock and dam system and whether there is some control over the flooding conditions, in particular. Participants often raised the question of who should have decision-making authority – i.e., who has trust among stakeholders and the ability to enforce rules? Solutions were often intertwined with questions and understandings about the costs of managing the system and responding to emergencies, including who pays and should pay for what and how.

While the northern meetings (located in Winona, Minnesota; Dubuque, Iowa; and Muscatine, Iowa) focused on in-river management (impacts and solutions in the mainstem), the southern meetings (located in Hannibal, Missouri; Godfrey, Illinois; and Cape Girardeau, Missouri) focused on the impacts of flooding and sedimentation to the floodplain. And whereas participants in the northern meetings strongly recognized that economic and ecological uses and values of the river intersect and are important, participants at the southern meetings view river management as primarily for navigation and flood management. The southern meetings also had a far greater focus around local community-based challenges, information needs, and actions, particularly related to emergency response.

These meetings were also helpful with respect to how language is interpreted. Terms have very different meaning in different areas of the river. The most notable example is the use of the term flood fighting. Interpretations of that term include temporarily raising levee heights (including sand bagging) on levees north of the Missouri River confluence and reducing seepage and preventing sand boils on levees between the Missouri and Ohio River confluences. It will be important for language to be both concise but also specific so that it is relatable and accurate.

Participants included a varied range of stakeholder interests – i.e., levee districts, farmers, conservationists/environmentalists, recreationists, commercial fisheries, community representatives, landowners, and reporters. The Dubuque and Winona meetings had the least amount of diversity among stakeholder groups, primarily including conservationists/recreationists. Participants overwhelmingly expressed appreciation for the forum.

Report Development

People who work and live in the river floodplain as well as key leaders in the watershed participated in developing various pieces of the report. Each major issue area (flood, drought, sediment, communications, long term planning) had a state and Corps co-lead.

The teams first organized on September 30, 2019 and October 1, 2019 in Bloomington, Minnesota. UMRBA and the Corps facilitated a working session to prioritize known opportunities (highly effective actions that enjoy regional consent) as well as more complex questions and issues needing further exploration or deliberation. The teams were asked to brainstorm all potential actions and sort them based on perceived levels of consent and their ability to build resilience in the river system – i.e., to effectively address the most pressing problems. The teams considered previous studies, planning efforts, and regional meeting outcomes and recommendations. Following this meeting, the team co-leads drafted a history of the issue, a problem statement, alternatives considered, and recommendations. These drafts were used to focus conversations during team meetings on January 27-31, 2020 and during the February 25-26, 2020 workshop. These conversations resulted in additional ideas, tabled opportunities, and refinements to previous ideas and language.

In addition, a survey was distributed broadly in March 2020 to gauge support for the suite of ideas, including suggestions for increasing their support. We found that the survey reached many individuals who were not involved in the process to-date and that there is support for the ideas. Generally, survey respondents expressed frustration regarding little resolution and action achieved over the past few decades. Planning and studying are viewed by some people as delaying action. There was a strong desire for on-the-ground implementation actions, with mixed feedback on what those actions should involve. Respondents noted that drought is of lesser concern. And that robust, dedicated funding is needed for this effort and for continual investment and management in the river system and watershed. Concern was expressed regarding perceived devaluing of agriculture, communities, and the ecosystem. In addition, questions were raised about whether and how climate change will be integrated into the long-term planning process (as described in Chapter 3) and recommended outcomes as well as the various roles and responsibilities of government agencies and private individuals and organizations. The survey again underscored the understanding that long term solutions will reside in the watershed.

Our Community

The Upper Mississippi River involves a complex array of human uses and interactions. Because of this, obtaining informed consent to the Section 729 planning process and resulting outcomes will be inherently challenging. But, as indicative of the past, doing so will lead to solutions that are carried forward for decades and that result in sustained multi-purpose management. First, we need to understand who the affected interests are, why they will want to engage, what they will want to achieve through the process, and how to reach them through the ways that they already receive information and communicate.

This report mostly reflects the ideas raised and prioritized among federal, state, and local leaders as well as interest groups and engaged members of the river communities who are familiar with river policies and programs. The recommended actions provided in Chapter 2 and resilience questions in Chapter 3 have been discussed, deliberated, and raised during various meetings, workshops, summits, and public forums over the past five years and build from hard work on the river extending over decades.

Overall, there has been an ebb-and-flow of community engagement and localized grassroots organization in driving federal, state, and local action on the river. While this has involved people with limited access to governmental services, river management has not involved people with diverse racial, ethnic, and cultural, backgrounds. The challenges that they face have not been adequately voiced and embedded in river management planning and projects.

Chapter 2: High-Impact Actions

This Chapter provides a suite of actions that will result in significant positive change and that are strongly supported among those affected by floods, drought, and sedimentation. These actions involve improving knowledge, addressing policy limitations, obtaining resources, and securing working agreements. These actions will result in immediate significant benefit and are integral to long term planning. Each action is important for developing long term strategies and building resilience in the economic, ecological, and societal uses of the river floodplain in ways that are socially and politically acceptable. Some actions will require funding appropriated via Congress or a state legislature, a change in administrative procedures, or other factor.

Flooding

Flood risk assessments and forecasting capabilities will help to reduce damages and loss of life associated with increasingly frequent and extreme flood events in the Upper Mississippi River. Accurate and accessible information will improve our ability to develop a systemic flood plan and improve management capabilities. HEC-RAS, flood frequency profiles, and economic vulnerabilities are foundational needs for facilitating informed deliberations regarding the future of flood management on the Upper Mississippi River as described in Chapter 3.

We need to finalize and utilize a two-dimensional hydraulic model (i.e., HEC-RAS)

HEC-RAS models water flowing through open river systems and estimating water surface profiles. In other words, it can be used to depict water levels and velocities at various flood stages and show the effects of past and future potential management actions. The model would serve as a foundational tool for the development of a systemic flood management strategy on the Upper Mississippi River. A singular hydraulic model will facilitate consistency in regulatory actions and other management and policy decisions among the relevant federal and state agencies as well as a shared understanding of flooding dynamics throughout the river. The model will serve as a basis for informing flood forecasting, management, mapping, response, mitigation, attenuation, and ultimately, decision making related to policy and funding needs.

As a result of the ongoing discussions during the development of this report, the Corps has funded completion of HEC-RAS on the Upper Mississippi River and the Illinois River. More information on HEC-RAS, or the Hydrologic Engineering Center River Analysis System, can be found on the Corps' webpage: <https://www.hec.usace.army.mil/software/hec-ras/>.

We need to renew flood frequency profiles

Assumptions about flood risk drive many important decisions faced by land owners, communities, elected leaders, and state and federal government officials. Current assumptions about the likelihood and magnitude of major flood events on the Upper Mississippi River are based on hydraulic and hydrologic conditions experienced between 1898 and 1997/1998. It is widely acknowledged that these risk assessments are now outdated and inaccurate. We have witnessed major flood events occurring nearly every year, sometimes multiple times within one year, at unusual times of the year, and in less predictable ways. Frequency data is central to many floodplain management decisions related to project design and engineering, insurance, regulations, economic analyses of projects, and local land use planning.

Renewing flood frequency profiles for the Upper Mississippi and Illinois Rivers is necessary to inform the development of a systemic plan, including sound strategies for floodplain management and flood damage

reduction planning. Efforts to update the profiles should reflect existing conditions and integrate assumptions about changing tributary influences given predictions about climate and land use changes.

We need to assess the economic vulnerabilities to major flooding

A comprehensive and accurate estimate of economic vulnerabilities and ensuing social and environmental impacts resulting from major flood events along the Upper Mississippi River, integrated with the updated flood frequency profiles and inundation mapping, would create an important risk assessment tool that could be used for a variety of decision-making purposes. This assessment would describe the economic consequences of major flood events (at various levels, durations, timing) to the river's many uses and users at the local, regional, and national scales.

The information would be used to develop systemic flood storage, conveyance, and mitigation strategies. It would provide a national understanding of the consequences of unresolved flood planning on the Upper Mississippi River as well as the need to invest in flood risk reduction solutions. This includes raising awareness of the implications to national and international food securities resulting from the frequency of flooded agricultural farmlands in the floodplain.

This action would involve creating a region-wide database of building-specific flood hazard and flood risk information. It would be available for river communities and businesses to inform their zoning and development decisions and aid in their mitigation planning.

Drought

The Upper Mississippi River watershed has historically had abundant water resources, and precipitation is expected to continue to increase in the Midwest. However, consequential droughts still occur in a wetter climate. The recent occurrences of rapid change between flood and drought conditions demonstrate the unique challenges facing the Upper Mississippi River. Major droughts in 1987-1989, 2005, 2012, and 2018 demonstrated the need for coordinated and integrated planning for both drought and heavy precipitation events, including the implications of rapid shifts between those two conditions.

We need to develop a shared assessment among government officials and stakeholders of the watershed's unique drought characteristics and the potential resulting economic vulnerabilities. The Upper Mississippi River Governors maintain their interstate commitment to protecting the watershed's water availability through an interstate charter. Collectively, these actions will help improve drought preparedness and response in the near future and help to inform long term resilience planning as outlined in Chapter 3.

We need to broadly understand the watershed's unique drought characteristics

Drought is generally characterized as a period of abnormally dry weather that persists long enough to cause a serious hydrological imbalance. Droughts differ from flood and storm events in that droughts are unique and complex occurrences that reflect a number of geographically-based factors and other variables – e.g., intensity, timing, duration, spatial extent, the magnitude of impacts, and governing law and policy. Drought has no universally accepted definition, creating differing opinions regarding its presence and severity. The onset and end of a drought event is difficult to determine with scientists and policy makers often disagreeing on the criteria. Scientists and meteorologists generally determine whether a drought exists based on meteorological and hydrological conditions and the extent to which water availability does not support agricultural and societal demands and ecological consequences.

This action is intended to provide a detailed explanation of the unique causes of drought onset, magnitude, and duration in the Upper Mississippi River watershed as well as how various drought scenarios might drive low water conditions in the river-floodplain. This includes how and when drought impacts water users and uses, such as agriculture, manufacturing, and local communities. These sector-specific definitions will be used to estimate societal and economic vulnerabilities. This assessment will likely require modeling various drought scenarios.

A shared assessment will support efforts to detect, manage, and mitigate drought as well as to inform integrated, regional drought planning as described in Chapter 3. The action supports NOAA's continued leadership through its National Integrated Drought Information System (NIDIS) Midwest Drought Early Warning System (DEWS).

We need to assess the economic vulnerabilities to various drought conditions

A comprehensive and accurate estimate of economic vulnerabilities and ensuing social and environmental impacts resulting from drought events within the Upper Mississippi River and floodplain, integrated with the assessment of various scenarios (see above), would create an important risk assessment tool that will be used for planning and decision-making purposes. This assessment would describe the economic consequences of low water conditions and prolonged drought and resulting sediment management to the river's many uses and users at the local, regional, and national scales.

The information would be used to develop systemic drought management strategies. It would provide a national understanding of the necessity and value of drought planning on the Upper Mississippi River as well as the need to invest in drought impact reduction solutions. This includes raising awareness of the economic, social, and ecological implications resulting from prolonged drought in the floodplain.

This action would involve creating a database of critical infrastructure within the river floodplain that is dependent on a specific quantity of water and would be negatively affected by drought/low water conditions. This includes water supply intakes, wastewater infrastructure, ports and terminals, shippers, manufacturers, energy companies and other industries, farming communities, and municipalities. It would be available for states, river communities, and businesses to inform their water conservation and allocation decisions and aid in their mitigation planning.

This action supports NOAA National Integrated Drought Information System's planned study through its Midwest Drought Early Warning System to evaluate the economic impacts associated with a variety of drought scenarios along the UMR corridor, including an in-depth vulnerability analysis of a few select communities.

We need to support strategic interstate cooperation

The Governors of the five Upper Mississippi River basin states have recognized their shared responsibilities in protecting, conserving, developing, and managing the water resources of the river basin. The Governors share an interstate charter that includes a notification and consultation process to evaluate any potential out-of-basin water diversion requests that would equal or exceed five million gallons per day. This Charter was established in 1989 and the existing threshold for interstate notification has never triggered the consultation process.

In light of increased interest from water-deprived regions of the country to access the Upper Mississippi River's abundant water resources, the states have directed UMRBA staff to evaluate potential changes to the agreement to ensure that the states fulfill their commitment to "conserve the levels and flows of the water resources; to protect the environmental ecosystem; to secure present development; to provide a foundation for future investment and development; and to assure all significant benefits and impacts are considered before a decision is made."

This action supports UMRBA's initiative to:

- Evaluate the existing and cumulative uses of water within the basin
- Perform scenario planning to illuminate clarifications and other improvements for the states' current out-of-basin water diversion notification and consultation agreement
- Compare existing processes for prioritizing and allocating available water in a low flow situation
- Develop regional drought management strategies

Sedimentation

The greatest opportunity to ensure resilience in the 9-foot navigation channel is to guarantee designated areas to place dredged material without harming the river's ecological or societal uses. This requires thoughtful planning, helpful federal and state policies, and sufficient and dedicated funding. Each of the high-impact action items listed below will help to build storage capacity for sediment (temporarily and permanently) as it is dredged from the 9-foot navigation channel. Long term resilience planning as outlined in Chapter 3 will explore the opportunities to more robustly and consistently implement these solutions.

The lack of places to put dredged material often results in channel constrictions and, sometimes, emergency closures. Many permanent placement sites previously used within the Mississippi River are at capacity. In addition, several existing island transfer sites have limited remaining capacity. Dredged material placed at island transfer sites will need to be offloaded to permanent sites prior to reaching capacity limitations that could result in channel restrictions or emergency dredging events in the future. This issue of limited capacity is particularly acute in the northern reaches of the Upper Mississippi River. However, placement is an ongoing challenge throughout the region. It is becoming a more pressing issue as flooding events occur more often.

Sedimentation in the Upper Mississippi River backwaters is also impacting to the river's resilience. It results in reduced flood conveyance in the river and storage in its backwaters and, in some cases, diminished quantity and quality of fish and wildlife habitat.

We need to ensure planning, permitting, and other agreements are established

A combination of the 1970 National Environmental Policy Act (NEPA), the 1972 Clean Water Act, and Congressional mandates require the Corps to develop long range plans for managing the 9-foot navigation channel and obtain Section 401 state water quality certifications from the states and tribes for the placement of dredged material. Appendix 2 provides a more detailed summary of the events that resulted in today's system-wide planning done through federal-state interagency committees.

Long range strategies for the Corps' channel maintenance (dredging operations) and channel management (in-river structures) facilitate proactive, cost-effective solutions for dredging and placement of dredged material. For example, planning might trigger the search and acquisition of placement sites near locations that will require large scale dredging in the future. These plans also serve as the basis for memorandums of understanding (MOUs) between the Corps and states or tribes to establish permits in advance of placement activities. The plans consider dredging volumes, containment and stabilization of dredged material placement sites, beneficial uses for dredged material, environmentally-sound techniques and approaches (including in-river structural modifications), sediment transport, and compliance with federal and state regulations. Channel management structures (e.g., wing dams,

closing dams, and chevrons) are used to increase hydraulic efficiencies and have long term effects of channel scouring, sediment movement, and overall water energy within the study reach.

Below are the types of plans, permits, and agreements that enable efficient and effective channel maintenance. The Corps and regional federal, state, and tribal partners should explore ways to enhance planning for sediment management by accounting for, and potentially monetizing, the ecological, social, and community impacts. These documents should also integrate or align with other river management efforts when possible and as appropriate – i.e., channel and environmental pool plans.

- Annual dredging schedules for mobilizing crews and equipment for dredging provide up-to-date information related to ongoing and proposed dredging
- Channel maintenance management plans (CMMPs) provide a District-based long-term plan that establishes coordination procedures, outlines an evaluation process for dredged material placement site alternatives, and provides historic data related to managing the 9-foot navigation channel
- Dredged material management plans (DMMPs) outline a more detailed coordinated plan for managing dredged material in a specific pool or smaller geographic area
- Channel management studies evaluate channel energy and hydraulic efficiencies for moving sediment into areas that are more easily dredged (e.g., closer to approved placement sites) or to address navigation concerns such as out-drafts.
- Clean Water Act Section 401 water quality certifications used by the states and tribes to set conditions on the placement of dredged material
- Memorandums of understanding (MOUs) are agreements between the Corps, states, and tribes, facilitating for more efficient permitting of dredged material placement

A beneficial use work group in each of the Corps' Upper Mississippi River Districts would focus specifically on advancing opportunities within a long range, systemic, and integrated management context. The St. Paul and Rock Island Districts have already formed beneficial use work groups. This includes aligning opportunities with the Corps' Upper Mississippi River Restoration program, Navigation and Ecosystem Sustainability Program, and other environmental and management authorities.

We need to market the availability of dredged material

River sediment is underutilized but is relatively inexpensive and useful for a variety of purposes, including road construction and habitat restoration. Dredged material at government-owned placement sites is provided free of cost to users less the cost of transporting dredged material from the placement sites. The intent of marketing the availability of “free” sediment is to facilitate offloading of permanent and temporary placement sites, thereby increasing the overall capacity to store sediment as it is dredged from the river channel.

Experts in marketing can help us engage existing users of dredged material, new entities who may find benefit from similar uses, and individuals and organizations who might utilize the dredged material in new and innovative ways. Marketing can be focused locally, regionally, or at a more targeted geographic area given the potential use. The exploration of markets may require an evaluation of longer hauling distances, strategic locations for stockpile sites, the technical characteristics and performance of the dredged material, or processing in order to serve particular uses.

We need to address policies limiting the beneficial use of dredged material

Commonly referred to as “beneficial use,” securing innovative and effective ways to utilize the dredged material for public or private use can minimize the amount of the material needing to be stored temporarily or permanently. Beneficial use as a consistent, dependable, and actionable strategy could greatly expand the system’s capacity to accommodate large sedimentation events while also avoiding, minimizing, and/or mitigating social and environmental impacts of dredging operations and material placement.

Existing policies that govern channel maintenance as well as agency budgets and planning processes impede beneficial use on the Upper Mississippi River and elsewhere across the country. For example, the use of dredged material for ecosystem restoration projects are often omitted because of their inherent inability to accommodate a full 40-year dredging volume. Additionally, the Corps’ real estate policies prefer fee title ownership for all dredged material placement sites.

The “Federal Standard” is particularly limiting to beneficial use. This standard is defined in 33 CFR Part 335.7, which requires each dredging project to establish an alternative for dredged material placement representing the least costly and environmentally acceptable option. This alternative becomes the metric against which all other alternatives are compared. Beneficial use opportunities are often not permitted because their cost to the Corps’ operations and maintenance budget is greater than the alternative established by the Federal Standard. Thus, it is critically important that all costs be included when determining the alternative that represents the Federal Standard. When only short-term costs are included, the cost may be artificially low and may fail to reflect the full life-cycle costs for placement of the material. A good example of this is when the use of an upland site might require future trucking contracts to restore capacity in the placement site.

There is an ongoing national conversation about modifying the Federal Standard to facilitate beneficial use and Congress has expressed interest in doing so. The Upper Mississippi River’s federal and state experts involved in channel maintenance planning should be involved in these national deliberations regarding potential changes to the Federal Standard. This includes communicating the types of potential opportunities that might result from a change in national beneficial use policy, including the use of various public-private partnership arrangements.

In addition, the states will work within their respective Administrations to evaluate potential modifications to state permitting for solid waste and to facilitate greater use of dredged material for public projects, such as road construction and beach nourishment. Non-federal partners will formally request that the Corps reevaluate its nation-wide accounting and policy procedures affecting beneficial use, including its accounting procedures to credit beneficial use and integrate efforts across programs and funding streams.

Watershed

It is widely acknowledged that the Upper Mississippi River watershed is sending an excessive volume of water and sediment through the floodplain at a high rate that is surpassing its capacity to handle. In developing this report, many conversations about high-impact actions within the river floodplain transitioned to discussions on how the watershed significantly affects the water resource challenges within the floodplain. Given that it will take substantial time for any efforts in the watershed to result in realized water and sediment load reductions to the Upper Mississippi River, we know we must also work towards solutions in the river-floodplain. We can both underscore the benefits of those watershed programs and projects and engage more directly in those efforts.

The actions below will be used to formulate assessments of baseline conditions in the watershed and to evaluate future scenarios for managing the river floodplain as described in Chapter 3.

We need to update forecasts of future precipitation

Preparedness for major floods and prolonged droughts requires understanding past events as well as reasonably estimating the risk of future occurrences. Regional climate analyses and predictions are important to developing integrated solutions for enhancing the river floodplain's economic and ecological resilience. Assumptions about future rainfall will provide context for watershed-based resilience planning as well as for more immediate infrastructure, policy, and planning needs locally and regionally.

This action supports updating and strengthening NOAA's Atlas-14 climate projection models and other state and local climate analyses. The NOAA Atlas 14 analyzes historical data in order to determine future hypothetical precipitation events. It serves as the basis for important national decision making, including for FEMA's National Flood Insurance Program. We support regional or national updates to Atlas-14 at the appropriate frequencies (e.g., 10 years) to avoid inconsistencies at geopolitical boundaries and to integrate new hydrologic shifts and new technologies. Atlas-14 was updated in 2013 covering Iowa, Minnesota, Wisconsin, and Missouri and in 2004 for Illinois and Indiana. New technologies would strengthen Atlas-14, by integrating future climate projection into the precipitation frequency analysis.

Individual states are also developing climate projection modeling. Illinois recently published a precipitation frequency study for the state (i.e., Bulletin 75), which concludes that average annual rainfall has increased 11 percent over the past century and that annual rainfall amounts will continue to grow at an increasing rate. Minnesota recently estimated that, under a high greenhouse gas emissions scenario, the wettest day in a typical year at the end of this century is projected to be 20 percent wetter than during the 1990s. Individual years may have even larger increases in extreme precipitation. Even as the amount of precipitation increases, scientists estimate that the longest time between precipitation events will increase. In other words, precipitation will occur in fewer events.

We need to slow the input of water and sediment from the river's tributaries

Projects, programs, and activities to slow the input of water and sediment from the river's tributaries will be the most effective, long term means to alleviate the problems. This action supports the ongoing investments in the Upper Mississippi River's more influential tributaries, particularly through the state's nutrient reduction strategies. UMRBA is working on behalf of its member states (Illinois, Iowa, Minnesota, Missouri, and Wisconsin) to significantly increase investment and regional collaboration in implementing the states' nutrient runoff reduction strategies. This action supports the states' work through UMRBA to collaborate and provide a watershed-scale, interstate forum for planning, measuring progress, and learning.

In concert with forecasted future precipitation, states and federal have plans and knowledge that can inform assumptions about future conditions in the river-floodplain. We will be able to utilize important insights about baseline conditions, future runoff projections, and the cumulative investment and lag time needed to realize reduced tributary runoff.

Long term resilience planning (as outlined in Chapter 3) will benefit from better coordination with ongoing watershed programs and projects, particularly for projecting long term trends of tributary inputs. Furthermore, resilience planning in the river floodplain can add justification for investment in the tributaries having the greatest impact on the river's resilience.

We need to facilitate information exchange

Numerous individuals and organizations are investing significant amounts of resources in monitoring problems and researching solutions. There is a tremendous amount of information at our disposal, but it is what we do with that information that is most important. Ongoing, regional forums are needed to convene robust discussions to share learned information among scientists, land managers and owners, decision makers, and interested stakeholders. Improving our overall knowledge will allow us to collectively respond to disasters and adapt to changing conditions.

This action will support a commitment by UMRBA to host routine conversations about watershed planning, action, status and trends monitoring, and research. This includes how regional climate and land use changes might affect the Upper Mississippi River. UMRBA will also build a central web-based platform to share information.

This action also supports ongoing discussions about climate change and flooding and drought predictions tools; planning efforts to reduce water, sediment, and nutrient runoff; and municipalities' work to improve their resilience. Of particular value is The Nature Conservancy's Floodplain Prioritization Tool, which can provide customized analytical applications for local communities to stimulate discussions among stakeholders, integrate multiple issues and align otherwise disconnected decisions. This action supports efforts to inform local communities of the tool's data and analytical potential.

Chapter 3: Long Term Strategies

This Chapter outlines an approach for developing integrated, systemic plans to managing floods, drought, and sediment for the purposes of improving disaster preparedness, facilitating economic growth, and restoring ecological health and building resilience in the river floodplain. It provides fundamental questions and planning needs to address through an evaluation of existing conditions, a future without action, and scenarios of potential action.

Through UMRBA, the Governors' joint interstate collaborative, the states of Illinois, Iowa, Minnesota, Missouri, and Wisconsin are continuing in their commitment to integrated water resources management for the purposes of increasing the economic, ecological, and social resilience of the Upper Mississippi River and its watershed to major flood events, prolonged drought, and excessive sediment. This includes continuing important projects, programs, and activities to slow the input of water and sediment from the river's tributaries in partnership with the relevant federal agencies, localities, farmers, wastewater and drinking water facilities, conversation interests, and others.

UMRBA recognizes that it will be important to consider the changing weather, landscape, hydrology, and geomorphology as well as the region's economic, social, and ecological values when advancing each of the following specific planning needs:

- 1) Develop an integrated, comprehensive, and systems-based plan to minimize the threat to health and safety resulting from flooding by using structural and nonstructural floodplain management measures
- 2) Develop new, or renew existing, comprehensive long-term channel maintenance and management plans that are sustainable, cost-effective, and ecologically sensitive
- 3) Develop mitigation strategies for multi-year drought events that would increase the resilience of communities, economies, and ecosystems adjacent to, or dependent on, the Upper Mississippi and Illinois Rivers

UMRBA's member states share many overlapping responsibilities with the Corps with respect to the 9-foot navigation channel, floodplain management, and watershed management as well as other federal agencies. Therefore, UMRBA is requesting a partnership with the Corps to utilize its Section 729 planning authority (see Appendix 4, hereafter referred to "planning effort") to collectively evaluate a suite of strategies, alternatives, and actions within a watershed context and across a broad range of stakeholders' authorities. Utilizing the region's deeply rooted partnership, the process will involve other federal agencies with management responsibilities on the river as well as the many stakeholder interests.

Resilience planning will require a transparent and collaborative process for the purposes of creating dynamic, balanced, objective, and adaptive solutions. We will invite affected people, communities, and businesses to participate throughout the planning process, building trust and creating outcomes that will benefit the diverse uses and purposes of the Upper Mississippi River floodplain. This will require ongoing conversations among the affected interests, with the decision makers listening and evaluating stakeholder input.

Vision and Objectives

This planning effort will center our collective interests and work towards advancing commonly-held vision and mission statements with corresponding objectives and strategies for achieving them. Values associated with a healthy, functioning, and resilient Upper Mississippi River will be used to define our collective vision.

Defining the shared vision statement will be the first task to accomplish and will be used to establish the planning effort's scope, timeline, and roles and responsibilities.

There is a resounding agreement among the region that the status quo is not acceptable and that new systemic management approaches (or a plan) are needed for managing the river corridor given changing watershed influences. Change is needed in policies, coordination and consultation, resources, and other management approaches.

There is a common appreciation among stakeholders that solutions will need to be complex, requiring consideration of the many uses and values of the river system. Stakeholders have widely called for solutions to "slow the water" or "make room for the river." But there are sometimes conflicting recommendations for how to do that, including creating spillways, restoring floodplain forests, investing in agriculture conservation practices in the watershed, setting back levees, and more. The planning process will guide us through a systemic, science-based evaluation of which solutions to land use and management are the best fit in different areas of the river floodplain, while also considering the social and economic dimensions of the problems and alternatives.

The overall objective is to define how to increase the resilience of the Upper Mississippi River to major flood events, prolonged drought, and excessive sediment. This will include evaluating:

- Where and how should existing land uses be protected and sustained into the foreseeable future?
- Where should land use be different?
- What does resilient and sustainable flood, drought, and sediment management look like?
- What impacts will occur and can we establish an equitable method for distributing costs and benefits?

Existing and "Future Without Project" Conditions

Generally, we know that the volume and rate at which water and sediment move through the Upper Mississippi River basin landscape to the tributaries and to the river is accelerating and is surpassing our ability to handle. Additionally, periods of low flow conditions create a unique set of economic and ecological vulnerabilities. There is significant federal, state, local, and private investment working to reduce and reverse these trends. Through an assessment of tributary influences to the river system, we will develop a comprehensive, collective understanding of how various actions are acting in tandem with, or against, other actions. And, how these cumulative actions as well as weather-related effects are driving the events that are manifesting in the river. This will add clarity about the many stakeholders and their various contributions, which are often disconnected.

Through the development of this report, it was plainly evident that we need a clear articulation of what is causing the increasing trends in water and sediment movement into the river floodplain. Specifically, we will evaluate:

- How are land use practices and developments in combination with climate change influencing the flood, drought, and sediment challenges occurring in the river?
- Which tributaries are more acutely affected by climate change?
- Which tributaries have the greatest impact on the river-floodplain's resilience?
- What systemic impacts result from low flows further limiting water availability?

A thorough examination of existing conditions will be used as a baseline to justify investment and evaluate the influence of any recommended actions. We will answer questions about what contributes to flood conveyance issues, the triggers that cause the demand for water to exceed its availability, the problems that are affecting sediment management, and the economic and social vulnerabilities to flood and drought.

Within the river floodplain, we need a detailed explanation of how the existing system of flood protection infrastructure and storage areas (including backwaters and floodplain forests) performed during major flood events occurring between 2000 and 2020. This will help us answer questions about where the existing system provides adequate protection and where it does not provide adequate protection as well as how floods are conveyed systemically given tributary influences. This includes the inherent connectedness of structural and nonstructural flood management measures. Additionally, it will be important to evaluate the current barriers to implementing new approaches to managing the river. That may include policy and funding constraints, the current governance framework, and politics, among other issues. For example, how does the multi-jurisdictional nature of governance on the Upper Mississippi River contribute to the challenges?

We will also define a future planning scenario that assumes no change in the current management system or additional investment beyond what is currently spent on an annual basis by federal agencies, states, local governments, and private entities. This will require a science-based understanding of how future precipitation and land use changes in the watershed will affect water and sediment delivery to the river floodplain as well as assumptions about human and biota uses over the next 50 years.

Potential Actions

Scenario planning will focus on building the resilience of the Upper Mississippi River to major flood events, prolonged drought, and excessive sediment through a collective suite of strategies, alternatives, and actions that would be implemented through a broad range of stakeholders' authorities. We will build solutions to flood conveyance and drought management that will stimulate economic growth, minimize economic and social vulnerabilities, and foster ecological health. Solutions will primarily focus on actions in the river-floodplain but will also illuminate where and how actions in the watershed would be most effective for improving the river's resilience. We will focus on answering:

- How should and can the floodplain be altered to allow for effective conveyance of floods and deposition of sediment?
- Where should current land uses be protected and sustained or changed to another form into the foreseeable future?
- How can sediment be removed from the river channel and backwaters at the rate needed to maintain an open and reliable navigation system under high and low water conditions and improve flood conveyance? This will include an analysis of how the problems affecting sediment management can be resolved.
- Collectively, how can management actions minimize the economic and social vulnerabilities to flood and drought? For example, what are general criteria that may inform water use in a low flow situation?

Based on the selected suite of management solutions, we will examine the appropriate governing arrangements, mitigation, and resource needs and make any recommendations for policy changes. Additionally, we will quantify and qualify the benefits of the selected solutions and determine metrics for evaluating progress in advancing those management solutions.

Chapter 4: Other Alternatives Considered

Listed below are other alternatives considered to improve the Upper Mississippi River’s resilience. These items may be evaluated or considered during a future planning effort, including under the UMRBA-proposed long term planning effort as described in Chapter 3. These alternatives were offered during various meetings and other correspondences, including surveys and letters, and during the review of this report.

Integrated or watershed management alternatives:

- Prepare an assessment of the flood, drought, and channel constriction and backwater sedimentation events and trends – e.g., describe areas with recurrent challenges
- Promote federal and state assistance opportunities, including pre-disaster mitigation and buyout programs
- Provide technical and financial assistance to low-income communities
- Increase the racial, ethnic, and cultural diversity in river management planning efforts
- Establish a common repository (or common library) to properly collect and store data and readily access and share that data
- Facilitate and accelerate soil health and restoration of the water cycle
- Review and update U.S. Department of Agriculture Natural Resource Conservation Service (NRCS) runoff curves

Flood-related alternatives:

- Evaluate impacts of existing and future upland water storage capacity and potential implications to reducing flood impacts on the Upper Mississippi River
- Encourage the consideration of nature-based solutions in local flood protection and risk reduction planning through the use of The Nature Conservancy’s Floodplain Prioritization Tool
- Review and modernize the National Weather Service’s website products
- Update LiDAR mapping
- Evaluate the impacts associated with flood fighting activities
- Inventory and assess county-level stormwater storage ordinances
- Document insights gained from construction and implementation of flood management techniques, including adding storage capacity
- Enhance communications in emergency situations, including among federal, state, and local governments as well as to affected individuals, communities, and businesses
- Increase engagements and outreach, including disseminating information through various social media channels
- Evaluate wetland protection policies, including prioritizing wetland banking in areas of greatest flood storage capacity

- Integrate nonstructural measures in levee repairs – e.g., provide controlled overtopping to levees that are repeatedly damaged by floods
- Reintroduce and incorporate beaver and/or beaver dam analogues
- Restore the water/hydrologic cycle and soil health

Drought-related alternatives:

- Create a repository of tools and resources to assist with drought planning
- Develop a communication system for facilitating regional-level response and mitigation
- Maintain current mitigation plans that reflect present-day conditions and relevant laws and policies
- Update and maintain accurate drought-related near-range forecasting tools
- Identify aquifer recharge zones within the river floodplain for the purposes of evaluating their potential role in flood storage and drought mitigation

Sediment-related alternatives:

- Assess opportunities for sediment deposition on flowage easement lands
- Improve collaboration of sediment-related efforts focused in the Upper Mississippi River floodplain with other programs and projects working on related goals in the watershed
- Develop comprehensive models that accurately depict current sediment transport dynamics and simultaneously assess ecological impacts and test future scenarios
- Integrate “engineering with nature” concepts into channel maintenance and management planning, such as the use of seed islands, staged delivery, and rock
- Evaluate the use of sand traps at key locations and other innovative practices (e.g., engineered soils) in the watershed and small town harbors
- Evaluate the use of bankline restoration to protect eroding shorelines
- Establish policies and outreach programs to reduce shoreline erosion – e.g., wake restrictions
- Assess opportunities for sediment deposition on flowage easement lands
- Provide compensation to landowners for flowage and sediment storage
- Develop a real-time placement site capacity database to inform offload scheduling
- Analyze the speed at which placement sites fill and how beneficial use extends the life of these sites
- Create a self-populating channel maintenance database with information about dredge cut quantities, dredged material placement quantities, and so forth

Appendix 1: Geographic Setting

The Upper Mississippi River watershed is a complex and dynamic system for water and sediment movement. The river's tributaries have significant influence on the river system, primarily for their discharge and sediment contributions. Floods and sedimentation are both inevitable and natural ecological processes, but are also the most vexing problems facing the Upper Mississippi River particularly with climate- and human-driven activities that modify these processes. Draining approximately 120 million miles, the river floodplain experiences natural flooding following snowmelt in the spring and after large precipitation events. The sources of sediment to the river are wide ranging and could be described generally as the lands and streams of the river basin. Sediment delivery to the river can be reduced but not halted.

Congress defines the Upper Mississippi River System by its 9-foot navigation channel extending from the confluence of the Ohio River north on the Mississippi River to the Twin Cities and on the Illinois Waterway to Chicago. Together, the Upper Mississippi and Illinois Rivers along with small portions of the Minnesota, St. Croix, Black, and Kaskaskia Rivers provide a 1,200-mile commercially navigable river network in the upper Midwest. Of the 850 river miles on the Mississippi River, the northern 670 miles are made navigable by a series of 29 locks and dams that create a stairway of water. The Illinois Waterway includes a system of eight locks. The 9-foot navigation channel is regulated by training structures south of St. Louis to the confluence of the Ohio River.

Water levels are regulated to maintain a continuous 9-foot navigation channel. All of the dams are "run-of-the-river" dams, meaning that they are operated to simply pass incoming flows and do not store water for flood control or other purposes. Each dam is operated to maintain a targeted water surface elevation at one or more control points within the pool.

The Upper Mississippi and Illinois River floodplain encompasses over 2.6 million acres of urban and agricultural areas and aquatic, wetland, forest, and grassland habitats. The floodplains have extensive existing flood control projects consisting of levees and floodwalls. Over 140 classified systems of floodwalls and levees extend over 2,200 miles along the Upper Mississippi and Illinois River floodplains, protecting urban and agricultural areas. Most of these floodwalls and levees (approximately 100) are federally constructed and locally owned and operated. The other systems were built by private interests. In addition, many unaccounted levees exist throughout the floodplain that are privately owned.

Levees protect about three percent of the floodplain north of the Quad Cities, 53 percent of the floodplain in the middle reach between the Quad Cities and St. Louis, and 83 percent of the floodplain south of St. Louis. Levees cover about 60 percent of the lower 160 miles of the Illinois River. There are also many small communities located along the river that lack flood protection structures and are directly vulnerable to overbank flooding.

Historically characterized as a rich mosaic of braided channels that flowed past countless islands and through abundant lakes and wetlands where diverse riparian plant communities flourished, the Upper Mississippi River's floodplain is a critically important source of food and shelter for an abundant array of birds, fishes, mammals, and other wildlife. The construction and operation of the 9-foot navigation channel, as well as land use changes in the watershed and floodplain, inundated much of the original floodplain forest or significantly restricted the lateral floodplain. This has significantly reduced the area available to absorb flood waters. At the same time, and in large part due to the Upper Mississippi River Restoration program, many areas of the river still retain many of their natural floodplain ecosystem

characteristics such as flood pulses. Over 318,750 acres of the river-floodplain are designated as Wetlands of International Importance in addition to numerous side channels, sloughs, and oxbows.

Over time, the growth of agriculture and urban and suburban areas, tile drainage, loss of wetlands, stream alterations, and changes to the timing, type (snow or rain), and amount of precipitation (i.e., climate change) have collectively resulted in an excessive volume of water and sediment moving through the watershed. The accelerated velocity of water movement to the river-floodplain is resulting in excess erosion, further increasing sedimentation and exceeding the current capacity to convey and absorb the additional inputs.

Long term monitoring on the Upper Mississippi River is showing a transition from the historical “spring pulse” with a period of low water in the summer and a small pulse in the fall to a relatively steady state of high water with high peaks in summer. The fourth National Climate Assessment reports that annual precipitation in the Midwest has increased from a rate of five percent to 15 percent from the first half of the last century (1901 to 1960) compared to present day (1986 to 2015). It estimates that winter and spring precipitation, which are important to flood risk on the Upper Mississippi River, will increase by up to 30 percent by the end of this century. This includes more frequent heavy precipitation events. This increase in precipitation will directly result in rising river discharge. At Lock 3, Minnesota DNR estimates that the discharge conditions of the 1960s will double by 2060 if the calculated rate of change from 1960 to 2020 continues until 2060.

The National Climate Assessment acknowledges that human activity is not a major component of past drought occurrences in the Midwest, and that it remains uncertain how droughts will behave in the future. However, the Assessment suggests that Midwest surface soil moisture likely will transition from excessive levels in spring due to increased precipitation to insufficient levels in summer driven by higher temperatures.

The processes of flooding, drought, and sedimentation are interrelated and actions to influence one will have an impact on the other. Flood events play a very significant role in the delivery of sediment to the Upper Mississippi River. Sedimentation does not occur at a constant rate, but instead is strongly correlated with high discharge events – i.e., floods carry large amounts of sediment off the landscape and/or remobilize sediment located on shorelines and islands or stored in backwater areas. High discharge events may result in channel-border island erosion (dissection). This increases sediment delivery to backwaters and reduces flows into the navigation channel, causing sediment to settle in the navigation channel. Flood events immediately following a drought will result in high rates of erosion. Floods that are quickly followed by low water events will result in large amounts of sediment deposition. The 9-foot navigation channel structures, including the levee system, as well as railroad embankments and bridges impact channel operability and flood dynamics as well as ecological health.

Discharge is a fundamental driver of the river floodplain’s ecological structure and function. Long term resource monitoring through the Upper Mississippi River Restoration program has shown that the increased discharge has affected the river ecosystem in various ways.

The variation in ecological and social-political conditions from north to south creates unique challenges and requires different approaches to managing the 9-foot navigation channel as well as floodplain development, restoration, and protection policies.

Appendix 2: Sociopolitical Context

The complex nature of the Upper Mississippi River and array of human uses require inclusive dialogue among the diverse suite of stakeholder representatives throughout the region. If the goal is to manage the Upper Mississippi and Illinois Rivers in ways that provide thriving and resilient floodplain economies and ecosystem, it will be incumbent upon the federal government, states, local communities, industry, and natural resource interests to join together in support of a commonly-held vision with goals, objectives, and an implementation strategy. Successful management of the Upper Mississippi River watershed and river-floodplain requires thoughtful coordination among numerous government agencies, organizations, and individuals with varying but related mandates, missions, talents, experiences, and expertise.

Regional Commitment to Multi-Purpose Management

In the 1970s, Congress tasked the federal-state Upper Mississippi River Basin Commission with resolving contentious disagreements about how the river should be managed and to make recommendations for balancing the demands of competing interests. The Commission set forward a comprehensive guide for managing the river that was ultimately published in 1981 and titled the Comprehensive Master Plan. The Commission evaluated governing options associated with the river and concluded that state and local governments' management responsibilities must be blended with federal responsibilities for future management of the river system's resources. It ultimately envisioned, and recommended the establishment of, the Upper Mississippi River Basin Association (UMRBA) to provide a) a mechanism for the states to take more a direct role in regional river management and b) a centralized coordination point for the federal agencies to carry out their river-related management and operations in cooperation with the states. Expanded regional institutional arrangements could originate from this cooperative organization. While this cooperative arrangement allows for interagency and intergovernmental coordination, it does not provide a single authority for broad-based river management functions. While there is no overarching watershed-based authority, the states work in collaboration with federal agencies, local governments, and private interests to manage water and sediment movement.

Immediately following the demise of the Commission, UMRBA was established in order to preserve a forum for coordinated joint action and policy development among the states and between the states and federal agencies in this region. As such, consensus-building is an important function of the organization. While UMRBA is arranged as a nonprofit entity, its Board is comprised of gubernatorial appointees from each of the five basin states and includes members from the various state agencies with river-related responsibilities and interests.

The Upper Mississippi River System has two national purposes mandated by Congress. Federal policy is reflected in both the authorized responsibility of the Corps for the operation and maintenance of the 9-foot navigation channel and of the Department of the Interior for fish and wildlife management. In addition to these two specific purposes, the river floodplain provides a diverse array of opportunities and experiences making it a unique multi-purpose system. The river is further complicated by the mosaic of state, federal, and private ownership of the floodplain and river bed.

Over the series of Rivers and Harbors Acts and Flood Control Acts, Congress established and expanded the federal government's role in constructing and managing the 9-foot navigation channel to include flood protection structures on the Upper Mississippi River. The flood-related responsibilities were added under the Corps' navigation mission. This initially included constructing and repairing flood levees and building wing dams to direct the river's current. Eventually, the Corps was made responsible for

implementing flood protection measures to prevent water from overflowing the natural and artificial banks and deepening the channel. The Corps integrated its navigation and flood-related missions, ultimately designing the 9-foot navigation channel in a way that would minimize flood-related implications to riverine communities and concentrate the greatest flowage effects to agricultural lands, floodplain forests, and brush lands.

State, Tribal, and Federal Roles and Responsibilities

Along with their collective work through UMRBA, the states have individual mandates related to the placement of dredged material and managing the floodplains. In the 1986 WRDA, Congress added responsibility to UMRBA to serve as the caretaker of the Master Plan. The states utilize authorities delegated by Congress through the Clean Water Act and the Fish and Wildlife Coordination Act to shape federal management of the Upper Mississippi River System. Their individual responsibilities related to flood, drought, and sediment management are described in further detail below.

The U.S. Fish and Wildlife Service (USFWS) serves as a significant land manager on the Upper Mississippi River and protects the river ecosystem through various authorities, including the Endangered Species Act. Refuge lands on the river encompass just over 300,000 acres in the river floodplain, with the Upper Mississippi River National Wildlife and Fish Refuge extending 261 river miles from north to south at the confluence of the Chippewa River in Wisconsin to near Rock Island, Illinois. While the Refuges are primarily managed for migratory birds, threatened and endangered species, and other Trust species, the Service's land conservation and management activities support the wide diversity of species present in the river. With the exception of forest management, the U.S. Army Corps of Engineers (Corps) delegates most of its wildlife and recreational land management activities on the Upper Mississippi River System to the Service through interagency agreements.

Tribal governments are sovereign nations with their own distinct recognition from the federal government. They play a unique and important jurisdictional role in water resources management. Reservations and communities throughout the watershed were retained or reserved by American native tribes after ceding large portions of their original homelands to the United States through treaty agreements. At the time of European settlement, tribal nations living in the Upper Mississippi River floodplain include the Sioux, Sauk and Fox, Ojibwe (or Chippewa), Pottawatomie, Illini, Menominee, and Ho-chunk (or Winnebago). The Prairie Island Indian Community, with members mostly from the Mdewakanton Dakota tribe, is the last remaining tribal nation located on the banks of the Upper Mississippi River. Its tribal boundaries changed over time mostly following the imposition of government treaties but also including the federal government taking land for the construction of L&D 3, which flooded burial grounds, and a nuclear power plant. Subsequently, the tribe had 300 livable acres within Red Wing, Minnesota. On May 12, 2006, President George W. Bush placed into trust 1,290 acres for the Prairie Island Indian Community that was intended to replace the tribal land that was inundated following the construction of L&D 3. None of this land is buildable.

Tribes have authorities to implement programs that protect water quality and prevent pollution under the Clean Water Act. The Corps cannot dispose of dredge material within the Prairie Island Indian Community Tribal jurisdiction unless agreed upon through a formal agreement or resolution through the Tribal Council. Tribes can set water quality standards within their respective waters. They also view their treaty rights as a responsibility to manage resources to ensure their future use.

Per the Clean Water Act, the U.S. Environmental Protection Agency (USEPA) regulates activities in point source discharges storm water discharge and nonpoint source pollution and, along with USACE, regulates activities in jurisdictional waters, including dredging and filling of wetlands and riparian areas. The U.S. Department of Agriculture Natural Resource Conservation Service (NRCS) provides national leadership in a partnership effort to help people (on a voluntary basis) conserve, maintain, and improve America's natural resources and the environment. The U.S. Geological Survey significantly invests in monitoring and researching water resources in the river, floodplain, and watershed, with its stream gaging network and ecological monitoring research through its Upper Midwest Environmental Sciences Center.

The Mississippi River Commission (MRC) has statutory authority for the general improvement of the river from the Head of Passes at the Gulf of Mexico to its headwaters near Lake Itasca in Minnesota. The MRC started a process of listening, inspecting, and partnering in the Upper Mississippi Basin in 1997. The Commission does not have the funded authority to implement plans of improvement in the Upper Mississippi River basin as it does with the comprehensive Mississippi River & Tributaries (MR&T) project below Cape Girardeau, Missouri.

Issue-Specific Context

Evolution of Long-Range, Integrated Channel Maintenance and Management Planning

Congress first authorized the Corps to maintain the Upper Mississippi River as a commercial navigation channel in 1824 and incrementally increased the channel's minimum water depth until the last increase to nine feet in the 1930 River and Harbors Act. Over time, the Corps' channel management techniques and strategies have evolved and become very sophisticated. The techniques used mostly include removing snags, shoals, and sandbars, constructing structural modifications (e.g., locks and dams, wing dikes, bendway weirs), and dredging.

In 1974, the Corps published an environmental impact statement (EIS) for the O&M of the 9-foot navigation channel in response to the 1970 enactment of the National Environmental Policy Act (NEPA). It found that there was insufficient information to appropriately evaluate and recommend approaches for managing the channel in ways that would minimize impacts to the river ecosystem and other uses, such as recreation. The EIS recommended that federal-state interagency partnerships develop a "river system management plan" for each of the three Upper Mississippi River Districts. These planning efforts were subsequently authorized in 1976 and collectively referred to as the Great River Study. Coordinated through interagency Great River Environmental Act Teams, the reports are referred to as the GREAT studies.

A key outcome of the GREAT studies was a detailed plan for managing the navigation channel, nestled in a broader, integrated resource management plan for the river's multiple uses. Facilitated by the Upper Mississippi River Basin Commission and in coordination with the District-based teams, each of the three Upper Mississippi River Corps Districts completed a GREAT study for management within its respective boundaries in 1980-1981. The St. Paul, Rock Island, and St. Louis District study reports were named GREAT I, GREAT II, and GREAT III, respectively. The St. Louis District did not formally adopt the GREAT III study, given simultaneous overlapping efforts under the 1982 UMRS Comprehensive Master Plan. Each report included a series of channel maintenance recommendations tailored to the respective District's unique environmental characteristics – i.e., sediment deposition, interagency partnerships, and management dynamics. The recommendations addressed dredging volumes, containment and stabilization of dredged material placement sites, beneficial uses for dredged material, environmentally-sound techniques and approaches (including in-river structural modifications), sediment transport, and compliance with federal and state

regulations. These plans were anticipated to remain viable in the long term, with the St. Paul District expecting the GREAT I's recommendations to remain relevant until 2025.

In parallel, the 1978 Inland Waterways Authorization Act authorized the Upper Mississippi River Basin Commission, in cooperation with the appropriate federal, state, and local interests, to develop a Comprehensive Master Plan, which took a system-wide approach to resource management issues rather than subdividing by District. The 1978 Act included a provision for evaluating the placement of dredged material. The GREAT studies served as a foundational reference for the Master Plan's channel maintenance resource recommendations regarding placement sites. The Master Plan also reinforced earlier recommendations for system-wide interagency governance of the river's multi-purpose management.

Over time, each District's channel maintenance program has evolved to deal with its unique circumstances, resulting in different management approaches among the Districts – in terms of planning, funding, interagency coordination, and approaches and techniques. For example, the St. Paul and Rock Island Districts have historically used dredging as the primary mean to maintain the nine-foot channel depth, whereas the St. Louis District has placed significant investment in structures (dikes and weirs) that use the system's high energy to concentrate flow and keep the sediment moving down river and prevent accumulation.

The St. Paul District completed a District-wide channel maintenance management plan (CMMP) in 1995 that outlined long term management strategies for channel and harbor maintenance, including location and use of placement sites and innovative channel maintenance techniques. While it is now outdated, interagency partners found the CMMP to be extremely valuable. The Rock Island District employed a federal-state interagency planning process that resulted in a draft long term channel maintenance plan. It was never formally adopted. The St. Paul and Rock Island Districts develop dredged material management plans (DMMPs) for sub-sections of the river to evaluate specific dredging locations. DMMPs outline subsequent management of the material, including identifying feasible alternatives and addressing capacity issues associated with the placement sites. These plans have reached the end of their useful planning life and the two Districts are now updating them as resources allow. The St. Louis District works through its Regulatory Works Program, employing more of an *ad hoc* approach to dredging and dredged material management and interagency coordination as the need arises. In 2014 and 2015, the District prepared a summary of chronic dredging sites and placement locations.

In managing the channel, the Corps is legally required to obtain approval from the respective state in which the placement of dredged material is desired. This led the Corps to establish standing federal-state interagency committees to develop and implement long range strategies for multi-purpose management of the system. The Corps convenes on-site inspection teams (OSITs) to evaluate dredged material placement sites and capacity needs. These teams include personnel from the Corps, USFWS, and applicable states.

Flood Management

Managing and responding to floods on the Upper Mississippi River is complicated, mostly because it involves "shared" responsibilities among a conglomerate of federal, state, and local government agencies (e.g., cities, levee and drainage districts, and other taxing authorities) as well as private citizens. It is also complex because of basin's geographic size and changing hydrology and hydraulics as well as the impacts to people and businesses affected by manipulation of the floodplain.

Congressional Authorizations

In the 1850 Swamp Land Act, Congress allowed Illinois, Iowa, and Missouri to acquire large areas of floodplain and convert the lands for settlement and agricultural purposes using drainage and flood control measures. In the end, this Congressional action resulted in the federal government transferring vast amounts of floodplain to the states and from states to counties and levee boards and private ownership. Decades later, these communities called on Congress to protect these agricultural lands as the 9-foot navigation channel inundated the southern portions of pools created by locks and dams.

To an opposite effect, Congress acted in 1924 to protect much of the northern half of the Upper Mississippi River floodplain through the U.S. Fish and Wildlife Refuge System amid discussions of transitioning the floodplain to agricultural development. The Refuge System covers just over 240,000 acres and extends 261 river miles from north to south at the confluence of the Chippewa River in Wisconsin and to near Rock Island, Illinois.

Levees and other flood risk management infrastructure on the Upper Mississippi River were developed at various points in time over decades with no holistic, systemic objectives or approaches. Prior to the 1930s, Congress had authorized levee projects in various patches from Rock Island to the Ohio River confluence. The Flood Control Acts of 1936 and 1938 authorized the construction of levees to protect mostly agricultural lands on the Upper Mississippi River between Missouri and Illinois on the Mississippi River as well as for 14 agricultural levees and one levee setback on the Illinois Waterway. These Acts also authorized several dam and reservoir projects throughout the basin, including on the Upper Iowa, Iowa, Des Moines, Kaskaskia, and Minnesota Rivers.

From 1944 to 1950, Congress focused its attention on protecting urban areas along the Upper Mississippi River with levee systems. In 1948, Congress also gave the Corps authority to approve many smaller flood protection projects at a cap of \$2 million each. Today, that cap is \$7 million. In the 1954 Flood Control Act, Congress authorized the Corps to modernize 386 miles of levee systems between Rock Island and Alton to protect a 200-mile stretch of agricultural lands in the Mississippi River floodplain as well as four urban areas: Alton, Hannibal, Sabula, and Muscatine. Projects at these cities were designed to provide protection from tributaries to the Mississippi River.

Up until the 1958 Flood Control Act, most of the flood protection measures were located on the Upper Mississippi River and not the tributaries, with the exception of the Illinois Waterway. In that measure, Congress authorized four projects located in Minnesota, a large earthen dam on the Eau Galle River in Wisconsin, and the Saylorville dam and reservoir to supplement flood storage capacity of the Red Rock reservoir downstream on the Des Moines River. Since the 1960s, Congress has expanded the Corps' role in providing urban flood protection infrastructure that often serves multiple purposes, including for fish and wildlife habitat.

Conflict over the nation's flood protection program stalled work between 1970 and 1986. Environmental concerns, budget deficits, less public support for water projects, and impasses over the Water Resources Council's Principles and Standards precluding Congress' appetite for moving large water resource authorizing legislation. In the 1986 Water Resources Development Act (WRDA), Congress declared the Upper Mississippi River as a nationally significant ecosystem and a nationally significant commercial navigation system and authorized construction of a second and 1,200-foot chamber at Mel Price L&D, the Upper Mississippi River Restoration Program (formally named 'Environmental Management Program'), and promoted nonstructural measures for floodplain management.

In 1986, through its Unified National Program for Floodplain Management, FEMA published a conceptual framework for floodplain management. It recommended avoiding or minimizing actions that adversely affect the floodplain whenever there is a practicable alternative, restoring previously degraded floodplains to serve their natural functions, and preserving those floodplains whose natural functions are relatively undisturbed.

The 2007 WRDA authorized the Navigation and Ecosystem Sustainability Program (NESP) and two major flood protection systems on the Upper Mississippi River: the St. Louis Metropolitan area and the Wood River Drainage and Levee District. As part of systemic mitigation for the 9-foot navigation channel, NESP would restore lateral connectivity (i.e., floodplain reconnection) at various points along the Upper Mississippi and Illinois Waterways among other ecological objectives.

In 2008, the Corps published an Upper Mississippi River Comprehensive Plan to collaboratively evaluate a broad range of flood risk management alternatives. The report concluded that a system of new federal levee raises was not economically justifiable, but instead that a suite of preparedness, performance, and resilience measures could improve overall flood risk management. To date, these measures have not been implemented.

Congress gave the Corps the authority to construct and repair levees along the Upper Mississippi River floodplain and in the tributaries. However, mandates related to flood preparedness, response, recovery, mitigation, and investment in the river floodplain are divided among and between federal, state, tribal, and local governments. The overlapping roles and responsibilities are not clearly defined and, in many cases, policies, rules, regulations, and management approaches conflict.

Floodplain Management

With respect to floodplain regulation, the Corps, FEMA, and states each exert policy and management influence in working with local governments and private interests. While the Corps and local communities build and design flood protection measures, the states assist local communities to plan, construct, and maintain dams, levees, and other protective works. This includes reviewing federally planned and designed flood management projects. There is no clear federal guidance or overarching federal policy. The states individually set their own individual statutes at the state level that designate floodplain management roles and responsibilities. With respect to the Upper Mississippi River, where there are multiple federal and state agencies with regulatory authorities, the states' statutes may conflict with, overlap, or exceed those rules and responsibilities designated by the federal government.

In 1968, Congress enacted the National Flood Insurance Program (NFIP) to slow ever rising disaster relief costs and loss of life and property caused by flooding. It makes flood insurance available to the general public with the intent to incentivize building away from flood hazards. FEMA administers NFIP, which is a voluntary agreement between the federal government and the local community. According to FEMA, the states' role is as a secondary assistant to the federal government in training and aiding local communities. To participate in the NFIP, states must adopt adequate floodplain management regulations that meet NFIP minimum requirements. More specifically, FEMA outlines state responsibilities under the general umbrella of "demonstrating a commitment to the floodplain management criteria." This includes ensuring that communities have the legal authorities to adopt and enforce floodplain management regulations. Additionally, the states assist communities in administering ordinances, mapping, notifying FEMA of local compliance issues, preventing environmental and water pollution during floods, and training. Federal

agencies such as the Corps are not required to comply with local laws, and therefore, may conflict with local floodplain management strategies.

The Corps is responsible for the P.L. 84-99 inspection and rehabilitation program, repairs damages to eligible flood risk management projects resulting from floods. The Corps requires that participating levee sponsors (districts or communities) maintain their respective levee to a specific standard as established by the Corps. The levee sponsor is responsible for the operation, maintenance, non-flood damage repair, and replacement of its levee. The Corps performs inspections and will notify the sponsor when it is out-of-compliance and makes determinations of whether the sponsor will be eligible to receive flood damage assistance through the P.L. 84-99 program.

Federal and state oversight of locally-owned or non-federally constructed levees was and remains diffuse. While states assist local governments in dealing with federal programs such as FEMA's NFIP and the Corps' P.L. 84-99 program, in many cases, states will not intervene in matters between federal and local governments. Sometimes this is because states had little or no involvement in the processes associated with federal levee programs since federal agencies generally dealt directly with the local organizations responsible for levee operation and maintenance. In other instances, states will try to work as a mediator to reach an agreeable resolution. In addition, decision making about flood fighting is not well coordinated, even though such actions can have hydraulic and environmental consequences elsewhere.

States are responsible for delineating their floodplains, however, the Upper Mississippi River states use different criteria to define floodway limits. The federal government requires a minimum standard of a 1-foot rise. Illinois delineates the floodway based on a 0.1 foot increase in base flood elevation, whereas Minnesota uses a 0.5 foot increase and Iowa and Missouri use a 1 foot increase (i.e., the federal standard). Wisconsin has a zero-rise standard, which means that the floodway is delineated by the effective flow area. Having inconsistent approaches among states becomes an issue whenever a project in the floodway overlays bordering states – i.e., a project in the floodway may be in compliance with one state's regulations while violating an adjoining state's regulations. Any damages resulting from projects in the floodway could trigger civil action between states. In addition, a state with more restrictive criteria than a neighboring state may be at a competitive disadvantage when project sponsors are selecting a project location.

In many instances, the Upper Mississippi River states and local governments have adopted floodplain management regulations that are in addition to the federal standards and thus are supplemental restrictions. Section 2(a)(3) of the federal Executive Order 11988 requires that, for all projects located in the floodplain and involving federal funds, the administering federal agency must notify the impacted state(s) and locally affected areas of the project goals, whether the project meets the respective state(s) and local FPM regulations, and the project alternatives considered. However, the Executive Order does not require the federal agencies to meet the applicable state and/or local FPM regulations. The Upper Mississippi River states assert that federal coordination and compliance with their respective state and local regulations have been inconsistent, although generally improving.

Multijurisdictional Collaboration

There have been various attempts to enhance interagency collaboration, consistency, and preparedness among federal agencies, states, and local governments and levee sponsors. In 1980, the federal government began convening interagency teams following post-disaster events to make recommendations given lessons learned. These teams called Interagency Hazard Mitigations Teams (IHMTs) were led by FEMA's Mitigation Directorate and governed by 44 CFR. However, the

recommendations were rarely implemented and only convene for a short period following a particular disaster. The IHMTs were dissolved in the 2000 Disaster Mitigation Act without any substitute.

The need for interagency collaboration and consultation remained apparent and, ultimately, the FEMA and the Corps formed the “Silver Jacket” concept at a 2005 Regional Interagency Steering committee mitigation subgroup meeting. The Silver Jackets program merged with the National Flood Risk Management Program (NFRMP) following Hurricane Katrina. Their primary purpose is to identify gaps and areas of similarity and to address programmatic needs. While primarily intended to focus on flood risk, the groups have evolved to address hazard mitigation more broadly.

It was the Flood of 1993 that brought flood issues to the forefront. Many policies and planning studies were developed in response to the flood. Following the 1993 flood, UMRBA established a Floodplain Management Task Force that developed position statements on flood recovery, hazard mitigation, pending legislation, the landmark 1994 Galloway Report (formally named the Interagency Floodplain Management Review Committee), and the Corps’ 1995 Floodplain Management Assessment.

The White House commissioned the Interagency Floodplain Management Review Committee to evaluate the major causes and consequences of the 1993 flooding, including the performance of the existing floodplain management and related watershed management programs. The retired Corps General Gerald Galloway was the Committee’s Executive Director at the time. In 1995, the Committee published its recommendations in a report that is now commonly known as “the Galloway Report.” Among a suite of other things, it recommended permanent evacuation of flood prone areas, increased roles of the states in floodplain management, enhanced collaboration among the multiple federal programs, restricted support for flood fighting – i.e., restrict increased level of protection.

UMRBA also worked through its Task Force to develop a 1995 Leveed Floodway MOA, which was signed by the five member states as well as Kansas and Nebraska. However, levee and drainage districts voiced strong concerns with the MOA’s emergency flood fighting provisions and what they viewed as a lack of consultation prior to the document’s signing. This ultimately led some states to withdraw from the MOA and the Board voted to hold the MOA in abeyance in February 1996.

Drought-Related Planning

The Upper Mississippi River Basin has traditionally been known for its abundance of water. Unlike other parts of the nation which struggle with proper water apportionment, this has traditionally not been an area of concern due to the basin’s abundant lakes, rivers, stream, and aquifers. Because of this, many water resources are designated for multiple uses, and rarely do these concurrent uses challenge each other for adequate supply or allocation. Uses include, but are not limited to, water supply, agriculture, recreation, habitat, navigation, manufacturing/industrial, and power generation.

Given the change in weather patterns over the last several decades and a greater understanding of drought, a problem with our traditional planning process starts to emerge. The historical abundance of water relied upon in the Upper Mississippi River may have been taken for granted, and less consideration has been given to what may happen to these potentially competing water uses if the historical quantities of water are no longer available due to a prolonged severe drought.

Traditional drought planning has been focused on changing the characteristics of physical infrastructure, and response efforts have typically resulted in “just in time” actions. Examples of drought response

activities have included emergency dredging and rock removal to ensure navigation remains ongoing, extension of docks to ensure recreation remains, and identification and adjustment of intake and discharge elevations of existing infrastructure. These types of solutions and planning efforts, when compared to the types of actions taken to address flooding and sedimentation, have traditionally been less controversial and are generally accepted.

Given the general lack of public interest related to drought in the Upper Mississippi River basin, it may appear that drought planning is less important than planning for future floods and sedimentation. This is partly because the transition into dry conditions mostly happens gradually as compared to a flood event or storm, and therefore, the onset of drought is easier to overlook. It is also because recent experiences suggest that droughts will be alleviated by precipitation events within a relatively short timeframe.

However, drought-related concerns are often raised when evaluating integrated water resources needs in the river-floodplain and watershed. For example, how will sediment impact the navigation channel and backwaters when flood waters quickly recede? Additionally, does drought impact agricultural productivity to the extent that it affects navigation?

In the United States, drought planning occurs at the national, regional, state, local, and tribal levels. In general, national policymakers allocate resources for drought response and planning. States are responsible for water and resource management. And local entities make decisions about land and water resource use and develop drought plans based on specific conditions and circumstances present in their unique areas. Local entities include tribal nations, regional planning commissions, municipalities, and water suppliers.

Drought planning typically involves a vulnerability assessment, development of actions to mitigate impacts, and public education about the local water supply and drought vulnerability. Effective plans include “early warning systems” to initiate response or mitigate actions in the event of a drought. An early warning system may include monitoring current conditions (e.g., reservoir and river levels) and implementing water restrictions when a community’s water supply reaches a certain level. Early warning systems may also include utilizing precipitation and/or drought forecasts extending a few weeks or months into the future.

The Upper Mississippi River states have, or are in various stages of developing, state-wide drought plans. These planning efforts often include descriptors of drought condition and an inventory of societal and economic sectors impacted by drought. However, much of the planning to-date has been internal within states. There is not a good understanding of how droughts in the watershed may influence low water events in the river floodplain nor is there an overarching plan for managing longer duration drought events in the Upper Mississippi River.