US Army Corps
of Engineers ®
Kansas City District

MISSOURI RIVER RECOVERY PROGRAM
PROJECT IMPLEMENTATION REPORT
With Integrated Environmental Assessment
And Section 404(b)(1)Evaluation

Jameson Island Unit Shallow Water Habitat Restoration Project
On the U.S. Fish & Wildlife Service's
Jameson Island Unit–Big Muddy National Fish & Wildlife Refuge

Right Bank, Missouri River - River Miles 210.5 to 211.7
Saline County, Missouri

March 2012

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DEPARTMENT OF THE ARMY
KANSAS CITY DISTRICT, CORPS OF ENGINEERS
700 FEDERAL BUILDING
KANSAS CITY, MISSOURI 64106-2896

Reply to
Attention of:

(DRAFT)
FINDING OF NO SIGNIFICANT IMPACT

Missouri River Recovery Program - Project Implementation Report
With Integrated Environmental Assessment And Section 404(b)(1) Evaluation

Jameson Island Unit Shallow Water Habitat Restoration Project

On the U.S. Fish and Wildlife Service's
Jameson Island Unit - Big Muddy National Fish and Wildlife Refuge

Project Summary

The Jameson Island Unit Shallow Water Habitat (SWH) Restoration Project is a component of the Corps' overall Missouri River Recovery Program. The Corps is working cooperatively with the U.S. Fish and Wildlife Service – Big Muddy National Fish and Wildlife Refuge on their existing public land to mitigate a portion of the diverse aquatic habitat that was lost as the result of the construction of the Corps' Missouri River Bank Stabilization and Navigation Project by restoring SWH through construction of a side channel chute and a backwater. The project is located on the Refuge's Jameson Island Unit, on the right descending bank of the Missouri River, near river miles 210.5 to 211.7, near the town of Arrow Rock, Saline County, Missouri. Shallow water habitat restoration at this site will not only assist in meeting the fish and wildlife habitat mitigation goals of the Corps' Missouri River Bank Stabilization and Navigation Fish and Wildlife Mitigation Project (Mitigation Project) but also contribute towards the SWH acreage metrics of the U.S. Fish and Wildlife Service's 2003 Amendment to the 2000 Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project (BSNP), and Operation of the Kansas River Reservoir System (Bi-Op). The Corps estimates that in Missouri alone, between 1912-2003, as a result of the BSNP, 55,800 acres of aquatic habitat and 27,700 acres of terrestrial habitat had been lost in the natural channel, with an additional 221,400 acres of terrestrial habitat within the meander belt. This loss of habitat has led to serious declines in native fish and wildlife populations. The project would restore 30 acres of SWH (27-acre chute and 3-acre backwater) and the dynamic river processes which maintain it for the benefit native fish and wildlife species, including the endangered pallid sturgeon. The project has been developed to maintain the existing Congressionally authorized project purposes of the Missouri River.

Alternatives

In addition to the "No Action" Alternative three "Build Alternatives" were considered for restoration of SWH on the Jameson Island Unit: Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75-foot-wide Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area; Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area; Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100-foot-wide Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan). The Alternatives are described in detail in the Environmental Assessment.

Recommended Plan

The Recommended Plan (Alternative 4) would extend the existing chute approximately 1 mile to the west where another outlet to the Missouri River would be constructed. The existing chute outlet would be diverted with a closure structure constructed with approximately 25,000 tons of clean rock riprap to +5 CRP. The area between the diversion and the river would serve as backwater habitat. Initially, a 200-foot-wide chute alignment would be cleared and grubbed using heavy construction equipment with woody vegetation and 3 to 4 feet of earthen material stockpiled on the outer limits of the cleared zone to facilitate dredge access. Next, to create the chute, approximately 420,812 cubic yards of earthen material would be removed using a hydraulic dredge. This would create a 100-foot-wide channel. Dredged earthen material would be pumped as slurry mixture of water and sediment and placed into the Missouri River in a location and manner that it would be integrated into the existing bedload. Through time and dependant on river levels the chute would be expected to widen and deepen and approximately 546,580 cubic yards of additional earthen material would be integrated through natural river processes into the Missouri River bedload. This process would continue until a balance of flow and chute width is reached as limited by flow control structures, and flow of sediment in versus out would be approximately balanced. Woody debris entering the river as the channel widened and meandered would provide additional fish and wildlife habitat. This would result in approximately 16.77 acres of SWH (13.77-acre chute and a 3-acre backwater) at completion of construction which would eventually be expected to develop through natural river processes to approximately 30 acres of SWH (27-acre chute and a 3-acre backwater).

Summary of Environmental Impacts

The Recommended Plan would require the clearing of approximately 34.4 acres of riparian timber. Cleared timber would be placed in a manner that it would eventually be incorporated into the aquatic habitat of the river. In addition, the project is estimated to impact a total of 5.00 acres of wetlands at completion of construction based on National Wetlands Inventory maps. This would include: 2.25 acres of freshwater emergent wetland; 1.84 acres of freshwater forested/shrub wetland; and 0.89 acre of freshwater

pond. At full chute development that area would be expected to extend to a total of 8.9 acres of wetland (3.74 acres freshwater emergent marsh, 3.45 acres freshwater forested/shrub wetland, 1.75 acres freshwater pond). Approximately 27 acres of the 34.4 acres cleared would be expected to develop into SWH. These adverse impacts would be long term minor but greatly outweighed by the long term environmental benefits associated with restoring the SWH and the natural river processes of erosion, cutting, filling and meandering along the length of the chute. These natural processes form backwaters, sandbars, side channels and wetlands on the floodplain. In addition, there would be noise and visual disturbance which could affect fish and wildlife resources and recreational users of the refuge. These impacts would be considered minor short term and related to the actual construction activity. While clearing of vegetation and initial construction may appear aesthetically unappealing, the subsequent natural development of the SWH/chute would provide a more natural and aesthetically appealing feature. These minor adverse aesthetic impacts would be greatest during and immediately after construction and expected to decrease over time dependant on river flows. While Missouri River sediment with associated nutrients would be remobilized during and after construction, site specific and system wide monitoring of this and similar SWH projects in the MRRP indentified no significant adverse impacts to water quality, aquatic habitat, dependant life forms, or socio-economic resources.

Mitigation Measures

As described above, clearing of riparian timber and conversion of wetlands to SWH would result in long term minor adverse impacts to those particular ecosystem components. In addition there are several short term minor adverse construction related impacts on fish and wildlife resources and recreational users of the refuge. These minor long term adverse impacts and minor short term adverse construction related impacts would be greatly outweighed by the long term environmental benefits of the project. Therefore no additional mitigation efforts are warranted or proposed. Best management practices would be utilized during construction to prevent any avoidable impacts to the aquatic ecosystem. Construction access for heavy equipment would be completed via floating plant to avoid adverse impacts to adjacent areas.

Public Availability

The proposed project was circulated to the public and resource agencies through a Public Notice, Number 2011-1602, dated March 30, 2012, with a thirty-day comment period ending on April 29, 2012. The notice was mailed to adjacent landowners, state and Federal resource agencies and other interested parties. In addition, the Public Notice was available for public/agency review and comment on the Corps Kansas City District Regulatory Branch web page, at: http://www.nwk.usace.army.mil/regulatory/CurrentPN/currentnotices.htm. In addition, the Corps held a Public Meeting during the public availability period to provide information on the proposed project and the Project Implementation Report. This meeting was held on April 17, 2012, from 6:00-8:00 pm at the Arrow Rock State Historic Site Visitor Center in Arrow Rock, Missouri.

Conclusion

In conclusion, while each of the three "Build Alternatives" considered would eventually result in the creation of 30 acres of SWH, Alternative 4 is recommended because it fulfills all of the program and site-specific goals for the Jameson Island Unit SWH Restoration Project, represents the least environmentally damaging practicable alternative, maximizes environmental benefits, avoids impacts to existing wetlands and riparian timber to the maximum extent practicable, has the least adverse impact on fish and wildlife, has the lowest cost, and results in no significant adverse impacts to the environment. The "No Action" alternative was not recommended because it fulfills none of the project objectives. The Recommended Plan is consistent with the Corps' responsibility to mitigate fish and wildlife habitat losses and the SWH restoration objectives of the Mitigation Project. The Recommended Plan also contributes towards meeting SWH acreage goals outlined in the Bi-Op.

The Corps prepared a *Feasibility Report and Environmental Impact Statement* in 1981 on the original Mitigation Project of 48,100 acres. After Congress modified the Mitigation Project by WRDA99, the Corps initiated a *Supplemental Environmental Impact Statement* (SEIS) in September 2001 for the additional 118,650 acres and including the restoration of 7,000 to 20,000 acres of SWH. The SEIS was completed in early 2003 and the *Record* of *Decision* (ROD) was signed in June 2003. Site specific fish and wildlife mitigation projects completed by the Corps of Engineers under authorization of the WRDA 86/99, generally do not require the preparation of an Environmental Impact Statement. These projects are designed to result in positive biological output and, therefore, also typically have a beneficial social and economic impact. Additionally, the adverse effects of these projects are primarily minor short-term construction related and greatly offset by the environmental benefits of the project.

After evaluating the anticipated environmental, economic, and social effects as described in the Environmental Assessment, I have determined that the Recommended Plan (Alternative 4) for the Missouri River Recovery Program - Jameson Island Unit SWH Restoration Project does not constitute a major Federal action that would significantly affect the quality of the human environment; and therefore, preparation of an Environmental Impact Statement is not required. In addition, I have determined that the Recommended Plan is in full compliance with the requirements of the Clean Water Act Section 404(b)(1) Guidelines.

DRAFT

TO BE SIGNED, IF APPROPRIATE, AFTER 30-DAY AVAILABILITY PERIOD

_____
DATE

Anthony J. Hofmann
Colonel, Corps of Engineers
District Commander

DEPARTMENT OF THE ARMY
KANSAS CITY DISTRICT, CORPS OF ENGINEERS
700 FEDERAL BUILDING
KANSAS CITY, MISSOURI 64106-2896

EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers, Kansas City District (Corps) is constructing the Missouri River Bank Stabilization and Navigation Fish and Wildlife Mitigation Project (Mitigation Project) under authorization of the Water Resources Development Acts (WRDA) of 1986 and 1999. The project purpose is to mitigate fish and wildlife habitat losses which resulted from the construction of the Corps' Missouri River Bank Stabilization and Navigation Project (BSNP). In addition, the U.S. Fish and Wildlife Service's (USFWS) 2003 Amendment to the 2000 Biological Opinion (Bi-Op) on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System calls for the Corps to establish SWH for the Federally listed endangered pallid sturgeon on the Missouri River. Mitigation Project and Bi-Op compliance activities are components of the Corps' overall Missouri River Recovery Program (MRRP), authorized in WRDA 2007. The proposed SWH restoration project on the Jameson Island Unit is consistent with the above project authorizations and Bi-Op goals.

The Corps proposes to restore additional SWH on the USFWS' Jameson Island Unit – Big Muddy National Fish and Wildlife Refuge by extending the existing Jameson Island Chute approximately 1 mile to the west where another outlet to the Missouri River would be constructed. The existing chute outlet would be diverted with a closure structure constructed with approximately 25,000 tons of clean rock riprap to +5 Construction Reference Plane. The area between the diversion and the river would serve as backwater habitat. Initially, the chute alignment would be cleared using heavy construction equipment with woody vegetation and 3 to 4 feet of earthen material stockpiled on the outer limits of the cleared zone to facilitate dredge access. Next, approximately 420,812 cubic yards of the remaining earthen material would be removed using a hydraulic dredge. This would create a 100-foot-wide chute. Dredged earthen material would be pumped as slurry mixture of water and sediment and placed into the Missouri River in a location and manner that it would be integrated into the existing bedload. Through time and dependant on river levels the chute would be expected to widen and deepen and approximately 546,580 cubic yards of additional earthen material would be integrated through natural river processes into the Missouri River bedload. This process would continue until a balance of flow and chute width is reached as limited by flow control structures, and flow of sediment in versus out would be approximately balanced. Stockpiled woody debris and standing trees entering the river as the channel widened and meandered would provide additional fish and wildlife habitat benefits. The project would result in approximately 16.77 acres of SWH (13.77-acre chute and a 3-acre backwater) at completion of construction which would eventually be expected to develop through natural river processes to approximately 30 acres of SWH (27-acre chute and a 3-acre backwater).

The Corps would be responsible for the long-term operation and maintenance of the project. The project is located right descending bank of the Missouri River, between river miles 210.5 and 211.7, on the Jameson Island Unit of the U.S. Fish and Wildlife Service - Big Muddy National Fish and Wildlife Refuge, in Sections 30 and 31, Township 50 North, Range 18 West, near the town of Arrow Rock, Saline County, Missouri.

The following Project Implementation Report with Integrated Environmental Assessment and Section 404(b)(1) Evaluation describes alternatives considered and the effects of the project. Considering all information related to the project, no significant impacts to the human environment are expected to result from the proposed SWH restoration project. The Project Implementation Report with Integrated Environmental Assessment and Section 404(b)(1) Evaluation is available for public review for 30 days from the date of this notice, March 23, 2012. Provided no substantive issues are identified, the documents would be finalized and the Finding of No Significant Impact would be approved by the District Commander.

The Corps will hold a public meeting to provide information on the proposed project on April 17, 2012, from 6:00 p.m. to 8:00 p.m. at the Arrow Rock State Historic Site Visitor Center, Arrow Rock, Missouri.

Additional information concerning this project or the upcoming public meeting may be obtained from Zachary L. White P.E., Project Manager, Jameson Island Unit Shallow Water Habitat Restoration Project, Missouri River Recovery Program, by writing the above address, by e-mail at zachary.l.white@usace.army.mil, or by telephone at 816-389-3019.

Missouri River Recovery Program - Project Implementation Report
With Integrated Environmental Assessment And Section 404(b)(1) Evaluation

Jameson Island Unit Shallow Water Habitat Restoration Project

On the U.S. Fish and Wildlife Service's
Jameson Island Unit - Big Muddy National Fish and Wildlife Refuge

Outline

(DRAFT) FINDING OF NO SIGNIFICANT IMPACT (FONSI)

FIGURES

TABLES

APPENDICES

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Chapter 1 – Introduction – Project History

The original Jameson Island Chute Construction Project was described in a Project Implementation Report (PIR) with Integrated Environmental Assessment (EA) dated March 2006. The selected alternative in that report was the construction of a 9,630-foot-long chute to create SWH and provide additional connectivity with the Missouri River. Current photos of that project are shown on the cover of this report and included in Appendix I – Enclosure 1. These photos show the tight bends of the Missouri River transected in the upper part of the photo by the Lisbon Chute formed by the 1993 Flood and in the center part of the photo by the original Jameson Island Chute Construction Project. This chapter provides a brief history of the original project and the controversy that surrounded it. Although in 2007 Corps construction was halted, natural river processes since that time have removed the remaining half of material needed to fully complete the chute. The original Jameson Island Chute exhibits good sinuosity, has incorporated a large amount of woody debris, and is exhibiting the meandering characteristics of cutting banks and expanding sandbars. That dynamic process and the habitat it creates is critical to the fish and wildlife resources of the Missouri River. That dynamic process and the resulting habitat were largely eliminated by construction of the Corps' Missouri River Bank Stabilization and Navigation Project. The original Jameson Island Chute Project's fish and wildlife habitat goals have been achieved, sediment was incorporated into the active Missouri River bedload through the natural river processes of the Missouri River and no major adverse environmental impacts have been observed or documented. The following provides a brief history of the original Jameson Island Chute Construction Project.

In December 2006, the Corps began construction of a side channel chute at the Jameson Island Unit to re-create SWH to benefit the endangered pallid sturgeon and other native fish and wildlife species. The chute, when completed, would be approximately 9,630 feet long, 100-feet wide; and approximately 5-feet deep during average August flows. The rock control structures for the project were sized to allow the constructed pilot channel to develop naturally through river processes from the constructed 22.5 acres of SWH to roughly 44 acres of SWH as the chute reached its desired ultimate width.

During the initial construction, sediment was being excavated from the chute with scrapers, track hoes and trucks, and was being deposited back into the Missouri River. These construction methods caused concerns from the Howard County Levee Districts located across the river from the site. Levee district members were concerned that material from the chute would increase the elevation of the river bottom causing floods to get higher, and were also concerned that the chute would force more water onto their levee due to the sharp turn in the alignment. To address these concerns, the Corps began monitoring the bottom of the river and constructed a scale physical model of the chute to view flow patterns and potential effects on the area levees. The physical model and repeat surveys showed no impacts to area levees or river bottom elevations. In addition, the levee district asked the Corps if the planned chute outlet could be angled downstream or if the chute itself could be extended with the outlet located further downstream.

In April 2007 the Missouri Clean Water Commission (MCWC) began raising additional concerns about the project related to water quality, Gulf hypoxia and what they considered to be a "permitting double standard". MCWC took the position that placement of soil from Corps' SWH project construction, along with the nutrients associated with that soil, was travelling down the Missouri River, down the Mississippi River into the Gulf of Mexico and directly contributing to Gulf hypoxia. Gulf hypoxia is a condition that occurs in the Gulf of Mexico when increased nutrients, primarily nitrogen and phosphorus, promote abnormally high levels of algal growth in the Gulf. As dead algae decompose, oxygen is consumed in the process, resulting in low levels of dissolved oxygen in the water. The resulting low dissolved oxygen levels inhibit animal life to the point where a large area of the Gulf is devoid of animal life. This large area devoid of animal life is often referred to as the "dead zone". MCWC also took the position that there was "double standard" in permitting requirements under Section 402 of the Clean Water Act as developers were required to implement erosion control measures that prevent storm water construction site runoff from washing soil into adjacent waterways while the Corps was actually placing a large amount of sediment directly into the Missouri River. MCWC noted that developers are often fined heavily for violations of these requirements.

Construction was temporarily halted in May 2007 due to flooding. When construction resumed in late June 2007 the contract had been modified to provide for temporary sediment disposal on the bank. This was in response to a MCWC's request that the contractor stop placing material in the river "until such time as the Corps could prove this activity has no adverse affect on the water quality of Missouri". In response to this request, the Corps, in coordination with the Missouri Department of Natural Resources (MDNR), initiated a soil and water testing program at the site. Test results showed that no contaminants or nutrients were found that would cause an exceedance of State water quality standards or other adverse impacts to water quality in the Missouri River.

In a letter dated September 13, 2007 (Appendix I – Enclosure 2) the MDNR transmitted the MCWC order of September 12, 2007, "that all sediment of all habitat restoration projects excavated or designed to erode shall be placed on land with such a design that it will not enter the waters of Missouri now or in the future."

In October 2007, the Corps halted construction of SWH in Missouri to allow completion of an independent science review of issues regarding sediment from these activities raised by the MCWC. In an Amended Order dated March 12, 2008 (Appendix I – Enclosure 3) the MCWC expanded its September 2007 Order and directed that the Corps, "shall, for all Missouri River shallow water habitat construction projects, put to beneficial reuse consistent with this Amended Order or place on land in accordance with an individual permit or certification for each specific site, all topsoil and excavated sediments. No sediment or topsoil disturbed by construction activities at said projects shall enter the waters of Missouri now or in the future, except in *de minimis* amounts related to normal construction and operation as provided in the applicable approvals by the Missouri Department of Natural Resources." Although the Corps had planned to

finish the original Jameson Island Chute Project by dredging, following these additional MCWC orders, the Contractor's work on the site was suspended and eventually terminated by the government in November 2007. Of the original planned excavation, roughly 30% was reintroduced to the river prior to April 2007 per the original plans, and another 20% was temporarily stockpiled on the bank between June and September 2007. A dredge was mobilized to the site but was never used for excavation.

While the MCWC has contended that their orders did not prevent the Corps from constructing SWH, the Corps has maintained the position that the conditions contained in the MCWC orders, effectively denied the Corps ability to construct SWH in Missouri. Constructing a chute project where both banks were completely stabilized would not meet the Corps project objective to re-establish and maintain the dynamic river processes that naturally create and maintain diverse riverine habitat. In an attempt to address MCWC concerns the Corps, seeking an independent and unbiased evaluation, enlisted the National Academies to evaluate and report on the role of sediment management in the Missouri River. The National Academies is a private, non-profit, self perpetuating society of distinguished scholars, chartered by Congress, who advise the federal government on scientific and technical matters. The Corps specifically asked the National Academies to address:

- the roles of Missouri River sediment in river ecology and restoration, and its implications for water quality and coastal restoration downstream in the northern Gulf of Mexico;
- environmental and economic considerations regarding nutrient and contaminant loadings;
- alternatives for reintroducing sediment into the system; and
- current Corps of Engineers restoration actions as they relate to sediment and nutrients, and how they might be improved.

The National Academies issued their study in 2011. In January 2011, four Federal agencies (Corps, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service and the National Park Service) completed a position statement (Appendix I – Enclosure 4) related to creation of SWH downstream of Gavins Point Dam. In that position statement the four signatory federal agencies stated their support for creation of SWH in furtherance of the requirements to mitigate habitat losses, as specified by the Bi-Op, and in accordance with their respective statutory responsibilities. The Federal agencies recognized the importance of receiving-water characteristics (i.e., the natural, chemical and physical condition of each specific waterbody and the associated water quality requirements of its resident aquatic life) in relation to the Clean Water Act. In creating SWH, and specifically at sites where sediment contribution to the Missouri River is likely, the four signatory federal agencies agreed to: continue to ensure decisions are formulated to enhance and protect native species, aquatic life, and designated beneficial uses.; monitor representative SWH sites to answer key questions such as effects and or benefits of SWH creation on water quality and primary productivity; and finally to continue to implement project activities in compliance with all laws. In addition, the Corps agreed to implement recommendations provided in the report by the National

Academies for improved sediment management and adaptive processes in association with the Missouri River Recovery Program, including SWH creation projects.

The intentional introduction and or erosion of sediment by the Corps to create SWH has lead to an impasse with the MCWC. The Corps has voluntarily taken several steps to address these concerns. However, the issue remains unresolved and construction funding for Missouri from FY 2008, FY 2009, FY 2010, and FY2011 was shifted to the states of Kansas, Iowa, and Nebraska. By 2011 the original Jameson Island Chute Construction Project had developed through natural river processes to the point that the Corps determined that the final rock grade control structure needed to be installed in order to avoid diverting too much river flow into the chute which could have adverse impacts on the navigation channel. Construction of the grade control structure would involve placement of clean rock riprap near the upstream end of the project and minor shaping and grading below the ordinary high water mark to facilitate rock placement. No clearing or grubbing was required. All work was to be accomplished from a floating plant. The Corps maintained that this effort was consistent with the MCWC orders and the Corps coordinated the activity with State and Federal natural resource management agencies and the Howard County Levee Districts prior to construction. Construction of the grade control structure was initiated in the fall of 2011 but was suspended by the Corps just prior to completion when the Corps diverted the construction crew to address flood damage on a Federal levee unit. Final work on the grade control structure is expected to be completed in 2012.

The original/existing Jameson Island Unit Chute Construction Project was evaluated in a PIR/EA completed by the Corps in March 2006. Since that time, additional opportunities to restore SWH have been identified on the Jameson Island Unit. This PIR evaluates the environmental impacts associated with increasing the amount of SWH on the Jameson Island Unit and provides information on the site specific and programmatic water quality monitoring efforts the Corps employs to ensure that SWH restoration projects completed as part of the MRRP are in full compliance with requirements of the Clean Water Act.

1.1 Purpose of Report and Scope

The purpose of this PIR is to evaluate alternatives to restore additional SWH on the Jameson Island Unit of the U.S. Fish and Wildlife Service's (USFWS) Big Muddy National Fish and Wildlife Refuge as part of the U.S. Army Corps of Engineers' (Corps) Missouri River Bank Stabilization and Navigation Fish and Wildlife Mitigation Project (Mitigation Project) and in accordance with goals outlined in the USFWS's 2003 Amendment to the 2000 Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System (Bi-Op). The Recommended Plan described in this PIR includes site specific measures that would be used to implement the Selected Alternative described in the Corps' 1981 *Feasibility Report and Environmental Impact Statement* in 1981 on the

original Mitigation Project and the 2003 *Supplemental Environmental Impact Statement* (SEIS) on the Mitigation Project as modified by WRDA99.

The Mitigation Project was authorized by the Water Resources Development Acts of 1986 and 1999 (WRDA86 and WRDA99) to develop 166,750 acres of fish and wildlife habitat along the lower 735 miles of the Missouri River from Sioux City, Iowa, to the mouth near St. Louis, Missouri, to mitigate for the loss of habitat that resulted from construction, operation, and maintenance of the Missouri River Bank Stabilization and Navigation Project (BSNP). This included the restoration of 7,000 to 20,000 acres of SWH.

The Jameson Island Unit of the Big Muddy National Fish and Wildlife Refuge was purchased by the USFWS in fee title from willing sellers between 1995 and 1997 for the purpose of preserving and restoring portions of the Missouri River floodplain and its fish and wildlife habitat. This Project Implementation Report (PIR) includes an Environmental Assessment (EA) consistent with the National Environmental Policy Act (NEPA). It provides an analysis of alternatives and a detailed description of the Recommended Plan for restoration of SWH at the Jameson Island Unit of the Big Muddy National Fish and Wildlife Refuge. This PIR also contains an evaluation of environmental impacts related to the development of SWH consistent with the requirements of pertinent Federal regulations including NEPA, the Endangered Species Act (ESA), the National Historic Preservation Act (NHPA), and Section 404 of the Clean Water Act (CWA).

The project site is ideal for restoration of SWH being located on the 1,871-acre Jameson Island Unit of the USFWS' Big Muddy Fish and Wildlife Refuge, located just downstream from the Refuge's 2,013-acre Lisbon Bottom Unit and chute. These Units form a substantial tract of natural riverine habitat whose geomorphology reflects the past function of the river's meander belt. Restoration of natural river habitat and functions in this section of the river will greatly improve the sustainability of the river's native fish populations and associated aquatic organisms. Reconnection of the channel to its floodplain and the creation of diverse shallow water habitat conditions are critical to the chemical, physical and biological integrity of the lower Missouri River and are consistent with the objectives of the Clean Water Act.

The scope of this study is confined to the project area shown on Figure 1. As terrestrial habitat restoration has been completed at this site by USFWS under their refuge authority, alternatives considered in this study were limited to those measures that would restore SWH on the acres currently owned by USFWS at the project site. A supplement to this PIR would be needed if additional acres were proposed for SWH development. All permanent project features would be constructed on government-owned land.

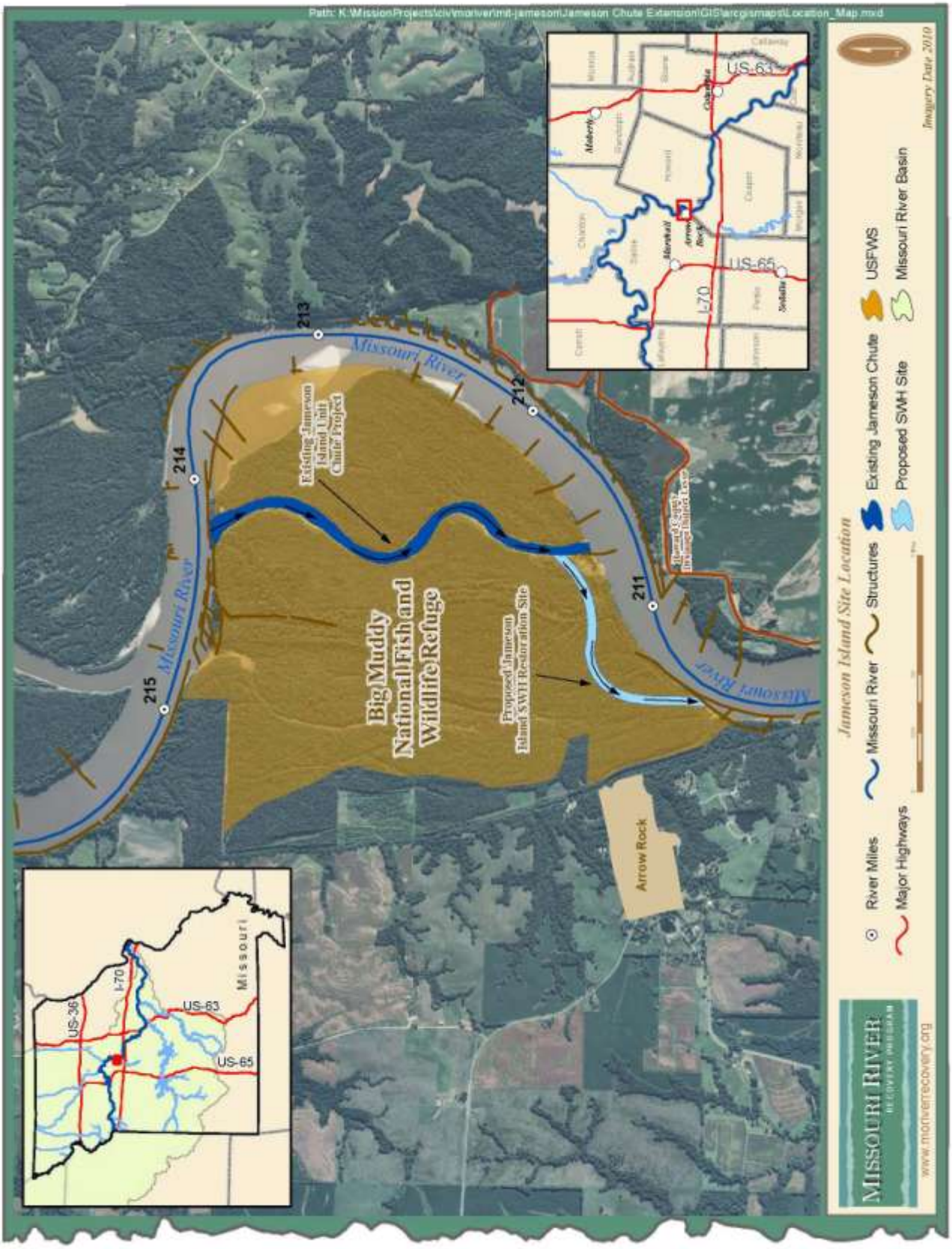

Figure 1. - Location Map - Jameson Island Unit SWH Restoration Project

1.2 Project Authority

The Jameson Island Unit was acquired from willing sellers by the USFWS as part of their Big Muddy National Fish and Wildlife Refuge. The Corps, working on these existing public lands in cooperation with USFWS, proposes to restore SWH on the site as part of the Mitigation Project and to achieve compliance with the goals established in the Bi-Op. The Mitigation Project was initially authorized in Section 601(a) of WRDA86 (Public Law 99-662). The authorization included the acquisition and development of 29,900 acres of land, and habitat development on an additional 18,200 acres of existing public land in the states of Iowa, Kansas, Missouri, and Nebraska. The total amount of land authorized for mitigation by WRDA86 was 48,100 acres. Section 334(a) of WRDA99 (Public Law 106-3) modified the Mitigation Project by increasing the amount of acreage to be acquired and/or mitigated by 118,650 acres and including the restoration of 7,000 to 20,000 acres of SWH. Therefore, the total amount of land authorized for mitigation is currently 166,750 acres. The Corps prepared a *Feasibility Report and Environmental Impact Statement* in 1981 on the original Mitigation Project of 48,100 acres. After Congress modified the Mitigation Project by WRDA99, the Corps initiated a *Supplemental Environmental Impact Statement* (2003 SEIS) in September 2001 for the additional 118,650 acres and including the restoration of 7,000 to 20,000 acres of SWH. The SEIS was completed in early 2003 and the *Record* of *Decision* (ROD) was signed in June 2003.

1.3 Project Description and Location

The proposed project would develop SWH on the Jameson Island Unit. Habitat development activities would include creating a chute with shallow water areas for native big river fish including the endangered pallid sturgeon. The proposed project is described in more detail in Chapter 2 of this report. The Jameson Island Unit is a 1, 871 acre rural area located just east of Arrow Rock, Missouri. The area is approximately 100 miles east of Kansas City, Missouri, located within Saline County, Missouri and is adjacent to the right descending bank of the Missouri River, at river miles 210.5 to 211.7. The project is located Sections 30 and 31, Township 50 North, Range 18 West, near the town of Arrow Rock, Saline County, Missouri (Figure 1). The riverbank opposite the proposed project is located in Howard County, Missouri with the nearest town being Petersburg. Between 1995 and 1997, the Jameson Island Unit was purchased from willing sellers by the USFWS to manage as part of the Big Muddy National Fish and Wildlife Refuge. The USFWS has implemented low maintenance operation plans for the area to let the land recover to natural conditions on its own. Development of the Jameson Island Unit SWH Restoration Project is the responsibility of the Kansas City District of the Corps. The Reaffirmation Report (Corps 1990) established that for the Mitigation Project, the Corps' Kansas City District would have responsibility for projects in Missouri and Kansas and the Omaha District would have responsibility for projects in Iowa and Nebraska.

1.4 Site Selection

The Mitigation Project authorizes the Corps to construct fish and wildlife habitat on 166,750 acres of fee lands acquired from willing sellers or existing public lands along the Missouri River from river mile 735 to river mile 0 in Iowa, Nebraska, Kansas and Missouri. The Jameson Island Unit SWH Restoration Project is consistent with the existing authority, it is located on existing public lands along the Missouri River in the State of Missouri. In Missouri, Mitigation Project goals are to acquire 104,741 acres of land and using an equal distribution of SWH/river mile, create 11,680 acres of SWH. Currently, mitigation project and SWH restoration goals have not been met in Missouri. The Jameson Island Unit and Lisbon Island Unit, located immediately upstream, are both owned and managed by USFWS as part of their Big Muddy NFWR. The Big Muddy NFWR consists of more than 16,700 acres of land along the Missouri River between Kansas City and St. Louis, Missouri. The Refuge was created in 1994 for the development, advancement, management, conservation and protection of fish and wildlife resources. The Refuge's authorized boundary includes up to 60,000 acres of floodplains and adjacent lands on the lower Missouri River. Several pallid sturgeon have been captured in this reach of the river. The presence of these two large tracts of natural riparian habitat along with the dynamic aquatic habitat associated with the two existing chutes provides an ideal location to further develop SWH.

Chapter 2 – Project Goals and Objectives

2.1 Problem and Opportunities / Purpose and Need for Action

As described in the 2003 SEIS, the need for the restoration of fish and wildlife habitat on the Missouri River can be found in the loss of over one-half million acres of terrestrial and aquatic habitat of the historic floodplain ecosystem which is today represented by minor fragments of this once diverse, vast, and unique ecological resource. The primary projects which created this loss of fish and wildlife habitat were the Corps' Missouri River Bank Stabilization and Navigation Project and the Corps' Missouri River Mainstem Reservoir system. These projects have provided, and continue to provide immense social and economic benefits but the associated decrease in the quantity and quality of natural habitat has greatly reduced fish and wildlife resources. The 2003 SEIS estimated that between 1912-2003, as a result of the BSNP, in Missouri alone 55,800 acres of aquatic habitat and 27,700 acres of terrestrial habitat had been lost in the natural channel, with an additional 221,400 acres of terrestrial habitat within the meander belt. Total habitat losses in Missouri were estimated at 304,900 acres. Considering that the estimated habitat losses for the four states (MO/IA/KS/NE) totaled approximately 522,000 it is clear to see that Missouri bore the brunt of fish and wildlife habitat losses as a result of the Corps projects.

The alternative selected in the 2003 SEIS also specifically identified the restoration of between a minimum of 7,000 acres to a maximum of 20,000 acres of SWH. These acres were identified to mitigate impacts of the BSNP and to meet goals related to the Federally listed endangered pallid sturgeon outlined in the Bi-Op.

Per a June 2009 letter amendment to the Bi-Op, the USFWS clarified that SWH includes side channels, backwaters, depositional sandbars detached from the bank, and low-lying depositional areas adjacent to shorelines. Key components of SWH are their dynamic nature with depositional and erosive areas, predominance of shallow depths intermixed with deeper holes and secondary side channels, lower velocities and higher water temperatures than main-channel habitats. This provided additional information from the previous definition which specified areas less than 5 feet deep and 2 feet per second velocity in August.

Bi-Op goals for creating SWH are 5,870 acres by 2010, 11,739 acres by 2015 and 20,000 acres by 2020 between Sioux City, IA, and St. Louis, MO. These dates were extended up to four years in 2009 due to work on Yellowstone Intake in Montana. In addition, existing SWH must be preserved.

SWH is meant to provide habitat important to both pallid sturgeon and fish species native to the Missouri River. For pallid sturgeon, SWH provides nursery habitat for larval and juvenile sturgeon, and food for juvenile and adult sturgeon (USFWS 2003); SWH is not intended to provide spawning habitat for pallids. For native fish, SWH provides increased diversity of aquatic habitat and production of food resources.

2.2 Project Goals and Objectives

The specific goals for the Jameson Island Unit SWH Restoration Project were developed to contribute to meeting the overall Mitigation Project authorization and to maximize habitat potential for the site. The Corps and USFWS identified these site-specific goals and objectives during project formulation, discussions between the two agencies, and in the field observations of site conditions. The site specific goals identified include:

1) Create a more diverse riverine habitat to benefit native fish and wildlife resources, including the endangered pallid sturgeon, and mitigate habitat losses resulting from the BSNP; and

2) re-establish and maintain the dynamic river processes that naturally create and maintain this diverse riverine habitat; and

3) meet SWH goals outlined in the Bi-Op .

The overall goal for the Jameson Island Unit SWH Restoration Project, as a component of the Mitigation Project, is to develop fish and wildlife habitat.

Beginning shortly after authorization by WRDA86, the Agency Coordination Team (ACT, discussed in more detail in Section 2.6) has been involved in Mitigation Project guidance and has helped establish overall objectives to:

- Maximize aquatic and terrestrial habitat and species diversity;
- Reconnect the river to the floodplain, and;
- Develop each site to optimize habitat conditions for that individual site.

2.3 Constraints

Fish and wildlife habitat restoration projects completed by the Corps as part of the MRRP must be developed and operated within numerous constraints.

Missouri River Authorized Purposes: Projects completed as part of the MRRP must be consistent with the currently authorized purposes of the Missouri River Mainstem Reservoir System and the BSNP. For the Mainstem Reservoir System these include: Flood Control, Hydropower, Navigation, Water Supply, Water Quality, Irrigation, Recreation, and Fish and Wildlife. For the BSNP these include: Bank Stabilization and Navigation.

Cultural/Tribal Resources: The Corps' BSNP resulted in the preservation in place of hundreds of historic shipwrecks along the Missouri River. The condition of these shipwrecks varies widely from just remnants of the hull to those that are completely preserved intact with their cargo like the Bertrand and the Arabia. As the Corps develops SWH restoration projects careful consideration is given to mapped shipwreck locations found in the historic record. Alignments are developed to avoid mapped locations and field surveys are made to try and identify any existing buried shipwrecks prior to construction. The Corps is committed to avoiding impacts to historic shipwrecks and is prepared to implement measures which avoid and/or preserve in place historic shipwrecks if they are inadvertently discovered during construction. In addition, during project planning the Corps consults with the State Historic Preservation Office and Tribes to ensure that every effort is made to avoid impacts to any known cultural/Tribal resource found in or adjacent to the project area.

Private Land: The Corps must develop SWH projects in a manner that does not increase erosion on adjacent private lands or reduce the effectiveness of existing flood risk management systems.

Public Infrastructure: The Corps must implement the Mitigation Project in a manner that does not adversely impact public roads, bridges, levee and drainage systems, sewer lines, drinking water intakes, etc.

Operation and Maintenance (O&M) Costs: The Corps must develop SWH restoration projects in a manner that is both environmentally and economically sustainable. Every effort must be made to ensure that these projects are as self maintaining and sustainable as possible and that project designs ensure that potential long term O&M costs are avoided and/or minimized.

Real Estate: The Corps must implement the Mitigation Project on existing public lands or on lands that are acquired from willing sellers.

Constraints specific to this project which were identified early in the planning process include the adjacent navigation channel, O&M costs, the non-Federal levee system located on the opposite bank, private property located on the opposite bank, the Arrow Rock National Historic Landmark and several sunken shipwrecks mapped on the western edge of the project area.

2.4 Resource Significance

The importance of the Missouri River has been well documented in numerous Corps reports. The Missouri River has played a great role in our Nation's history, provides great social and economic benefits and supports extensive fish and wildlife populations. Modifications to achieve social and economic benefits like the Corps' Mainstem Reservoir System and Missouri River Bank Stabilization and Navigation Project resulted in extensive losses of fish and wildlife habitat and corresponding decreases in fish and wildlife populations. Currently the U.S. Fish and Wildlife Service has listed three species found on the Missouri River as threatened or endangered. These include: interior least tern (endangered), piping plover (threatened), and pallid sturgeon (endangered). The pallid sturgeon is known to occur in the project area while the piping plover and least tern are both known to migrate through the project area.

2.5 Previous Related Reports

The following previous reports are related to this PIR:

- U.S. Army Corps of Engineers, Missouri River Division, 1981. *Missouri River Fish and Wildlife Mitigation Iowa, Nebraska, Kansas, and Missouri Final Feasibility Report and Final Environmental Impact Statement.*

- U.S. Army Corps of Engineers, Kansas City District, 1990. *Missouri River Bank Stabilization and Navigation Fish and Wildlife Mitigation Project, Reaffirmation Report.*

- U.S. Fish and Wildlife Service, 1980. *Missouri River Stabilization and Navigation Project, Sioux City, Iowa to Mouth Detailed Fish and Wildlife Coordination Act Report.*

- U.S. Army Corps of Engineers, Kansas City and Omaha Districts, 2003. *Missouri River Fish and Wildlife Mitigation Project, Final Supplemental Environmental Impact Statement and Record* of *Decision.*

- U.S. Army Corps of Engineers, Missouri River Division, 2004. *Missouri River Fish and Wildlife Mitigation Project, Program Management Plan.*

- U.S Army Corps-of Engineers, Missouri River Division; 1990; *Missouri River Bank Stabilization and Navigation, Fish and Wildlife Mitigation Project, Real Estate Design Memorandum #1.*

- U.S. Fish and Wildlife Service, 1994. *The Big Muddy National Fish and Wildlife Refuge Final Environmental Impact Statement.*

- U.S. Army Corps of Engineers, Kansas City District, 2006. *Project Implementation Report, Missouri River Bank Stabilization and Navigation Fish and Wildlife Mitigation Project, Jameson Island Unit, USFWS Big Muddy Fish and Wildlife Refuge, Chute Construction Project.*

2.6 Agency Coordination

The Mitigation Project Agency Coordination Team (ACT) meets quarterly. Representatives from the USFWS, Environmental Protection Agency (EPA), Natural Resource Conservation Service (NRCS), Iowa Department of Natural Resources (IDNR), Kansas Department of Wildlife, Parks and Tourism (KDWPT), Missouri Department of Conservation (MDC), Nebraska Game and Parks Commission (NGPC) and Missouri Department of Natural Resources (MDNR) along with the Kansas City and Omaha Districts of the Corps comprise the ACT. The initial responsibility of the ACT was to develop selection criteria for screening and prioritizing general areas to identify willing sellers for potential mitigation sites. The ACT also meets to discuss future activities, priorities, funding, and other issues related to implementing, managing, and monitoring the Mitigation Project.

As noted above, in January 2011, four Federal agencies (Corps, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service and the National Park Service) completed a position statement (Appendix I – Enclosure 4) related to creation of SWH downstream of Gavins Point Dam. In that position statement the four signatory federal agencies stated their support for creation of SWH in furtherance of the requirements to mitigate habitat losses, as specified by the Bi-Op, and in accordance with their respective statutory responsibilities.

Coordination between the Corps and the USFWS has been occurring throughout the planning process for development of the Jameson Island Unit SWH Restoration Project via telephone calls, emails, and meetings. On May 12, 2011 the Corps design team for the Jameson Island Unit SWH Restoration Project and members from the Big Muddy National Fish and Wildlife Refuge held a design charette to discuss potential design alternatives for the Jameson Island SWH Restoration Project and address the comments and recommendations received from the Shallow Water Habitat Adaptive Management Project Delivery Team regarding the grade control structure on the original Jameson Island Chute Project that still remained to be constructed.

In addition, the Corps is coordinating these efforts with the Howard County Levee Districts. During construction of the original Jameson Island Chute Construction Project the Levee Districts requested that the outlet be angled slightly downstream or that the chute be extended and outlet located further downstream. The Corps and USFWS met with representatives of the Howard County Levee Districts on January 26, 2011 to discuss erosion problems on the left bank adjacent to their levee and to discuss potential

plans to block the existing outlet, extend the existing Jameson Island Chute and locate the outlet further downstream. The Howard County Levee Districts continued to express their support for plans to block the existing outlet, extend the existing Jameson Island Chute and locate the outlet further downstream. In addition, the Howard County Levee Districts had no objection to placement of the excavated material into the Missouri River provided it was placed in a manner that did not deflect flows towards the left bank.

On March 30, 2012, a description of the proposed project was circulated to the public and resource agencies through Public Notice No. 2011-1602 issued jointly by the Corps - Kansas City District and the Missouri Department of Natural Resources, Water Pollution Control Program. The public notice included a thirty-day comment period that ended on April 29, 2012, and provided instructions for the public to provide comments on the proposed project. The public notice also included information on the Corps preliminary determination to prepare a Finding of No Significant Impact (FONSI) for the project and a draft Section 404(b)(1) Evaluation. In addition, the Public Notice contained information on an open forum Public Meeting to be held by the Corps on April 17, 2012, from 6:00-8:00 PM at the Arrow Rock State Historic Site Visitor Center, Arrow Rock, Missouri to provide the public an opportunity to comment or obtain additional information on the proposed project. The public notice was mailed to adjacent landowners, individuals/agencies/businesses listed on the NWK-Regulatory Branch's general, state of Missouri, mailing list. The agencies provided information on Federally listed and proposed threatened and endangered species, state species of special concern, natural communities, and sites of historic or archeological significance. A copy of the public notice, list of recipients, and comments can be found in Appendix B – Public Notice and Distribution List and Appendix C – Public Notice/Public Meeting Comments.

2.7 Future Without Project Condition

Without construction and operation of the Jameson Island Unit - SWH Restoration Project, restoration of additional SWH to enhance fish and wildlife resources would not be undertaken. The original/existing Jameson Island Chute Construction Project would continue to provide SWH and associated fish and wildlife benefits. The USFWS currently holds fee title to the Jameson Island Unit and is currently managing the land to benefit fish and wildlife resources. These efforts would continue. SWH restoration opportunities are fairly rare along the Missouri River as they must be undertaken on existing Mitigation Project lands or other existing public land. The opportunity to work collaboratively with USFWS on the Big Muddy National Fish and Wildlife Refuge allows both agencies to achieve their goals to improve fish and wildlife habitat on the Missouri River. Without the proposed SWH project, few, if any, additional SWH acres would be developed at this location and these would be solely dependent on the occurrence of high energy flood events and severely limited by the existing BSNP, flow modification of the mainstem reservoirs, and the dense floodplain vegetation on the site. These habitat changes, if they ever occurred, would be expected to require many years before any increase in SWH was observed. There would be no further progress towards SWH goals of the Mitigation Project at this site or to meet goals of the USFWS

2003 Bi-Op. The desired additional increase in fish and wildlife benefits at the Jameson Island Unit would not be achieved.

At the program level, failure to meet the Bi-Op goals through construction of SWH could require the Corps to meet SWH targets using mainstem reservoir flows, may require reconsultation with USFWS and potentially could lead to legal action and court directed measures. Changes in operations to meet SWH goals could impact the current level of economic benefit associated with the mainstem reservoir system.

Chapter 3 – Alternatives

3.1 Introduction

This chapter presents the alternatives considered for the development of fish and wildlife habitat at the Jameson Island Unit. The Corps considered four alternatives including: Alternative 1 - "No Action" ; Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area; Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area; Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan). Alternatives two thru four are the "Build Alternatives". These alternatives were evaluated against their ability to fulfill the previously described site objectives. This chapter includes a description of each alternative, an evaluation of the alternatives, and a detailed description of the recommended alternative. The following sections describe the alternatives developed for the Jameson Island Unit SWH Restoration Project.

3.2 Alternatives

3.2.1 Preliminary Measures and Methods Considered

The Corps working with the USFWS and the ACT consider a wide variety of environmental restoration measures and methods for implementation on each Mitigation Site. Individual site conditions often dictate which opportunities are available. The following includes a list of typical environmental restoration measures that were considered for the Jameson Island Unit.

Habitat Restoration Measures

- Flows to create SWH
- Wetland and terrestrial restoration
- Floodplain connectivity
- Chutes, shelving, backwaters

Chute Construction Methods:

Construction of a pilot channel with sidecasting in meander process area

Construction with mixing dredged materials with the existing Missouri River water and sediment load

Construction with Full Excavation, Sidecasting and Stabilization Outside Meander Process Area / Haul Off-Site / Beneficial Use / Stabilization of all Excavated Areas to Prevent Future Erosion

3.2.2 Preliminary Screening

Based on our preliminary evaluation some of the measures were removed from further consideration. The following provides a brief description of the measures/methods considered and the results of our preliminary analysis.

Flows to create SWH – In considering how to meet the SWH goals of the Bi-Op the Corps was directed by the USFWS to consider using flows from the Gavin's Point Dam to create SWH. Due to constraints associated with the authorized purposes, the Corps needs to achieve some SWH through construction. The Corps has attempted to meet SWH goals set forth in the Bi-Op thru physical construction of SWH. The Corps believes that construction of SWH can meet the Bi-Op targets while having the least socio-economic impact. In addition, construction of SWH allows the restoration of the natural processes associated with erosion and deposition of sediment at appropriate locations along the Missouri River floodplain. At the program level, failure to meet these goals through construction of SWH could require the Corps to meet SWH targets using mainstem reservoir flows, may require reconsultation with USFWS and potentially could lead to legal action and court directed measures. Changes in operations to meet SWH goals could impact the current level of economic benefit associated with the mainstem reservoir system. Flows have been assessed in the Master Manual revision and are being assessed further as part of the overall MRRP, but flows specifically associated with the Jameson Island Unit SWH Restoration Project were not moved forward for further consideration.

Wetland and terrestrial restoration – The Jameson Island Unit is part of the USFWS' Big Muddy National Fish and Wildlife Refuge, as such wetland and terrestrial habitat restoration and management on the area currently being implemented by USFWS. No additional wetland or terrestrial restoration opportunities were identified on the Jameson Island Unit.

Floodplain connectivity – At the Jameson Island Unit there are no intact levee systems which exclude floodplain connectivity. Therefore for this project there are more limited opportunities to increase floodplain connectivity. Implementing the Jameson Island Unit SWH Restoration Project on an area that already has well established riparian habitat provides greater habitat values for both the existing wetland/terrestrial habitat and the newly constructed aquatic habitat. Construction of SWH off the main river channel at this site, while not providing the benefits one would expect if levee removal or setback were involved, does increase floodplain connectivity. Floodplain connectivity allows

more natural flow of water on the floodplain, allows the dynamic river processes of deposition and scouring to act on the floodplain, and allows fish and wildlife resources to move freely between the aquatic and terrestrial habitat whose boundary is constantly in flux with the changing level of the river. Measures that increase floodplain connectivity were moved forward for further consideration.

Chutes, shelving, backwaters – These areas meet the definition of SWH. Chutes are flowing side channels adjacent to the main river channel. Chutes are typically constructed to an initial design width and expected to further develop by natural river processes. Allowing the river flows to act on the floodplain along the length of the chute restores the dynamic river processes. Chutes provide a refuge for juvenile native fish, including the pallid sturgeon. Created chutes are dominated by juveniles (61-75% of all catch was juvenile fishes). Older chutes and natural chutes tend to have greater numbers of fish and higher diversity of species. The chutes had an average of 57 different species (45-68), with numbers of species generally increasing as the chutes age. 22 pallid sturgeon were captured within chutes between 2006 and 2008 (predominantly hatchery raised fish). Adult sturgeon travel through chutes when migrating upstream (including Lisbon Bend and Hamburg Bend).

Shelving consists of excavation of material along the main riverbank to widen the top width of the river and create SWH. Backwaters developed in the historic river when large scours holes formed during flooding or natural chutes were blocked. Backwaters have little if any flow through them and therefore create habitat diversity with less turbid water and low velocities which are important for young and larval fish. Backwaters with connections to the main channel tend to have greater numbers of fish, species and diversity compared to isolated backwaters. Fish communities in backwaters differ from those in chutes. Backwaters contained large numbers of sunfishes (centrarchids); shads and herrings (clupeids); and temperate basses, walleye and sauger (perciformes); while chutes contained large numbers of blue sucker, shovelnose sturgeon, and chub species (benthic riverine species).

Additional opportunities were identified on the Jameson Island Unit to increase shallow water habit thru constructing an additional chute or by extending the existing chute. Development of a backwater area was identified as a potential component of existing chute extension if the existing chute outlet was blocked. Angling the existing chute outlet downstream or extending the chute and relocating the outlet further downstream was identified by the Howard County Levee Districts during construction of the original project and during our January 26, 2011 meeting. Maintaining the existing chute outlet would not address concerns of the Howard County Levee Districts or divert enough water down the chute extension to ensure full development. No opportunities for shelving were identified at the site. The August 2005 project drawing shows alternative alignments that had been considered for the original Jameson Island Chute Project (Figure 2). Option 1 – blue line represents the existing chute. Two additional alternative alignments for SWH restoration had been evaluated in the original Jameson Island Chute Construction Project PIR . These were to create a 15,515 lineal foot chute (Option 3 – green line) which ran from north to south on the island along the old channel scar just east of the Missouri

River bluff line and another potential alignment to construct a 11,425 lineal foot chute (Option 2 – black/grey line) which would run the length of the old channel scar that transects the center of the island running north to south located just west of the chute that was eventually constructed. These alternative were again reviewed during the design charrette for the current project and were not moved forward for further consideration due to the fact that these alignments required greater impacts to existing wetlands, created more limited opportunities for recreational visitors to access the site, were not consistent with Levee District recommendations that the existing chute entrance be blocked, the existing chute extended, and a new outlet created downstream. The Corps also considered just slightly angling the existing out let downstream as was originally discussed with the Levee District. This alternative would partially address the Levee District concern but would not result in an increase in SWH. It was not moved forward for further consideration. The alignment identified for further consideration extended the existing chute, created a backwater, avoided/minimized impacts to existing wetlands and terrestrial vegetation, did not limit opportunities for recreational visitors to access the site as much as the other alignments, and was consistent with Levee District recommendations that the existing chute entrance be blocked, the existing chute extended, and a new outlet created downstream. This alignment was moved forward for further evaluation under several chute construction methods.

SWH construction methods: The Corps considers a variety of methods to construct SWH. Each site has unique constraints, typically costs and environmental factors, which limit or eliminate the ability to utilize certain methods. The following methods were considered for the Jameson Island Unit SWH Restoration Project:

> **Construction of a pilot channel with sidecasting in meander process area:** This construction method involves the use of heavy construction equipment to clear and grub the alignment and then to remove the earthen material from the chute alignment and pile it along the outer boundary of the chute alignment within the meander process area. Heavy construction equipment is also used to cut through the bank on the upstream and downstream ends at the proposed chute entrance/outlet. Natural river flows then remove the remainder of the earthen material including the stockpiles of earthen material and woody debris. This would be similar to how the original Jameson Island Chute Project ultimately was constructed where flows excavated the majority of the chute and earthen material from the chute was integrated into the Missouri River bedload through natural river processes. This method can achieve habitat goals but, since all material must be returned to the river by its natural processes, it is ultimately dependant on high river flows and is slower to develop. In addition to the uncertainty of high flows, drought conditions may allow fast developing woody vegetation to recolonize the alignment and require subsequent clearing and grubbing. The piles of excavated material create a very unnatural landform on the floodplain. Temporary adverse environmental effects include hindering wildlife movement between the aquatic and riparian habitat, blocking flow on the floodplain,

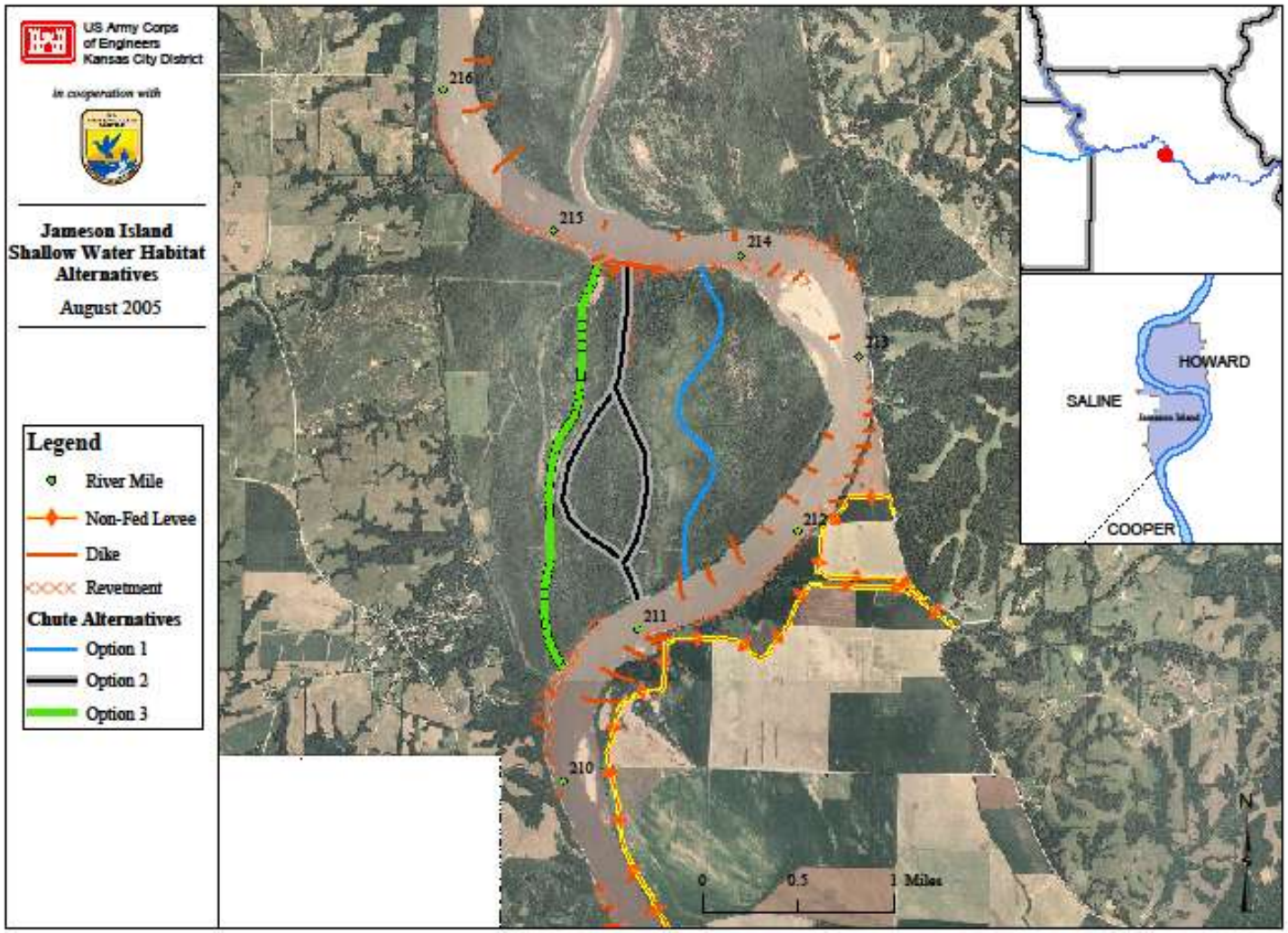

Figure 2. 2005 Alternative Chute Alignments

increasing sedimentation of existing adjacent wetland areas. This method does not involve the direct placement of excavated material into the Missouri River. As not as much material is excavated costs are lower than excavation of the chute to the full design width. This method was moved forward for further consideration.

Construction with Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load

This construction method involves the use of heavy construction equipment to clear and grub the alignment of woody debris. Then a hydraulic dredge is used to remove the remainder of the earthen material from the chute alignment. During clearing and grubbing approximately 3-4 feet of soil along with woody vegetation is moved to the edge of the cleared area within the meander process area. Heavy construction equipment is also used to cut through the bank on the upstream and downstream ends at the proposed chute entrance/outlet. This allows the hydraulic dredge to move in and begin operation. Dredged earthen material is pumped through a pipe and mixed into the existing Missouri River water and sediment load along the thalweg. This method was moved forward for further consideration.

Construction with Full Excavation, Sidecasting and Stabilization Outside Meander Process Area / Haul Off-Site / Beneficial Use / Stabilization of all Excavated Areas to Prevent Future Erosion

These SWH construction methods are those that would be consistent with the MCWC Order. The Corps considers these measures to be more environmentally damaging, not consistent with the project purpose and requiring much higher costs. Any permits issued with these measures as conditions would be considered constructive denial by the Corps. The Corps has moved full excavation with sidecasting and stabilization outside the meander process area forward for further consideration although it would be highly unlikely that the project would be completed in this manner considering the avoidable adverse environmental impacts associated with this method.

Haul Off-Site: This method requires full excavation of all material from the chute and then the material would be hauled to another location and stabilized. Placing the material on another part of the Refuge would require clearing a haul road and a roughly 45-acre stockpile area, hauling the material to that location and stabilizing it with vegetation. Additional temporary construction impacts to wetland areas would result from construction of the haul road depending on the location of the stockpile location. This would result in additional adverse impacts to fish and wildlife resources and visitors to the refuge, create a landform not typical of the floodplain, along with substantially higher costs. Hauling the excavated material by truck and stockpiling it on another part of the Refuge was not given further consideration due to the additional avoidable adverse environmental impacts. Hauling excavated material off the refuge was not given

further consideration as this would require extensive heavy truck traffic through the Arrow Rock National Historic Landmark and again have impacts associate with clearing the haul road off the Refuge. In addition, if not constrained by the Historic Landmark, hauling the material would have substantially higher cost. The Corps preliminary total project cost estimate to construct the Jameson Island SWH Restoration Project by fully excavating the chute, loading the material onto trucks, transporting the material by truck 5 miles and stockpiling the material was estimated at $14.6 million. This figure does not account for the additional cost needed to clear a new haul road or restore the haul road area after construction. Loading material onto a barge and hauling it offsite was not considered practicable because of the higher cost. While this method would avoid impacts associated with truck traffic through the Historic Landmark, the Corps preliminary total project cost estimate to construct the Jameson Island SWH Restoration Project by fully excavating the chute, loading the material onto a barge, transporting the material by barge 5 miles, offloading the material onto trucks and hauling it to the stockpile was estimated at $27.1 million. This method would not achieve the environmental benefits associated with restoring a minimal portion of the historic Missouri River's active bedload by mixing the dredged material with the existing Missouri River water and sediment load or by allowing it to become part of the active bedload through the natural processes of the river. This method was not moved forward for further consideration.

Beneficial Use: This method involves full excavation and then all excavated material is made available for beneficial use. In developing SWH the Corps considers if there is any additional beneficial use for the excavated material. Typically this is limited by the need at the time the material is available and the haul costs. The Corps has used material excavated during SWH construction to improve or rehabilitate existing flood risk management systems and to construct in river fish and wildlife habitat, i.e. islands. The Corps has even made material available to the public at nominal cost, with very little interest and, or for very little amounts. To utilize material for beneficial use, cost must be similar to other alternatives. For the Jameson Island Unit SWH Restoration Project no feasible potential beneficial use, outside sediment reintroduction, was identified. The Corps has and will continue to utilize earthen material excavated during SWH construction for beneficial use over sediment reintroduction where appropriate. Utilizing the material from Jameson Island SWH Restoration Project for beneficial use was not moved forward for further consideration.

Stabilization of all Excavated Areas to Prevent Future Erosion: This method would require the Corps to use rock to stabilize both banks along the full length of the proposed chute. The chute would be locked in place much like the main river channel. The Corps considers this method inconsistent with the project purpose because this method would not restore the dynamic process of cut and fill and the associated habitat types developed by this process that have been largely eliminated by the BSNP. This method would not remobilize much needed sediment that was once part of the active Missouri River bedload but has been

trapped by BSNP structures. This method would not be consistent with the goals of the Bi-Op or the goals of the Corps' Mitigation Project. Finally, this method was not economically feasible due to the high costs to fully stabilize the chute alignment. In 2008, the Corps developed a cost estimate for rock stabilization of the original 9,630-foot-long Jameson Island Chute. Estimated cost to rock both banks with a 3-foot-deep blanket of riprap exceeded $10 million. Construction with stabilization of all excavated areas was not moved forward as this method would not meet the goal of restoring the natural dynamic river processes along the length of the chute.

3.3 Final Alternatives

3.3.1 Final Alternatives Evaluated in this PIR

In addition to the Recommended Plan described in Section 3.4, three other alternatives were considered for restoration of SWH on the Jameson Island Unit. The three "Build Alternatives" include a plan which would restore SWH using a chute/backwater, improve floodplain connectivity, and addresses recommendations of the Howard County Levee District, utilizing three different methods to accomplish project construction. Typical cross sections for each alternative are shown in Figures 3 and 4. The following describes the final alternatives evaluated in this PIR:

Alternative 1 - "No Action"

Alternative 1 –The "No Action" Alternative would involve no additional construction of SWH on the Jameson Island Unit – Big Muddy National Fish and Wildlife Refuge. The "No Action" Alternative considers the existing condition at the site and this includes the original/existing Jameson Island Chute Construction Project. Baseline and Future Without Project conditions described for the project area include the original/existing Jameson Island Chute Construction Project. This alternative would result in no increase in SWH.

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

This alternative would extend the existing chute approximately 1 mile to the west where another outlet to the Missouri River would be constructed. The existing chute outlet would be diverted with a closure structure constructed with approximately 25,000 tons of clean rock riprap to +5 Construction Reference Plane (CRP). The area between the diversion and the river would serve as backwater habitat. The chute alignment would be cleared using heavy construction equipment with woody vegetation stockpiled on the outer limits of the cleared zone. A 75-foot-wide pilot channel would be excavated along the entire length of the proposed chute. Approximately 441,377 cubic yards of earthen material would be excavated using heavy construction equipment. Excavated earthen material would be placed on the floodplain adjacent to the chute and within the meander

process area. Through time and dependant on river levels the chute would be expected to widen and deepen and the stockpiled material along with approximately 526,015 cubic yards of additional earthen material would be integrated through natural river processes into the Missouri River bedload, until a balance of flow and chute width is reached as limited by flow control structures. Woody debris entering the chute as the channel widened and meandered would provide additional fish and wildlife habitat. This would result in 17 acres of SWH (14-acre chute and 3-acre backwater) at completion of construction and 30 acres of SWH (27-acre chute and 3-acre backwater) once the chute has developed through natural processes to its full 200-foot design width. This alternative involves no direct placement of earthen material into the Missouri River. After initial excavation all material is placed in the meander process area and is dependent on Missouri River flows to complete the development of the chute. The project costs for this alternative is approximately $4.5 million. Although not consistent with the MCWC Order, the Corps has evaluated the effects this alternative in comparison to effects resulting from methods consistent with the MCWC Order.

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

This alternative would extend the existing chute approximately 1 mile to the west where another outlet to the Missouri River would be constructed. The existing chute outlet would be diverted with a closure structure constructed with approximately 25,000 tons of clean rock riprap to +5 CRP. The area between the diversion and the river would serve as backwater habitat. The chute alignment would be cleared using heavy construction equipment with woody vegetation stockpiled on the outer limits of the cleared zone. Next, approximately 967,392 cubic yards of earthen material would be mechanically excavated with heavy construction equipment and stockpiled on the floodplain outside the anticipated future meander process area of the chute. The chute would be excavated to a 200-foot width and to a depth of -5 CRP, representing the approximate dimensions of the chute when the flow will be limited by the control structure, rather than the size of the pilot channel. At this point, it is anticipated that the net cut and fill sediment balance will be essentially negligible, though the chute could meander through natural processes over time. Stockpiled earthen material and cleared woody debris would not be integrated into the Missouri River bedload, other than perhaps minimal amounts if meander patterns of the chute were to change over time. Excavating the channel to the full 200-foot design width would result in 30 acres of SWH (27-acre chute and 3-acre backwater) at completion of construction with no further increase expected. This alternative involves the greatest amount of clearing and widest excavated channel so all material can be removed and stabilized outside meander process area as described in the MCWC Order. The project costs for this alternative is approximately $8.6 million. As stated above in Section 3.2.2 Preliminary Screening while this alternative was moved forward for further evaluation, the Corps' initial assessment has found that constructing the project in this manner would have greater adverse environmental impacts, that many of these adverse impacts would be considered avoidable, that project costs would be much higher than the other alternatives, and that

this alternative would not represent the least environmentally damaging practicable alternative or be consistent with the Section 404(b)(1) Guidelines. Although highly unlikely that this alternative could be implemented, it was given consideration to fully illustrate the differences in potential impacts.

3.4 Description of Recommended Plan

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

This alternative would extend the existing chute approximately 1 mile to the west where another outlet to the Missouri River would be constructed. The existing chute outlet would be diverted with a closure structure constructed with approximately 25,000 tons of clean rock riprap to +5 CRP. The area between the diversion and the river would serve as backwater habitat. The chute alignment would be cleared using heavy construction equipment with woody vegetation and 3-4 feet of earthen material stockpiled on the outer limits of the cleared zone to facilitate dredge access. Next, approximately 420,812 cubic yards of earthen material would be excavated using a hydraulic dredge. This would create a 100-foot-wide chute. Excavated earthen material would be pumped as slurry mixture of water and sediment and placed into the Missouri River in a location and manner that it would be integrated into the existing bedload. Through time and dependant on river levels the chute would be expected to widen and deepen and approximately 546,580 cubic yards of additional earthen material would be integrated through natural river processes into the Missouri River bedload. This process would continue until a balance of flow and chute width is reached as limited by flow control structures, and flow of sediment in versus out would be approximately balanced. Woody debris entering the river as the channel widened and meandered would provide additional fish and wildlife habitat. This would result in 30 acres of SWH (16.77-acre chute and 3-acre backwater) at completion of construction and 30 acres of SWH (27-acre chute and 3-acre backwater) once the chute has developed through natural processes to its full 200-foot design width. This alternative involves the least amount of clearing and a median excavated channel. Less clearing is required because only a minimal amount of woody debris and earthen material are stockpiled on the floodplain and that material would be placed within the meander process area. The project costs for this alternative is approximately $3.5 million. Although not consistent with the MCWC Order, the Corps has evaluated the effects this alternative in comparison to effects resulting from methods consistent with the MCWC Order.

3.5 Chute/Diversion Structure Design and Construction Considerations

The typical chute cross sections for Alternatives 2, 3 and 4, and the typical diversion structure cross section (Figures 3 and 4) were determined to be the most

appropriate to use to allow both land based and dredging excavation equipment, while also considering maximizing cost efficiency and safety. The typical construction slopes have been used on past projects including the original Jameson Island Chutes, and are designed to erode and widen. The Contractor and hired labor crews will be required to meet the specified construction widths. It is anticipated that if dredging occurs, the contractor will need to over excavate several feet on each side to allow for sloughing following dredging a vertical slope. Depending on the method of excavation and survey method(s) chosen by the contractor, additional excavation may be required in order for the survey and general working methods to meet EM 385-1-1 (USACE Safety and Health Requirements Manual).

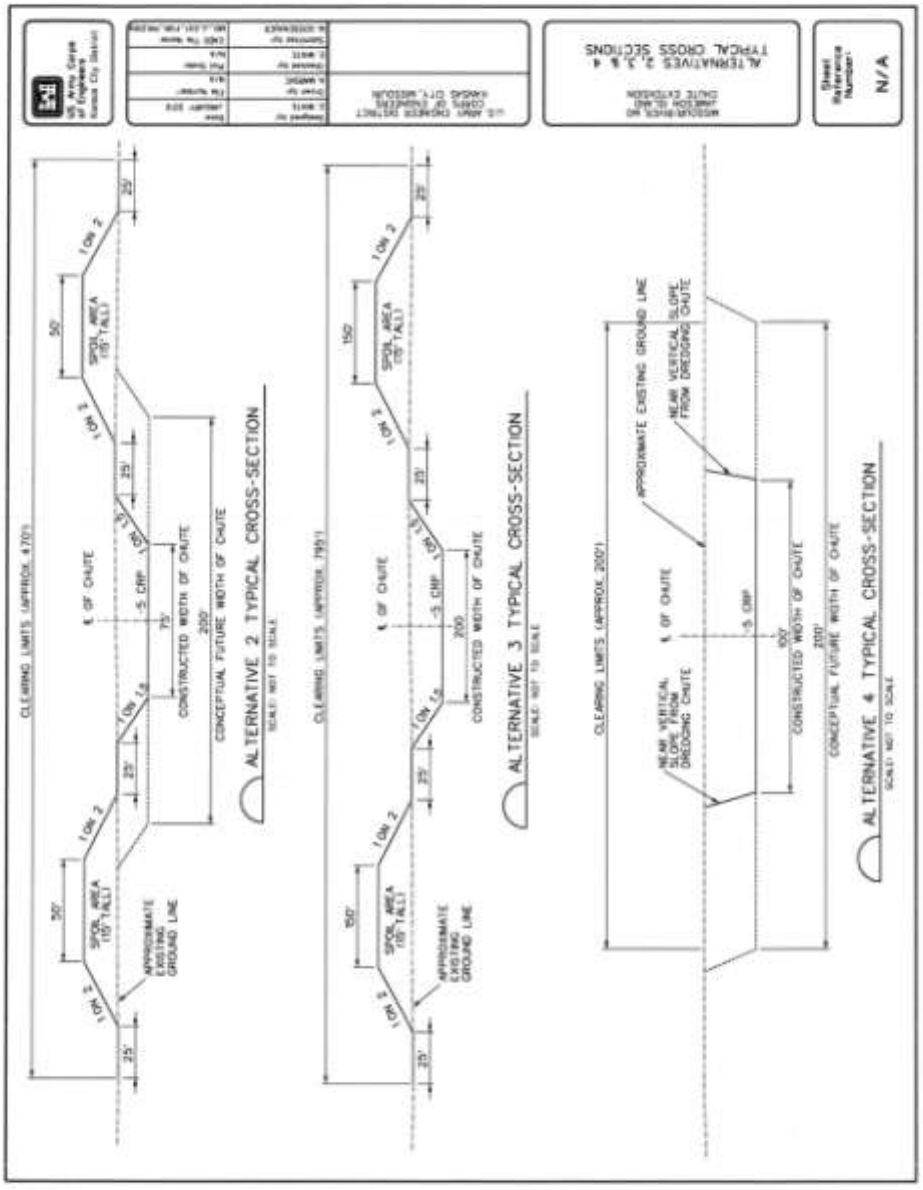

Figure 3 – Typical Chute Cross Sections (Alternative 2, 3 & 4)

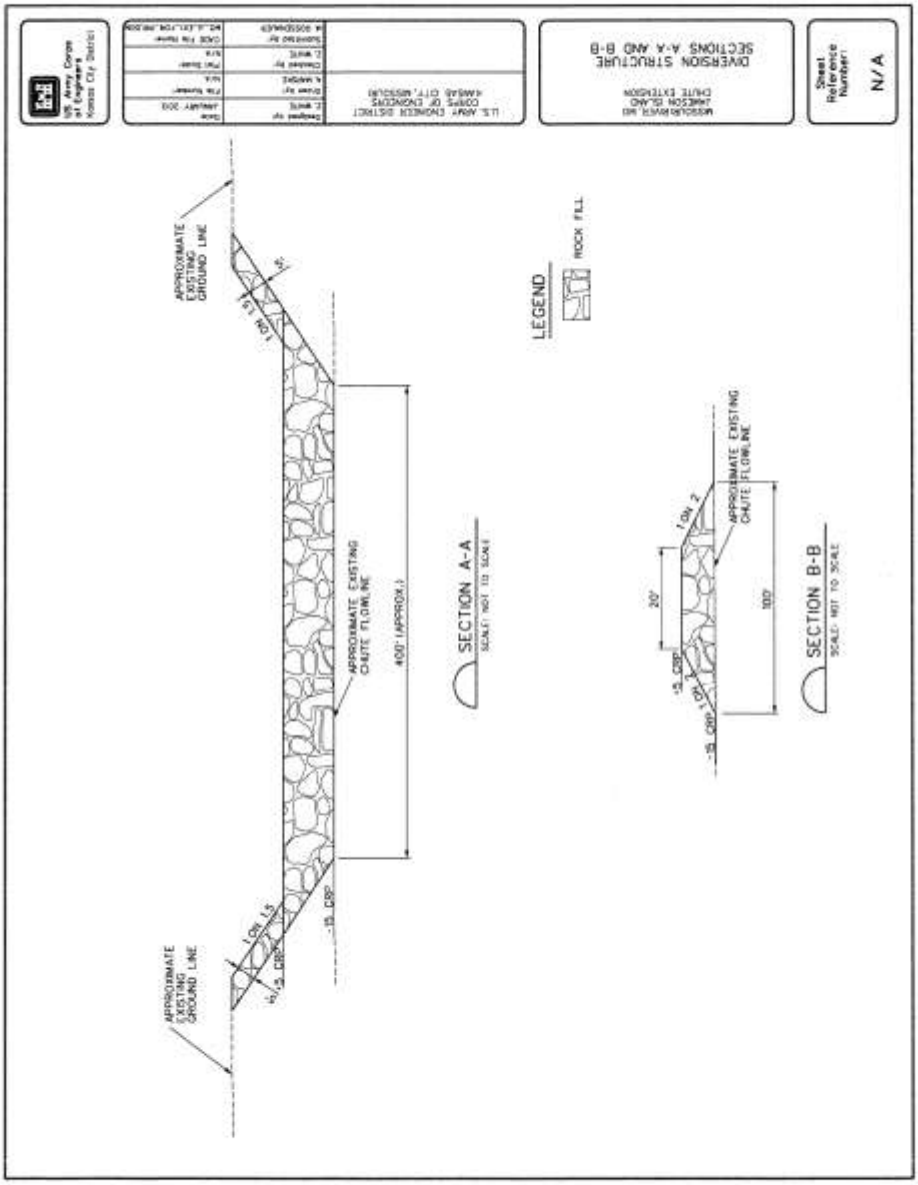

Figure 4 - Typical Diversion Structure Cross Section

Chapter 4 – Affected Environment

4.1 Introduction

This chapter presents the affected environment for the Jameson Island Unit SWH Restoration Project Site. The affected environment is the baseline against which potential beneficial and adverse impacts caused by the action are evaluated. The existing conditions described in this chapter for the Jameson Island Unit are based on the current state of the site and not as the site was at the time of purchase by the USFWS. In addition, baseline conditions described for the project area include the original/existing Jameson Island Chute Construction Project. Various sources of information were used to compile the affected environment presented in this chapter including: field investigations, geographic information systems data, literature searches, review of maps and aerial photography, agency coordination, and previous reports.

4.2 History of Project Area

Prior to construction of the BSNP, the lower Missouri River was uncontrolled and meandered across the floodplain. This created a highly dynamic environment through the physical processes of erosion, deposition, and accretion. The historic lower Missouri River consisted of numerous islands, channels, sandbars, and slack water supporting vegetation in various stages of succession. Historically, the Jameson Island Unit would have consisted of an area where the meander of the Missouri River across the floodplain would have created a bountiful fish and wildlife habitat. In addition, the proportions of habitat types would have been constantly changing due to the physical processes mentioned previously. Following construction of the BSNP, accreted lands in the area of the Jameson Island Unit were created, claimed, and converted to cropland. At the time of purchase by the USFWS, the Jameson Island Unit was primarily woodland and cropland. The lands were purchased from willing sellers between 1995 and 1997. The USFWS has managed the site since the time of its purchase, through low maintenance operations in order to let the land recover to pre-agricultural conditions on its own. Arrow Rock, Missouri lies on the bluff just west of the project area and played an important role in the early history of Missouri. This historic river town, located on the Santa Fe Trail crossing of the Missouri River, includes numerous buildings listed on the National Register of Historic Places, hosts numerous history related special events and is designated both a National Historic Landmark and State Historic Site.

4.3 Soils/Topography

The Jameson Island Unit contains the following soil types: Grable Very Fine Sandy Loam, Leta Silty Loam, Sarpy Loamy Fine Sands, Waldron Silty Clay, and Haynie-Waldron Silty Complex. These soil types comprise approximately 1,871 acres of the Jameson Island Unit. Soils designated as prime or unique farmland are not found within the area of the Jameson Island Unit SWH Restoration Project site.

Pre-construction sediment, water, elutriate samples were collected from the Jameson project site in March 2011 using protocols agreed upon between the Corps and the Missouri Department of Natural Resources in 2007. The approved Field Sampling Plan can be found in Appendix E. Sediment samples were sent to a contract laboratory for analysis. Samples were collected from six locations along the proposed chute alignment (Figure 5) and the results can be found in Table A. Soil tests showed that total phosphorus concentrations in all of the borings samples (494 to 613 milligrams per kilogram [mg/kg]) were within the observed range of 100 to 6,100 mg/kg for Missouri agricultural soils (Tidball 1984) and similar to total phosphorus samples collected from other SWH creation sites (Figure 6). Similarly, total nitrogen concentrations from soil samples collected at the Jameson Island project site were similar to those collected at other SWH creation sites (Figure 7).

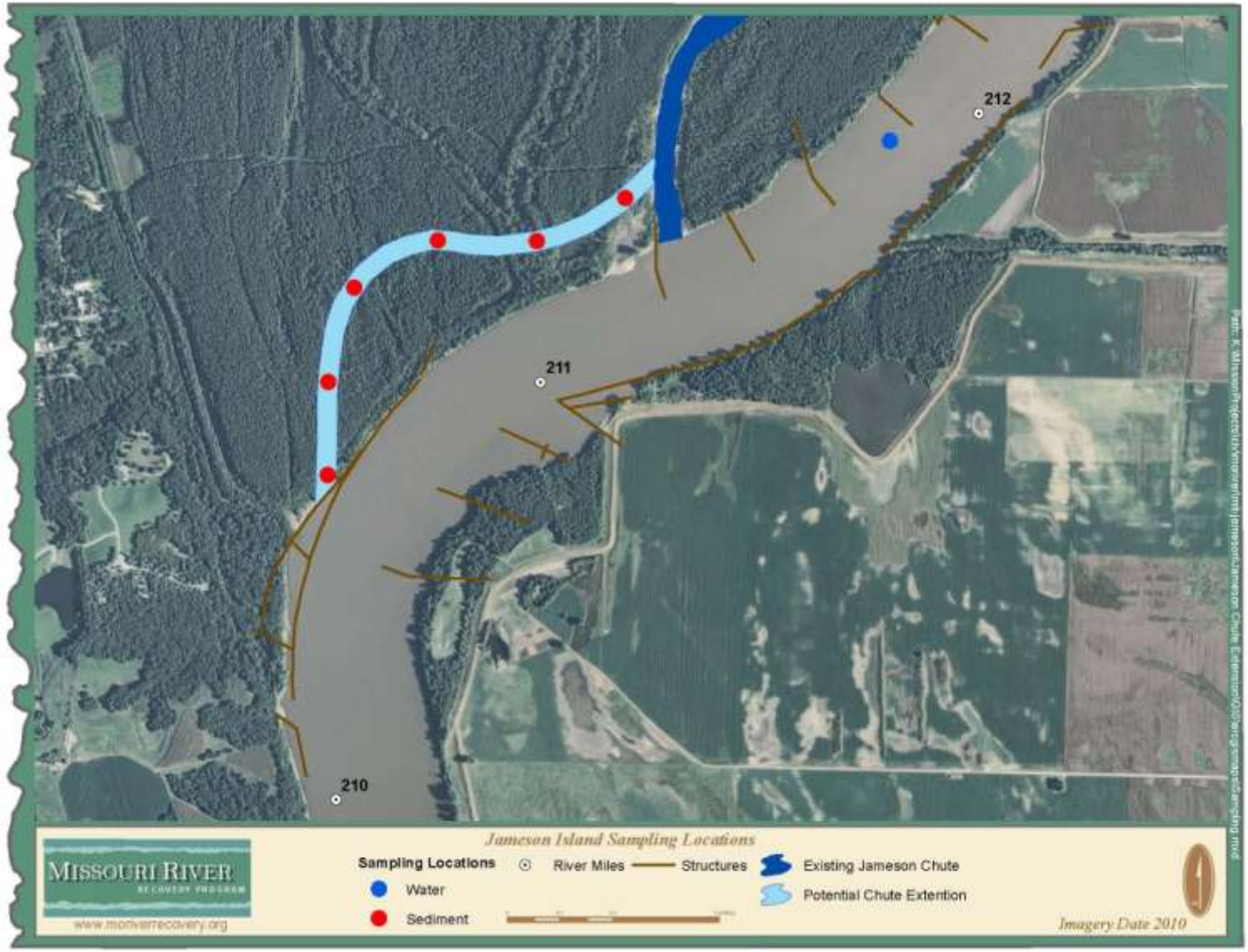

Figure 5. Location of sites sampled as part of the Jameson Island Mitigation project; JA-S = sediment and JA-W= water.

Table A. Median and mean (in parentheses) concentrations of analytes measured from sediment at the Jameson Island site.

Analytes	Sediment
Ammonia Nitrogen (mg/kg)	24.95 (23.20)
Chlordane (gamma) (ug/kg)	<5.1 (<5.1)
DDT (ug/kg)	<5.1 (<5.1)
Dieldrin (ug/kg)	<5.1 (<5.1)
Nitrate/Nitrite as N (mg/kg)	3.1 (4.83)
OrthoPhosphate (mg/kg)	2.55 (2.63)
Percent Solids	75.6 (74.5)
TOC (mg/kg)	4350 (4267)
Total Kjeldahl Nitrogen (mg/kg)	921 (975)
Total phosphorus (mg/kg)	492 (508)
Total Suspended Solids	
Metals -- Total (ug/kg)	
Cadmium	<0.33 (<0.33)
Chromium	16.8 (17.3)
Copper	14.4 (13.8)
Lead	11 (11.4)
Nickel	16.2 (17.3)
Zinc	49.75 (54.12)
Metals -- Dissolved (ug/kg)	
Cadmium	
Chromium	
Copper	
Lead	
Nickel	
Zinc	
Samples	6

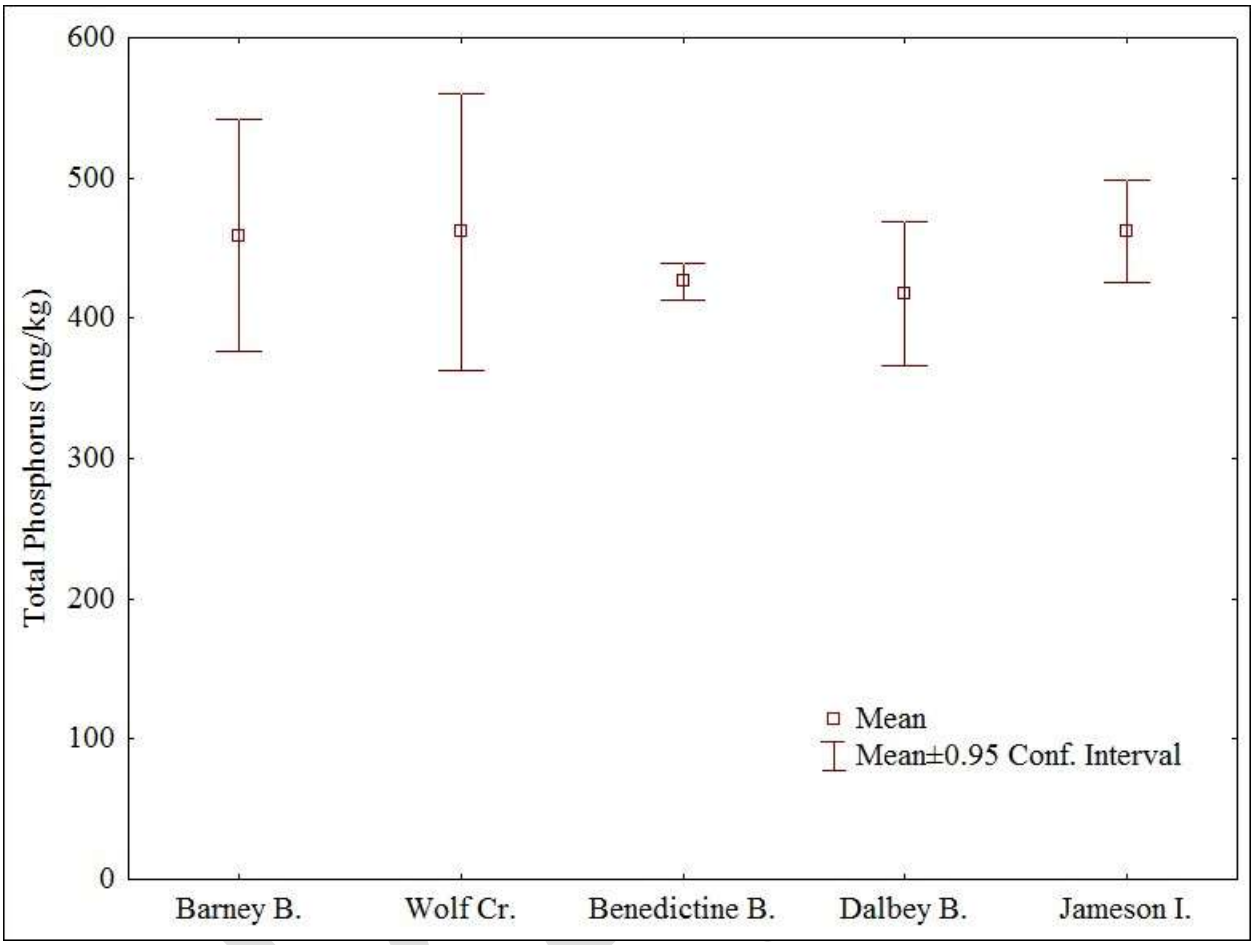

Figure 6. Total phosphorus concentrations in sediment samples collected from multiple SWH creation sites (Jameson Island includes sediment samples collected in 2007).

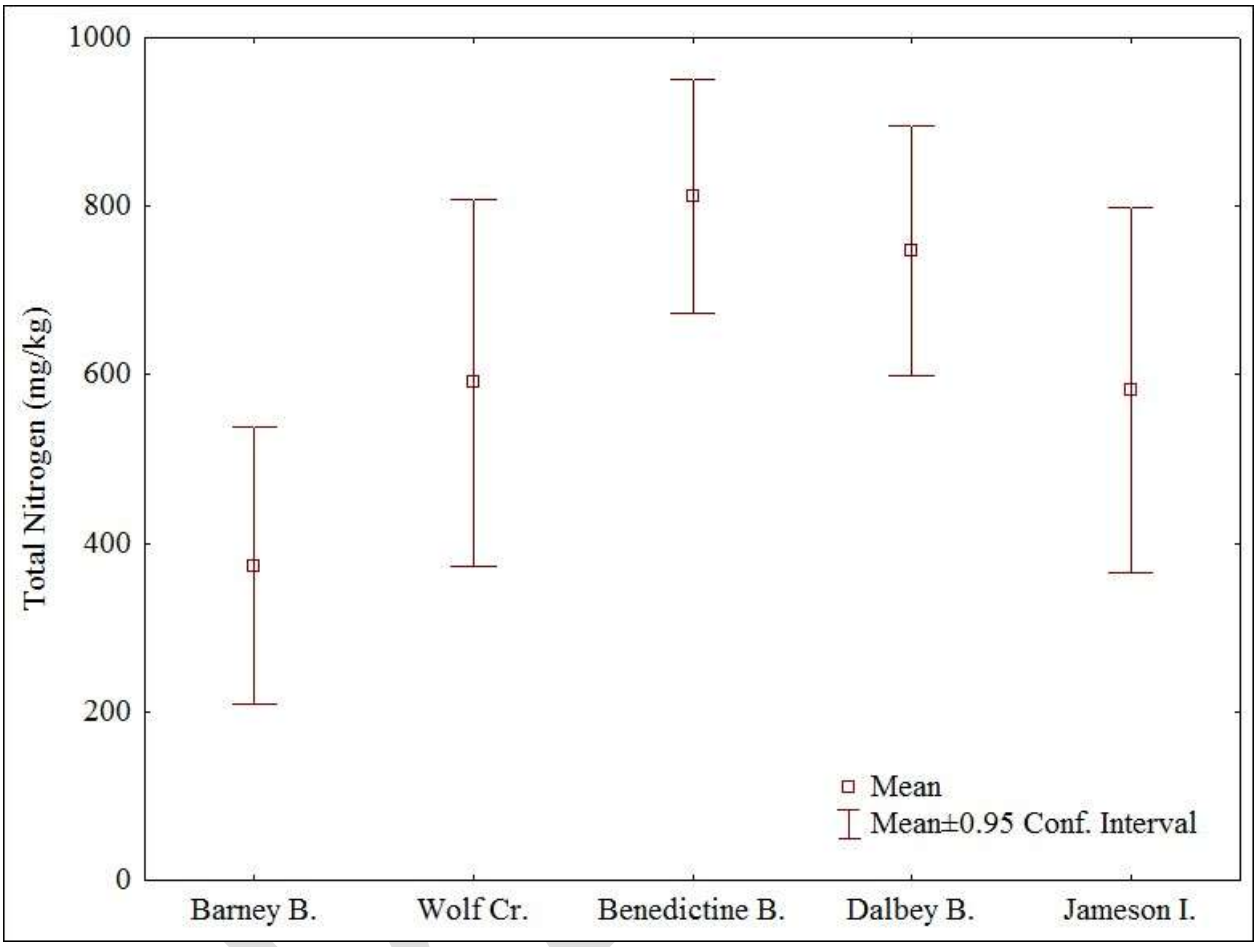

Figure 7. Total nitrogen concentrations in sediment samples collected from multiple SWH creation sites (Jameson Island includes sediment samples collected in 2007).

4.4 Biological Resources

Biological resources include the native or introduced plants and animals and the habitats in which they occur. The resources discussed in this section include aquatic resources including fisheries; terrestrial/wetland resources including vegetation communities, wildlife populations; and species that are candidates for, or listed as, threatened or endangered.

4.4.1 Aquatic Resources

Aquatic resources include aquatic habitat, fisheries, and other aquatic biota of the Jameson Island Unit. Aquatic habitat on the Jameson Island Unit consists of the Missouri River, which borders the site, SWH within the dike field along the banks of the refuge, and the existing chute. Common fish species in the lower Missouri River include emerald shiner *(Notropis atherinoides*), river carpsucker *(Carpiodes carpio*), channel catfish *(lctalurus punctatus*), gizzard shad *(Dorosoma cepedianum*), red shiner *(Notropis lutrensis*), fathead minnow (*Pimephales promelas*) shorthead redhorse (*Moxostoma macrolepidotum*), carp (*Cyprinus carpio*), and gold eye

(*Hiodon alosoides*) (Pflieger 1975). Pallid and shovelnose sturgeon and paddlefish *(Polyodon spathula*) are also found in the lower Missouri River (Corps 2001).

Sport fish include channel catfish, white crappie *(Pomoxis annularis),* black crappie *(Pomoxis nigromaculatus),* sauger *(Stizostedion canadense),* flathead catfish *(Micropterus salmoides),* bluegill *(Lepomis macrochirus),* walleye *(Stizostedion vitreum),* and paddlefish (Pflieger 1975). Species important to the commercial fishery on the lower Missouri River include buffalo *(lctiobus* spp.), carp, and freshwater drum *(Aplodinotus grunniens);* (Corps 1995).

The original Jameson Island Chute Project described above in Section 1 Introduction – Project History consists of a 9,630-foot-long chute. Although project construction was halted in 2007, the chute subsequently developed fully through natural river processes and as of July 2011 currently provides approximately 66 acres of SWH. In addition, the Jameson Island Chute Project is clearly demonstrating how restoring the natural processes of the river on even a small segment can result in a dynamic habitat where river forces act on the outer bends cutting and recruiting large woody debris into the aquatic ecosystem. This woody debris located in the slower moving water of the chute provides important fish and wildlife habitat. On the inner bends sandbars are developing with young woody vegetation along the upper limits, areas of sand with high organic content along the middle of the bar, and at the lowest area clean recently deposited sand. The alignment shows good sinuosity. The large stockpiles of earthen material that were excavated and placed in the meander process area are now largely gone and during high flow conditions the chute has good floodplain connectivity

4.4.2 Woodlands

The vast majority of 1,871-acre Jameson Island Unit consists of a bottomland forest comprised of willows, cottonwoods, box elders and other native tree species typically found on the Missouri River floodplain. Much of the woody vegetation has developed since the 1993 Flood and after the site was acquired by USFWS for the Big Muddy National Fish and Wildlife Refuge. Prior to that, the majority of the site was in agricultural rowcrop production. Remnants of older more mature trees are found in a narrow band along the Missouri River and adjacent to the old channel scars. Located just south of the USFWS Lisbon Bottom Unit these two tracts comprise a large contiguous block of natural woody vegetation immediately adjacent to the Missouri River.

4.4.3 Wetlands

A review of the USFWS National Wetlands Inventory Map (Figure 8) shows that the Jameson Island Unit contains approximately 56.96 acres of wetlands. Considering a maximum corridor width of 470 feet there are approximately 14.9 acres of wetlands (6.30 acres freshwater emergent marsh, 5.68 acres freshwater forested/shrub wetland, 2.92

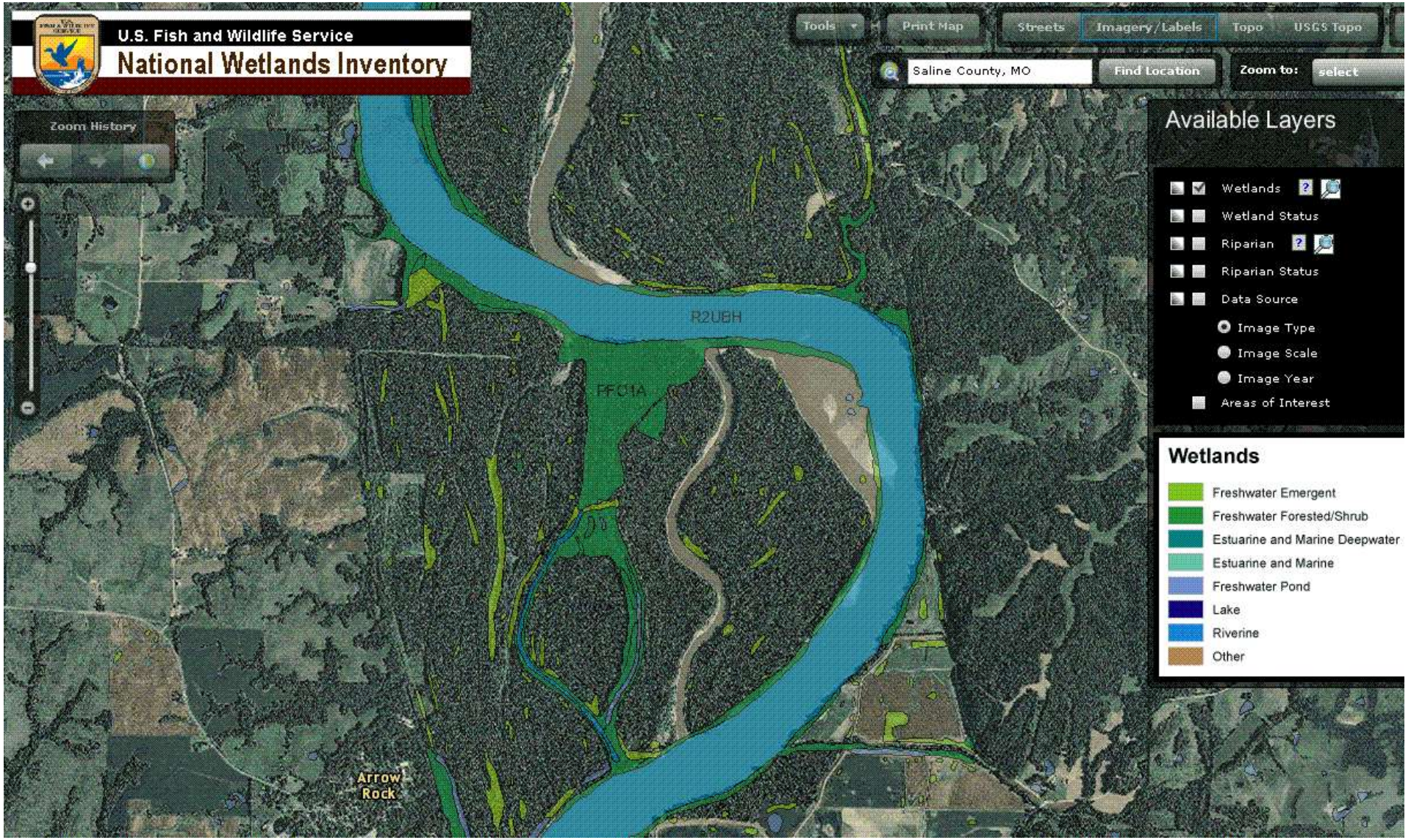

Figure 8 – USFWS National Wetlands Inventory Map of Jameson Island Unit

acres freshwater pond) located within the potential construction corridor. The extent of these areas was verified as part of a preliminary jurisdictional determination through a review of NWI maps, soil surveys, topographic maps, aerial photographs and field survey of the proposed alignment.

4.4.4 Wildlife

The Jameson Island Unit provides habitat for numerous wildlife species. Common mammalian species likely to occur in the bottomland forest of the site include; gray squirrel *(Sciurus carolinesis),* cottontail rabbit *(Sylvilagus floridanus),* red fox *(Vulpes vulpes),* coyote *(Canis latrans)* and white-tailed deer *(Odocoileus virginianus).*

Common furbearers likely to occur within the site include: mink *(Mustela vison),* muskrat *(Ondatra zibethicus),* beaver *(Castor canadensis),* otter *(Lontra canadensis),* bobcat (*Lynx rufus*) and raccoon *(Procyon lotor).* Other furbearers expected to occur within the site include: opossum *(Didelphis virginiana),* striped skunk *(Mephitis mephitis),* and long-tailed weasel *(Mustela frenata).*

Game birds expected to occur within the site include: mourning dove (*Zenaida macroura*), bobwhite quail *(Colinus virginianus),* and wild turkey (*Meleagris galopavo*). Common songbirds likely to occur within the site include American robin *(Turdus migratorius),* eastern kingbird *(Tyrannus tyrannus),* American goldfinch *(Carduelis tristis*), rose-breasted grosbeak (*Pheucticus ludovicianus*), white-breasted nuthatch (*Sitta carolinensis*), tufted titmouse (*Parus bicolor*), black-capped chickadee (*Parus atricapillus*), blue jay(*Cyanocitta cristata*), Eastern phoebe (*Sayornis phoebe*), indigo bunting (*Passerina cyanea*), red bellied woodpecker (*Melanerpes carolinus*) downy woodpecker (*Picoides pubescens*), red-winged blackbird· *(Agelaius phoeniceus*), eastern bluebird *(Sialia sialis*), northern cardinal *(Cardinalis cardinalis),* northern oriole - Baltimore race - *(Icterus galbula),* and brown thrasher *(Toxostoma rufum),* among others.

The Big Muddy National Fish and Wildlife Refuge maintains a list of neotropical migratory species that are particularly important at the site. It is interesting to note the greater than average numbers and diversity of species that occur at the site.

The bald eagle (*Haliaeetus leucocephalus*) is commonly found as both a resident population and in higher concentrations as winter migrants in the project area. Bald eagles commonly nest along the Missouri River. USFWS reports their 2007 records show the closest active nest located upstream of the project area is near Glasgow, Missouri about river mile 225 and an active nest located downstream near river mile 207. Bald eagles utilize large trees along the Missouri River for nesting, roosting, and foraging perches. Bald eagles primarily feed on fish and migratory waterfowl. Although no longer listed under the Endangered Species Act the bald eagle still falls within requirements of the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

The Missouri River Valley is an important nesting and feeding area along the Central Flyway for many migratory waterfowl species including wood duck *(Aix sponsa),* bluewinged teal *(Anas discors),* green-winged teal *(Anas crecca),* mallard *(Anas platyrhynchos),* gadwall *(Anas strepera),* northern pintail *(Anas acuta),* Canada goose *(Branta Canadensis),* and snow goose *(Chen caerulescens),* among others. In additional to these fairly common species, the management of the Refuge by the U.S. Fish and Wildlife Service has resulted in a greater diversity and abundance of neotropical migratory species. The reader may obtain a list of these species by contacting the Big Muddy National Fish and Wildlife Refuge.

Common reptiles found on this unit include, timber rattlesnake (*Crotalus horridus*), Osage copperhead (*Agkistrodon contortrix phaeogaster*), Eastern garter snake (*Thamnophis sirtalis sirtalis*), Western ribbon snake (*Thamnophis proximus proximus*), Midland brown snake (*Storeria dekayi wrightorum*), Northern water snake (*Nerodia sipedon sipedon*), red milk snake (*Lampropeltis triangulum syspila*), black rat snake (*Elaphe obsolete obsolete*), five lined skink (*Plestiodon fasciatus*), Eastern spiny turtle (*Apalone spinifera spinifera*), red-eared slider (*Trachemys scrpta elegans*), false map turtle (*Graptemys pseudogeographica pseudogeographica*), Western painted turtle (Chrysemys picta bellii), and common snapping turtle (*Chelydra serpentina serpentina*).

Common amphibians found on the Jameson Island unit are Southern leopard frog (*Rana sphenocephala*), bull frog (*Rana catesbeiana*), plains leopard frog (*Rana blairi*), Western chorus frog (*Pseudacris triseriata*), Northern spring peeper (*Pseudacris crucifer crucifer*), Gray treefrog (*Hyala chrysoselis*), Blanchard's cricket frog (*Acris creptains blanchardi*), Woodhouse's toad (*Bufo woodhousii woodhousii*), Amercan toad (*Bufo amercanus*), and small-mouthed salamander (*Ambystoma texanum*) (Johnson 2006).

4.4.5 Invasive Species

Invasive species have the potential to displace native plants and animals. According to Executive Order 13122, Federal agencies may not authorize, fund, or carry out actions that are likely to cause or promote the introduction or spread of invasive species. Invasive aquatic species that are a concern in Missouri which have the potential to be introduced into new water bodies as a result of contaminated construction equipment include zebra mussels (*Dreissena polymorpha*), quagga mussels (*Dreissena bugensis*), New Zealand mudsnails (*Potamogyrpus antiposarum*), purple loosestrife (*Lythrum salicaria*), and Eurasian watermilfoil (*Myriophyllum spicatum*), among others. Invasive terrestrial species often flourish on land that has recently been disturbed. They may also be transported to new locations on construction equipment. Examples of invasive terrestrial species of concern in Missouri include johnsongrass (*Sorghum halepense*), reed canary grass (*Phalaris arundinacea*), and bromegrass (*Bromus sterilis*). Invasive plant species are common on disturbed areas in the general project area.

Common invasive fish species on the lower Missouri River include, common carp (*Cyprinus carpio*), goldfish (*Carassis auratus*), grass carp (*Ctenopharyngodon idella*),

silver carp (*Hypophthalmichthys molitrix*), bighead carp (*Hypophthalmichthys nobilis*), western mosquitofish (Gambusia affinis).

4.5 Threatened and Endangered Species

The Federally listed endangered pallid sturgeon generally occurs in the main channel of the large, turbid, free-flowing Missouri River, in the lower segments of some major tributaries, and in the shallow water of these areas. Modification of the natural Missouri River hydrograph, habitat loss, fish migration blockage, pollution, hybridization, and over harvesting are likely responsible for pallid sturgeon decline (USFWS 1993). SWH provides nursery habitat for larval and juvenile pallid sturgeon, and food for juvenile and adult pallid sturgeon (USFWS 2003). SWH is not intended to provide spawning habitat for pallid sturgeon. Sampling since 2002 has found the pallid sturgeon in the Missouri River adjacent to the project site.

The Federally listed endangered Indiana bat (*Myotis sodalis*) is presumed to occur in the project area because of suitable foraging and/or roosting habitat in and around the project area. From late fall through winter Indiana bats in Missouri hibernate in caves in the Ozarks and Ozark Border Natural Divisions. During the spring and summer, Indiana bats utilize living, injured (e.g., split trunks and broken limbs from lightening strikes or wind), dead or dying trees for roosting throughout the state. Indiana bat roost trees tend to be greater than 9 inches diameter at breast height (dbh) (optimally greater than 20 inches dbh) with loose or exfoliating bark. Most important are structural characteristics that provide adequate space for bats to roost. Preferred roost sites are located in forest openings, at the forest edge, or where the overstory canopy allows some sunlight exposure to the roost tree, which is usually within 1 km (0.6 mi.) of water. Indiana bats forage for flying insects (particularly moths) in and around the tree canopy of floodplain, riparian, and upland forests. In the project area Indiana bats could be found roosting in the uplands adjacent to the project area and foraging in the floodplain. USFWS reports there is a known hibernacula in Boone County, Missouri and maternity records in both Randolph and Chariton Counties, Missouri. Each of these counties borders the Missouri River and are either adjacent or in close proximity to Saline County where the proposed project is located.

4.6 Water Quality

The Clean Water Act authorizes States to adopt water quality standards to protect "waters of the United States" within their jurisdiction. By legislative design, water quality standards include; designated beneficial uses assigned to each waterbody; both general water quality criteria which are broad prohibitions against poor water quality and specific water quality criteria for individual pollutants or conditions; and an antidegradation policy which, in general, would maintain water quality which is better than minimally required to protect designated uses. Water quality criteria are developed to protect specific beneficial uses assigned to individual waterbodies. The Missouri River, in Missouri, is designated for irrigation, livestock watering, the protection of aquatic life and fish consumption, whole body contact recreation, secondary contact

recreation, drinking water supply and industrial water supply uses. Missouri's general water quality criteria apply to the Missouri River and Missouri's specific water quality criteria apply to those uses for which the river is designated in the State's standards. At present, the State's water quality standards do not include any specific criteria for nutrients or suspended solids applicable to the Missouri River. For waterbodies determined by the State to be not in compliance with the State's water quality standards because of pollutants, the State includes them on a list of waterbodies impaired by pollutants for which a Total Maximum Daily Load or TMDL is needed. An approved 2006 TMDL exists for PCBs and chlordane, legacy sediment and fish tissue contaminants on the Missouri River, and is listed in the State's proposed 2012 303(d) list for non-support of its recreational uses based on bacteria levels. The State's water quality standards, each biennial list of impaired waters and each TMDL is subject to EPA approval.

Since the state of Missouri does not have specific criteria for the protection of aquatic life, applicable to the Missouri River, for solids, total suspended solids, or nutrients (except for ammonia nitrogen) we based our evaluations of these constituents with regards to the State's general water quality criteria, comparisons of upstream and downstream conditions, and with consideration to past TMDLs and the State's proposed 2012 303(d) list. For constituents with numerical standards (i.e. metal concentration) evaluations utilized those State adopted, EPA approved, water quality criteria.

To evaluate baseline conditions and assess if habitat creation actions would adversely impact water quality, water, soil, and elutriate samples were collected in March 2011 from the Jameson Island site. Water collections were made from surface water immediately upstream of the project site (Figure 5.) from four locations across the mainstem river to account for potential lateral variability. Water samples were sent to a contract laboratory for analysis. Results from sampling (Table B) show concentrations of total phosphorus from the Jameson site are within the range or slightly below total phosphorus concentrations from samples collected at a nearby, long term monitoring locations (Figure 9). Similarly, concentrations of total nitrogen (calculated by summing results from total Kjeldahl nitrogen and nitrate/nitrite analyses) in samples collected at the project site were similar to collections taken at other nearby, long term monitoring locations (Figure 10). Note: The Jameson I. water samples were collected on one day so 0.95 percent confidence intervals cannot be calculated.

Table B. Median and mean (in parentheses) concentrations of analytes measured from elutriate and Missouri River water samples at the Jameson Island site.

Analytes	Elutriate	Water	MO WQS*
Ammonia Nitrogen (mg/L)	0.20 (0.21)	0.15 (0.14)	8.4 (pH 8.0)
Chlordane (gamma) (ug/L)	<0.05 (<0.05)	<0.05 (<0.05)	
DDT (ug/L)	<0.05 (<0.05)	<0.05 (<0.05)	
Dieldrin (ug/L)	<0.05 (<0.05)	<0.05 (<0.05)	
Nitrate/Nitrite as N (mg/L)	1.7 (1.7)	1.8 (1.93)	
OrthoPhosphate (mg/L)	0.074 (0.069)	0.13 (0.13)	
Percent Solids			
TOC (mg/L)	3.55 (3.57)	3.85 (3.85)	
Total Kjeldahl Nitrogen (mg/L)	0.68 (0.79)	0.94 (0.94)	
Total phosphorus (mg/L)	0.12 (0.12)	0.32 (0.32)	
Total Suspended Solids		155.5 (155.75)	
Metals -- Total (ug/L)			
Cadmium	<0.002 (<0.002)		11.6
Chromium	<0.05 (<0.05)		1207
Copper	<0.01 (<0.01)		32
Lead	<0.003 (<0.003)		172
Nickel	<0.015 (<0.015)		1017
Zinc	<0.006 (<0.006)		255
Metals -- Dissolved (ug/L)			
Cadmium		<0.002 (<0.002)	11.6
Chromium		<0.05 (<0.05)	1207
Copper		<0.01 (<0.01)	32
Lead		<0.01 (<0.01)	172
Nickel		<0.02 (<0.02)	1017
Zinc		<0.02 (<0.02)	255
Samples	6	4	

* State of Missouri Water Quality Standards for protection of aquatic life (Missouri 10 CSR 20-7.031)

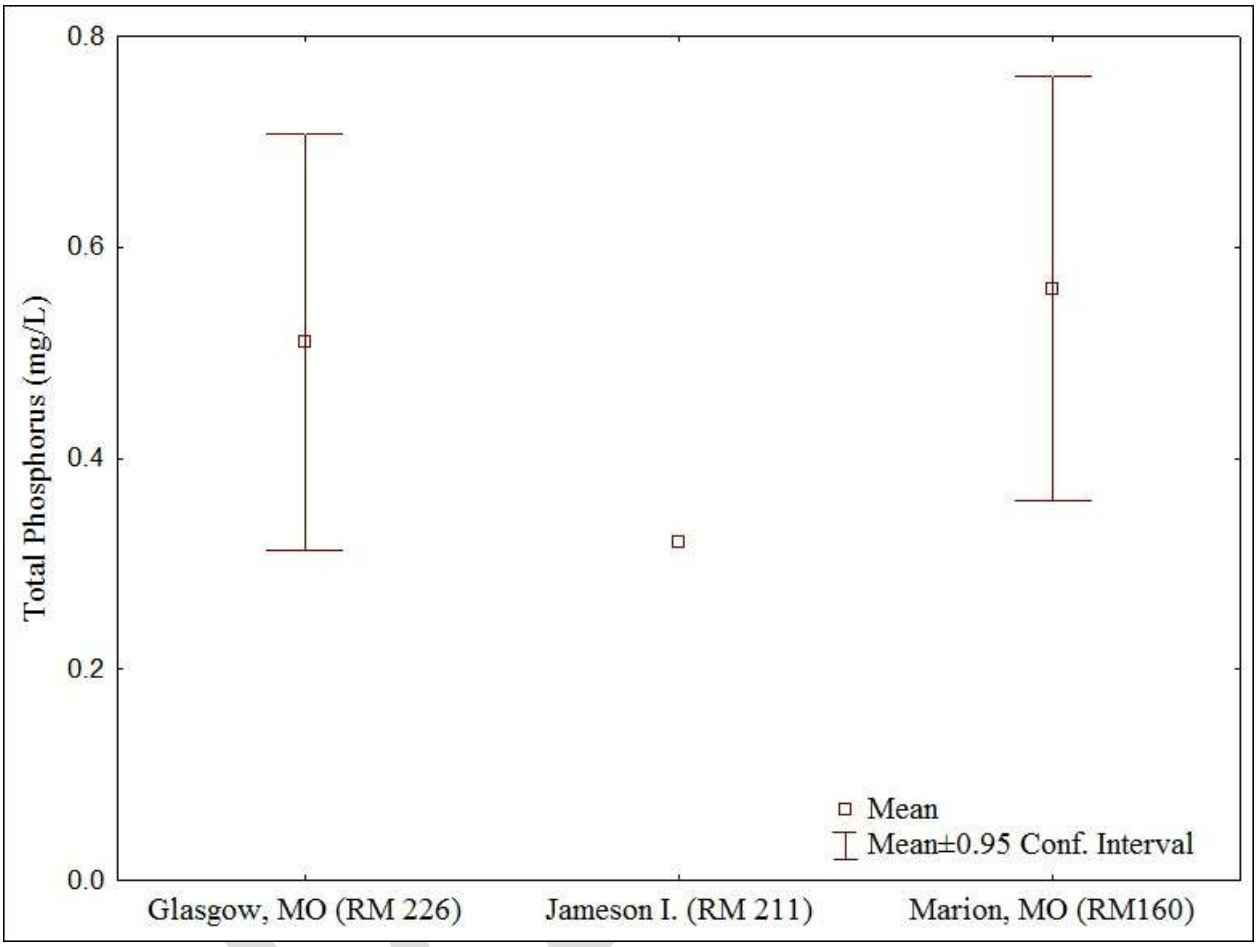

Figure 9. Total phosphorus concentrations in water samples collected from the Jameson Island project site and two nearby, long term monitoring stations.

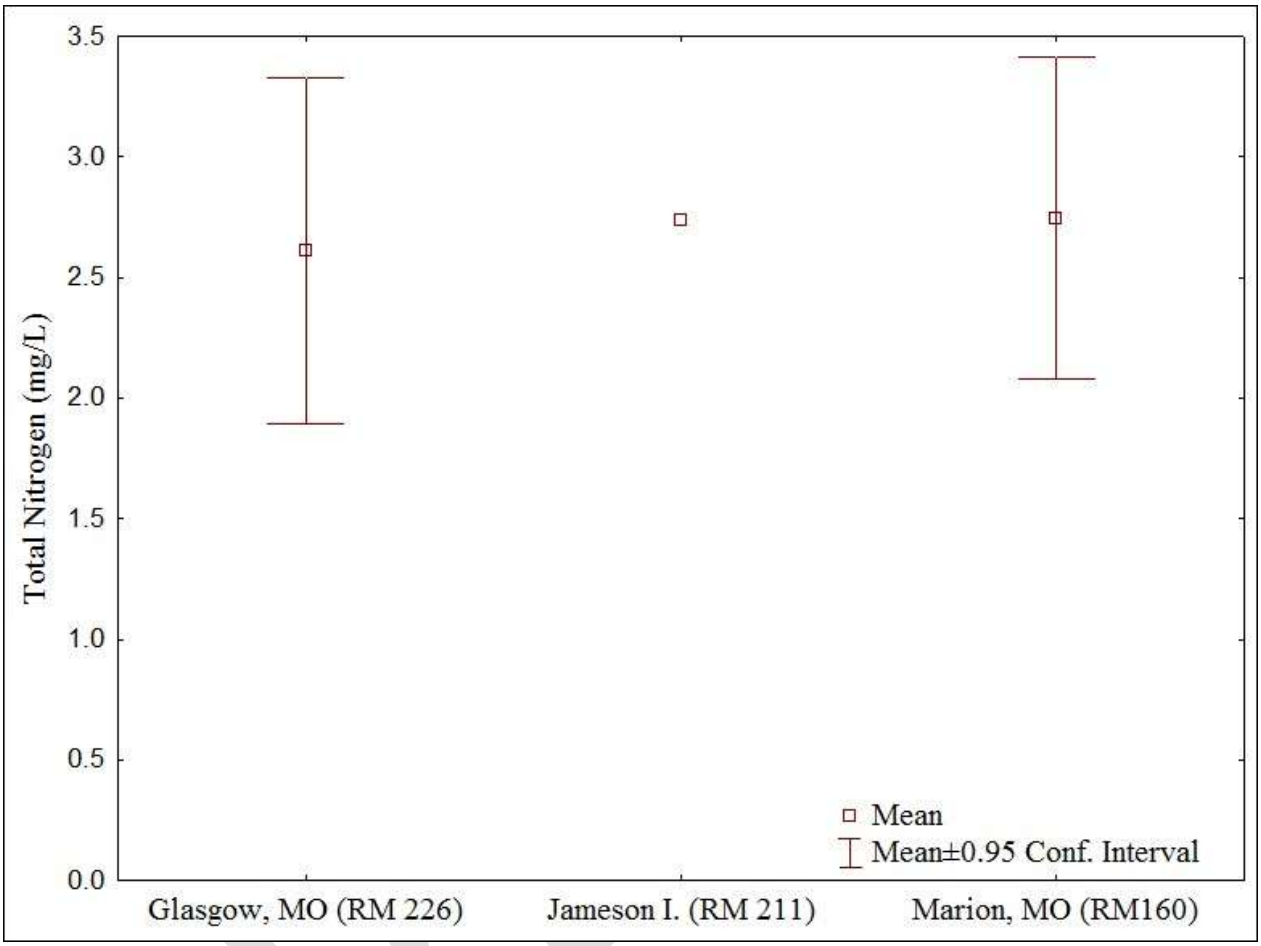

Figure 10. Total nitrogen concentrations in water samples collected from the Jameson Island project site and two nearby, long term monitoring stations.

All metal concentrations in elutriate samples and Missouri River surface water were compared to the acute criteria for protection of aquatic life for surface water hardness of 250 mg/L which can be found in Missouri 10 CSR 20-7 (see Table B). A comparison of the concentrations of select metals in water and elutriate samples to the State water quality criteria for those same metals, shows that none of the samples exceeded State standards.

4.7 Air Quality

Air quality in a given location is described by the concentrations of various pollutants in the atmosphere. The quality of the air is measured against National Ambient Air Quality Standards (NAAQS) set by the U.S. Environmental Protection Agency. The Jameson Island Unit is located in an attainment area, which is an area wherein the concentrations of all criteria pollutants meet the NAAQS.

4.8 Noise

Sounds that disrupt normal activities or otherwise diminish the quality of the environment are designated as noise. Noise can be stationary or transient and intermittent or continuous. The Jameson Island Unit is located in a rural setting. Existing noise levels in the proposed project area are highly variable. Noise sources include road traffic, distant railroad sounds, aircraft over flights, farm equipment, boats/barges on the Missouri River, firearms discharges during hunting and target shooting, and natural sounds of the wind, water flowing and wildlife. Lands surrounding the project site includes agricultural lands, wetlands, prairie, forest, the Missouri River, the Big Muddy NFWR, Arrow Rock National Historic Landmark, Arrow Rock State Historic Site, the town of Arrow Rock and other private lands. Big Muddy NFWR, Arrow Rock National Historic Landmark, Arrow Rock State Historic Site, would all be considered sensitive noise receptors.

4.9 Historic Properties and Cultural Resources

Cultural resources are defined as any area of past human activity, occupation, or use, identifiable through inventory, historical documentation, or oral evidence. Cultural resources include, but are not limited to, archeological sites, buildings or structures, cemeteries, and traditional cultural properties. Background research of the area was conducted to determine if any previously recorded cultural resources were present in the Jameson Island Unit SWH Restoration Project area. This research included a review of the National Register of Historic Places (NRHP) for sites listed on the NRHP, archeological and historic structure site location maps at the Missouri State Historic Preservation Office (SHPO), and shipwreck location maps in the Corps Kansas City District office. The entire proposed project area is part of the Big Muddy National Fish and Wildlife Refuge in Saline County, Missouri.

The review found five shipwrecks including the Sam Gaty (1867), the New Sam Gaty (1868), Tom Rodgers (1887), Benton No.2 (1895), and Plowboy No.2 (1877) have been recorded in the northwest part of the project area. In addition, review of historic Missouri River channel location maps from 1803, 1879, 1894, and 1926 found that the majority of the proposed chute location was crossed by the main channel of the Missouri River. Small portions of the proposed alignment could not be confirmed as a former channel location and hence recently accreted land. However, based on the former channel locations, it's most likely these areas were crossed by the channel in the mid to late 19th Century. Also, because of the recent age of the soils in the project area, it's unlikely that any prehistoric archeological sites are present in the area. However, the Arrow Rock National Historic Landmark, a 19th Century town, listed on the National Register of Historic Places and comprised of 8 listed properties and 260 contiguous acres lies on the bluff just west of the project area. A map showing the potential location of shipwrecks, non-accreted land is included as Figure 11 and the extent of the Arrow Rock National Historic Landmark is shown in Figure 1. No recorded prehistoric archaeological sites or other historic properties were identified in the immediate project area. However, it's

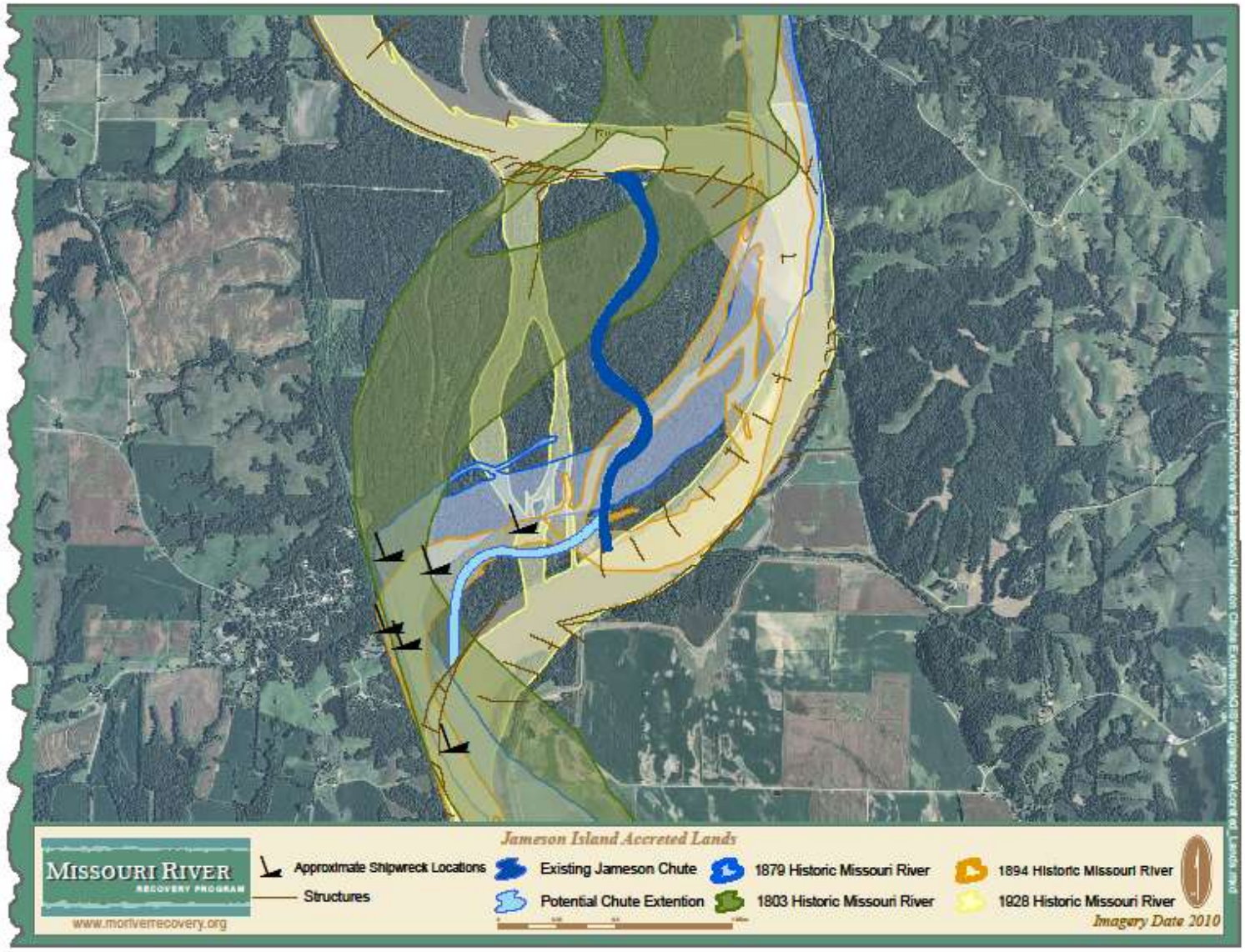

Figure 11. Accreted Lands and Mapped Shipwrecks

possible unknown historic archeological deposits associated with Arrow Rock may be present in the floodplain along the bluff line below the town.

In accordance with requirements of Section 106 of the National Historic Preservation Act, the Corps provided the Missouri State Historic Preservation Office with a determination of "no historic properties affected" for the proposed project. In addition, through this process the project is being coordinated with affiliated federally recognized Native American tribes.

4.10 Socioeconomic Resources

Socioeconomic resources are the part of the human environment that includes the economic, demographic, and social characteristics of individuals and communities.

4.10.1 Population and Income

The proposed project is located in Saline County, Missouri. As of the census of 2010, there are 23,370 people, 8,883 households, and 5,802 families residing in Saline County. The racial makeup of the county is 86.2% White, 5.3% Black or African American, 0.3% American Indian and Alaska Native, 0.5% Asian, 0.7% Native Hawaiian and Other Pacific Islander, 4.6% Some Other Race, 2.4% from Two or More Races, and 8.2% are Hispanic or Latino.

The population is spread out with 23.1% under the age of 18, 61.1% from 18 to 64 and 15.8% who are 65 years of age or older. The median age is 38.2 years old. Females comprise 50.5% of the population and males 49.5%. The median income for a household in the county is $38,819 (2006-2010). The per capita income for the county is $18,581 (2006-2010 in 2010 dollars). A total of 19.1% of the population (2006-2010) is below the poverty line (US Census Bureau-QuickFacts).

4.10.2 Navigation

The Missouri River from river mile 735 near Sioux City, NE to river mile zero near St. Louis, MO is maintained and operated by the Corps under the authority and in accordance with requirements of the Missouri River Bank Stabilization and Navigation Project (BSNP). The Corps must maintain a 9-foot deep by 300-foot wide navigation channel on the lower 735 miles of the Missouri River including the segment in the project area. In addition, Missouri River flows are managed in part, for commercial navigation on the Missouri River. Navigation on the Missouri River is limited to the normal ice-free season, with a full-length flow support season of 8 months (Corps 2001). At Sioux City, the full-length support season extends from March 23 to November 22 and at St. Louis the full-length support season extends from April 1 to December 1 (Corps 2001).

Since the BSNP was completed the area immediately upstream and adjacent to the proposed project site has always had two of the narrowest and sharpest bends on the lower Missouri River. In addition there is a very large sandbar on the inside of the

Jameson Bend which pre-dates SWH restoration efforts in this area by many years. The Corps routinely monitors the Missouri River navigation channel and coordinates these efforts with U.S. Coast Guard and commercial navigators on the river. In areas where navigation impediments are identified the Corps works with U.S. Coast Guard and commercial navigators to develop and implement corrective action that will restore and maintain the authorized 9-foot deep by 300-foot wide navigation channel.

The Corps must develop the Mitigation Project in a manner that does not adversely affect the current Congressionally authorized purposes of the Missouri River, including navigation. Designs for SWH are developed to maintain sufficient flow in the navigation channel, and not result in deposition that would result in shoaling within the navigation channel or create other hazards to navigation.

As noted above, since the BSNP was completed this area has always had two of the narrowest and sharpest bends on the lower Missouri River. In addition there is a very large sandbar on the inside of the Jameson Bend which pre-dates SWH restoration efforts in this area by many years. On October 29 and November 14, 2011 vessels pushing upriver broke tow to pass through the Jameson/Lisbon Bend area.

The Corps must ensure that the Mitigation Project does not adversely impact the Congressionally authorized purposes of the Missouri River, including navigation. Three bathymetric surveys were performed on the bend at river mile 213 – 214 this year (Oct 13, 2011; Nov 10, 2011; and Dec 21, 2011). These surveys were compared against previous surveys and combined with visual inspection to report the following:

1) This bend is historically prone to shoaling. Recent shoaling occurred at the same location as shoaling prior to the construction of the Jameson chute.

2) This bend is the tightest bend on the river.

3) The shoaling is transient. There is no discernible trend towards decreased channel depths.

4) A substantial volume of flow travels across the point bar and behind flanked dikes during higher flows and is a dominant factor contributing to channel shoaling.

Upcoming repairs/modifications of structures in this bend as part of standard BSNP maintenance are anticipated to decrease the flow across the point bar. It is hoped that this will ease the navigation problems. The Corps continues to monitor the area and plans to take corrective action as needed to when navigation problems occur. These actions are independent of additional shallow water habitat restoration on Jameson chute.

4.10.3 Flood Risk Management

While there is an extensive flood risk management system along the Missouri River, there are no existing flood risk management systems located on the project area. The project area at one time did have an agricultural levee but this was severely damaged by the 1993 Flood and was not restored by USFWS as one of their management goals for the Jameson Unit was to restore floodplain connectivity. On the river bank opposite the project area is an extensive flood risk management system comprised of the Howard County Levee District No. 3, Section 2, the Howard County Levee District No. 7, and the Howard County Levee District No. 2. These Districts were organized by the Howard County Circuit Court and together provide a complete flood risk management unit. Total area within the unit is 13,861 acres of which approximately 13,400 acres are in agricultural production. The area within the unit includes the community of Petersburg, a 4 mile Section of State Highway Route Z, approximately 30 miles of gravel surfaced County roads, several residences and farm related buildings. These Districts participate in the Corps P.L. 84-99 Levee Rehabilitation and Inspection Program.

The Corps must develop the Mitigation Project in a manner that does not adversely affect the current Congressionally authorized purposes of the Missouri River, including flood control. Designs for SWH are developed to ensure that these projects do not adversely impact existing flood risk management systems. One of the main "lessons learned" out of the original Jameson Chute Construction Project was that the Corps must do a better job of coordinating proposed SWH restoration projects with adjacent Levee Districts. As with the BSNP, the Corps routinely monitors performance of SWH restoration projects to determine if they are contributing to adverse impacts on adjacent flood risk management systems. If these conditions are identified the Corps works with the affected Levee District to develop and implement a corrective plan of action.

4.10.4 Recreation / Aesthetics

The Jameson Island Unit is managed by the USFWS as part of The Big Muddy National Fish and Wildlife Refuge (Refuge). The Refuge was established in 1994 and is authorized to expand 60,000 acres in 25 to 30 units along the Missouri River and the lower reaches of its tributaries between St. Louis and Kansas City, Missouri. The Jameson Island Unit consists of 1,871 acres and forms one of the units. Located just upstream is the Refuge's 2,013 acre Lisbon Bottom Unit. Objectives of the Refuge include: restoring portions of the Missouri River Floodplain; improving and restoring wetland habitat; improving fisheries and wildlife resources; and providing public opportunities for outdoor recreation and environmental restoration. The USFWS allows approved recreational activities for the public at the site such as hunting, fishing, nature study, wildlife viewing, photography, hiking, and nature walking. The Jameson Island Unit is highly valued by visitors for these recreational opportunities which can be experienced in a large contiguous area of natural habitat adjacent to the Missouri River, rich in natural beauty and wildlife, and providing the opportunity for peace and solitude.

Located just west of the Project Area is the Missouri Department of Natural Resource's Arrow Rock State Historic Site. The park is located within the boundary of the Arrow Rock National Historic Landmark shown in Figure 1. The park preserves several historic structures and interprets the history of Arrow Rock while offering compatible recreation use for camping, picnicking, fishing, hiking, and wildlife viewing.

Chapter 5 – Environmental Consequences

5.1 Introduction

This chapter presents the evaluation of beneficial and adverse impacts of the alternatives including if there is the potential for significant impacts of the Federal action on the human environment. The analysis focused on identifying types of impacts and estimating their potential significance in various environmental and socioeconomic resource areas. The environmental impacts of the implementation and site selection process for the Mitigation Project were previously evaluated and documented in the *Feasibility Report and Environmental Impact Statement* (Corps 1981) and the *Supplemental Environmental Impact Statement* (Corps 2003), Thus, this PIR only evaluates those impacts anticipated from the construction and operation of the alternatives specific to the Jameson Island Unit SWH Restoration Project. The "No Action" Alternative considers the existing condition at the site and this includes the original/existing Jameson Island Chute Construction Project. Baseline and Future Without Project conditions described for the project area include the original/existing Jameson Island Chute Construction Project.

The concept of "significance" used in this chapter encompasses several factors, including the magnitude of change from existing conditions and the likelihood of the change to occur. An impact is considered adverse when the outcome of the action results in undesirable effects. A beneficial impact can result if the current condition is improved or if an existing undesirable effect is lessened. Adverse impacts can be mitigated by different means such as through avoidance or minimization of adverse effects. Beneficial and adverse impacts, including unavoidable adverse effects, are discussed in each resource section of this chapter.

5.2 Summary of Effects

A Comparison of Alternatives which briefly summarizes the effects of the various alternatives is included in Table B.

TABLE B - COMPARISON OF ALTERNATIVES
JAMESON ISLAND UNIT SHALLOW WATER HABITAT RESTORATION PROJECT

Alternative/ Resource	Shallow Water Habitat (SWH) Created	Wetlands Impacted	Riparian Timber Impacted	Floodplain Connectivity	Water Quality	Fish and Wildlife incl. Endangered Species	Flood Risk Management	Navigation	Sediment Reintroduction	Cultural/Tribal Resources	Noise	Aesthetics /Recreation	Estimated Construction Costs
Alternative 1 – "No Action"	No adverse impacts to SWH / no increase in SWH	No adverse impacts to wetlands / no improvement	No adverse impacts to riparian timber	No adverse impacts to floodplain connectivity / no improvement	No adverse impacts to water quality	No adverse impacts to fish and wildlife incl. endangered species / no improvements	No adverse impacts to flood risk management – Does not address Levee District recommendation	No adverse impacts to navigation	No improvement to sediment reintroduction / no improvement	No adverse impacts to cultural/Tribal resources No risk to encounter unmapped deeply buried shipwreck	No adverse noise impacts to recreational users/wildlife of the Refuge	No adverse impacts to aesthetics / recreation	$0.00
Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area	At construction completion: 17 acres SWH (14 acre chute +3 acre backwater) At full development: 30 acres SWH (27 acre chute + 3 acre back water)	At construction 8.9 acres total (3.74 ac. freshwater emergent marsh, 3.45 ac. freshwater forested/shrub wetland, 1.75 ac. freshwater pond) No expected increase at full development	64.7 acres cleared	Minor temporary adverse impact to floodplain connectivity as large stockpiles of earthen material inhibit natural flow & scouring/deposition on the floodplain – offset by long term benefits to floodplain connectivity	Median adverse impact on water quality. These adverse impacts would be related to the potential erosion of the earthen stockpiles and deposition of this material in wetlands adjacent to the chute alignment & the permanent loss of wetlands.	Median adverse impacts due to riparian timber/wetland loss and stockpiles temporarily inhibiting movement – greatly offset by long term benefits to aquatic habitat and native life forms that are dependent on it incl. pallid sturgeon	No adverse impacts to flood risk management - addresses Levee District recommendation	No adverse impacts to navigation	Minor benefits to sediment reintroduction but since excavated material is stockpiled on floodplain within meander process area - more dependent on high flows	No adverse impacts to cultural/Tribal resources Minor risk to encounter unmapped deeply buried shipwreck	Minor short term construction related noise impacts that could affect recreational users/wildlife of the Refuge – considered median adverse impact of three "Build Alternatives"	Minor short term construction related adverse impacts & temporary stockpiles of earthen material - considered median adverse impact of three "Build Alternatives"	$4,457,042
Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area	At construction completion:30 acres SWH (27 acre chute + 3 acre backwater) At full development: No change	At construction 14.9 acres total (6.30 ac. freshwater emergent marsh, 5.68 ac. freshwater forested/shrub wetland, 2.92 ac. freshwater pond) No expected increase at full development	109.5 acres cleared	Greatest adverse impact to floodplain connectivity as permanent large stockpiles of stabilized earthen material inhibit natural flow and scouring/deposition on the floodplain	Greatest adverse impact on water quality. These adverse impacts would be related to the potential erosion of the earthen stockpiles and deposition of this material in wetlands adjacent to the chute alignment & the permanent loss of wetlands.	Greatest long term adverse impacts to riparian timber/wetland to clear additional land and permanent stockpiles inhibiting movement – impacts partially offset by long term benefits to aquatic habitat and native life forms that are dependent on it incl. Pallid sturgeon. Little potential to integrate large woody debris into aquatic system	No adverse impacts to flood risk management - addresses Levee District recommendation	No adverse impacts to navigation	Least benefit to sediment reintroduction as full chute is excavated and material stockpiled/stabilized outside meander process area	No adverse impacts to cultural/Tribal resources Minor risk to encounter unmapped deeply buried shipwreck	Minor short term construction related noise impacts that could affect recreational users/wildlife of the Refuge - considered greatest adverse impact of three "Build Alternatives"	Minor short term construction impacts / Minor long term adverse impacts resulting from large permanent stockpiles of earthen material - considered greatest adverse impact of three "Build Alternatives"	$8,670,085
Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)	At construction completion: 16.77 acres SWH (13.77 acre chute + 3 acre backwater) At full development: 30 acres SWH (27 acre chute + 3 acre backwater)	At construction 5 acres total (2.25 ac. freshwater emergent marsh, 1.84 ac. freshwater forested/shrub wetland, 0.89 ac. freshwater pond) Potential to increase to 8.9 acres at full development	34.4 acres cleared	No adverse impact to floodplain connectivity as no large piles of stockpiled earthen material would inhibit natural flow, scouring/ deposition on the floodplain – long term benefits to floodplain connectivity	Least adverse impact on water quality. These adverse impacts would be related to the potential erosion of the earthen stockpiles and deposition of this material in wetlands adjacent to the chute alignment & the permanent loss of wetlands.	Least adverse impacts due to riparian timber/wetland loss, very minimal temporary stockpiles of woody debris/earthen material – greatly offset by long term benefits to aquatic habitat and native life forms that are dependent on it incl. pallid sturgeon	No adverse impacts to flood risk management - addresses Levee District recommendation	No adverse impacts to navigation	Minor benefits to sediment reintroduction as material is dredged and quickly integrated into the bedload – not as dependant on high flows	No adverse impacts to cultural/Tribal resources Minor risk to encounter unmapped deeply buried shipwreck	Minor short term construction related noise impacts that could affect recreational users /wildlife of the Refuge - considered least impact of three "Build Alternatives"	Minor short term construction related adverse impacts - considered least impact of three "Build Alternatives"-	$3,539,225

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5.3 Soils/Topography

Alternative 1 - "No Action"

Alternative 1 –The "No Action" Alternative would involve no additional restoration of SWH on the Jameson Island Unit – Big Muddy National Fish and Wildlife Refuge. The "No Action" Alternative would have no impact on soils or topography.

"Build Alternatives"

The Corps does not expect any change in the existing soil conditions to result from implementation of any of the "Build Alternatives". All "Build Alternatives" would change the site topography. The varying levels of effect resulting from changes to site topography for each alternative are:

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

Alternatives 2, which involves the construction of temporary earthen stockpiles within the meander process area would be considered to have median adverse impacts to topography of the three "Build Alternatives" considered. Alternative 2 would temporarily block fish and wildlife movement back and forth from the floodplain to the SWH, alter flood flow on the floodplain, and increase sediment deposition into existing adjacent wetland areas. Alternative 2 would temporarily create an unnatural landform not typically found on the floodplain resulting in a temporary adverse aesthetic impact. Removal of stockpiled earthen material through natural river processes under Alternatives 2 would be expected to take several years and would be totally dependent on the occurrence and frequency of high flow events. While the adverse the impacts of Alternative 2 on soils/topography would be much less than the long term permanent adverse impacts associated with Alternative 2 they would be greater than those associated with the "Recommended Plan".

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

Alternatives 3, which involve full excavation of the chute and construction of large permanent earthen stockpiles outside the meander process area, would have the greatest adverse impacts on topography of the three Build Alternatives considered. Alternative 3 the stockpiled material would be expected to permanently alter the topography of the floodplain and create an unnatural landform not typically found on the floodplain. The large earthen mounds block fish and wildlife movement back and forth from the floodplain to the SWH, alter flood flow on the floodplain, and increase sediment deposition into existing adjacent wetland areas. Alternatives 3 create the greatest and most long term adverse aesthetic impact of the "Build Alternative" considered. As other

alternatives exist that do not involve the construction of large earthen stockpiles that do not permanently alter the site topography, these impacts would be considered avoidable.

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

Alternative 4 which involves minimal stockpiling of earthen material adjacent to the chute would have the least adverse impacts associated with changing site topography. As this minimal amount of earthen material would be placed within the meander process area these minor adverse impacts would be temporary. Of the "Build Alternatives" considered, the low level earthen stockpiles to be constructed under the Recommended Plan would have the least impact on fish and wildlife movement back and forth from the floodplain to the SWH, the least impact of altering flood flow on the floodplain, and the least potential to increase sediment deposition into existing adjacent wetland areas. The Recommended Plan does not include large amounts of stockpiled material on the floodplain and therefore it is not as dependant on high river flows for integrating the material into the river. There would be no significant adverse impacts to soils/topography under the "Recommended Plan".

5.4 Biological Resources

Biological resources include the native or introduced plants and animals and the habitats in which they occur. Aquatic resources include fisheries, and terrestrial/wetland resources include vegetation communities and wildlife populations. Species that are candidates for, or listed as, threatened or endangered are included in both aquatic and terrestrial/wetland resources. Impacts to these resources would be from the construction and operation of the Jameson Island Unit SWH Restoration Project. An adverse impact would be significant if the viability of a biological resource of the area was jeopardized, with little likelihood of reestablishment to its original state or the action would result in the taking of a listed threatened or endangered species. The significance of the impact would also be dependent upon the importance of the resource and its relative occurrence in the vicinity of the site.

5.4.1 Aquatic Resources

Alternative 1 - "No Action"

Alternative 1 –The "No Action" Alternative would involve no additional restoration of SWH on the Jameson Island Unit – Big Muddy National Fish and Wildlife Refuge. Under the "No Action" Alternative the adverse impacts of the BSNP which have severely reduced aquatic habitat diversity, including greatly reducing SWH, and constrained the dynamic natural river processes which create this diverse habitat would continue.

"Build Alternatives"

Each of the "Build Alternatives" would have both beneficial and adverse impacts to aquatic resources. The majority of potential adverse impacts are short term and construction related. No significant adverse impacts to aquatic resources are anticipated. The fisheries resource associated with the Jameson Island Unit SWH Restoration Project could temporarily be disturbed during construction of the chute extension and diversion structure across the existing chute outlet. An important intent of the "Build Alternatives' is to create and restore fisheries habitat. It is expected that approximately 30 acres of SWH (27-acre chute and a 3-acre backwater) would be restored at full development under each of the "Build Alternatives".

Extending the existing Jameson Island Chutre and development of the backwater aresa would create SWH. Deep holes, shallow flats, and backwater habitats would be expected to develop. These areas would provide habitat for fish species, macroinvertebrates, and plankton and provide a critical forage base needed for larval and juvenile fish. Populations of fish species, including the endangered pallid sturgeon, that have been declining in numbers, would benefit from SWH development. Long term and cumulative beneficial effects of the project on aquatic resources of the Missouri River would greatly outweigh any minor temporary construction related impacts.

The following provides an assessment of impacts to aquatic resources under the "Build Alternatives".

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

Chute development under Alternatives 2 would be somewhat dependant on flows and the resulting final bottom width of the chute and scouring action of the banks. As with the "Recommended Plan" an increase in sediment load within the Missouri River would help simulate historic conditions of the river and would provide additional sediment for downstream deposition and improvement of SWH conditions. Increased turbidity lowers light transmission into the water. This could benefit the native species which are adapted to these conditions. Alternative 2 would be expected to integrate large amounts of woody debris which provides important habitat. As Alternative 2 involves stockpiling of earthen material on the floodplain it would have the potential to restrict fish movement from the chute onto the floodplain during high flow events. As that material would be placed within the meander process area the impact would be temporary. While that impact would be greater than under the "Recommended Plan", it would be much less than the long term adverse impact expected under Alternative 3.

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

Chute development under Alternative 3 would not be dependant on flows and the resulting final bottom width of the chute and scouring action of the banks. Benefits to aquatic resources associated with the natural development of the chute and integration of woody debris that would occur under Alternatives 2 and the "Recommended Plan" would not be realized under Alternative 3 as the chute would be excavated to its full width and all material, including woody debris, would be stockpiled and stabilized outside the meander process area to prevent its introduction into the aquatic system. As Alternative 3 involves the greatest amount of earthen material stockpiled on the floodplain it would have the greatest potential to restrict fish movement from the chute onto the floodplain during high flow events. As that material would be placed outside the meander process area and stabilized that adverse impact would be long term. In addition, these adverse impacts to aquatic resources associated with the permanent earthen stockpiles would be considered to be avoidable.

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

Chute development under 4 would be somewhat dependant on flows and the resulting final bottom width of the chute and scouring action of the banks. As with Alternative 2, an increase in sediment load within the Missouri River would help simulate historic conditions of the river and would provide additional sediment for downstream deposition and improvement of SWH conditions. Increased turbidity lowers light transmission into the water. This could benefit the native species which are adapted to these conditions. Alternative 4 would be expected to integrate large amounts of woody debris which provides important habitat. As Alternative 4 involves only minimal stockpiling of earthen material on the floodplain it would have the least potential to restrict fish movement from the chute onto the floodplain during high flow events. As that material would be placed within the meander process area the impact would be temporary. No significant adverse impacts to aquatic resources where identified for the 'Recommended Plan".

5.4.2 Woodlands

Alternative 1 - "No Action"

Alternative 1 –The "No Action" Alternative would involve no additional restoration of SWH on the Jameson Island Unit – Big Muddy National Fish and Wildlife Refuge. As there would be no clearing and grubbing, the "No Action" Alternative would have no adverse impact on woodland resources. While the "No Action" Alternative would not result in any adverse impacts to woodlands there would be no benefits

achieved as the proposed project would be expected to produce an uneven aged stand of woody vegetation along the length of the proposed chute. The current BSNP greatly limits floodplain connectivity and the ability of high flows to erode and deposit material along the river. Creating areas where cutting integrates large standing trees into the aquatic ecosystem and sedimentation creates sandbars where stands of young willows and cottonwoods develop, creating woody vegetation diversity, would not be achieved under the "No Action" Alternative.

"Build Alternatives"

Each of the "Build Alternatives" (Alternative 2 through 4) would require the clearing and grubbing of the chute alignment which would result in permanent adverse impacts to riparian woodlands. Considering the extent of timbered riparian habitat on the Jameson Island Unit this would not be considered a significant impact. The current condition created by the BSNP tends to result in an even aged stand of woody vegetation on the floodplain. By restoring the dynamic process where the chute is allowed to meander on the floodplain woody debris is added to the chute on the cutting side river bank while on the slack side sediment deposition results in sandbars that quickly become populated with cottonwoods and willows creating a ever changing variety in the age and type of woody vegetation found along the length of the chute. The varying levels of effect resulting from clearing of riparian woodlands for each alternative are:

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

The clearing of approximately 64.7 acres of riparian woodland required under Alternative 2 would result in a median adverse impact of the "Build Alternatives" considered. For Alternatives 2 the chute alignment would be converted from riparian timber to SWH. Impacts associated with clearing of timber to construct the chute would be considered unavoidable.

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

The clearing of approximately 109.5 acres of riparian woodland required under Alternative 3 would result in the greatest adverse impact of the "Build Alternatives" considered. In addition to clearing the chute alignment Alternative 3 requires the clearing of approximately 45 additional acres to create an area outside the meander process area where earthen material from the fully excavated chute can be permanently stockpiled. While impacts associated with clearing of timber to construct the chute would be considered unavoidable, the adverse impacts associated with clearing 45 additional acres to accommodate the permanent earthen stockpiles would be considered avoidable.

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

The clearing of approximately 34.4 acres of riparian woodland required under Alternative 4 would result in the least adverse impact of the "Build Alternatives" considered. For Alternatives 4 the chute alignment would be converted from riparian timber to SWH. Additional riparian timber could be eliminated if the chute meandered beyond the cleared alignment. The "Recommended Plan' does not involve the stockpiling of large amounts of excavated material along the chute alignment and would allow this to occur more quickly. Impacts associated with clearing of timber to construct the chute would be considered unavoidable. No significant adverse impacts to woodlands were identified under the "Recommended Plan".

5.4.3 Wetlands

Alternative 1 - "No Action"

Alternative 1 –The "No Action" Alternative would involve no additional restoration of SWH on the Jameson Island Unit – Big Muddy National Fish and Wildlife Refuge. The "No Action" Alternative would result in no adverse impacts to existing wetland resources. While existing wetlands would not be adversely impacted there would be no increase in floodplain connectivity which could benefit the existing wetland resources on the Jameson Island Unit. In addition, there would be no restoration of the dynamic river processes which would be expected to naturally develop and maintain wetlands on areas adjacent to the proposed chute.

"Build Alternatives"

Each of the Build Alternatives would result in the permanent loss of wetland habitat. The Corps has developed a chute alignment that avoids existing wetlands to the greatest extent practicable in addition the Corps will utilize Best Management Practices during construction to avoid/minimize impacts to wetland areas adjacent to the construction site. During initial alternative analysis for the original Jameson Chute Construction Project reopening of the old channels that crosses the site from north to south was considered. After being blocked off by the BSNP these areas have developed as wetlands. Under each of the "Build Alternatives" the Corps would utilize a rock and/or earthen structure across the old river channel scar to ensure that the "Build Alternatives" did not result in headcutting into or adverse impacts to these existing wetlands.

Wetlands on the pre-altered Missouri River floodplain were rarely static but were simultaneously being created and destroyed by the ever meandering channel, scouring flows and sediment deposition. The Lisbon Chute is a good example of how wetland benefits can be achieved by restoring the natural process on even a small portion of the

river. Along the Lisbon Chute there are backwater and fringe areas where wetlands are developing adjacent to the chute. Finding wetland habitat immediately adjacent to the main Missouri River is rare and most areas along the main channel have steep sided banks. Meandering of the channel along the Lisbon Chute has also created shelving and depressional areas that exhibit wetland characteristics. We would in the future expect to see this same kind of wetland habitat development along the length of the existing Jameson Island Chute and the chute extension proposed under the Recommended Plan.

The Corps has developed habitat mapping at time of acquisition for each mitigation site and then updates this as mapping as habitat restoration efforts progress. Looking at time of acquisition in Missouri on 31,073 acres there were a total of approximately 2,152 acres of wetland (206.74 acres forested wetland, 1,689 acres emergent wetland, and 257 acre scrub-shrub wetland). In a review of current habitat on 29,116 of those existing acres in Missouri there were now approximately 3,225 acres of wetland (767.79 acres forested wetland, 1,974 acres emergent wetland, and 484 acres scrub-shrub wetland) representing a gain of approximately 1,073 acres in wetland habitat. During implementation of the Mitigation Project every effort is made to avoid and/or minimize adverse impacts to existing wetlands. One of the Mitigation Project's primary objectives on areas where terrestrial restoration is being carried out is to restore degraded wetlands and/or enhance existing wetlands. Unavoidable minor impacts to wetlands resulting from those wetland/aquatic resource restoration activities are clearly outweighed by an overall increase in wetland quantity and quality on the Mitigation Project sites.

The following provides an assessment of wetland impacts under the "Build Alternatives".

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

Of the three "Build Alternatives", Alternative 2, which includes stockpiling within the meander process area, would result in the loss of approximately 8.9 acres of wetlands (3.74 acres freshwater emergent marsh, 3.45 acres freshwater forested/shrub wetland, 1.75 acres freshwater pond) at completion of construction with no increase expected as the chute becomes fully developed. While initially this impacts more wetland than the "Recommended Plan" in the long term, when the chute is fully developed, wetland impacts under Alternative 2 and the "Recommended Plan" are expected to be equal at approximately 8.9 acres. Stockpiling of earthen material on the floodplain under Alternative 2 would temporarily alter flow patterns blocking flow to adjacent wetlands and limiting the scouring/ depositional effects of overbank flow on the floodplain. These temporary stockpiles could contribute sediment and fill in wetland areas adjacent to the chute alignment causing further losses. Under Alternative 2 the area that would be cleared, including the area where the excavated earthen material would be stockpiled, would eventually be converted to SWH. Wetland impacts under Alternative 2 are considered unavoidable as SWH construction will almost invariably transect across some remnant of wetland on the floodplain. The minor temporary impacts associated with

stockpiles contributing sediment and filling in wetland areas adjacent to the chute alignment would be slightly greater than the Recommended Plan but far less than Alternative 3. Construction of SWH would be considered a water dependant activity.

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

Of the three "Build Alternatives", Alternative 3, with the greatest amount of clearing and permanent stockpiling outsider the meander process area would involve the greatest loss of wetlands at approximately 14.9 acres (6.30 acres freshwater emergent marsh, 5.68 acres freshwater forested/shrub wetland, 2.92 acres freshwater pond). Stockpiling of earthen material on the floodplain under Alternative 3 would permanently alter flow patterns blocking flow to adjacent wetlands and limiting the scouring/depositional effects of overbank flow on the floodplain. These permanent stockpiles could contribute sediment and fill in wetland areas adjacent to the chute alignment causing further losses. Alternative 3 would have the greatest potential for these impacts considering the amount and permanent nature of the stockpiles. While wetland impacts under Alternative 3 to construct the chute are unavoidable as SWH construction will almost invariably transect across some remnant of wetland on the floodplain, the filling of 6 additional acres of wetlands to accommodate permanent stockpiling of excavated earthen material outside the meander process area, would be considered avoidable as this material would have less impact on wetlands if it were placed within the meander process area as in Alternative 2 or if integrated directly into the Missouri River bedload as in the Recommended Plan. Construction of SWH would be considered a water dependant activity. As this alternative includes avoidable impacts to wetland resources it would not be considered the least environmentally damaging practicable alternative.

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

As the Recommended Plan would involve minimal stockpiling of earthen material and minimal clearing initially it would result in the least impact to wetland areas, totaling approximately 5 acres (2.25 freshwater emergent marsh, 1.84 acre freshwater forested/shrub wetland, 0.89 freshwater pond) at completion of construction. As the chute fully developed it would be expected that these impacts would extend to a total of approximately 8.9 acres of wetlands (3.74 acres freshwater emergent marsh, 3.45 acres freshwater forested/shrub wetland, 1.75 acres freshwater pond). While having less impact at completion of construction, long term wetland impacts are expected to be equal between the Recommended Plan and Alternative 2. As only a very minimal amount of earthen material would be stockpiled on the floodplain under Alternative 4, it would have the least potential to alter flow patterns, block flow to adjacent wetlands or limit the scouring/ depositional effects of overbank flow on the floodplain. These temporary stockpiles could contribute sediment and fill in wetland areas adjacent to the chute

alignment causing further losses but these impacts would be the least of the "Build Alternatives". As the material would be placed in the meander process area, these impacts would be temporary. Under Alternative 4 the area that would be cleared and adjacent wooded areas would eventually be converted to SWH. Wetland impacts under Alternative 4 are considered unavoidable as SWH construction will almost invariably transect across some remnant of wetland on the floodplain. Construction of SWH would be considered a water dependant activity. The Recommended Plan has the least impact on wetland resources and those impacts have been avoided and/or minimized to the greatest extent practicable. No significant impacts to wetland resources have been identified.

5.4.4 Wildlife

Alternative 1 - "No Action"

Alternative 1 –The "No Action" Alternative would involve no additional restoration of SWH on the Jameson Island Unit – Big Muddy National Fish and Wildlife Refuge. No adverse impacts to wildlife would occur. Existing habitat would continue to benefit wildlife resources but there would be no improvement in habitat conditions for wildlife that depend on the aquatic ecosystem.

"Build Alternatives"

Impacts to wildlife inhabiting the Jameson Island Unit SWH Restoration Project site would occur under each of the "Build Alternatives". During construction, species would be temporarily displaced, but would likely return to the area after construction is completed. Species with limited mobility could be destroyed. Human activity (i.e., construction) is likely to affect wildlife by causing disruptions to the normal behavior, altering travel patterns, removing den/nest trees, and by displacing wildlife to surrounding habitat.

The bald eagle may be affected by any of the "Build Alternatives" since large trees that may be used for roosting would be cleared for chute construction. In addition, human activity (i.e., construction) in the vicinity of wintering bald eagles is likely to affect eagles by causing disruptions to the normal behavior, removing potential roosting/ perching trees, and by displacing eagles to non-preferred, marginal habitat. Any disturbance would be temporary in nature and would cease when construction has been completed. Since the proposed project area contains adjacent large expanses of mature willow and cottonwood trees, impacts to the normal behavior of the eagle will be minimized. Currently there are no bald eagle nests located in the project area. Prior to and during construction the Corps and/or USFWS biologist will survey the area for any active bald eagle nest. Should an active nest be discovered, the Corps will coordinate with USFWS in accordance with requirements outlined in the USFWS' Bald and Golden Eagle Protection Guidelines and implement measures to avoid adversely impacting the bald eagle. The "Build Alternatives" would provide increased aquatic habitat for foraging; therefore, the proposed project is likely to benefit the bald eagle.

In accordance with requirements of the Migratory Bird Treaty Act, and to avoid project impacts, clearing of the project alignment would occur outside the time when the majority of nesting migratory birds would be expected in the project area (April 1 through July 15).

Over the long-term, it is anticipated that wildlife would benefit from creation of more diverse and productive aquatic habitat. Alternative 3 was determined to have the greatest adverse impact on wildlife resources and impacts to wildlife associated with clearing additional areas to accommodate the large permanent earthen stockpiles were considered avoidable. No significant adverse impacts to wildlife habitat were identified under any of the "Build Alternatives'. Side channel chute construction would provide habitat diversity for numerous bird species which rely on the aquatic ecosystem, including waterfowl. The increased amount and diversity of aquatic habitat would also benefit mammals like the beaver, muskrat and otter. Reptiles are also expected to benefit greatly because of the additional aquatic habitat that would develop. Terrestrial habitat would continue to be abundant for many bird and mammal species.

The following provides a comparison of project impacts to wildlife under each of the "Build Alternatives".

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

Alternative 2 and "Recommended Plan" in the long term would be expected to have similar impacts to wildlife after the chute was fully developed. These impacts would be beneficial. Alternative 2 would be considered to have slightly greater adverse impact as it involves more initial clearing and temporary stockpiles of earthen material when compared to the Recommended Plan. These impacts would be much less than those associated with Alternative 3. Alternative 2 would have a median potential to disturb wildlife as there would be less equipment movement/noise. Noise disturbance would be temporary in nature and would cease when construction has been completed. Alternative 2 would have a median potential to disturb wildlife, including the bald eagle, as there would be much less equipment movement/noise than Alternative 3 but more than under the "Recommended Plan". Earthen stockpiles would impede wildlife movement between the terrestrial and the aquatic habitat. These adverse impacts would be temporary.

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Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

As Alternative 3 would require the greatest amount of clearing to accommodate the permanent stockpiles of earthen material it would have the greatest potential adverse impact on wildlife habitat. While noise disturbance would be temporary in nature and would cease when construction has been completed, the adverse impacts associated with

clearing woody vegetation to accommodate large permanent stockpiles of earthen material would be considered long term. Again, as Alternative 3 would require the greatest amount of clearing to accommodate the permanently stockpiles of earthen material and require the greatest movement of heavy construction equipment and noise it would have the greatest potential adverse impact to disturb wildlife. As Alternative 3 would require the greatest amount of clearing to accommodate the permanent stockpiles of earthen material it would have the greatest potential adverse impact on bald eagle roosting/perch trees. Again, as Alternative 3 would require the greatest amount of clearing to accommodate the permanent stockpiles of earthen material and require the greatest movement of heavy construction equipment movement and noise it would have the greatest potential adverse impact to disturb bald eagles. Adverse impacts to wildlife under Alternative 3 related to clearing additional areas for permanent stockpiles would be considered avoidable. The large permanent earthen stockpiles would impede wildlife movement between the terrestrial and the aquatic habitat. These adverse impacts would be long term and considered avoidable.

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

Alternative 2 and 4 in the long term would be expected to have similar impacts after the chute was fully developed but Alternative 2 would be considered to have slightly greater adverse impact as it involves more initial clearing and temporary stockpiles of earthen material when compared to the "Recommended Plan". Alternative 4 would have the least potential to disturb wildlife as it requires the least movement of equipment and produces the lowest amount of noise. Noise disturbance impacts would be temporary. Alternative 4 would have the least potential to disturb bald eagle as it requires the least movement of equipments and produces the lowest amount of noise. No significant adverse impacts to wildlife, including the bald eagle, were identified under the "Recommended Plan".

5.4.5 Invasive Species

Alternative 1 - "No Action"

Alternative 1 –The "No Action" Alternative would involve no additional restoration of SWH on the Jameson Island Unit – Big Muddy National Fish and Wildlife Refuge. The "No Action" Alternative is not expected to benefit any invasive species.

"Build Alternatives"

No substantive differences in impacts to invasive species identified. The following provides an assessment of project impacts to invasive species that is applicable to each of the "Build Alternatives".

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

While none of the "Build Alternatives" would be expected to benefit any invasive species it should be noted that standard Corps construction specifications include numerous measures to ensure that construction equipment brought on site is free from any pest or invasive species. These requirements are also included in permits the Corps is required to obtain from USFWS prior to implementing project construction on the refuge. As part of their management efforts, where appropriate, the USFWS takes actions to control and or eliminate invasive species that occur on terrestrial habitat within the refuge.

Frequently the Corps has been asked if the construction of SWH benefits the invasive carp species which have become very prevalent in the Missouri River. Shallow water habitat provides the greatest benefits to young fish by providing very shallow, slow moving water where very small fish can avoid being swept away while feeding and growing. The loss of SWH on the Missouri River which resulted from construction of the BSNP, is limiting the survival of larval/young of the year native Missouri River fish species. At this point the invasive carp species do not seem limited by lack of early survival as their numbers have increased dramatically in a very short time. As such, the restoration of SWH on the Missouri River would not be considered a benefit or a detriment to the highly adaptable invasive carp species. In addition to the native fish benefits described above, SWH provides benefits to native mammals, birds, reptiles and amphibians whose numbers have also seriously declined as a result of this habitat loss. What is readily apparent is that the loss of SWH on the Missouri River has negatively affected native species and any efforts to address those declines must include measures that restores the habitat types (SWH, wetlands, native riparian vegetation) that have nearly been eliminated or severely reduced by the BSNP.

Due to the highly turbid conditions, the invasive zebra mussel is not found to be as prevalent in the Missouri River as in other lakes and streams in Missouri. The proposed chute itself would be expected to provide minimal, if any, additional habitat for zebra mussels as turbidity in the chute would be similar to that found in the adjacent main river channel. The proposed backwater area may provide an area of less turbid water that may be more suitable for zebra mussels. As zebra mussels have already become

established on the Missouri River the project under any of the "Build Alternatives" would not be expected to substantially increase the population or current range of the zebra mussel. The "Build Alternatives", including the Recommended Plan, have been developed to benefit native species and no adverse impacts related to invasive species are anticipated.

5.5 Threatened and Endangered Species

Alternative 1 - "No Action"

Alternative 1 –The "No Action" Alternative would involve no additional restoration of SWH on the Jameson Island Unit – Big Muddy National Fish and Wildlife Refuge. The "No Action" Alternative would not have the positive effects to pallid sturgeon because it would not provide the additional feeding, breeding, and sheltering aspects that the proposed project provides.

"Build Alternatives"

As noted above under Section 5.4.4 Wildlife, potential disturbance and adverse habitat impacts to wildlife, which would include threatened and endangered species would be greatest under Alternative 3, median under Alternative 2 and least under the "Recommended Plan" (Alternative 4). Impacts associated with clearing additional areas to permanently stockpile the excavated material under Alternative 3 would be considered avoidable.

The endangered pallid sturgeon has regularly been documented using the Missouri River in the project area. The goal of the Mitigation Project, of which the Jameson Island Unit SWH Restoration Project is a component, is to restore fish and wildlife habitat along the lower Missouri River. Each of the "Build Alternatives" would result in long-term benefits to the pallid sturgeon by increasing habitat for feeding and sheltering for the sturgeon itself or the prey species upon which it depends. The "Build Alternatives" would all be anticipated to result in beneficial effects to the pallid sturgeon through increases in rearing, nursery, feeding, and sheltering habitat. Each of the "Build Alternatives" would create approximately 30 acres of SHW (27-acre chute and 3-acre backwater) at full development.

The endangered Indiana bat would be expected to utilize the forested habitat in the project area for foraging and roosting. No suitable hibernacula occur in the project area. While the majority of the project area would be considered foraging habitat, clearing along the length of the alignment would impact some trees with loose or exfoliating bark that are suitable as roosts. The Corps would avoid the potential for direct effects by clearing of trees during the winter months when Indiana bats are not present in the project area. Construction of the chute under any of the "Build Alternatives" would create another forest opening along the edge of aquatic and terrestrial habitat that Indiana bats are known to prefer during their nighttime foraging activities.

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

Alternative 2 which stockpiles earthen material adjacent to the chute within the meander process area could hinder movement of pallid sturgeon onto the floodplain during high flow events. This would be considered a temporary impact under Alternative 2.

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

A difference between the alternatives is that Alternative 3 which permanently stockpiles material adjacent to the chute meander process area could hinder movement of pallid sturgeon onto the floodplain during high flow events. This would be considered a long term avoidable impact under Alternative 3.

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

The "Recommended Plan" includes minimal stockpiles of earthen material which could limit pallid sturgeon access to the floodplain during high flow events. This would be considered a temporary impact under the "Recommended Plan". No adverse impacts to pallid sturgeon or Indiana bats are anticipated under the "Recommended Plan".

5.6 Water Quality

5.6.1 Potential Environmental Consequences During Construction

Alternative 1 - "No Action"

Alternative 1 –The "No Action" Alternative would involve no additional restoration of SWH on the Jameson Island Unit – Big Muddy National Fish and Wildlife Refuge and therefore would not adversely affect water quality. While water quality benefits associated with the original Jameson Island Chute Project would continue, there would be no additional water quality benefits from construction of the chute extension and backwater habitat.

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

This section addresses the physical disturbances during construction that could have short term adverse impacts on water quality (potential post construction impacts as chutes develop can be found in Section 5.6.2). Significant impacts would be those that would affect water quality in a manner that would exceed state criteria, including degrading existing water quality. Since the state of Missouri does not have specific criteria for solids, total suspended solids, or nutrients (applicable to the Missouri River) we based our evaluation on the State's general water quality criteria and comparisons of upstream and downstream conditions to detect changes in existing water quality.

Table C. State of Missouri General Water Quality Criteria
(http://dnr.mo.gov/env/wpp/wqstandards/wq_criteria.htm)

1. Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses.
2. Waters shall be free from oil, scum, and floating debris in sufficient amounts to be unsightly or prevent full maintenance of beneficial uses.
3. Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses.
4. Waters shall be free from substances or conditions in sufficient amounts to result in toxicity to human, animal, or aquatic life.
5. There shall be no significant human health hazard from incidental contact with the water.
6. There shall be no acute toxicity to livestock or wildlife watering.
7. Waters shall be free from physical, chemical , or hydrologic changes that would impair the natural biological community.
8. Waters shall be free from used tires, car bodies, appliances, demolition debris, used vehicles or equipment and solid waste as defined in Missouri's Solid Waste Law, section 260.200, RSMo, except as the use of such materials is specifically permitted pursuant to section 260.200-260.247.

Elutriate tests are an effective means of evaluating potential impacts of introducing sediment during habitat creation efforts into the mainstem river. Elutriate samples were generated in the laboratory by combining sediment collected from the borings along the proposed chute alignment with water collected from the mainstem Missouri River (USEPA and USACE1998). Elutriate results for Jameson Island can be found in Table B. Both water and elutriate samples were collected at relatively low flow conditions. Total phosphorous in elutriate samples (0.12 mg/L) was less than total phosphorus in river water samples (0.32 mg/L) collected at the Jameson site. This suggests that the introduction of sediment from habitat creation projects allows a portion

of the phosphorus (in the water column) to bind with introduced sediment particles and is settled out. Phosphorus, subsequently, is then transported through the system with bedload and is re-deposited downstream of the project location. Adverse effects related to the cumulative effect of the increased load of phosphorus from SWH projects are further discussed in Section 5.13 Cumulative Effects. Total phosphorus in the elutriate samples at the Jameson site were also compared to samples collected from nearby mainstem water monitoring locations located upstream and downstream of the Jameson site (Figure 11). At these upstream and downstream monitoring locations, grab samples were collected in monthly intervals between 2009 and2011, excluding the months of November through February to assess the ambient concentrations in the river. Phosphorus concentration was significantly lower in elutriate samples collected at all SWH sites, including the Jameson Island site, relative to phosphorus concentrations in water samples collected from these mainstem sites. While this comparison does not include either the nutrients in the bedload of the river or in the settleable solids from the elutriate sample, it does allow a comparison of total phosphorus concentrations actually present in the water column and shows that the discharge of slurry during dredging operations would have lower concentrations of phosphorus than what is found under ambient conditions. Based on this, dredging operations will not cause a departure from upstream or downstream conditions and is consistent with the state of Missouri's general water quality criteria. This further supports our assessment that there would be no nutrient related adverse effects to native species from dredging. Figure 12 also shows that phosphorus concentrations are similar among elutriate samples collected at the Jameson site and other SWH sites.

Total nitrogen in elutriate samples (2.39 mg/L) was less than total nitrogen in water samples (2.74 mg/L) collected at the Jameson site (see Table A). Nitrogen concentration from elutriate samples at the Jameson site were also compared to samples collected from the same nearby monitoring locations described above (Figure 13). Mean total nitrogen concentration was not significantly different between elutriate samples collected at the Jameson site and water samples collected at other mainstem sites suggesting that concentration of nitrogen in water discharged during dredging operations would be the same concentration as what is found in the river during ambient conditions. Figure 13 also shows that nitrogen concentrations are similar among elutriate samples collected at the Jameson site and other SWH sites with the exception of the Wolf Creek and Dalbey Bottoms sites. Elutriate samples collected at the Jameson site had a lower mean nitrogen concentration than elutriate samples from the Wolf Creek and Dalbey Bottoms sites. One possible explanation for the lower nitrogen concentration at the Jameson site could be due to differences in recent land use among the sites. Borings taken from both the Dalbey Bottoms and Wolf Creek sites were collected from areas in active agricultural production. The application of nitrogen based fertilizers to these areas may have resulted in localized increased nitrogen levels in these soils. Sediment collections taken from other sites were conducted in areas that were not in agricultural production for multiple years similar to the Jameson site.

To put the quantity of phosphorus in the sediment to be relocated at the Jameson site into perspective, it is also helpful to compare it to the average daily load of phosphorus delivered by the Mississippi River to the Gulf, which is 423 metric tons per day based on the annual load of 154,300 metric tons (NRC 2011). In order to get a comparable value for the Jameson project, the total amount of sediment to be relocated, the nutrient concentration of the sediment, and the length of time over which the sediment removal would take place must be evaluated. Based on the cost estimate for Jameson, 421,000 cubic yards (321,875 cubic meters) of material would be relocated by dredge and placed in the main channel of the Missouri River. The resulting mass of that material is equal to 551,300 tons (500,130 metric tons) based on a soil unit weight of 97 pounds per cubic foot (K. Stark, USACE pers. communication). The median concentration of total phosphorus at Jameson is 492 ppm. Assuming that the construction could be completed over a single, full navigation season, construction would take 243 days. The rate of removal and placement into the Missouri River main channel can be figured as an average of the total material to be moved divided by the number of days for the construction of the project. Therefore, sediment would be relocated from the chute alignment into the main channel by dredge at an average rate of 2,269 tons per day (2,058 metric tons per day). Using the median concentration for total phosphorus of 492ppm and an average sediment removal rate of 2,058 metric tons per day, the average daily load of total phosphorus from the Jameson Island project site is 1.01 metric tons of total phosphorus per day. Even in the hypothetical situation that all of the relocated sediment made it downstream to the Gulf of Mexico, this is approximately 0.24% of the average daily total phosphorus load being delivered by the Mississippi River to the Gulf during the 243 day construction period.

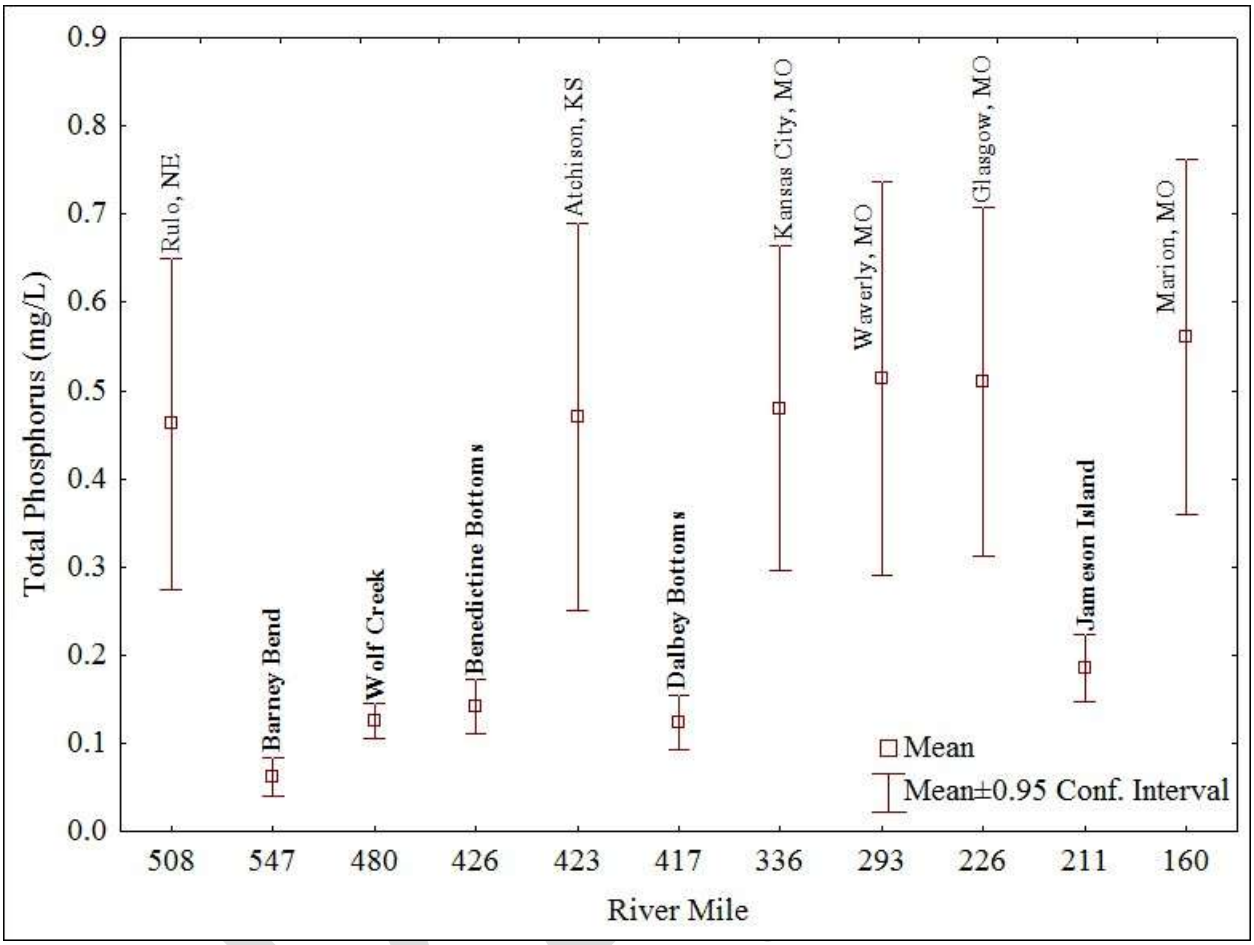


Figure 12. Total phosphorus concentrations in elutriate samples collected from SWH creation sites (bolded text) and water samples collected from Missouri River monitoring locations.

Assuming nitrogen is not lost during transport and using calculations as outlined above (same methodology as used for phosphorus) with a total nitrogen median value of 924.1ppm in sediment, the Jameson project would result in an average daily load of 1.9 metric tons of nitrogen per day being delivered to the Gulf. Assuming 1,470,000 metric tons of nitrogen is delivered to the Gulf annually (USGS Open-File Report 2007-1080), the Jameson project would result in less than a 0.05% increase in the average daily total nitrogen load being delivered by the Mississippi to the Gulf during the 243 day construction period.

Dredging operations during chute creation could also temporarily increase sediment load and suspended solids, decreasing water clarity and light penetration, below the project site. These impacts would be unavoidable but short-term and insignificant. . In fact, most of the native Missouri River fish species are specially adapted to highly turbid conditions. To evaluate these concerns and to insure that the general criteria for State water quality standards were not exceeded during habitat restoration and to detect any significant change in water quality, turbidity measurements were collected, during dredging operations, at the Rush Bottoms project site in Sep 2007 (Figure 14). Transects

were established 0.5-miles upstream, 100-meters downstream, and 0.5-, 1.0-, and 2.0-miles downstream of the discharge site. The highest turbidity measurement of 112.6 NTU was detected 0.5 miles downstream of the discharge pipe resulting in an increase of 13.7 NTUs from the upper most transect. At this location the mixing plume was not

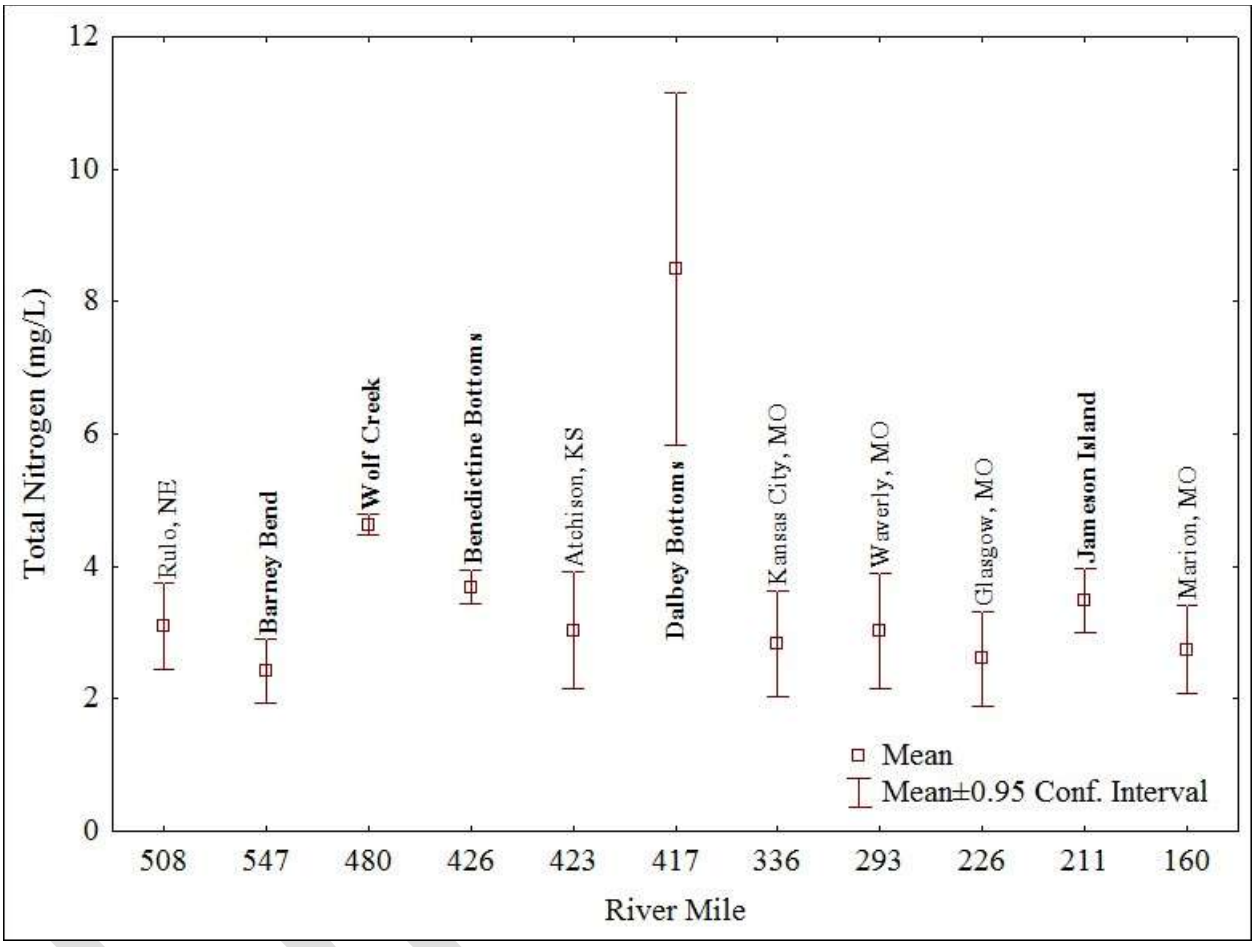


Figure 13. Total nitrogen concentrations in elutriate samples collected from SWH creation sites (bolded text) and water samples collected from Missouri River monitoring locations.

distinguishable from the ambient waters suggesting that dredging does not exceed the State of Missouri's general water quality criteria (see Table C, number 3). Differences in turbidity should also be evaluated in the historical context of Missouri River ecology. Historically, turbidity levels were much higher in the Missouri River (Figure15) and have decreased by over 50% since 1953(Blevins 2006). Increases in turbidity due to dredging operations are insignificant when compared to historical conditions suggesting that impacts to native Missouri River species are inconsequential and the impacts of restoring cut and fill alluviation to the river may be necessary to the recovery of native species

Additional real-time turbidity measurements were being conducted at the St. Joseph gauge downstream of the Rush Bottom dredging site. Figure 16 shows measurements of turbidity at St Joseph, Missouri before and after dredging commenced.

The St Joseph gauge is located 52 miles downstream of the project, and water travel time from Rush Bottom to St Joseph is less than one day. Discharge at Rulo, Nebraska, two miles

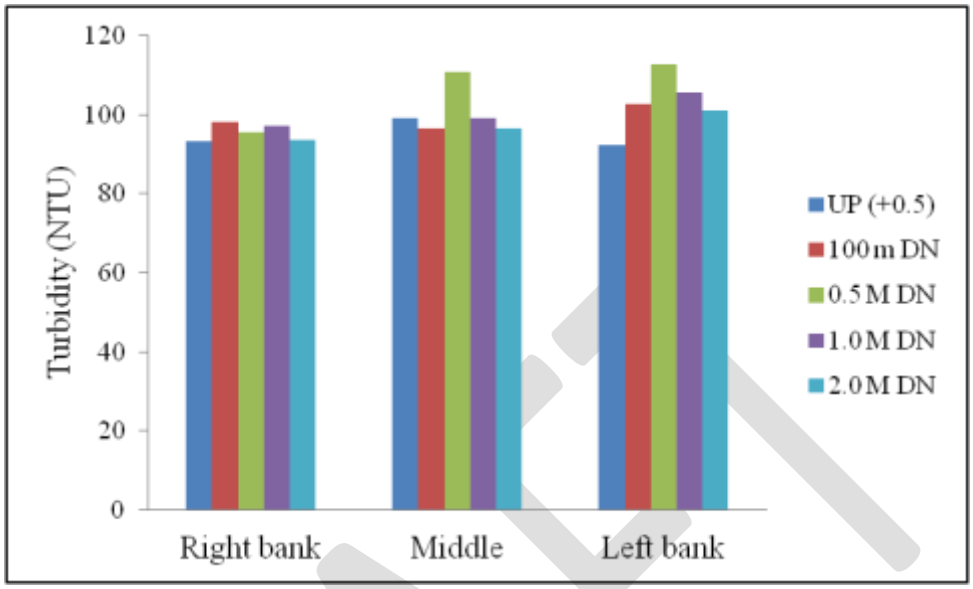


Figure 14. Turbidity (NTU) measurements taken at Rush Bottoms during dredging on 14 Sep 2011.

downstream of Rush Bottom, is also included in the figure. While significant spikes in turbidity were noted following rainfall events upstream of St. Joseph, such as the July 24, 2007 rainfall event that fell over the Big Nemaha, Little Nemaha, Nishnabotna, Tarkio, and Nodaway River Basins, and especially the high flow event of August 9, 2007, no observation of turbidity increase before and after dredging was apparent. Accordingly, turbidity measurements at St Joseph appeared to be highly dependent on tributary flows following rain events, and independent of dredging at Rush Bottom.

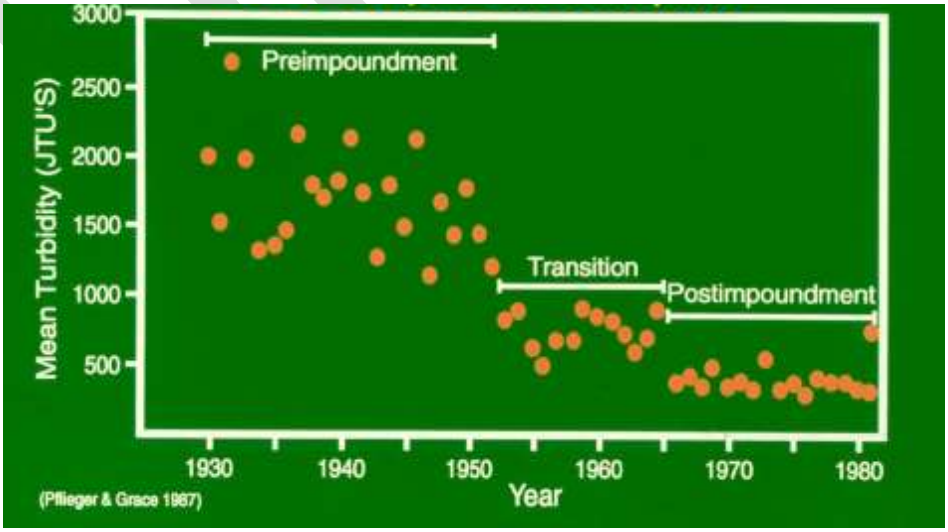


Figure 15. Changes in Missouri River Turbidity 1930-1982 at St Louis, MO.

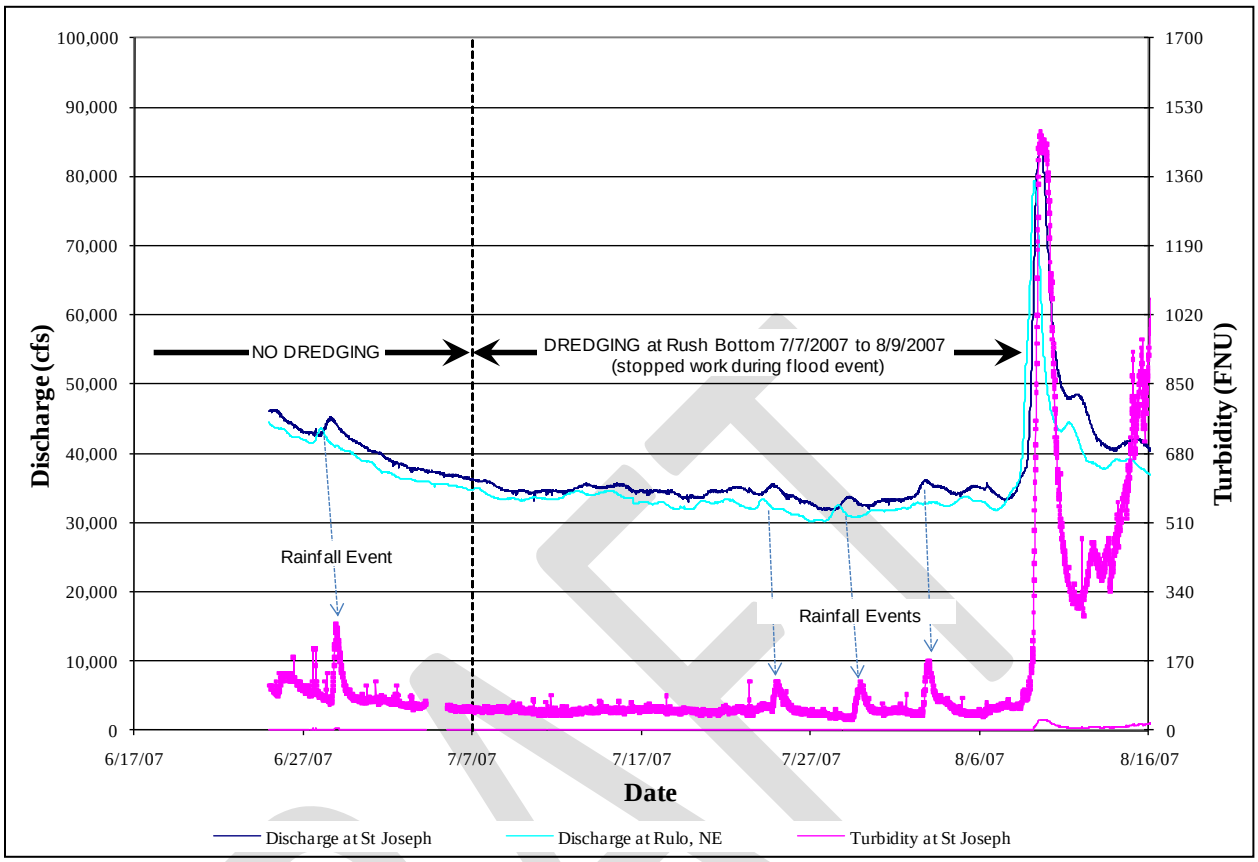


Figure 16. Discharge and Turbidity at St. Joseph, MO: June to August 2007 (Downstream of the Rush Bottom Chute Project).

While the Corps does not have any reason to believe that introducing inorganic sediment into the Missouri River would cause a decrease in oxygen concentrations and exceed state water quality standards, dissolved oxygen is a water quality parameter of common interest since it is vital for most aquatic organisms. A dissolved oxygen level of 5 mg/L is generally considered to be protective of warm water aquatic life and is consistent with Missouri water quality criteria. To insure that dredging operations during chute construction does not cause a decrease in dissolved oxygen levels below 5 mg/L, dissolved oxygen measurements were collected simultaneously with the turbidity measurements described above. Results can be found in Figure 17. The data show that dredging operations have no impact on dissolved oxygen concentrations and does not exceed the State of Missouri water quality criteria.

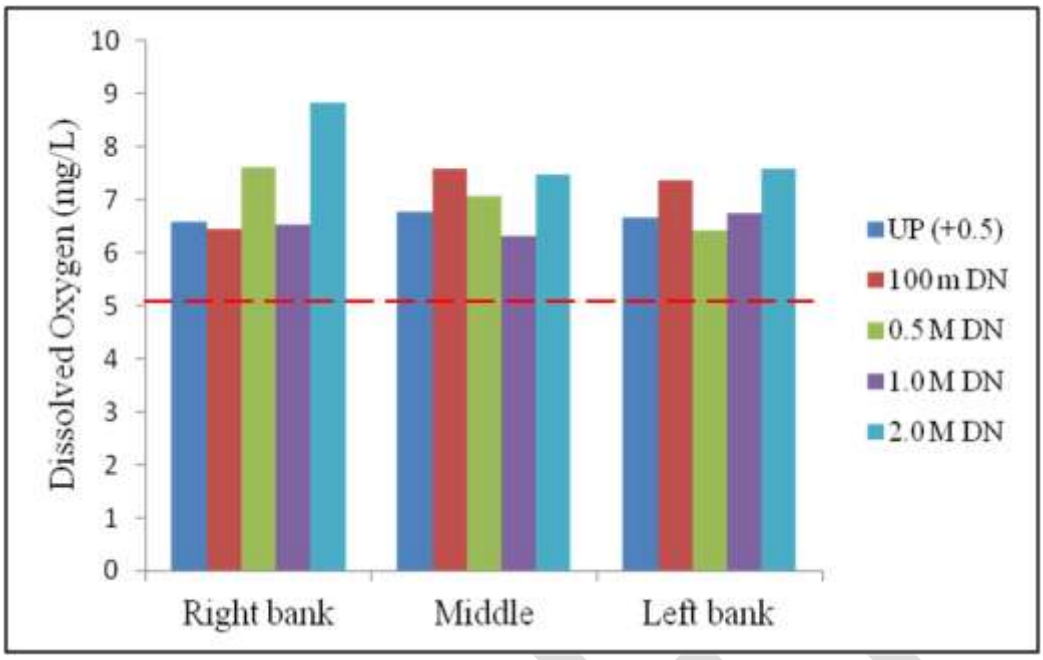


Figure 17. Dissolved oxygen (mg/L) measurements taken at Rush Bottoms during dredging on 14 Sep 2011 (Dashed red line represents the State of Missouri's dissolved oxygen water quality criteria of 5 mg/L).

The dredging process has brought to light concerns such as potential sediment build up in the navigation channel and potential water quality concerns. Concerns would be warranted if sediment discharge exceeded the assimilative capacity of the river while dredging was occurring. Dredging normally occurs during navigation season, i.e. times when navigation is supported by releases from the main stem reservoirs to meet dates and targets summarized in Table B.

Table B. Normal Navigation Season Opening/Closing Dates and Target Flows

Location	River Mile	Opening	Closing	Full Service Target (cfs)	Minimum Service Target (cfs)
Sioux City, IA	732.3	23 March	22 November	31,000	25,000
Omaha, NE	615.9	25 March	24 November	31,000	25,000
Nebraska City, NE	562.6	26 March	25 November	37,000	31,000
Kansas City, MO	366.1	28 March	27 November	41,000	35,000
Mouth near St Louis	0	1 April	1 December	NA	NA

*Note: Table from USACE RCC (2000) "Releases Needed to Support Navigation"

Under the "Reccommended Plan", sediments removed by a dredge from desired habitat areas would be pumped to the Missouri River channel and allowed to mix with existing river water and sediment load. The end of the dredge discharge pipe would be submerged at a location in the water column where mixing and integration into the sediment load occurs quickly. Studies and construction experience from other projects (California Bend, Nebraska and Hidden Lake/Great Marsh) indicate that suspending the discharge four to six feet off the bottom of the river provides for adequate entrainment of the dredge material. To address these concerns, proposed dredging rates and minimum dredge discharges were examined at Hermann and St Joseph, and other river gages, and compared to the dredge discharge schedule previously produced by similar analysis by the Corps Omaha District at Nebraska City. Table C presents a dredge discharge schedule for various river locations, also referred to as the maximum dredge rate in this document. Dredge discharge schedules would be implemented if shoaling begins to encroach upon the navigation channel to insure that the assimilative capacity of the river is not exceeded and navigation is not negatively impacted.

Table C. Dredge Discharge Schedule

Dredge Water & Sediment Discharge (gpm / cfs)	Discharge at Nebraska City (cfs)	Discharge at St Joseph (cfs)	Discharge at Waverly (cfs)	Discharge at Boonville (cfs)	Discharge at Hermann (cfs)
8,000 / 18	25,000	25,000	30,000	32,000	38,000
12,000 / 27	37,500	40,500	55,000	55,000	60,000
16,000 / 36	50,000	50,000	65,000	75,000	100,000
20,000 / 45	62,500	65,000	80,000	95,000	150,000
24,000 / 53	75,000	82,000	110,000	150,000	200,000

*NOTE: Approximately 15-20% solids in dredge discharge

Recent depth-integrated sediment measurements and proposed maximum dredging rates for Hermann Missouri are provided in Figure 18. Two post-dam data periods are plotted with the dredging data, 1974-1983 and 1991 to 2001. As seen in the figure, 1991 to 2001 data plot below the 1974 to 1983 data at each location, indicating a recent drop in suspended sediment concentrations. Adding the dredging rates in Table 3 to a power fit of the 1991 to 2001 data does not increase sediment load above the 1974 to 1983 data, and does not exceed normal scatter of the 1974 to 1983 suspended sediment data even at five times the dredging rates. This analysis shows that following the dredging guidelines above, sediment loading in the river will not exceed historical values or the assimilative capacity of the river.

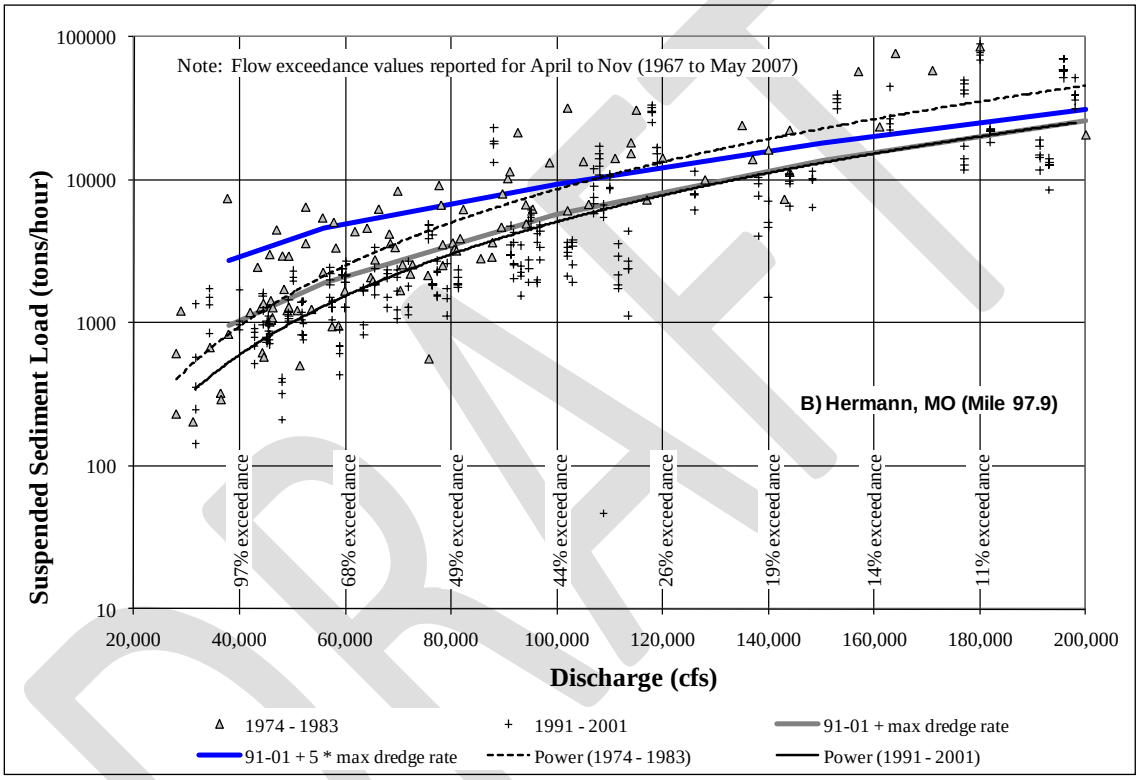


Figure 18: Sediment Measurements and Dredge Rates at St Joseph and Hermann, MO

5.6.2 Potential Environmental Consequences <u>Post Construction</u>

This section addresses concerns about nutrient and sediment delivery to the Missouri River after chute creation as these habitats widen and evolve via natural riverine processes over a longer period of time. Given the relationship between sediment and nutrients an assumption could be that water exiting chutes would have higher concentrations of nutrients and total suspended solids, relative to water entering the chute and water in the adjacent mainstem. To test this hypothesis and further understand nutrient and sediment contributions from chutes as they develop, water samples were collected from 5 constructed chutes in 2009, 4 constructed chutes in 2010 and 2011. Within each chute, surface grab samples were collected at the chute entrance and exit to allow comparison of water quality parameters within the chute (entrance vs. exit).

Surface grab samples were also collected immediately upstream of the chutes to allow comparison of water quality parameters between the chute and the mainstem river (chute vs. mainstem river). Samples were shipped to a contract laboratory and analyzed for nutrients and total suspended solids. Results can be found in Figures 19-21.

For each parameter (total phosphorus, total nitrogen, and total suspended solids) a Kruskal-Wallis ANOVA was used to test for differences among samples collected at chute entrances, chute exits, and adjacent mainstem sites. No statistical differences ($p>0.05$) were found among sampling locations for any of the variables indicating that although the chutes do widen via natural processes, there is no significant change or deviation from typical river loadings resulting from chute development. Figures 19-21 may suggest that river mile and date (possibly a surrogate for flow) may be better correlated with each of the variables (total phosphorus, total nitrogen, and total suspended solids), however further data analysis is needed to test this. Similar results were reported by Woodward and Rus (2011) when they examined the contribution of suspended sediment to the mainstem at two created chutes. They concluded that "the chutes had no detectable effect on the sediment characteristic in the main channel" (Woodward and Rus 2011). Both of these post construction evaluations suggest that as individual chutes mature they have an insignificant impact on the concentrations of nutrients and suspended sediment in the mainstem of the Missouri River.

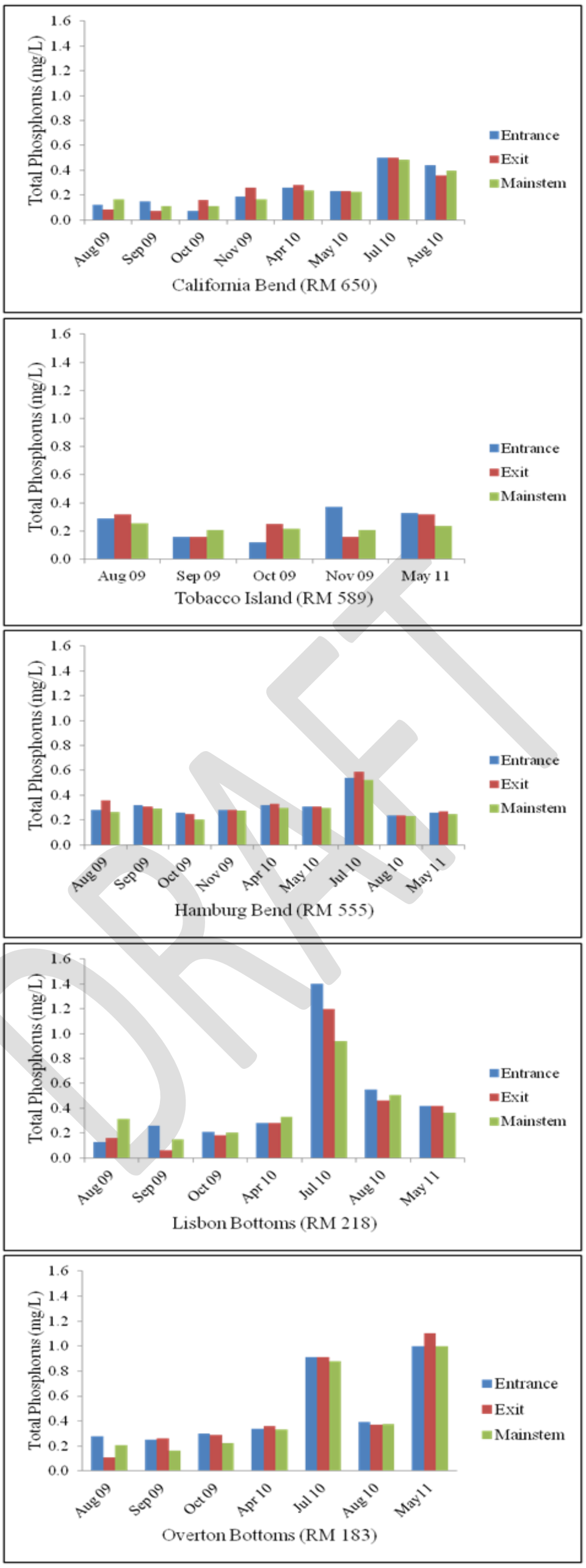
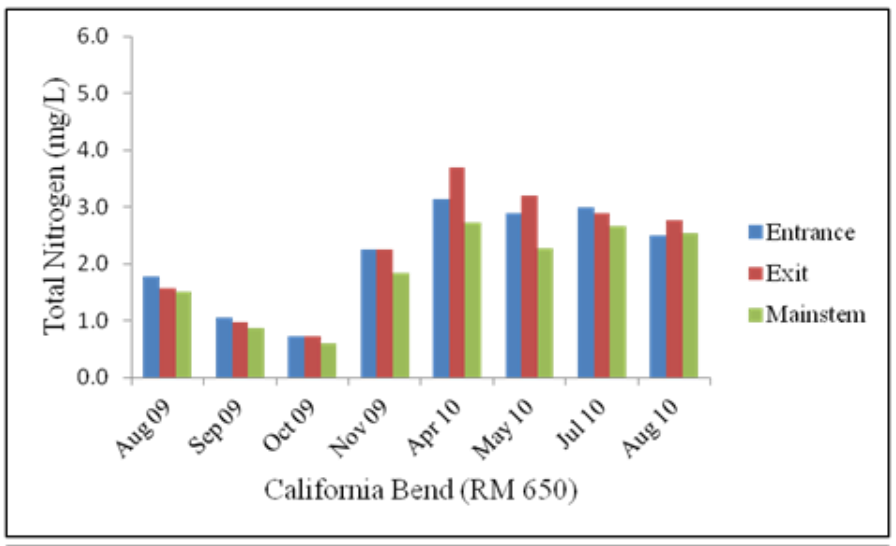
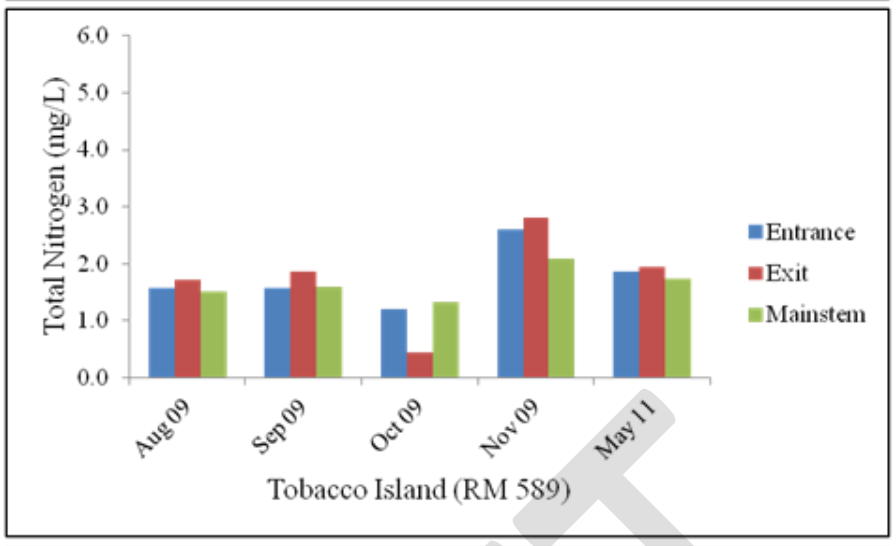
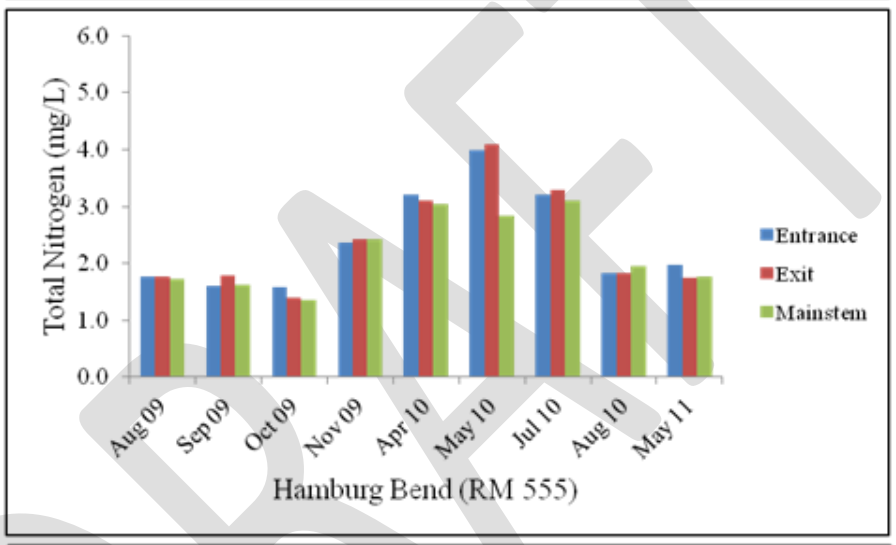
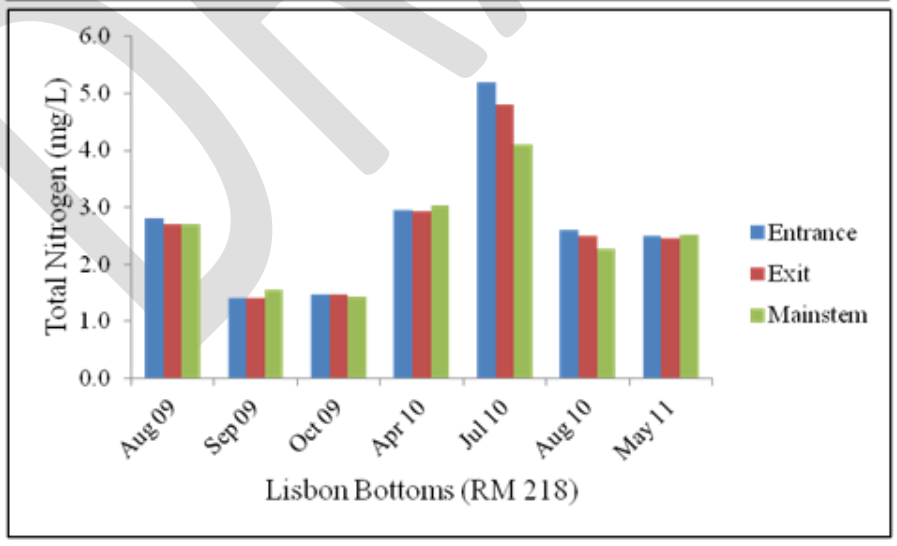


Figure 19. Total phosphorus (mg/L) at multiple chute locations from 2009 to 2011.









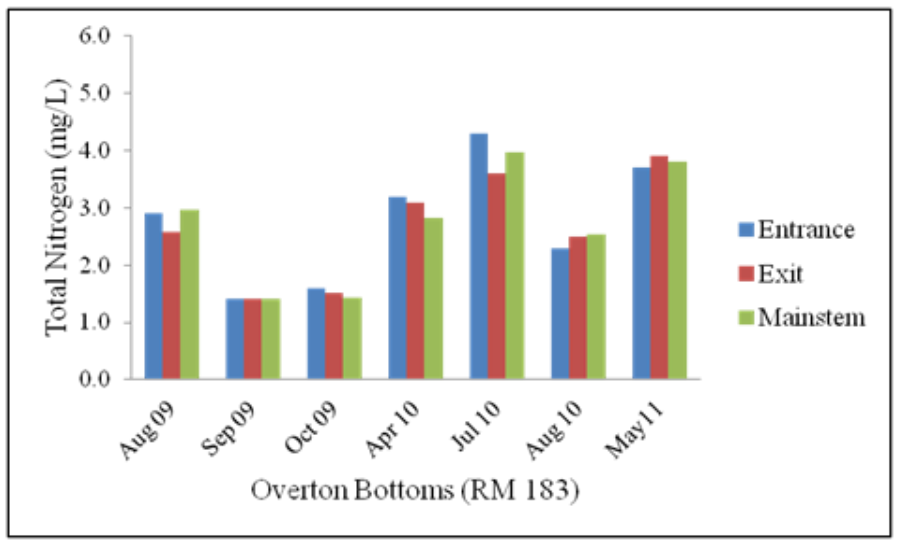
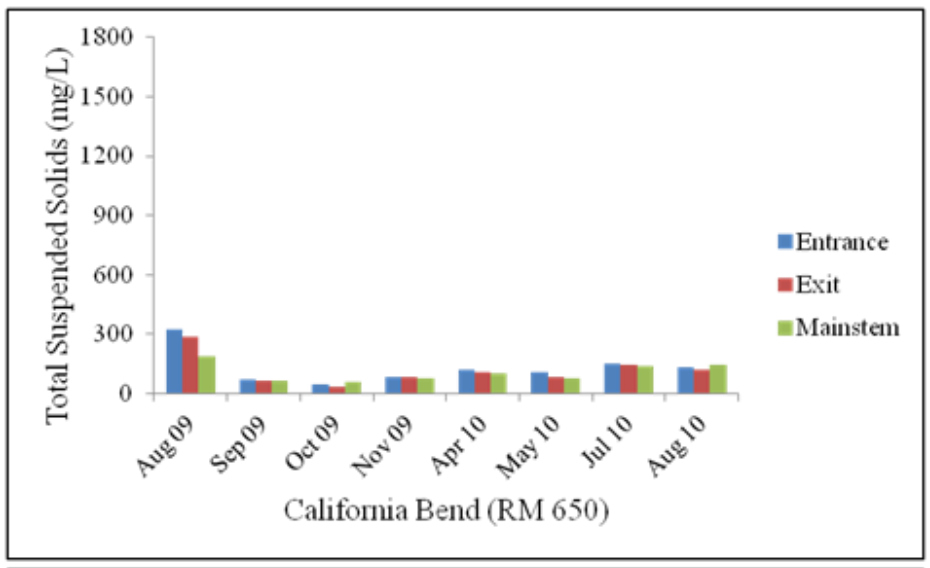
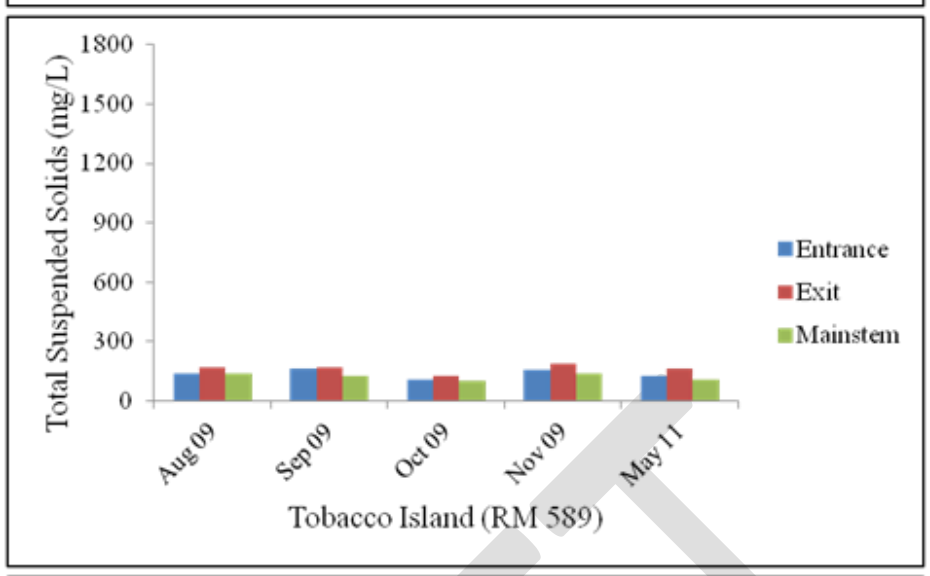
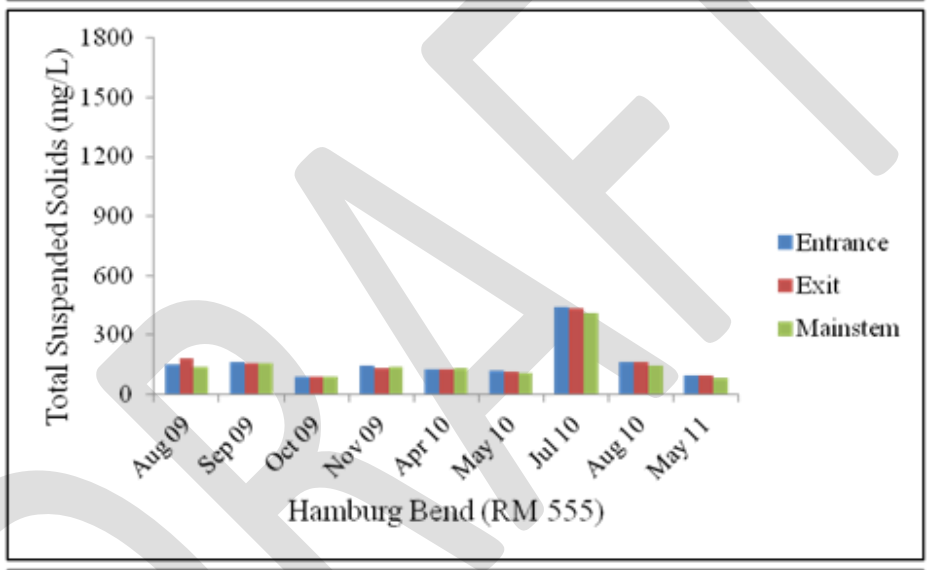
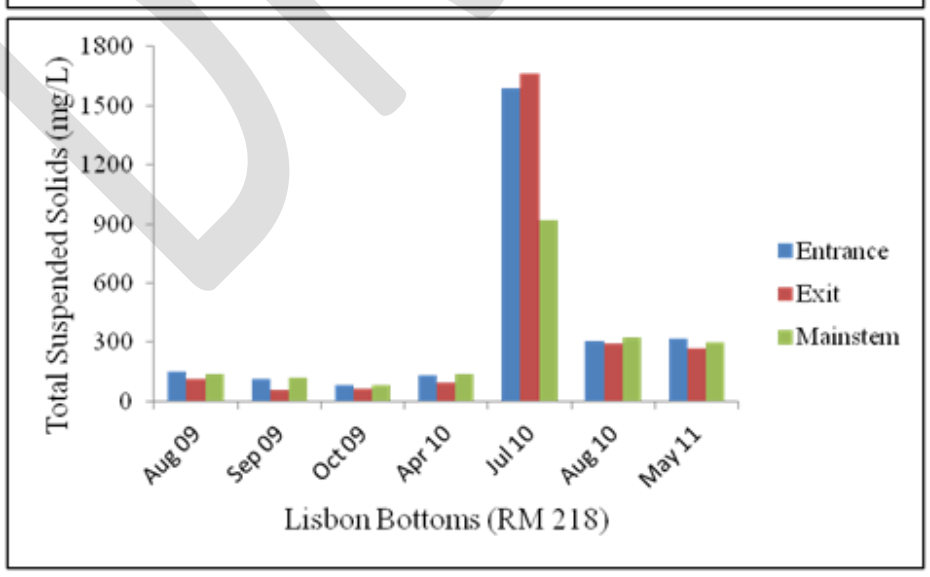


Figure 20. Total nitrogen (mg/L) at multiple chute locations from 2009 to 2011.









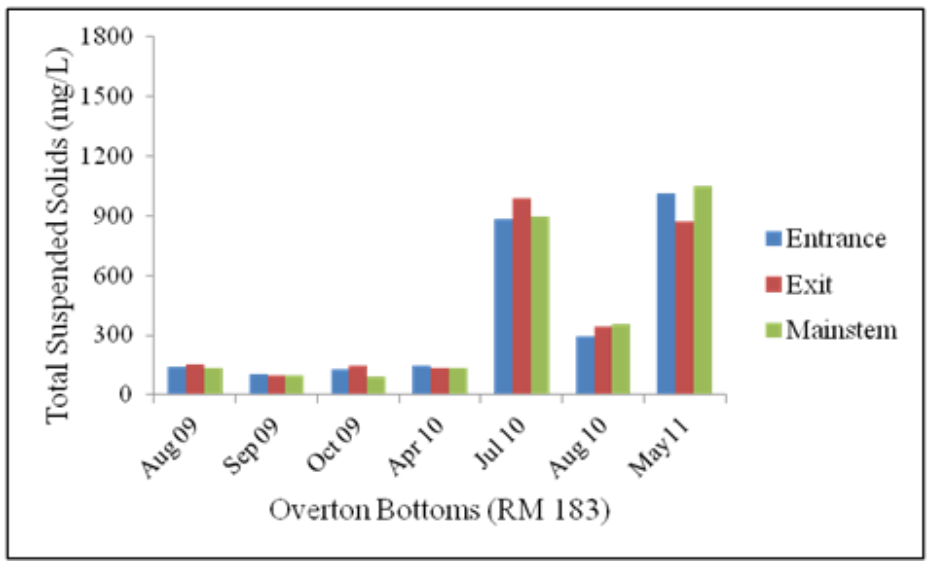


Figure 21. Total suspended solids (mg/L) at multiple chute locations from 2009 to 2011.

5.6.3 Potential Environmental Consequences – Summary

Methods to reduce discharges of pollutants in storm water runoff from the construction areas (e.g., Best Management Practices) would be implemented (see Section 5.16 Compliance with Environmental Quality Statutes – Clean Water Act). Construction of the Jameson Island Unit SWH Restoration Project would impact more than one acre, thus requiring a permit for storm water discharge for land disturbances from the Missouri Department of Natural Resources (a National Pollutant Discharge Elimination System (NPDES) permit). The permit and associated storm water pollution prevention plan would address control issues for pollutants during and after construction activities would also comply with any conditions recommended by the Corps and Missouri Department of Natural Resources in issuing respectively the Section 404 authorization and 401 water quality certification. Construction activities at the Jameson Island Unit SWH Restoration Project site would not cause an exceedance of Federal or state water quality standards; therefore no significant adverse impacts would result.

Alternative 1 - "No Action"

The "No Action" Alternative would not adversely affect water quality.

"Build Alternatives"

In considering the difference in water quality impacts, none of the "Build Alternatives" would be expected to result in significant adverse impacts to water quality. The varying levels of effect on water quality for each "Build Alternative" are:

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

Alternative 2: Of the three "Build Alternatives", Alternative 2 would have a median adverse impact on water quality. These adverse impacts would be related to the potential erosion of the earthen stockpiles and deposition of this material in wetlands adjacent to the chute alignment and the permanent loss of wetlands. As Alternative 2 involves the stockpiling of excavated material on the floodplain, it would have median potential to have sediment enter existing wetlands adjacent to the proposed chute alignment. As the stockpiles would be located within the meander process area, these impacts would be temporary. As described above in 5.4.3 Wetlands, Alternative 2 would result in the permanent loss of 8.9 acres of wetlands at completion of construction with no anticipated increase as the chute fully develops. In order to develop the proposed SWH project these wetland losses were determined to be unavoidable. Wetlands can improve water quality by processing nutrients. While resulting in a greater wetland impact at completion of construction than the Recommended Plan, long-term the impacts are expected to be the same after the chute fully develops. Alternative 2 would increase the amount of sediment in the active Missouri River bedload providing a very minor benefit to restoring the condition that existed prior to the BSNP and in which native

species evolved. This would occur more slowly and be more dependent on high flows than under the "Recommended Plan".

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

Alternative 3: Of the three "Build Alternatives", Alternative 3 would have the greatest adverse impact on water quality. These adverse impacts would be related to the potential erosion of the earthen stockpiles and deposition of this material in wetlands adjacent to the chute alignment and the permanent loss of wetlands. As Alternative 3 involves the stockpiling of excavated material on the floodplain outside the meander process area, it would have the greatest potential to have sediment enter existing wetlands adjacent to the proposed chute alignment. As the stockpiles would be located outside the meander process area, these impacts would be long term. As described above in 5.4.3 Wetlands, Alternative 3 would result in the permanent loss of 14.9 acres of wetlands at completion of construction with no anticipated increase as the chute fully develops. Wetlands can improve water quality by processing nutrients. Alternative 3 would not appear to be in compliance with the Section 404(b)(1) Guidelines as long term direct and secondary adverse impacts to existing wetlands as a result of placing all excavated material outside the meander process area are avoidable. This would include 6 acres of avoidable wetland impacts associated with the permanent earthen stockpiles. Alternative 3 would have the least potential to increase the amount of sediment in the active Missouri River bedload and provide the very minor benefits associated with restoring the condition that existed prior to the BSNP and in which native species evolved.

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

Alternative 4: Of the three "Build Alternatives", the "Recommended Plan" would have the least adverse impact on water quality. These adverse impacts would be related to the potential erosion of the earthen stockpiles and deposition of this material in wetlands adjacent to the chute alignment and the permanent loss of wetlands. The "Recommended Plan" as it involves the least amount of stockpiling excavated material on the floodplain would have the lowest potential to have sediment enter existing wetlands adjacent to the proposed chute alignment. As the stockpiles would be located within the meander process area, these impacts would be temporary. As described above in 5.4.3 Wetlands, Alternative 4 would result in the permanent loss of 5 acres of wetlands at construction completion and this would be expected to increase to 8.9 acres of wetlands when the chute fully develops. Wetlands can improve water quality by processing nutrients. While resulting in a less wetland impact at completion construction than the Alternative 2, long-term the impacts are expected to be the same after the chute fully develops. In order to develop the proposed SWH project these wetland losses were determined to be unavoidable. The Recommended Plan would increase the amount of

sediment in the active Missouri River bedload providing a very minor benefit to restoring the condition that existed prior to the BSNP and in which native species evolved. This would occur more quickly and be less dependent on high flows under the "Recommended Plan".

Appendix H contains the Clean Water Act Section 404(b)(1) Evaluation for the Recommended Plan. The Corps' preliminary determination, pending completion of the public interest review, is that the Recommended Plan is in full compliance with the Section 404(b)(1) Guidelines.

5.7 Air Quality

Alternative 1 - "No Action"

Alternative 1 –The "No Action" Alternative would involve no additional restoration of SWH on the Jameson Island Unit – Big Muddy National Fish and Wildlife Refuge. The "No Action" Alternative would not experience any construction related air quality effects.

"Build Alternatives"

Under each of the Build Alternatives (Alternative 2 through 4) direct air quality impacts that would result from construction activities including excavation, grading, and construction-related traffic.

An air quality impact would be considered significant if it results in a violation of NAAQS. No significant adverse impacts are expected to air quality at the site under any of the "Build Alternatives".

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

Increases in fugitive dust (suspended particulate matter) and increases in exhaust emissions from Alternative 2 construction activities would be result in a median adverse impacts of the "Build Alternatives" considered. Alternative 2 would be expected to have greater adverse impacts on air quality than the "Recommended Plan because it relies solely on multiple units of heavy construction equipment. Alternative 2 would be expected to have less adverse impact on air quality than Alternative 3 because much less earthen material would be moved and it would be moved a shorter distance. These impacts would be temporary and would be relatively low emission levels. These pollutants are expected to disperse quickly; therefore, any impact would be minimal. When necessary, construction access roads would be watered to minimize the escape of fugitive dust during high wind speeds and periods of high construction vehicle activity.

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

Increases in fugitive dust (suspended particulate matter) and increases in exhaust emissions from Alternative 3 construction activities would be result in the greatest adverse impacts of the "Build Alternatives" considered. Alternative 3 adverse air quality impacts are expected to exceed both Alternative 2 and the Recommended Plan because this alternative relies solely on multiple units of heavy construction equipment, requires the movement of much greater amounts of earthen material and requires moving that material further to place it outside the meander process area. These adverse impacts would be temporary and would be relatively low emission levels. These pollutants are expected to disperse quickly; therefore, any impact would be minimal. When necessary, construction access roads would be watered to minimize the escape of fugitive dust during high wind speeds and periods of high construction vehicle activity.

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

Increases in fugitive dust (suspended particulate matter) and increases in exhaust emissions from Alternative 4 construction activities would result in the least adverse impacts of the "Build Alternatives" considered. Alternative 4 air quality impacts would be minimized by only using heavy construction equipment for initial clearing and grubbing and then utilizing a hydraulic dredge to excavate the chute. Once initial clearing and grubbing was complete fugitive dust from construction activity would be very minimal. Exhaust emissions would be minimized because after initial clearing and grubbing was complete a single hydraulic dredge would be used to complete chute excavation as opposed to multiple pieces of heavy construction equipment. Alternative 4 would be expected to have less adverse impact on air quality than Alternatives 2 and 3 because only a very minimal amount of earthen material would be moved during initial clearing and grubbing and it would be moved a shorter distance. These impacts would be temporary and would be relatively low emission levels. These pollutants are expected to disperse quickly; therefore, any impact would be minimal. When necessary, construction access roads would be watered to minimize the escape of fugitive dust during high wind speeds and periods of high construction vehicle activity.

5.8 Noise

Alternative 1 - "No Action"

Alternative 1 –The "No Action" Alternative would involve no additional restoration of SWH on the Jameson Island Unit – Big Muddy National Fish and Wildlife

Refuge. There would be no adverse impacts resulting from increased noise under the "No Action" Alternative.

"Build Alternatives"

The noise impacts from the "Build Alternatives" at the Jameson Island Unit SWH Restoration Project site are related to the magnitude of the noise levels generated by construction activities and the proximity of sensitive noise receptors. A sensitive noise receptor is commonly defined as the occupants of a facility or location where a state of quietness is a basis for use. These locations include residences, hospitals, churches, and wilderness areas. Some species of protected wildlife are also considered to be sensitive noise receptors, for instance, the bald eagle.

The human response to noise is generally subjective (e.g., annoyance). Temporary increases in ambient noise levels at the Jameson Island Unit SWH Restoration Project site would be caused by construction activities. A person who is interested in viewing the construction activity may not be bothered by the equipment noise in the least while a person who is out for a birding hike would probably find any construction noise very disturbing and seek areas to avoid it.

Noise impacts to wildlife vary depending on a species hearing ability, time of year, and physical condition. Species behavior, mating, and feeding activities can be adversely affected due to increases in noise levels.

Noise impacts under each of the "Build Alternatives" would be considered temporary and construction related. Upon completion of construction the lack of manmade noise so important to recreational users and wildlife would return to current levels with the only minor difference possibly being when a small motorboat would enter or pass through the chute. Under each of the "Build Alternatives" Corps construction specifications would require the proper installation and maintenance of noise suppressing systems on heavy construction equipment used on site. Construction methods that require the greatest use of heavy construction equipment would have the greatest noise impact as multiple vehicles would have constantly variable engine noise as they continually worked back and forth across the site. Noise would not only be generated by the equipment motor but the equipment tracks, buckets/blades and back up signal horn.

Adverse noise impacts would be greatest under Alternative 3, followed by Alternative 2, and least under the "Recommended Plan". Noise impacts associated with construction of the large permanent earthen stockpiles under Alternative 3 would be considered avoidable. Even considering the greatest noise impacts that would result under Alternative 3 these impacts would not be considered significant. Most recreational users and wildlife would avoid the area affected by construction noise. There are currently large tracts of public land available in the immediate project area that would provide alternate locations for recreational use and areas for disturbed wildlife populations to relocate. Once the project was complete noise levels would return to existing conditions and no long-term significant noise impacts are anticipated.

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

Adverse noise impact under Alternative 2 would be less than Alternative 3 but greater than the "Recommended Plan". Although still relying solely on heavy construction equipment to excavate the chute, less material would be moved and it would be moved a shorter distance than under Alternative 3. Noise impacts associated with a heavy construction project under Alternative 2 would be considered unavoidable.

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

Adverse noise impacts would be greatest under Alternative 3 which relies solely on heavy construction equipment excavates the full chute width and requires the greatest movement of material to place it all outside the meander process area. While noise impacts associated with a heavy construction project would be considered unavoidable, the additional noise impacts associated with construction of the large permanent earthen stockpiles under Alternative 3 would be considered avoidable.

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

Alternative 4 would be expected to have the least adverse noise impact as multiple pieces of heavy construction equipment would only be used for initial clearing/grubbing and then a single hydraulic dredge would be used to remove the remainder of the material. A single hydraulic dredge would be expected to produce a much more even noise level when removing material as they are fairly stationary and would be working at the river level. This would be in contrast with highly mobile multiple pieces of heavy construction equipment where there is great variability in noise related to engine speed, equipment tracks, buckets/blades and back up signal horns working on top of the high bank. Noise impacts associated with the "Recommended Plan" would be considered unavoidable.

5.9 Historic Properties and Cultural Resources

Alternative 1 – "No Action" Alternative

As Alternative 1 – "No Action" Alternative would involve no construction activity. The "No Action" Alternative would have no effect on any cultural resource in or adjacent to the project area.

"Build Alternatives"

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

For each of the "Build Alternatives", 2 through 4, the Corps during the design of the Jameson Island Unit SWH Restoration Project has shifted the proposed alignment southeast to avoid areas where potential historic shipwrecks and non-accreted lands are mapped. These areas have the highest potential for containing cultural resources and as such the Corps determination is that the proposed project would not impact any sites listed or eligible for listing on the National Register of Historic Places in the immediate project area. Although the mapped shipwreck locations have been avoided during project design, should a shipwreck be located during actual construction, work would halt and additional coordination with the SHPO would be required. It is the Corps intent to avoid impacting historic shipwrecks during SWH restoration activities. Under each of the "Build Alternatives" there is always a minor risk to encounter an unmapped or deeply buried shipwreck. Should evidence of a historic shipwreck be exposed during construction it would be the Corps intent to avoid any project impacts by shifting the alignment and by preserving the historic property in place utilizing an appropriate amount of earthen cover and stabilizing the property to avoid future exposure. As with any other inadvertent discovery of a historic property this would require additional coordination with the SHPO and potentially a revision of the National Environmental Policy Act evaluation and Section 404(b)(1) evaluation.

Another area of concern identified during the early planning stages for the project was the Arrow Rock National Historic Landmark, which is located just west of the project area. Preliminary project design and construction planning was developed to avoid any potential construction noise or construction related traffic impacts. Access to the project site by road would require driving through at least a portion of the Arrow Rock National Historic Landmark using existing road ways. There are no existing roads that access the project site outside of the Arrow Rock area. To avoid construction related traffic impacts on the Arrow Rock National Historic Landmark the Corps has committed to constructing the project via floating plant. This would avoid heavy equipment moving through the Arrow Rock National Historic Landmark to the project site. Heavy construction equipment would be moved to and removed from the site using a barge on the Missouri River. While workers may move back and forth through the Arrow Rock

National Historic Landmark to the project site on a daily basis, this would be expected to increase traffic in the Arrow Rock National Historic Landmark by less than 10 vehicles per day, with workers using their personal or company provided pick-up trucks and/or SUVs. Movement of workers through the Arrow Rock National Historic Landmark would be expected to occur during the early morning just before sun up and late evening just after sunset. While some residents may detect the repeating traffic pattern, the traffic to and from the site would be similar to the type vehicles used by area residents and visitors to the area, within the daily limit of expected traffic variability and as such would be expected to pass unnoticed. Workers may also access the project site by boat as fuel would need to be brought up on a regular basis. As no heavy equipment would be moved through the National Historic Landmark no adverse impact to roads or other historic properties within the Arrow Rock National Historic Landmark are anticipated.

The Arrow Rock National Historic Landmark would be considered a sensitive noise receptor. At its closest point the proposed project is within 1,200 linear feet of the boundary of the Arrow Rock National Historic Landmark. The Corps has evaluated noise impacts during the various phases of the project and potential measures to avoid/minimize noise impacts as they are not only a concern to the National Historic Landmark but to area residents, visitors to MDNR's Arrow Rock State Park and the USFWS' Jameson Island Unit of the Big Muddy NFWR. Noise impacts are described above in Section 5.8 Noise. As the NHL is further from the proposed construction site and there is a great deal of woody vegetation and a substantial change in topography the noise effects are expected to be much less than on the Refuge. As noted above noise impacts are expected to be least under the Recommended Plan and greatest under Alternative 3. Measures to avoid/minimize noise impacts would be incorporated into project construction specifications. Once the project was complete noise levels would return to existing conditions and no long-term significant noise impacts are anticipated.

The Corps provided the SHPO with a determination of no historic properties affected by the proposed project and in a response email dated 21 March 2012 (Appendix D) the SHPO provided concurrence with the Corps' determination that there would be "no historic properties affected" by the proposed project.

5.10 Socioeconomic Resources and Human Use

Socioeconomic resources are the part of the human environment that includes the economic, demographic, and social characteristics of individuals and communities.

5.10.1 Population and Income

Alternative 1 - "No Action"

The "No Action" Alternative would involve no construction activity and therefore no impacts to populations or income in the project area are anticipated.

"Build Alternatives"

None of the "Build Alternatives" including the "Recommended Plan" would be anticipated to adversely affect the makeup of the local population or their current income levels. Some minor short-term increases in employment could be realized during construction of the project and there could be minor short-term increases in business to support the project workforce and supply necessary construction materials. No adverse impacts to facilities, services, or nearby communities are expected under any of the "Build Alternatives". The following provides a description of the potential differences.

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

As estimated project cost for Alternative 2 are more than Alternative 4 but less than Alternative 3 it has median potential to provide minor short-term increases in employment during construction of the project and to provide minor short-term increases in business to support the project workforce and supply necessary construction materials.

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

As Alternative 3 has the highest overall estimated project cost it has the greatest potential to provide minor short-term increases in employment during construction of the project and to provide minor short-term increases in business to support the project workforce and supply necessary construction materials.

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

As Alternative 4 has the lowest overall estimated project cost it has the least potential to provide minor short-term increases in employment during construction of the project and to provide minor short-term increases in business to support the project workforce and supply necessary construction materials.

5.10.2 Navigation

Alternative 1 - "No Action"

Alternative 1 –The "No Action" Alternative would involve no additional restoration of SWH on the Jameson Island Unit – Big Muddy National Fish and Wildlife Refuge. It should be noted that under the "No Action" Alternative the remaining work on the final grade control structure on original Jameson Chute Construction Project would be

completed along with continuing Operation and Maintenance of the BSNP as these are separate non-dependant actions.

The Corps has determined that the "No Action" Alternative would not be expected to result in adverse impacts to navigation. Upcoming repairs/modifications of structures in this bend as part of standard BSNP maintenance are independent of the shallow water habitat action or lack of action. The Corps continues to monitor the area and plans to take corrective action as needed to ease navigation problems.

"Build Alternatives"

No substantive differences in project impacts to navigation were identified. The following provides an assessment of project impacts to navigation that is applicable to each of the "Build Alternatives".

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

No adverse impacts to navigation are expected from construction and operation of the Jameson Island Unit SWH Restoration Project under any of the "Build Alternatives", Alternatives 2 through 4. Under any of the "Build Alternatives", alignment of the chute at the lower end will not affect the high velocities, shoaling, or other navigation issues. The U.S. Congress requires the Corps to maintain a 9-foot deep by 300-foot wide navigation channel on the lower 735 miles of the Missouri River including the segment in the project area. The Corps intends that the navigation channel would not be adversely affected by any of the "Build Alternatives". The Corps routinely monitors the Missouri River navigation channel and coordinates these efforts with U.S. Coast Guard and commercial navigators on the river. In areas where navigation impediments are identified the Corps works with U.S. Coast Guard and commercial navigators to develop and implement corrective action that will restore and maintain the authorized 9-foot deep by 300-foot wide navigation channel. Under the Recommended Plan the discharge of dredged material into the Missouri River will be at a location along the thalweg so that the material will become quickly integrated in the Missouri River bedload and not permanently or substantially change the bottom elevation or create shoaling hazards within the navigation channel. The thalweg is the line running along the course of the river that typically has the deepest water and the fastest flow. As such, this area is where

the greatest amount of sediment transport occurs. In addition, discharge rates in relation to current Missouri River flow at time of dredging and project location, as shown in Table C, would be included in contract specifications to ensure that dredge discharge does not exceed the rivers capacity to integrate the dredged material quickly into the active bedload.

5.10.3 Flood Risk Management

Alternative 1 - "No Action"

Alternative 1 –The "No Action" Alternative would involve no additional restoration of SWH on the Jameson Island Unit – Big Muddy National Fish and Wildlife Refuge.

Since development of the original Jameson Island Chute Project concerns have been raised about its effect on the Howard County Levee, located on the opposite bank of the Missouri River, and particularly whether the chute is causing increased erosion on the bank immediately adjacent to the levee. In a letter from the Corps, dated December 14, 2010 (Appendix A – Enclosure ?), to Mr. Tom Waters, President of the Missouri Levee and Drainage Association the Corps provided aerial photos that clearly show erosion problems near river mile 211 pre-date the original 2007 Jameson Island Chute Construction project and had been a recurrent problem in this area since at least the 1993 Flood. In the letter, the Corps also provided a figure showing the model study results for the Jameson Chute Exit. These results clearly show that flows from the original Jameson Island Chute project are quickly diverted downstream by the main flow of the Missouri River and are not diverting or forcing flow onto the opposite bank. At the time of that letter the Corps was already scheduled to meet with the Howard County Levee Districts to discuss the erosion problem and to gain input from the levee concerning their earlier recommendations to relocate the original Jameson Island Chute exit further downstream. Based on that meeting a plan was developed to address work on the BSNP structure adjacent to the levee. In addition, the Howard County Levee Districts continued to express their support for modifications to the original Jameson Island Chute Project which would block the existing outlet, extend the channel further downstream where a new outlet would be constructed. The Howard County Levee Districts expressed no concerns about direct placement of excavated material from chute construction into the Missouri River provided it was not placed in a manner/location that would divert flows toward the levee, reduce channel capacity or increase flood heights.

Under the "No Action" Alternative no additional construction would be undertaken to block the existing chute outlet and move the chute exit further downstream. While Corps studies have determined that the erosion problem area adjacent to the Howard County Levee predated construction of the original Jameson Island Chute Project by many years and that subsequent construction of the chute has not exacerbated that problem, the "No Action" Alternative would not address recommendations made by the Howard County Levee Districts.

"Build Alternatives"

No substantive differences in impacts to flood risk management systems were identified. The following provides an assessment of project impacts to flood risk management systems that is applicable to each of the "Build Alternatives".

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

None of the "Build Alternatives" would adversely impact the existing flood risk management systems in the project area. None of the "Build Alternatives" would involve the placement of excavated material in a manner or location that would divert flows towards the left descending bank of the river, reduce channel capacity or increase flood heights. Each of the "Build Alternatives" would address recommendations by the Howard County Levee Districts to block the existing chute outlet and construct a new outlet further downstream. Under each of the "Build Alternatives" the Corps would continue to coordinate with the Howard County Levee Districts concerning the condition of the proposed project and the BSNP adjacent to their levee system and take corrective actions if warranted.

5.10.4 Recreation / Aesthetics

Alternative 1 - "No Action"

Alternative 1 –The "No Action" Alternative would involve no additional restoration of SWH on the Jameson Island Unit – Big Muddy National Fish and Wildlife Refuge. Alternative 1 would have no adverse impacts on recreation or aesthetics.

"Build Alternatives"

Each of the "Build Alternatives" would have adverse impacts on recreation and aesthetics. These would be greatest during the actual construction activity and primarily related to noise impacts and visual impacts associated with the initial unnatural appearance of the constructed chute. Longer term adverse aesthetic impacts are anticipated under Alternative 3 due to the large permanent earthen stockpiles. The

following provides a description of potential impacts to recreation / aesthetic of the "Build Alternatives".

Alternative 2 – Extend Chute Using Heavy Construction Equipment to Excavate a 75' Wide Pilot Channel and Stockpile Excavated Material within Meander Process Area

As described above in Section 5.8 Noise, adverse construction noise impacts would be median under Alternative 2. Aesthetic impacts are directly related to the quality of the recreational experience. Visitors to Refuge expect to experience quiet or natural sounds and experience natural viewscapes. Alternative 2 would have a median impact as the stockpiled earthen material would be placed within the meander process area and expected to eventually be integrated into the active Missouri River bedload. Long term Alternative 2 would create an aesthetically appealing landscape feature reminiscent of the historic meandering side channels and chutes of the pre-BSNP Missouri River.

Alternative 3 – Extend Chute Using Heavy Construction Equipment to Excavate a Full 200-Foot-Wide Channel and Stockpile Excavated Material Outside of the Meander Process Area

As described above in Section 5.8 Noise, adverse construction noise impacts would be greatest under Alternative 3. Aesthetic impacts are directly related to the quality of the recreational experience. Visitors to Refuge expect to experience quiet or natural sounds and experience natural viewscapes. Long-term adverse impacts to recreation and aesthetics would be greatest under Alternative 3 as it requires the greatest clearing of natural vegetation and the creation of large permanent stockpiles of earthen material which create an unnatural landform on the floodplain. Long term while Alternative 3 would create an aesthetically appealing landscape feature reminiscent of the historic meandering side channels and chutes of the pre-BSNP Missouri River, it would be much less aesthetically appealing due to the large permanent stockpiles of earthen material that would run along its entire length. These long term adverse impacts would be avoided under either Alternative 2 or Alternative 4.

Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan)

As described above in Section 5.8 Noise, adverse construction noise impacts would be least under the "Recommended Plan". Aesthetic impacts are directly related to the quality of the recreational experience. Visitors to Refuge expect to experience quiet or natural sounds and experience natural viewscapes. The "Recommended Plan" would be expected to have the least adverse impact to recreation and aesthetic as it involves the least amount of clearing of riparian vegetation and involves only minimal stockpiling of earthen material that would be placed within the meander process area and expected to

eventually be integrated into the active Missouri River bedload. Long term the "Recommended Plan" would create an aesthetically appealing landscape feature reminiscent of the historic meandering side channels and chutes of the pre-BSNP Missouri River. No significant adverse impacts to recreation /aesthetics are anticipated under the "Recommended Plan".

5.13 Cumulative Impacts

Cumulative effects of the Mitigation Project were addressed in the SEIS (2003). The SEIS evaluated cumulative effects on the following topics:

- *Land acquisition*
- *Economic impacts*
- *Recreation*
- *Navigation*
- *Water Resources (including water quality)*
- *Flood Control*

Cumulative effects associated with these resource categories do not need to be evaluated in the PIR because there are no extraordinary site-specific circumstances that necessitate an additional cumulative impacts analysis. However, there are other cumulative effects not addressed in the SEIS that would result from the construction and operation of the Jameson Island Unit SWH Restoration Project. These include the following:

• Regional increases in fish and wildlife populations resulting from site-specific habitat development activities on the land use. Increases in regional habitat quality should positively correlate to increases in fish and wildlife resources in terms of species diversity and abundance. These would include efforts of the USFWS as part of their Big Muddy National Fish and Wildlife Refuge, NRCS and their Wetland Reserve Program, public and private land management programs of the Missouri Department of Conservation, habitat restoration and preservation activities of the MDNR and finally efforts undertaken by individuals on private lands to benefits fish and wildlife resources.

• Overall beneficial increases in aquatic habitat that support the pallid sturgeon and other native fish and wildlife species.

• Cumulative effects of sediment reintroduction on sediment transport/availability in the lower Missouri River - The effects of sediment removal by commercial dredging operations from the Missouri River on shallow water habitat have been evaluated in *The Missouri River Commercial Dredging Final Environmental Impact Statement*, prepared for the U.S. Army Corps of Engineers, Kansas City District and dated February 2011 as part of a Section 404 Clean Water Act permit application. Limitations established for commercial dredging were developed to ensure that activity does not adversely impact shallow water habitat or dependant life forms. In addition, criteria established for commercial dredging ensure adverse impacts associated with bed degradation are

avoided. The cumulative effect of sediment reintroduction from Missouri River SWH restoration projects could provide minor benefits related to the amount of available sediment in the active bedload. The cumulative effect of increased material in the active bedload from SWH construction projects could provide very minor benefits to commercial dredgers and help offset adverse impacts associated with bed degradation. No significant adverse cumulative impacts to sediment transport/availability in the lower Missouri River were identified.

• Cumulative effects of sediment reintroduction projects on water quality of the Missouri River:

Concerns have been raised about the cumulative impact of the total amount of sediment (and potentially associated nutrients) required to enter the Missouri River to create 20,000 acres of SWH. To fully understand the consequences of sediment re-introduction the cumulative effects need to be evaluated in the historical context of Missouri River ecology. The Missouri River has undergone significant alterations since the beginning of the 20th century. Six reservoirs were built along the mainstem and the river has been channelized on the lower 735 miles as part of the bank stabilization and navigation project (BSNP). In addition to alterations on the mainstem, most of the major tributaries currently have dams and have undergone channel modifications as well. These alterations and hydrologic controls placed on the Missouri River dramatically altered the landscape of the river and caused a decrease in the amount of sediment transported by the river.

According to the National Research Council the historically high concentration of sediment in the Missouri River was possibly as important as the quantity and flow of water given that the sediment is necessary for habitat creation for native species and that high sediment concentrations were important to the evolution of native species (NRC 2011). Additionally, sediment from the Missouri River was significant in sustaining coastal wetlands in Louisiana (NRC 2011). The Gulf Coast Ecosystem Restoration Task Force recognizes a sediment deficit and calls for increased and wiser use of sediments for use in habitat restoration projects (preliminary draft 2011).

As of 2010, the Corps has created approximately 3,443 acres of SWH. During the same time period as this construction, suspended sediment loads at St. Louis have continued to decrease (Table D). This indicates that sediment introductions during habitat creation projects, as well as the natural processes that occur as SWHs mature, have not reversed the decreasing trend in suspended sediment and are immeasurable at this time. As such, any short-term increases in suspended sediment loads from SWH creation, if measureable, are likely to be masked by the overall declining trend in suspended sediments observed throughout the Missouri and lower Mississippi Rivers.

Table D. Summary of Annual Suspended Sediment Data (Million Tons / Year).

Data Period	Tarbert + RR Landing	St Louis (d/s Mile 0)	Hermann (Mile 97.9)	Kansas City (Mile 366.1)	St Joseph (Mile 448.2)	Omaha (Mile 615.9)	Yankton (Mile 805.8)
1940 - 1948	-	-	-	-	-	163	140
1949 - 1952	510	320	326	328	257	164	133
1955 - 1966	222	107	102	80	60	29	2
1967 - 1976	220	109	95	75	55	28*	0.9*
1977 - 1991	188	116	73	36*	48	18	-
1992 - 2002	172	88	62	51	37	18	0.3*
2003 - 2009	158	63	43	35	24	10	0.2*

*No data available: 1972-1976 at Omaha, 1982-1987 at Kansas City, 1970-2000, 2009 at Yankton
St Louis and Lower Mississippi, all 2009 data from USGS Data Series 593 (Heimann et all 2011)
Omaha and Yankton data from Corps Suspended Sediment Reports 1937-1974
Hermann, Kansas City, and St Joseph data 1948-1976 from Sediment Series 22 (USACE 1980)
Omaha data 1977-1999 from Sediment Series 39 (USACE 2001)
All remaining data from USGS Data Series 530 (Heimann et all 2010)

The introduction of sediment to the mainstem river, and associated nutrients, however, should also be evaluated within the historical context of the Missouri River when discussing the potential increase in downstream nutrient delivery. The alluvial sediments, and associated nutrients, being mobilized to create SWH, are materials deposited from river transport that are in temporary storage in the flood plain. The sediment that would be excavated and placed in the river was once part of the active Missouri River bedload and the area it would be excavated from was once part of the Missouri River channel. Under natural conditions, these materials would have been transported through the system by natural geomorphic processes as the river would flood, rework, remove, and deposit these materials in a dynamic fashion, thus the sediment and phosphorus being remobilized as a result of habitat restoration activities are not a net addition to the system (D. Soballe, USACE, pers. communication). Given the relationship between phosphorus and sediment, it is likely that historically, there were elevated background concentrations of phosphorus in the Missouri river (prior to the BSNP and the construction of mainstem dams) and was part of the natural ecosystem that supported native species (NRC 2011). A comparison of potential phosphorus loads from Corps SWH projects to phosphorus loads required to change the areal extent of the Gulf hypoxic zone shows that these projects will not significantly change the extent of the hypoxic zone (NRC 2011). Upper bound estimates summarized by the National Research Council (using data supplied by Jacobson et al. 2009), show the maximum increase in total phosphorus delivery to the Gulf by Corps habitat restoration projects could be 6-12 percent, hypothetically, if a variety of conditions occurred as discussed in the following paragraph. Even at upper bound estimates, these rates on the basin and reach scale are small and temporary during the construction period and likely difficult to detect at the Gulf (D. Soballe, USACE 2007, pers. communication).

While upper bound estimates are useful to understand maximum potential impacts to sediment transport and or nutrient loads, and maximum potential to influence the sediment deficit on the Missouri River, these estimates may overestimate the quantity of sediment that could actually enter the river and be available for downstream transport.

Recent analysis by the Corps has shown that it is unlikely that actual SWH sedimentation rates have exceeded 10% of the amount estimated by Jacobson et al 2009 (C. Bitner, USACE, pers. communication). For example, much of the strategy has been to create SWH through structure modifications, encouraging sediment deposition in the margins of the existing river channel. Some past construction projects have also included a portion of the sediment excavated being placed in areas that would not enter the Missouri River, such as along levees. Additionally, under most conditions, sediment settling and storage processes in the Missouri and Mississippi River channels will attenuate the load and spread delivery to the Gulf over a long period of time (NRC 2011). Assuming excavation rates could increase to the upper level projected by the Corps of 5 million cubic yards per year, and assuming that those projects on average increase in size up to 100% over a ten year period then stabilize, peak annual sediment inputs would approach 13.6 million tons per year (12.1 million metric tons per year), or approximately 1/3 of the Jacobson et al 2009 estimate (Bitner 2011 pers. communication). When evaluating impacts to the Gulf hypoxic zone it is also important to understand that addressing nutrients on the Missouri River alone will not solve the hypoxia problem in the Gulf (Zellmer 2011). Additionally, consistent with the January 2011 Federal Position, the Corps is currently working to create a database that will track actual contributions of sediment (and allow estimates of nutrient loads) to the Missouri River from both construction and natural development over time following periodic surveys after construction. Any information gained from this process will be used to help inform future decisions and guide SWH restoration activities.

The Gulf Coast Ecosystem Restoration Task Force states "A comprehensive watershed-based approach to the management of river systems is required to ensure that current and future ecosystem needs are met. Giving ecosystem restoration equal footing with navigation and flood damage risk reduction is an important element of this strategy and should be applied to river management activities across multiple agencies" (Gulf of Mexico Regional Ecosystem Restoration Strategy 2011). Corps SWH projects attempt to address this issue. From a watershed perspective habitat creation actions along the Missouri River are designed to return the natural form and function lost during the BSNP. Historically, wetlands and off channel habitats would have served as natural nutrient sinks and reduced nutrient delivery to the Missouri River. Corps mitigation projects attempt to emulate these historical features. As these sites mature over time, riparian buffers develop, shallow water develops and these habitat features may begin to serve as natural nutrient sinks, thus reducing nutrient delivery to the mainstem. For example, data collected by the Corps in 2010 showed that created backwater SWH sites have statistically lower total phosphorus concentrations relative to adjacent mainstem sites. Based on our analysis no adverse cumulative impacts to water quality were identified.

5.14 Probable Adverse Environmental Impacts Which Cannot Be Avoided

Adverse environmental effects which cannot be avoided include noise disturbance impacts to fish and wildlife resources and recreational users during construction, direct loss of wildlife resources as a result of construction, loss of riparian and wetland habitat

that would be converted to SWH by construction, and aesthetic impacts resulting from the extensive construction area during and after construction.

5.15 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable resource commitments due to construction and operation of the Jameson Island Unit SWH Restoration Project include the loss of some Federal funds, labor, energy, and construction materials used to plan, design, construct, and monitor the project. During project construction and subsequent natural chute development, sediment would be remobilized and would become part of the active Missouri bedload. This material could produce landforms (SWH/sandbars/wetlands) downstream of the project area or be extracted by commercial dredgers.

5.16 Compliance with Environmental Quality Statutes

This Section contains a summary of the statutory and regulatory environmental compliance requirements and status of the major Federal and state permits and clearances that would be required for the approval and implementation process for the Jameson Island SWH Restoration Project.

Clean Air Act, as amended. No aspect of the Recommend Plan, either short- or long- term, has been identified that would result in violations to air quality standards. The environment will not be exposed to contaminants in such quantities and of such duration as to be injurious to human, plant, or animal life, or property, or which unreasonably interferes with the comfortable enjoyment of life, or property, or the conduct of business.

Clean Water Act (Sections 404, 401 and 402) as amended. The Corps has made a preliminary determination that the project is in full compliance with the Clean Water Act Section 404(b)(1) Guidelines. The preliminary Section 404(b)(1) Evaluation is included as Appendix H of this report. The Corps believes that the information contained in this report would demonstrate that the proposed project is in compliance with the State of Missouri's Section 401 Water Quality Certification. Prior to project approval the Corps would review comments from the Public Notice then request Section 401 Water Quality Certification from MDNR. Section 401 Water Quality Certification or a waiver of would be required for project approval. In addition, prior to project construction the Corps would need to secure a Section 402 NPDES Permit from MDNR.

The MCWC has contended that there is a "double standard" under permitting requirements of Section 402 of the Clean Water Act – National Pollutant Discharge Elimination System (NPDES) for stormwater runoff from general construction projects and Corps fish and wildlife habitat restoration projects on the Missouri River. The Section 402 NPDES permit program is administered in the State of Missouri by the MDNR. MCWC further contends that the CWA defines soil as a pollutant and that pollutants must be prevented from entering the waterways of Missouri to the point that the MCWC order requires the Corps to stabilize all excavated material and all excavated areas to prevent any sediment greater than *de minimus* from entering the Missouri River.

The Corps believes that those conditions are not consistent with the project purpose and constructively represent denial. Through the MCWC March 2008 order, a zero sediment input standard appears to have been created. This same standard is not applied to local governments, water treatment facilities, levee districts, commercial sand dredgers, casino owners, or the numerous other interests who have applied for and received Clean Water Act permits to discharge sediment or other pollutants into waters of the United States. MDNR has worked with the Corps on the Mitigation Project for many years, regularly attends the Mitigation Project's quarterly ACT meeting, provides input on our NEPA compliance and Section 404 Clean Water Act evaluations, and reviews requests for Section 401 and Section 402 authorizations. In 2005 the Corps working with MDNR developed a General Permit (GP-699000) (Appendix I – Enclosure 5) that specifically recognized the differences between typical construction and the Corps' environmental restoration activities on the Missouri River. GP-69900 authorized "return water and stormwater runoff from dredged material deposition sites, bank notching/chute excavation to allow the river to actively scour and widen and other disturbances along the Missouri and Mississippi Rivers for fish and wildlife mitigation projects and shallow water habitat development projects."

GP-699000 ensured that appropriate construction Best Management Practices were included in Corps fish and wildlife mitigation projects but that requirements that did not consider the current/historic condition of the receiving waterbody, that did not reduce environmental harm, and finally that were not consistent with the project purpose were not included. GP-699000 recognized that there were basic differences in the project purpose and the receiving waterbody from what was addressed in the standard Construction Stormwater General Permit. First there is the project purpose. In a typical NPDES permit application the applicant is proposing to clear and grub land for future development or to construct some type of permanent facility (building, road, parking lot, housing development). Under GP-699000 the project purpose is restoration of fish and wildlife habitat on the Missouri River. A very important part of the project purpose is to restore the dynamic process where the river acts on floodplain sediment, scouring and depositing in a constant state of flux which results in a highly diverse aquatic habitat. This dynamic process and the important fish and wildlife habitat it creates has largely been eliminated by the Corps' BSNP and the Mainstem Reservoir System. This process remobilizes Missouri River sediment that has been trapped by the BSNP structures and returns it to the active bedload. GP-699000 further recognized the differences in the receiving water body. Native species which inhabit the Missouri River evolved in a much more turbid system and are adapted to much more turbid conditions than exist in the Missouri River today or could ever result from the Corps' SWH restoration efforts. In addition, this remobilization of the bedload and restoration of the natural river process provides a very, very minor benefit to coastal wetlands in the Gulf of Mexico. Restoration of sediment flow to the Gulf of Mexico is an important step needed to rebuild coastal wetlands that can assists in naturally reducing nutrients and lessen the extent of the associated "dead zone". GP-69900 ensured the protection of wetlands adjacent to the proposed habitat construction project, prevented the introduction of and hazardous or deleterious substances from entering adjacent wetlands and the Missouri River, required notification to MDNR on each project prior to construction and issuance by MDNR of a

State Operating Permit, and outlined conditions where GP-699000 could not be used and an individual permit would be required. What GP-699000 didn't do was prevent the Corps from restoring fish and wildlife habitat and the dynamic natural river processes that would further develop and maintain it. MCWC often notes that EPA levies substantial fines on developers who are not in compliance with Section 402 CWA requirements. What MCWC fails to mention is that many of these fines are the result of individuals/developers failing to secure the necessary permits or to comply with the conditions contained in those permits. It should be noted that the Corps has always secured the appropriate CWA permits prior to construction for our SWH projects and fully complied with the conditions of those permits.

As with the Section 401 Water Quality Certification any conditions in the Section 402 NPDES permit that limit or eliminate the proposed projects ability to fully achieve the stated objective of restoring the natural dynamic river process or arbitrarily restricts the reintroduction of sediment that is not in violation of the States Water Quality standards would be viewed as constructive denial by the Corps.

Endangered Species Act of 1973, as amended. As previously discussed, the proposed project would not impact any species listed or proposed for listing under this Act.

Fish and Wildlife Coordination Act. This project has been coordinated with the USFWS. Project plans have also been closely coordinated with the Mitigation Project ACT, which includes MDC, to ensure that all natural resource concerns associated with the project have been and will continue to be taken into account. The Corps will continue to coordinate with USFWS and the Mitigation ACT through project construction and any operation and maintenance action. This report has been circulated to these Federal and state resource agencies for their review and comment.

Floodplain Management (Executive Order 11988). Implementation of the Recommended Plan will avoid, to the extent possible, long- and short-term adverse impacts associated with the occupancy and modification of the base floodplain. It also will avoid direct and indirect support of development or growth (construction of structure and/or facilities, habitable or otherwise) in the base floodplain.

National Environmental Policy Act of 1969, as amended. The compilation, public review, and responses to public comment of this PIR with integrated Environmental Assessment fulfill compliance with NEPA.

National Historic Preservation Act of 1966. This undertaking is in full compliance with the National Historic Preservation Act of 1966, as amended and its implementing regulations, 36 CFR Part 800.

Protection of Wetlands (Executive Order 11990). The Recommended Plan would result in the loss of approximately 5 acres of wetland at completion of construction and be expected to expand to a total of 8.9 acres of wetland loss at full chute development.

These areas would be converted to SWH. These minor long-term impacts will be greatly offset by benefits to the aquatic ecosystem of restoring SWH and the dynamic natural river processes which increase floodplain connectivity and would eventually result in the natural formation of additional wetlands adjacent to the proposed chute.

Environmental Justice (Executive Order 12898). This order directs Federal agencies to incorporate environmental justice in their decision making process. Federal agencies are directed to identify and address as appropriate any adverse environmental inequities resulting from their programs, policies, and activities on minority or low income populations. Within the intent and spirit of Executive Order 12898, no minority or low income populations would be negatively impacted or displaced by any Corps action under any of the alternatives considered in this PIR.

The project is in full compliance statutory and regulatory environmental compliance requirements and is currently contingent upon finalization of this NEPA/Section 404 CWA review and issuance by MDNR of authorization under Section 401 of the Clean Water Act and Section 402 of the Clean Water Act.

5.17 Short-Term Versus Long-Term Productivity

Construction activities would temporarily disrupt fish, wildlife and human use of the immediate project area. The long-term health and productivity of the fish and wildlife resources in the project area are anticipated to benefit greatly from the proposed project. Short-term human use impacts would be greatly offset by the long-term fish and wildlife gains and their associated benefits to human use.

5.18 Relationship of the Proposed Projects to Other Planning Efforts

The proposed project is not in conflict with any other planning efforts currently covering the project area. The proposed project is consistent with current planning efforts of the USFWS Big Muddy National Fish and Wildlife Refuge.

Chapter 6 – Other Considerations

6.1 Introduction

The Recommended Plan for the Jameson Island Unit SWH Restoration Project (Alternative 4) includes various activities, previously described, to develop fish and wildlife habitat. This section describes the adaptive management for SWH, operations and maintenance plan, real estate considerations, implementation responsibilities, views, cost estimates, schedules, and conclusions and recommendations for the Jameson Island Unit SWH Restoration Project.

6.2 Adaptive Management Stategy for Creation of SWH

The Corps has been creating SWH on the Missouri River for nearly 20 years. Projects include chutes, backwaters, and modifications to the structures which comprise the BSNP. Shallow water habitat creation supports two components of the MRRP; Bi-Op compliance and the Mitigation Project. As such, SWH creation aims to both aid in the recovery of pallid sturgeon and to mitigate for habitat lost as a result of the BSNP.

Because uncertainties exist regarding the effectiveness of SWH creation efforts at restoring quality habitats and in turn benefitting pallid sturgeon and other native species, an adaptive approach is necessary to ensure that learning from past management actions guides future direction. In 2010, as part of this adaptive process, the USACE took a "step back" from routine monitoring efforts to evaluate the current approach, to consider recent guidance such as the MRRP Adaptive Management Framework and clarified SWH definition provided by USFWS, and to consider recommendations provided by the Aquatic Habitat Working Group (a team tasked by the USACE and USFWS to develop SWH performance metrics).

This "step back" led to the creation of a seventeen-member, multi-agency team comprised of staff from the USACE, USFWS, US Geological Survey, Environmental Protection Agency, Missouri Department of Conservation, Iowa Department of Natural Resources, and Nebraska Game and Parks Commission to develop an Adaptive Management Strategy for Shallow Water Habitat Creation. This collaborative effort will ensure that monitoring efforts are tied to objectives and that learning from management actions can guide future decisions.

The Adaptive Management Strategy for Creation of SWH is included as Appendix F. Section 4 Monitoring and Assessment outlines the procedures for evaluating SWH, including chutes and backwaters. Section 6.1.4 Site Adjustments provides a decision matrix for site specific adjustments to SWH projects intended to develop over time that is applicable to the Jameson Island Unit SWH Restoration Project. An important aspect of this matrix is that it compares trends in physical habitat complexity with trends in biological response to determine if change is warranted. Section 3.2 Potential Adjustments outlines potential adjustments, along with potential estimated costs, that may be taken to alter previously created SWH sites to ensure that they better achieve the state objectives.

6.3 Operations and Maintenance Plan

The USFWS would continue to operate and maintain the Jameson Island Unit as part of the Big Muddy National Fish and Wildlife Refuge. The Corps would operate and maintain the Jameson Island Unit SWH Restoration Project. Funding for O&M of the river structures that are part of the SWH restoration project would be borne by the Corps. The Corps will incorporate the Jameson Island Unit SWH Restoration Project into the BSNP O&M manual which includes the SWH restoration projects on the Missouri River. Need for O&M activities is determined based on annual river inspections, special inspections after major flood events, or in response to reports/requests from the public or government entities. Typical operation and maintenance activities include ensuring that

structures constructed as part of the project are consistent with original design criteria and that any damages from flooding which adversely impact operation are repaired. Major design changes and modifications based on recommendations from site monitoring typically fall outside basic O&M. O&M typically involves replacement of lost/displaced rock and minor structure modifications. Estimated costs associated with O&M of the original Jameson Island Chute and the proposed Jameson Island Unit SWH Restoration Project combined is approximately $10,000 per year. No substantial differences in anticipated O&M cost were identified between the three "Build Alternatives".

6.4 Real Estate Considerations

The Jameson Island Unit is 1,871 acres and is owned by the USFWS. The USFWS purchased the land from willing private sellers between 1995 and 1997. The USFWS currently manages all lands on the site as part of the Big Muddy National Fish and Wildlife Refuge and would continue to do so upon completion of the project. Management of the chute and shallow water areas would fall under the responsibility of the Corps in coordination with USFWS.

6.5 Implementation Responsibilities

The Corps is responsible for study management and coordination with USFWS, MDC, and other impacted/interested agencies. The Corps will prepare and submit the subject PIR and complete all environmental review and coordination requirements. The Corps will then prepare any design plans that may be required, finalize any plans and specifications, prepare and implement a M&E Plan, advertise and award a construction contract, perform construction contract supervision and administration, develop an O&M Manual, ensure O&M is carried out in accordance with the O&M Manual, and develop and implement the real estate agreement. The Corps will maintain all project features. In the event of flood damages to the project, the Corps will evaluate and complete the work necessary to reestablish project features.

The USFWS is responsible for management of the terrestrial portions of Jameson Island Unit, Big Muddy National Fish and Wildlife Refuge. The ACT meets quarterly to discuss the status of the Mitigation Project. As part of the meetings, an O&M update is given at which time the ACT ensures that site O&M is appropriate and reasonable.

6.6 Cost Estimate

The total estimated cost of the Jameson Island Unit SWH Restoration Project includes: design, construction, and construction management. See Table G below for the Jameson Island Unit SWH Restoration Project cost estimate.

Activity	Cost ($)
Design	353,922
Construction	3,539,225
Construction Mgt.	353,922
Total	4,247,069

Table G. Cost Estimate

The Jameson Island Unit SWH Restoration Project would be Federally funded in its entirety. If Federal funds are not available to accomplish general operations, management and maintenance at the site, then such work would likely be deferred or not accomplished. The annual O&M costs are estimated at $10,000. The cost estimate would be updated throughout the life of the project as project features are further defined.

6.7 Schedule

Milestones	Schedule	Actual
Cooperative Agreement Signed	N/A	
PIR Initiated	OCT 2011	OCT 2011
PIR Approved	APR 2012	
Plans Initiated	OCT 2011	OCT 2011
Plans Reviewed	JUN 2012	
Plans Approved	JUL 2012	
Construction Start	AUG 2012	
Construction Complete	AUG 2013	

6.8 Conclusions and Recommendations

SWH restoration on the Jameson Island Unit has been identified as a priority project for inclusion into the Mitigation Project and to meet goals of the Bi-Op. The USFWS and ACT concur.

Implementation of the Jameson Island Unit SWH Restoration Project would extend the original Jameson Island Chute Construction Project and create a backwater

area further increasing the environmental benefits of the original project. Creation of additional SWH would benefit fish and wildlife resources by greatly improving aquatic habitat on the Jameson Island Unit and increasing the value of the adjacent terrestrial habitat managed by USFWS. Construction and operation of the Jameson Island Unit SWH Restoration Project are not expected to create toxic conditions nor will it create water quality conditions that will not support native aquatic life or other beneficial uses.

It is recommended that Alternative 4 – Extend Chute Using Heavy Construction Equipment for Initial Clearing/Grubbing and a Hydraulic Dredge to Excavate a 100' Wide Channel Mixing Dredged Materials with the Existing Missouri River Water and Sediment Load (Recommended Plan) to create 30 acres of SWH be constructed as described in this PIR. The Recommended Plan represents the least environmentally damaging practicable alternative, results in the greatest benefits to fish and wildlife habitat and would not significantly adversely affect the human environment.

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