



UNITED STATES ARMY CORPS OF ENGINEERS

# Missouri River Commercial Dredging Draft EIS

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PREPARED BY



ENTRIX, Inc.  
200 First Avenue West, Suite 500  
Seattle, WA 98119  
T 206.269.0104 ▪ F 206.269.0098

# Executive Summary

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## ES.1 INTRODUCTION

Commercial sand and gravel dredging companies (the Dredgers) have filed applications with the Kansas City and St. Louis Districts of the U.S. Army Corps of Engineers (USACE) to continue extracting sand and gravel from the Missouri River, from its confluence with the Mississippi River (river mile [RM] 0) upstream to Rulo, Nebraska (RM 498). Activities to be conducted under permits issued by the USACE would include dredging of river sediments from the navigable waters of the lower Missouri River (LOMR), extraction of suitable sand and gravel, and return (discharge) of some of the dredged material into the river. These activities are regulated under Section 10 of the Rivers and Harbors Act (RHA) of 1899 (33 United States Code [USC] 403). Discharge of dredged material into a navigable water of the United States is also regulated under Section 404 of the Clean Water Act (CWA) (33 USC 1344).

Authorizing a permit by the USACE under Section 10 or Section 404 is a discretionary action that requires environmental review under the National Environmental Policy Act (NEPA). Permitting commercial dredging in the LOMR involves a decision about whether commercial dredging should be allowed to continue, the allowable amounts to be dredged, and the locations of dredging. Prior USACE decisions to permit current commercial dredging mandated that an environmental impact statement (EIS) be completed prior to further permitting of commercial dredging in the LOMR, to ensure that the USACE is fully informed about the environmental consequences of the permitted action. In 2008, the USACE St. Louis District agreed to participate with the USACE Kansas City District in preparing a joint EIS for all dredging in the LOMR. In 2009, the USACE extended the expiration date of all eight existing permits (to six applicants) to December 31, 2010, in order to allow time for the EIS to be completed (USACE 2009).

## ES.2 BACKGROUND

Early development occurred on the Missouri River because the river offered (1) a reliable water supply for consumptive, agricultural, and industrial use; and (2) links to commerce and navigation. Since the 1930s, two major modifications to the river have been constructed, resulting in dramatic long-term

changes to the flows and habitat of the LOMR – the Missouri River Main Stem Reservoir System and the Missouri River Bank Stabilization and Navigation Project (BSNP).

Although records show that sand and gravel have been dredged or excavated from the LOMR since the 1930s, undocumented dredging may have begun earlier. Early dredging removed sand and gravel to aid in river navigation, and the materials removed were put to commercial use. In the 1930s, an active commercial sand and gravel industry developed to supply regional construction and road building industries. Recent dredging data indicate that commercial sand and gravel dredging primarily occurs near Kansas City, Jefferson City, and the St. Louis/St. Charles areas.

The LOMR exhibited river bed degradation in the latter 1900s. Recent investigations by the USACE Kansas City District of changes in water surface and river bed elevations have revealed that significant degradation of the river bed has occurred along major portions of the LOMR. Recent observations near Kansas City indicate that the rate of degradation is accelerating (USACE 2010).

In 2003 and 2004, the USACE Kansas City District received 10 applications from commercial sand and gravel companies for permits to extract sand and gravel from the LOMR. In August 2007, the USACE Kansas City District authorized four applicants to continue existing dredging operations; the remaining six applications for new or inactive dredging operations were not approved (USACE 2007). In conjunction with its review of the applications, the USACE Kansas City District determined that substantial river bed degradation was occurring in portions of the LOMR. The reaches of the river most degraded—Kansas City, Jefferson City, and St. Charles—were found to coincide with areas where commercial sand and gravel dredging was the greatest.

Additional concerns were that (1) dredging and associated river bed degradation could be contributing to impacts on habitats of federally listed threatened or endangered species; and (2) lowered water levels associated with river bed degradation were affecting the operation of municipal and industrial water intakes and the structural integrity of other public infrastructure. Because dredging was considered by the USACE Kansas City District to be one of the contributing causes of river bed degradation and related potential impacts to threatened and endangered species, approved dredging activity was restricted and limited under the reauthorized permits.

The new authorizations required that an EIS be prepared as the basis for any future permit reauthorizations and were limited to durations of 3 years, which was thought to be sufficient time for the EIS to be completed. In fall 2009, as it became obvious that the EIS would not be completed by the end of the year, the USACE extended the expiration date of all eight existing permits (to six applicants)

to December 31, 2010, in order to allow time for the EIS to be completed (USACE 2009). The commercial sand and gravel dredging operations on the LOMR will cease on January 1, 2011, and may not resume unless the dredging permits are reauthorized.

### ES.3 PURPOSE AND NEED

The Proposed Action considered in this Draft EIS is (1) reauthorization by the USACE of eight existing dredging permits (to six applicants); (2) authorization of three additional proposed dredging permits; and (3) authorization of any as yet unforeseen proposed dredging permits. The Dredgers jointly propose to remove approximately 11.615 million tons of sand and gravel annually from specifically identified reaches of the LOMR that together comprise approximately 390 miles of the river between St. Louis, Missouri and Rulo, Nebraska. For purposes of the CWA, the basic purpose of the Proposed Action is to supply aggregate required to support the region's construction and manufacturing needs. The overall Project purpose is to profitably extract sand and gravel from the Missouri River that meet certain specifications in order to supply the region's construction and manufacturing needs. As stated by the Dredgers, the Project purpose is to economically provide sufficient quantities of quality sand and gravel to a wide variety of construction and manufacturing customers in the region.

The Project is needed because sand and gravel are essential components of construction materials, which are integral to the economy of the region that encompasses St. Joseph, Missouri; greater Kansas City; central Missouri; and greater St. Louis. Dredging in the LOMR represents one of the most cost-effective methods for supplying sand and gravel because the river provides sorted sand and gravel that does not require certain types of additional processing.

### ES.4 ISSUES CONSIDERED

Issues to be evaluated in the EIS were developed through a NEPA scoping process that included public notice and opportunity for public and agency comment. Three public scoping meetings and a cooperating agency scoping meeting were conducted in the Project area. A total of 149 scoping comments were received and evaluated to form the scope of analysis for the EIS. Issues raised during the scoping process related to the alternatives evaluated: geomorphology of the river, including bed degradation and changes in water surface levels; effects of geomorphology on infrastructure and water supplies; economic effects of changing costs for commercial sand and gravel; impacts on the ecosystem and protected species; existing environmental programs; the NEPA process; recreation; and cumulative effects.

## ES.5 ALTERNATIVES CONSIDERED

NEPA requires that the USACE evaluate the Proposed Action (the Dredgers' proposal), taking into consideration the No Action Alternative and a reasonable range of other alternatives. In addition to the Proposed Action and the No Action Alternative, three action alternatives were considered:

Alternative A, Alternative B, and Alternative C.

### ES.5.1 Proposed Action

The Proposed Action includes approval of the 11 Department of the Army Permits (DA permits) for dredging of specified quantities of sand and gravel from designated reaches of the LOMR, with the existing permit conditions. The applicants include companies who would:

- Own and operate dredging equipment, tug boats, and barges and who would dredge sand and gravel from within their requested dredging reaches and deliver it to their own onshore sand plants;
- Own onshore sand plants and contract with other companies to dredge sand and gravel from within their requested dredging reaches and deliver it to onshore sand plants; and
- Own dredging equipment and contract to deliver sand and gravel dredged from their requested dredging reaches to onshore plants owned by other companies.

All applicants are existing dredge operators or contractors on the LOMR, except for The Master's Dredging Company, Inc., and Edward N. Rau Contractor Company. Together, the Dredgers propose being permitted to dredge up to 11,615,000 tons of sand and gravel from the LOMR annually. Average annual dredging from the LOMR from 2004 to 2008 (existing conditions) was 6,891,930 tons. In addition, two of the applicants propose constructing onshore facilities (sand plants) to support the proposed dredging operations.

### ES.5.2 No Action Alternative

Under the No Action Alternative, the pending permit applications for dredging commercial sand and gravel in the LOMR would not be approved, and current commercial dredging permits would expire on December 31, 2010. Currently available alternate sources of commercial sand and gravel would supply sand and gravel needs in the market and region currently served by permitted commercial dredging.

The No Action Alternative would result in the cessation of commercial dredging in the LOMR following the denial of permit requests and expiration of existing extended permits held by the applicants.

### ES.5.3 Alternative A

Under Alternative A, allowable commercial dredging would be set at 2,190,000 tons per year, a level at the lower end of the range that is reasonably expected to reduce the contribution of sand and gravel dredging to continued river bed degradation in the LOMR. Production of sand and gravel from alternate sources would need to increase in order to offset the reduced supplies from the LOMR.

### ES.5.4 Alternative B

Under Alternative B, allowable commercial dredging would be set at 5,050,000 tons per year, a level at the upper end of the range that is reasonably expected to reduce the contribution of sand and gravel dredging to continued river bed degradation. Production of sand and gravel from alternate sources would need to increase under Alternative B in order to offset the reduced supplies from the LOMR.

### ES.5.5 Alternative C

Under Alternative C, allowable commercial dredging would be set at a level that approximates recent dredging amounts: 6,900,000 tons per year. Permitted dredging from the LOMR would equal or exceed existing demand levels; therefore, increased production from alternate sources would likely not be necessary.

### ES.5.6 Other Actions Considered

During the EIS scoping process, the applicants, public, agencies, and organizations were provided the opportunity to submit suggestions for alternative means for achieving the Project purpose. Each alternative was considered with regard to the Project purpose and need, current laws and regulations, practicability, and other criteria. They were not carried forward into detailed environmental analysis for differing reasons including lack of practicability, lack of jurisdiction, or lack of sponsorship. The alternatives considered but not carried forward for analysis include (1) No Cap Mine-and-Relax Strategy; (2) Sand Supplied from Distant Sources; (3) Sand from Locally Available Alternate Sources; and (4) Increasing Sediment Supply in the Lower Missouri River.

## ES.6 AFFECTED ENVIRONMENT

The Project area includes the main channel and floodplain of the LOMR, the most downstream portions of tributaries to the Missouri River to the extent that they may be indirectly affected by river bed degradation, and the region surrounding the river to the extent that specific resources may be affected by dredging or use of alternate sources of sand and gravel. The LOMR within the Project area was

divided into five segments for environmental analysis based primarily on the intersection of the LOMR with major tributaries. The segments, designated by river mile, include St. Joseph (RM 391 – RM 498), Kansas City (RM 357 – RM 391), Waverly (RM 250 – RM 357), Jefferson City (RM 130 – RM 250), and St. Charles (RM 0 – RM 130). For each segment, the environmental resources listed below were evaluated.

### ES.6.1 Geology and Geomorphology

The EIS describes the geologic setting, geomorphic character, hydrology, sediment transport and loads, and existing river bed degradation for the LOMR. The St. Joseph segment exhibits decreased low-flow water surface elevations and a stable river bed. In the Kansas City segment, the river bed and low-flow water surface elevations have dropped 10–15 feet over the past 50 years, with one-half of the degradation occurring in the past 15 years. The Waverly segment has been stable or aggrading based on river bed elevation and water surface profiles. The Jefferson City segment has experienced moderate degradation over the past 40 years and exhibits the only instance of increase in low-flow water surface elevation among the Project area segments. The St. Charles segment also has experienced river bed degradation near the urban area.

Those areas where river bed degradation is most pronounced were found to be the same areas where commercial dredging has been most active.

### ES.6.2 Infrastructure

Infrastructure in the Project area includes 31 water intake facilities, most of which are located in currently dredged segments that are experiencing river bed degradation; several large-capacity collector water supply wells; 147.5 miles of federal levees; and 97 non-federal levee systems. The Bank Stabilization and Navigation Project (BSNP) in the Project area includes more than 2,700 dike structures and approximately 540 miles of bank revetments. Additional infrastructure in the Project area includes 38 bridge crossings, 31 pipeline crossings, nine cable crossings, one water tunnel crossing, and 155 wharf and dock facilities.

### ES.6.3 Navigation and Transportation

Existing navigation and surface transportation resources in the Project area include freight and raw materials transport via barges, tugs, and towboats in the main channel and an extensive network of roadways, including state and interstate highways, and secondary and municipal roads. Freight traffic commodities transported on the Missouri River by private companies include agricultural products;

chemicals and fertilizers; petroleum products; building materials; and river-related materials such as rock, sand, and gravel dredged from the river.

#### ES.6.4 Water Resources

The EIS describes the baseline conditions for surface water quality (nutrients, temperature, dissolved oxygen, total suspended solids and turbidity, sediment quality and toxicity, and metals) and groundwater resources.

#### ES.6.5 Aquatic Resources

The aquatic resources of the LOMR have been altered as a result of development of the river for hydropower, flood control, navigation, and bank stabilization. To mitigate these effects, shallow-water aquatic habitats continue to be constructed along the LOMR under the authority of the USACE Missouri River Recovery Program (MRRP), in cooperation with local, state, and federal agencies. Present in the Project area are fish, other aquatic biota, special-status species, and habitats (main channel, sand bar complexes, and shallow-water habitat).

#### ES.6.6 Wetland, Floodplains, and Terrestrial Ecology

Past commercial dredging in the LOMR has contributed to river bed degradation, which affects the river stage level. River stage levels in turn affect the frequency, depth, and duration of surface water interaction with adjacent wetlands in the floodplain and the level of the alluvial aquifer that supports groundwater wetlands. Commercial dredging could indirectly affect wetland habitats adjacent to the river and its floodplain, as well as terrestrial species.

#### ES.6.7 Federally Listed Species

Federally listed threatened or endangered species that are known to occur or have the potential to occur in the general Project area and that may be affected by the Proposed Action and the alternatives include 10 federally listed species: one mammal, two birds, two fish, two invertebrates, and three plant species. No designated critical habitat for any of these species occurs in the Project area. The five species that were judged to be potentially affected by the Project are Indiana bat (*Myotis sodalis*), least tern (interior population) (*Sterna antillarum*), piping plover (*Charadrius melodus*), pallid sturgeon (*Scaphirhynchus albus*), and decurrent false aster (*Boltonia decurrens*).

### ES.6.8 Land Use and Recreation

Agriculture is the predominant use along the river. Urban centers exist along the river at St. Charles, Jefferson City, Kansas City (Missouri and Kansas), and St. Joseph. Small towns are scattered along the river banks. Open space along the river includes areas dedicated for conservation and wildlife, some of which are also used for recreation. The LOMR is widely utilized for recreation.

### ES.6.9 Economics and Demographics

The population in the primary market area<sup>1</sup> along the LOMR represents a substantial component of the population base in Missouri. Unemployment in the primary market area averaged 6.6 percent between October 2008 and November 2009, lower than the statewide average. In 2007, the largest concentration of employment was in the St. Charles market area followed by the Kansas City market area. The largest economic sectors in the primary market area are Other Services, Wholesale and Retail Trade, and Government (federal and state/local); the Natural Resources and Mining sector accounts for less than 1 percent) of total employment in the primary market area and the state. The Construction sector that relies on sand and gravel as a production input represents approximately 6.4 percent of the employment base in the state.

### ES.6.10 Noise

Sources of noise in the Project area include operation of tug boats, engines, and processing equipment associated with dredging, and operation of onshore terminal facilities (use of front-end loaders, cranes, conveyors, and other processing equipment, and delivery trucks). Proposed changes in commercial dredging activity on the LOMR could change the level of noise generated by this activity and related onshore activities. Changes in dredging locations could expose noise-sensitive uses to dredging-related noise.

### ES.6.11 Visual and Aesthetic Resources

The LOMR and its riparian corridor are the predominant visual features in the Project area landscape and viewshed. The majority of development along the river is comprised of rural areas and small towns and cities with roots as agricultural communities. The cities of St. Joseph, Kansas City, North Kansas City, Jefferson City, and the outlying suburbs of St. Louis are larger metropolitan centers in the Project area and along the river; these urban areas add to the view characteristics in the Project area.

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<sup>1</sup> For this EIS, the "primary market area" is defined as the area encompassing an approximately 25-mile-wide radius from the processing facilities (sand plants) associated with existing and proposed dredging operations. The primary market area represents the total of the five individual market areas serving each segment.

### ES.6.12 Cultural Resources

Cultural resources typically found in or near the LOMR include Native American habitation and burial sites, historic trails, settlements, farmsteads, shipwrecks, and bridges. Major themes that have shaped the cultural development of the Missouri River basin include exploration, settlement, and transportation. Known cultural resources in the Project area include shipwrecks, campsites, bridges, and archaeological sites.

### ES.6.13 Air Quality and Climate Change

The St. Charles segment is the only river segment located in an area that is designated as nonattainment with regard to the National Ambient Air Quality Standards.

## ES.7 ENVIRONMENTAL CONSEQUENCES

### ES.7.1 Overview

Most of the direct and indirect environmental effects associated with the Proposed Action and action alternatives are closely related to (1) the volume, location, and direct localized effects of dredging activity; and (2) indirect effects related to changes in river bed and water surface elevations. Impacts for most environmental resources (excluding economics and air quality) are indirect impacts generated by dredging and its effects on water surface elevations, river bed elevations, and sediment dynamics.

The economic analysis, in part, addresses impacts related to increased production from alternate sources of sand and gravel. Under the No Action Alternative, Alternative A, and Alternative B; output, labor income, and employment would shift from the primary market area of the dredging industry along the LOMR to production of sand and gravel at alternate sources. The air quality analysis found that the Project could affect compliance with federal air quality regulations because of the existing ozone degradation in the St. Charles segment.

### ES.7.2 Comparison of Impacts of the Proposed Action and Alternatives

The Proposed Action could result in the greatest effects to environmental resources. Under existing conditions, river bed degradation was found to exist in the Kansas City, Jefferson City, and St. Charles segments. Effects of the Proposed Action would include increased river bed degradation in the LOMR where river bed degradation already has occurred. This includes portions of the LOMR at Kansas City, Jefferson City, and St. Charles where substantial additional river bed degradation is projected to occur. Increased dredging over current levels would cause moderate to substantial river bed degradation in

the St. Joseph segment while only slight river bed degradation is expected to occur in the Waverly segment. The environmental impacts on most affected resources are indirect effects of river bed degradation and changing water surface elevations; consequently, the environmental impacts on these resources under the Proposed Action are similar to the changes found for river bed degradation and changes in water surface elevations. The Proposed Action was projected to cause little change to regional or state output, income, or employment.

The No Action Alternative would result in no adverse effect to environmental resources directly from dredging and would lessen related river bed degradation and changes in water surface elevations. However, the No Action Alternative would lead to increased production of sand and gravel at existing alternate sources in the short term and could result in development of new floodplain open-pit mines or additional instream mining sites in the long term to offset the reduction in sand and gravel supplies from dredging in the LOMR. Additional production at existing alternate sources and development of new supply sources could result in increased air and noise emissions, disturbance of habitat, and dedication of land for industrial use. These impacts likely would occur in the vicinity of existing or new alternate sources.

Although the No Action Alternative is projected to result in the greatest negative economic effects (changes in output, labor income, and employment) in the primary market area of the LOMR, it would result in the greatest net economic gain statewide because of geographic and industry shifts in employment.

Adverse environmental consequences under Alternative A and Alternative B are expected to be substantially less than those under the Proposed Action. Alternative A would result in the least impact to environmental resources affected by dredging. Alternative B is expected to result in less impact than the Proposed Action but greater impact than Alternative A. Similar to the No Action Alternative, Alternative A and Alternative B would rely to some extent on increased production from alternate sources to offset the reduction in sand and gravel produced from the LOMR. Increased production from existing alternate sources in the short term and development of new alternate sources in the long term are expected to result in increased environmental consequences to alternate sources under Alternative A and Alternative B, but less than under the No Action Alternative.

Loss of output, income, and employment in the primary market area of the LOMR is likely to occur under Alternative A. However, geographic and industry shifts in employment would balance job losses

and would result in net statewide increases in output, income, and employment. Under Alternative B, a net loss in statewide output, income, and employment is projected to occur.

Alternative C would continue to generate impacts to environmental resources at current or cumulatively increasing levels. In particular, river bed degradation, which has previously occurred in the areas with the most concentrated dredging, would be expected to continue where dredging is most concentrated. The continuing trend of river bed degradation would further lower river bed elevation and further affect water surface elevations. Alternative C is not expected to increase reliance on alternate sources of sand and gravel; therefore, minimal change in the existing level of utilization of these resources is expected to occur under Alternative C. Alternative C would likely have a neutral effect on regional and statewide output, income, and employment.

## ES.8 CUMULATIVE IMPACTS

“Cumulative impacts” are effects on the environment that result from the incremental impact of a proposed action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes the actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR Section 1508.7). The geographic scope for the cumulative impact analysis includes the Project area plus certain geographic areas beyond the Project area, depending on the resource. The selections of geographic boundaries were based on the natural boundaries of resources of concern. Projects and programs reasonably likely to occur within a 20-year time frame were evaluated.

### ES.8.1 Past, Present, and Reasonably Foreseeable Future Actions

The Missouri River transformed during the 20<sup>th</sup> century to a channelized, hydrologically and physically altered river with highly regulated flow (NRC 2002). These changes have resulted in significant ecological effects on the river and its biota. Programs that led to development of dams, water diversion structures, and flood control and navigation structures have substantially altered the natural processes that structured the evolution of Missouri River species. Initial restoration efforts that began in 1984 focused on mitigating effects of the BSNP by restoring aquatic and terrestrial habitats. In 2004, restoration activities began to emphasize creation of shallow-water aquatic habitat.

Ongoing restoration actions in the LOMR focus on the assessment of management actions; development of planning alternatives; and implementation of mitigation, restoration, and recovery efforts. Present and future actions or programs included in the cumulative effects analysis include

Regional Sediment Management, flow management under the Master Water Control Manual for the Missouri River basin, infrastructure development and management under the BSNP, the MRRP and related components, the Big Muddy National Fish and Wildlife Refuge expansion, the Missouri River Authorized Purposes Study (MRAPS), and the Missouri River Bed Degradation Feasibility Study.

## ES.8.2 Cumulative Impact Assessment

The primary cumulative impacts of the Proposed Action and the alternatives are summarized below.

### ES.8.2.1 Impacts on Geomorphology

The ongoing and reasonably foreseeable projects evaluated for potential cumulative effects on river bed degradation are those with the potential to change the sediment supply or sediment transport and that are likely to interact with commercial dredging of sand and gravel. The most significant project in terms of potential for changes in sediment availability is the Shallow Water Habitat Program mandated by a 2000 biological opinion that was amended in 2003 (*USFWS 2003 Amendment to the 2000 Biological Opinion on the Operation of the Missouri River Mainstem Reservoir System Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project and Operation of the Kansas River Reservoir System* [2003 Biological Opinion]) and subsequently has been embodied in the MRRP. In the long term, although the impact of MRRP restoration activities would offset impacts associated with commercial dredging, river bed degradation is still likely to occur in areas of concentrated dredging and likely would reduce the potential for shallow-water habitat creation in those areas.

### ES.8.2.2 Impacts on Water Resources

Water resources in general were not considered to be cumulatively affected because dredging does not affect water quantity or water use in ways beyond those discussed in the Environmental Consequences analysis. However, given the attention that has been directed in recent years to the nutrient contributions of the Missouri and Mississippi Rivers to the anoxic zone conditions in the Gulf of Mexico, the analysis considers the contribution of dredging as a potential cumulative impact on water quality, specifically nutrients.

### ES.8.2.3 Impacts on Aquatic Resources and Federally Listed Species

The LOMR includes shallow-water habitat that provides for primary and secondary productivity, production of forage fish, and early life stage development for native Missouri river aquatic species,

including federally listed threatened and endangered species. Considerable management efforts and funds have been directed toward restoration of shallow-water habitat, which is the goal of the 2003 Biological Opinion. River bed degradation impacts would affect the shallow-water habitat currently in the LOMR and would have the potential to reduce the effectiveness of efforts to create shallow-water habitat in the future. The incremental contribution of commercial dredging to cumulative impacts likely would be greatest in urban areas; in these areas, existing river bed degradation is the greatest and is projected to continue. Continued river bed degradation could result in a decrease in the quantity of natural and created shallow-water habitat, and could affect the success of restoration efforts to create shallow-water habitat.

#### ES.8.2.4 Regional Economic Effects

The socioeconomic analysis was based on a quantitative analysis of both local and regional effects. Reductions in dredging in the LOMR under some alternatives would result in increased production from existing alternate sources of supply in the short term, in order to satisfy the existing demand for commercial sand and gravel. A higher delivered cost of sand and gravel to consumers based on higher transportation costs also is likely to occur in the short term. The loss of jobs, income, and economic output in the dredging industry would be offset in some cases by increased employment in the trucking industry, as additional supplies would be hauled longer distances from the alternate sources of supply. In response to reduced supplies from the LOMR, new sand and gravel operations likely would be developed in the Missouri River floodplain in the long term. The long-term cumulative impacts associated with new floodplain operations most likely would be a decline in the cost of sand and gravel in the region relative to the use of existing sources because new floodplain sources likely would be located in proximity to the areas with the greatest demand. A reduction in the delivered cost of sand and gravel would benefit the construction industry with lower-cost inputs to production.

Other major factors that could influence the cumulative impacts of sand and gravel production by changing demand include population growth and road building. According to the 2010–2014 Missouri Statewide Transportation Improvement Program (MoDOT 2010), highway and bridge expenditures are expected to decline. A continuing decline in transportation funding could reduce demand for construction sand and gravel from the LOMR, and could place downward pressure on sand and gravel prices. If commercial dredging slowed in response, river bed degradation and its associated economic impacts would be lessened. Conversely, if economic conditions became much more favorable, the opposite could occur.

### ES.8.2.5 Effects on Cultural Resources and Infrastructure

Cultural resources and infrastructure located in the Project area may be adversely affected by the indirect effects of river bed degradation, headcutting, erosion, and scouring of the bed of the LOMR and its tributaries near bridge abutments. Effects to cultural resources and infrastructure, therefore, are intimately linked to changes in the geomorphology of the LOMR and management of water flows. Maintenance of the BSNP may both prevent and contribute to effects to cultural resources and infrastructure over time. Maintaining the BSNP structures contributes cumulatively to the same indirect effects as the Proposed Action; however, by keeping the BSNP operational, the system prevents flooding and more widespread erosion from occurring within the Missouri River Valley, thus reducing broader effects to cultural resources and infrastructure.

### ES.8.2.6 Greenhouse Gas Emissions and Climate Change

No scientific or regulatory consensus exists regarding a threshold above which emissions would be considered adverse in the context of NEPA. Estimated greenhouse gas (GHG) emissions generated by the Project are very small in comparison to current and projected global GHG emissions. However, because GHG are a topic of increasing concern, any Project-related net increase in GHG emissions compared to baseline emissions was considered an adverse effect in the analysis of air quality and climate change. General climate changes predicted for the Project area include warmer temperatures, smaller snowpack, earlier snowmelt, reduced river flows and water quantities, increased drought, increased spring flooding, increased winter precipitation (rain), and changes in evapotranspiration and soil moisture. The long-term implications of these climate change impacts for commercial dredging of sand and gravel include (1) reduced river flows and water quantities, which could lead to restricted dredging in certain areas and changes in the amount and location of sediment deposited along the river bottom; (2) more frequent flooding in low-lying cities near rivers and streams, resulting in an increased need for bags of sand and gravel; and (3) safety hazards and delays in the regional transportation systems, thereby affecting distribution of sand and gravel.

### ES.8.2.7 Environmental Resources Not Cumulatively Affected

The remainder of the resources addressed in the Draft EIS (navigation and transportation; wetlands, floodplains, and terrestrial ecology; land use and recreation; noise; and visual and aesthetic resources) were judged not to be cumulatively affected. One of the following is true for each resource: (1) the resource did not meet the general criteria outlined above; (2) commercial dredging of sand and gravel and operations were judged not to significantly affect the resource; (3) the potential range of cumulative

impacts were adequately addressed in the geomorphology impact analysis; or (4) no other reasonably foreseeable future projects or programs would interact with dredging to create synergistic impacts on the resource.

## ES.9 POTENTIAL MITIGATION MEASURES

The EIS describes existing and potential measures to avoid, minimize, or mitigate adverse effects of the Proposed Action and the alternatives. Mitigation measures resulting from the previous permit decisions (2007 and 2009) and consultation with the U.S. Fish and Wildlife Service include volume restrictions, exclusion zones, discharge and disposal requirements, navigation requirements, and monitoring and reporting requirements. These measures were incorporated into the descriptions of the Proposed Action and Alternatives A, B, and C, and into the respective impact analyses.

The USACE determination under the Clean Water Act Section 404(b)(1) Guidelines will be based on and coordinated with this EIS. Under these guidelines, the USACE has a formal process, requirements, and restrictions that must be met, including identification of the least environmentally damaging practicable alternative. Until that determination is made, the needed mitigation measures will not be fully known. The mitigation measures presented below are potential measures, to be considered pending the Section 404(b)(1) analysis, Final EIS, and Record of Decision.

Additional dredging restrictions and operational conditions are proposed to avoid, minimize, or mitigate identified impacts. These include restrictions on dredging volumes, restrictions on concentrated dredging, excluding the use of cutter-head dredges, limits on dredging times, and a revised version of the Dredgers' proposed mine-and-relax strategy. These measures were not incorporated into the descriptions of the Proposed Action or Alternative A, B, or C; nor were they included in the respective impact analyses.

Management actions could include implementation of a detailed monitoring and adaptive management plan for geomorphic parameters. The plan elements could include (1) details related to temporal scale, spatial scale, and implementation; (2) adjusting dredging limits based on flows; (3) developing and implementing a sediment monitoring plan; and (4) monitoring changes in channel cross sections and water surface elevations. Other potential mitigation measures include repairing or stabilizing vulnerable infrastructure, developing a Programmatic Agreement for protection of cultural resources that includes a Historic Properties Management Plan, dredging to create shallow-water habitat, removing or repositioning submerged objects, monitoring fish entrainment and mortality in dredges, and

implementing emissions control technology on equipment and vehicles to reduce nitrogen oxide (NO<sub>x</sub>) and GHG emissions.

## ES.10 REFERENCES

MoDOT (Missouri Department of Transportation). 2010. Statewide Transportation Improvement Program, 2010–2014. Website ([http://contribute.modot.mo.gov/plansandprojects/construction\\_program/STIP2010-2014/index.htm](http://contribute.modot.mo.gov/plansandprojects/construction_program/STIP2010-2014/index.htm)) accessed on June 21, 2010.

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# Contents

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<b>List of Tables</b>	<b>iv</b>
<b>List of Figures</b>	<b>xii</b>
<b>List of Acronyms</b>	<b>xvii</b>
<b>Executive Summary</b>	<b>ES-1</b>
ES.1 Introduction	ES-1
ES.2 Background	ES-1
ES.3 Purpose and Need	ES-3
ES.4 Issues Considered	ES-3
ES.5 Alternatives Considered	ES-4
ES.6 Affected Environment	ES-5
ES.7 Environmental Consequences	ES-9
ES.8 Cumulative Impacts	ES-11
ES.9 Potential Mitigation Measures	ES-15
ES.10 References	ES-16
<b>CHAPTER 1 Introduction</b>	<b>1-1</b>
1.1 Introduction	1-1
1.2 Purpose and Need	1-2
1.3 Scope of the EIS	1-4
1.4 Decisions to be Made	1-7
1.5 History of Commercial Dredging, Permits, and Decisions	1-9
1.6 NEPA Scoping Process	1-16
1.7 EIS Overview	1-21
1.8 References	1-22
<b>CHAPTER 2 Proposed Action and Alternatives</b>	<b>2-1</b>
2.1 Introduction	2-1
2.2 Proposed Action	2-2
2.3 No Action Alternative	2-26
2.4 Development of Alternative Actions	2-46
2.5 Alternatives Considered but Not Included in Detailed Analysis	2-54

2.6	Summary of Environmental Consequences – Proposed Action and Alternatives.....	2-56
2.7	References.....	2-83
<b>CHAPTER 3</b>	<b>Segmentation of the Lower Missouri River.....</b>	<b>3-1</b>
3.1	Introduction.....	3.1-1
3.2	Overview of Project Area.....	3.2-1
3.3	Segmentation of the Lower Missouri River.....	3.3-1
3.4	Geology and Geomorphology .....	3.4-1
3.5	Infrastructure .....	3.5-1
3.6	Navigation and Transportation .....	3.6-1
3.7	Water Resources.....	3.7-1
3.8	Aquatic Resources .....	3.8-1
3.9	Wetlands, Floodplains, and Terrestrial Resources.....	3.9-1
3.10	Federally Listed Species .....	3.10-1
3.11	Land Use and Recreation.....	3.11-1
3.12	Economics and Demographics.....	3.12-1
3.13	Noise .....	3.13-1
3.14	Visual and Aesthetic Resources.....	3.14-1
3.15	Cultural Resources.....	3.15-1
3.16	Air Quality and Climate Change.....	3.16-1
<b>CHAPTER 4</b>	<b>Environmental Consequences.....</b>	<b>4-1</b>
4.1	Introduction.....	4-1
4.2	Geology and Geomorphology .....	4.2-1
4.3	Infrastructure .....	4.3-1
4.4	Navigation and Transportation .....	4.4-1
4.5	Water Resources.....	4.5-1
4.6	Aquatic Resources .....	4.6-1
4.7	Wetlands, Floodplains, and Terrestrial Resources.....	4.7-1
4.8	Federally Listed Species .....	4.8-1
4.9	Land Use and Recreation.....	4.9-1
4.10	Economics and Demographics.....	4.10-1
4.11	Noise .....	4.11-1
4.12	Visual and Aesthetic Resources.....	4.12-1
4.13	Cultural Resources.....	4.13-1
4.14	Air Quality and Climate Change.....	4.14-1

<b>CHAPTER 5</b>	<b>Cumulative Impacts .....</b>	<b>5-1</b>
5.1	Introduction.....	5-1
5.2	Past, Present, and Reasonably Foreseeable Future Actions.....	5-2
5.3	Cumulative Impact Assessment.....	5-13
5.4	References .....	5-36
<b>CHAPTER 6</b>	<b>Potential Mitigation Measures.....</b>	<b>6-1</b>
6.1	Existing Mitigation Measures Integrated into the Proposed Action and Alternatives.....	6-2
6.2	Potential Dredging Restrictions and Operational Conditions .....	6-4
6.3	Monitoring and Adaptive Management.....	6-6
6.4	Other Mitigation Measures .....	6-8
6.5	References .....	6-12
<b>CHAPTER 7</b>	<b>Environmental Statutes, Executive Orders, and Governing Agencies .....</b>	<b>7-1</b>
7.1	Federal .....	7-1
7.2	State .....	7-14
7.3	Local.....	7-18
7.4	References .....	7-19
<b>CHAPTER 8</b>	<b>List of Preparers.....</b>	<b>8-1</b>
8.1	Consulting Team .....	8-1
8.2	U.S. Army Corps of Engineers .....	8-6
<b>CHAPTER 9</b>	<b>List of Reviewing Agencies, Organizations, and Indian Tribes .....</b>	<b>9-1</b>
9.1	Agencies and Organizations .....	9-1
9.2	Indian Tribes.....	9-5

## List of Appendices

<b>Appendix A</b>	<b>Geomorphic Analyses Technical Details</b>
<b>Appendix B</b>	<b>Related Action – Development of New Sand Plants</b>
<b>Appendix C</b>	<b>Noise Ordinances</b>
<b>Appendix D</b>	<b>Air Quality and Climate Change Technical Information</b>
<b>Appendix E</b>	<b>Distribution List for the Draft EIS</b>

List of Tables

	<u>Page</u>
1.6-1	Public Scoping Meetings ..... 1-18
1.6-2	Summary of Written Comments Received during the Scoping Period ..... 1-19
2.2-1	Summary of Permit Applications for Commercial Dredging in the Lower Missouri River ..... 2-3
2.2-2	River Reaches Requested for Permitting by the Applicants by River Segment ..... 2-4
2.2-3	Production Equipment Proposed by the Applicants ..... 2-20
2.2-4	Existing and Proposed Sand Plants in the Lower Missouri River ..... 2-21
2.2-5	Potential Annual Dredging Amounts by River Segment (tons/year) ..... 2-23
2.2-6	Pallid Sturgeon Habitat Areas Excluded from Dredging on the Lower Missouri River ..... 2-25
2.3-1	Estimated Production and Available Capacities of Alternate Sand and Gravel Sources (tons/year) ..... 2-42
2.3-2	Permits, Approvals, and Consultations Potentially Required for Development of Alternate Sources of Sand and Gravel ..... 2-44
2.4-1	Dredging Amounts for the Proposed Action and Alternatives by River Segment (tons/year) ..... 2-49
2.4-2	Annual Tonnage for the Proposed Action ..... 2-51
2.4-3	Annual Tonnage for Alternative A ..... 2-52
2.4-4	Annual Tonnage for Alternative B ..... 2-53
2.4-5	Annual Tonnage for Alternative C ..... 2-53
2.6-2	Comparison of Dredging under the Proposed Action to 2004–2008 Annual Average Dredging by River Segment (tons/year) ..... 2-59
2.6-1	Summary of Impacts of the Proposed Action and Alternatives ..... 2-60
3.3-1	Description of River Segments Used in the Analysis ..... 3.3-2
3.4-1	Average Valley Widths of the Lower Missouri River ..... 3.4-5
3.4-2	Bedrock Outcrops and Coarse Substrate Patches in the Lower Missouri River ..... 3.4-6
3.4-3	Revetments and Dikes in the Lower Missouri River ..... 3.4-22
3.4-4	Changes in Distances between Locations on the Lower Missouri River ..... 3.4-24
3.4-5	Significant Cutoffs between St. Joseph and Waverly ..... 3.4-25
3.4-6	Federal Levees on the Lower Missouri River ..... 3.4-26
3.4-7	Design Widths for the Missouri River Bank Stabilization and Navigation Project ..... 3.4-27
3.4-8	Flow Data on the Lower Missouri River ..... 3.4-29

List of Tables (continued)

3.4-9	Significant Tributaries to the Lower Missouri River .....	3.4-30
3.4-10	Minimum Daily, Maximum Daily, and Average Daily Discharge on the Lower Missouri River.....	3.4-39
3.4-11	Minimum Daily, Maximum Daily, and Average Daily Seasonal Discharges on the Lower Missouri River .....	3.4-40
3.4-12	Ten Largest Floods Recorded at Gage Locations on the Lower Missouri River (1898–1997) .....	3.4-43
3.4-13	Annual Suspended Sediment Loads at Four Locations on the Lower Missouri River (tons/year).....	3.4-45
3.4-14	Cumulative Frequency Particle Sizes of Bed Material at Four Gage Locations on the Lower Missouri River.....	3.4-47
3.4-15	Summary Results for Suspended Sediment Particle Size Analysis .....	3.4-54
3.4-16	Preliminary Estimates of Annual Total Suspended Sediment and Total Suspended Sand Loads (1994–2008).....	3.4-57
3.4-17	Estimated Average Annual Suspended Sediment Loads and Suspended Sand Loads for Tributaries to the Lower Missouri River with Comparisons to the Nearest Gage on the Mainstem .....	3.4-59
3.4-18	Total Bed Material Loads Estimated from Bed Material Load Equations (tons/year) .....	3.4-63
3.4-19	Comparison of Estimated Average Annual Bed Material Loads at Four Gaging Stations on the Lower Missouri River.....	3.4-64
3.4-20	Comparison of Dredging Amounts to Bed Material Loads for Four Segments on the Lower Missouri River (2000–2009) .....	3.4-94
3.5-1	Federal Levees on the Lower Missouri River .....	3.5-4
3.5-2	Construction Reference Plane Adjusted Elevations (2010) .....	3.5-6
3.5-3	Water Intake Facilities – St. Joseph Segment.....	3.5-9
3.5-4	Federal Levee Units – St. Joseph Segment.....	3.5-11
3.5-5	Bridge Crossings – St. Joseph Segment.....	3.5-12
3.5-6	Pipeline and Cable Crossings – St. Joseph Segment.....	3.5-13
3.5-7	Wharf and Dock Facilities – St. Joseph Segment .....	3.5-14
3.5-8	Water Intake Facilities – Kansas City Segment .....	3.5-16
3.5-9	Federal Levee Units – Kansas City Segment.....	3.5-18
3.5-10	Bridge Crossings – Kansas City Segment .....	3.5-20
3.5-11	Pipeline and Cable Crossings – Kansas City Segment.....	3.5-22
3.5-12	Wharf and Dock Facilities – Kansas City Segment .....	3.5-22
3.5-13	Water Intakes – Waverly Segment.....	3.5-24

List of Tables (continued)

3.5-14	Bridge Crossings – Waverly Segment.....	3.5-26
3.5-15	Pipeline Crossings – Waverly Segment .....	3.5-26
3.5-16	Wharf and Dock Facilities – Waverly Segment .....	3.5-27
3.5-17	Water Intake Facilities – Jefferson City Segment.....	3.5-28
3.5-18	Levee Units – Jefferson City Segment.....	3.5-29
3.5-19	Bridge Crossings – Jefferson City Segment.....	3.5-30
3.5-20	Pipeline and Cable Crossings – Jefferson City Segment.....	3.5-31
3.5-21	Wharf and Dock Facilities – Jefferson City Segment .....	3.5-31
3.5-22	Water Intake Facilities – St. Charles Segment.....	3.5-33
3.5-23	Bridge Crossings – St. Charles Segment.....	3.5-35
3.5-24	Pipeline and Cable Crossings – St. Charles Segment.....	3.5-35
3.5-25	Wharf and Dock Facilities – St. Charles Segment .....	3.5-36
3.6-1	Navigation Season Schedule on the Missouri River .....	3.6-6
3.6-2	Commodity Shipment Data (tons) .....	3.6-8
3.6-3	Average Annual Commerce-Related Navigation Traffic on the Lower Missouri River (2003–2007).....	3.6-10
3.6-4	Estimated Annual Haul Truck Trips under Existing Conditions by River Segment.....	3.6-12
3.6-5	Average Daily Traffic Volume Ranges for Major Transportation Corridors in the Project Area.....	3.6-13
3.7-1	State Designated Uses and Attainment Status in the Lower Missouri River by River Segment.....	3.7-3
3.7-2	Representative High and Low Temperatures in the Lower Missouri River by River Segment.....	3.7-7
3.7-3	Representative High and Low Dissolved Oxygen Levels in the Lower Missouri River by River Segment .....	3.7-8
3.7-4	Representative High and Low Turbidity in the Lower Missouri River by River Segment.....	3.7-10
3.8-1	Governing Agencies Maintaining Special-Status Species List .....	3.8-2
3.8-2	Common and Scientific Names of Species in the Benthic Fish Guild. ....	3.8-4
3.8-3	Special-Status Aquatic Species with the Potential to Occur in the Project Area.....	3.8-7
3.9-1	Wetland Types and Estimated Quantities in the Project Area.....	3.9-8
3.9-2	Big Muddy National Fish and Wildlife Refuge Units .....	3.9-15
3.9-3	Common Wildlife Species found in the Lower Missouri River Floodplain .....	3.9-18

List of Tables (continued)

3.10-1	Preliminary Effects Determination for Federally Listed Threatened and Endangered Species .....	3.10-4
3.10-2	Pallid Sturgeon Stocking Data (1994–2009) .....	3.10-12
3.12-1	Primary Market Area for Sand and Gravel Production in the Lower Missouri River .....	3.12-4
3.12-2	Population Estimates for the Study Area.....	3.12-7
3.12-3	Population Projections for the Study Area (2000–2030) .....	3.12-8
3.12-4	Race and Ethnicity of the Study Area Population (2000) .....	3.12-9
3.12-5	Economic Indicators of Social Well-Being in the Study Area .....	3.12-10
3.12-6	Total Employment and Employment by Industry in the Study Area (2007) .....	3.12-13
3.12-7	Earnings by Industry in the Study Area (2007).....	3.12-14
3.12-8	Construction Sand and Gravel Production and Value in Missouri (2005–2007) .....	3.12-16
3.12-9	Economic Benefits of the Construction Aggregate Industry .....	3.12-18
3.12-10	Annual Production of Construction Sand and Gravel from the Lower Missouri River (2004–2008).....	3.12-20
3.12-11	Annual Production Value of Construction Sand and Gravel from the Lower Missouri River (2004–2008) .....	3.12-21
3.12-12	Annual Royalty Payments to the State of Kansas for Sand Production from the Lower Missouri River.....	3.12-24
3.12-13	Statewide Economic Benefits of Sand and Gravel Production from the Lower Missouri River.....	3.12-26
3.12-14	Statewide Economic Benefits of Sand and Gravel Production from the Lower Missouri River by Economic Sector.....	3.12-27
3.13-1	Typical A-Weighted Sound Levels .....	3.13-2
3.13-2	Noise Standards for Residential Uses.....	3.13-5
3.13-3	Existing Ambient Noise Levels at Noise-Sensitive Land Uses in the Project Area (dB).....	3.13-7
3.13-4	Typical Ambient Noise Levels by General Location Type .....	3.13-12
3.13-5	Tug Boat Noise Levels .....	3.13-13
3.13-6	Dredger Operation Noise Levels .....	3.13-14
3.13-7	Summary of Facility Processing and Haul Truck Noise .....	3.13-17
3.14-1	NoLocations with Views of the Missouri River in the St. Joseph Segment .....	3.14-14
3.14-2	NoLocations with Views of the Missouri River in the Kansas City Segment .....	3.14-17
3.14-3	NoLocations with Views of the Missouri River in the Waverly Segment .....	3.14-22
3.14-4	NoLocations with Views of the Missouri River in the Jefferson City Segment .....	3.14-25

List of Tables (continued)

3.14-5	NoLocations with Views of the Missouri River in the St. Charles Segment.....	3.14-29
3.15-1	Cultural Resources in the St. Joseph Segment.....	3.15-8
3.15-2	Cultural Resources in the Kansas City Segment .....	3.15-9
3.15-3	Cultural Resources in the Waverly Segment.....	3.15-9
3.15-4	Cultural Resources in the Jefferson City Segment.....	3.15-10
3.15-5	Cultural Resources in the St. Charles Segment.....	3.15-12
3.16-1	National Ambient Air Quality Standards .....	3.16-2
3.16-2	Regional Emissions for the <i>de Minimis</i> Conformity Analysis of Ozone (tons/year) .....	3.16-5
3.16-3	State Rules and Regulations Restricting Emissions .....	3.16-6
3.16-4	Local Agency Rules and Regulations Restricting Emissions .....	3.16-8
3.16-5	Pollutants Commonly Emitted during Sand and Gravel Operations.....	3.16-9
3.16-6	Background Ambient Air Quality Data for 8-Hour Ozone .....	3.16-10
3.16-7	Background Ambient Air Quality Data for PM <sub>10</sub> .....	3.16-11
3.16-8	Background Ambient Air Quality Data for PM <sub>2.5</sub> .....	3.16-11
3.16-9	Background Ambient Air Quality Data for CO .....	3.16-12
3.16-10	Estimated Existing Emissions Inventory by River Segment (tons/year).....	3.16-15
4.2-1	Perennial Tributary Streams in Areas with the Most Dredging under Existing Conditions .....	4.2-6
4.2-2	Dredging under Existing Conditions and the Proposed Action.....	4.2-12
4.2-3	Dredging under Existing Conditions and the No Action Alternative .....	4.2-21
4.2-4	Dredging under Existing Conditions and Alternative A.....	4.2-26
4.2-5	Dredging under Existing Conditions and Alternative B.....	4.2-33
4.2-6	Dredging under Existing Conditions and Alternative C .....	4.2-40
4.2-7	Summary of Potential Impacts on Geology and Geomorphology .....	4.2-48
4.2-7	Summary of Potential Impacts on Geology and Geomorphology .....	4.2-54
4.3-1	Water Intake Facilities in the Kansas City Segment Potentially at Risk under the Proposed Action .....	4.3-7
4.3-2	Water Intake Facilities in the St. Charles Segment Potentially at Risk under the Proposed Action .....	4.3-9
4.3-3	Federal Levees in the St. Joseph Segment Potentially at Risk under the Proposed Action .....	4.3-13
4.3-4	Federal Levees in the Kansas City Segment Potentially at Risk under the Proposed Action .....	4.3-14

List of Tables (continued)

4.3-5	Bridge Crossings in the Kansas City Segment Potentially at Risk under the Proposed Action .....	4.3-25
4.3-6	Pipeline and Cable Crossings in the Kansas City Segment Potentially at Risk under the Proposed Action .....	4.3-25
4.3-7	Bridge Crossings in the St. Charles Segment Potentially at Risk under the Proposed Action .....	4.3-28
4.3-9	Pipeline and Cable Crossings in the St. Charles Segment Potentially at Risk under the Proposed Action .....	4.3-28
4.3-9	Summary of Potential Impacts on Infrastructure .....	4.3-44
4.4-1	Estimated Annual Dredging-Related Tug/Barge Trips on the Lower Missouri River .....	4.4-4
4.4-2	Estimated Annual Haul Truck Trips Under the Proposed Action and Alternatives.....	4.4-7
4.4-3	Summary of Potential Impacts on Navigation and Transportation .....	4.4-21
4.5-1	Summary of Reported Suspended Solid Levels in the Lower Missouri River and Typical Suspended Solids Plume Concentration and Extent .....	4.5-3
4.5-2	Summary of Potential Impacts on Water Resources.....	4.5-25
4.6-1	Reproductive Strategies of Selected Common Fish in the Lower Missouri River .....	4.6-12
4.6-2	Summary of Potential Impacts on Aquatic Resources .....	4.6-26
4.7-1	Estimated Acres of Groundwater-Supported Wetlands in the Lower Missouri River Floodplain .....	4.7-5
4.7-2	Land Cover Types on the Proposed Sand Plant Properties.....	4.7-7
4.7-3	Summary of Potential Impacts on Wetlands, Floodplains, and Terrestrial Resources .....	4.7-20
4.8-1	Summary of Potential Impacts on Federally Listed Species in and near the Action Area.....	4.8-13
4.9-1	Potentially Converted Wetlands under the Proposed Action (acres) .....	4.9-8
4.9-2	Potentially Converted Wetlands under Alternative B (acres) .....	4.9-26
4.9-3	Potentially Converted Wetlands under Alternative C (acres) .....	4.9-33
4.9-4	Summary of Potential Impacts on Land Use and Recreation.....	4.9-36
4.10-1	Production of Construction Sand and Gravel (tons/year).....	4.10-7
4.10-2	Short-Term Costs of Construction Sand and Gravel (\$/ton) .....	4.10-8
4.10-3	Short-Term Annual Royalty Payments to the State of Kansas.....	4.10-10
4.10-4	Short-Term Regional Economic Effects under the Proposed Action.....	4.10-19
4.10-5	Short-Term Regional Economic Effects under the No Action Alternative .....	4.10-34

List of Tables (continued)

4.10-6	Short-Term Regional Economic Effects under Alternative A.....	4.10-47
4.10-7	Short-Term Regional Economic Effects under Alternative B.....	4.10-60
4.10-8	Short-Term Regional Economic Effects under Alternative C .....	4.10-71
4.10-9	Short-Term Regional Economic Effects Proposed Action and Alternatives (\$ millions).....	4.10-81
4.10-10	Summary of Potential Short-Term Economic Impacts .....	4.10-83
4.11-1	Construction Noise Levels for Industrial Facility Construction .....	4.11-2
4.11-2	Summary of Noise Levels Produced by Tugs and Dredges for Each Dredger .....	4.11-6
4.11-3	Summary of Facility Processing and Haul Truck Noise – Proposed Action .....	4.11-10
4.11-4	Summary of Facility Processing and Haul Truck Noise – Alternative A .....	4.11-18
4.11-5	Summary of Facility Processing and Haul Truck Noise – Alternative B .....	4.11-24
4.11-6	Summary of Facility Processing and Haul Truck Noise – Alternative C.....	4.11-28
4.11-7	Summary of Potential Noise Impacts .....	4.11-31
4.12-1	Summary of Potential Impacts on Visual and Aesthetic Resources.....	4.12-22
4.13-1	Effects to Cultural Resources in the St. Joseph Segment under the Proposed Action .....	4.13-5
4.13-2	Effects to Cultural Resources in the Kansas City Segment under the Proposed Action .....	4.13-7
4.13-3	Effects to Cultural Resources in the Waverly Segment under the Proposed Action .....	4.13-9
4.13-4	Effects to Cultural Resources in the Jefferson City Segment under the Proposed Action.....	4.13-11
4.13-5	Effects to Cultural Resources in the St. Charles Segment under the Proposed Action .....	4.13-13
4.13-6	Effects to Cultural Resources in the St. Joseph Segment under Alternative A .....	4.13-18
4.13-7	Effects to Cultural Resources in the Kansas City Segment under Alternative A.....	4.13-21
4.13-8	Effects to Cultural Resources in the Waverly Segment under Alternative A.....	4.13-22
4.13-9	Effects to Cultural Resources in the Jefferson City Segment under Alternative A.....	4.13-24
4.13-10	Effects to Cultural Resources in the St. Charles Segment under Alternative A .....	4.13-26
4.13-11	Effects to Cultural Resources in the St. Joseph Segment under Alternative B .....	4.13-30
4.13-12	Effects to Cultural Resources in the Kansas City Segment under Alternative B.....	4.13-33
4.13-13	Effects to Cultural Resources in the Waverly Segment under Alternative B.....	4.13-35
4.13-14	Effects to Cultural Resources in the Jefferson City Segment under Alternative B.....	4.13-36

List of Tables (continued)

4.13-15	Effects to Cultural Resources in the St. Charles Segment under Alternative B .....	4.13-39
4.13-16	Effects to Cultural Resources in the St. Joseph Segment under Alternative C .....	4.13-43
4.13-17	Effects to Cultural Resources in the Kansas City Segment under Alternative C .....	4.13-46
4.13-18	Effects to Cultural Resources in the Waverly Segment under Alternative C .....	4.13-48
4.13-19	Effects to Cultural Resources in the Jefferson City Segment under Alternative C .....	4.13-49
4.13-20	Effects to Cultural Resources in the St. Charles Segment under Alternative C .....	4.13-52
4.13-21	Summary of Potential Effects on Cultural Resources .....	4.13-55
4.14-1	Summary of Criteria Pollutant and Greenhouse Gas Emissions from Construction of The Master’s Dredging Company Sand Plant at Waldron (tons/year) .....	4.14-6
4.14-2	Summary of Criteria Pollutant and Greenhouse Gas Emissions from Construction of the Edward N. Rau Contractor Company Proposed Sand Plant at Washington (tons/year) .....	4.14-7
4.14-3	Conformity Analysis for the Proposed Action (tons/year) .....	4.14-8
4.14-4	State Implementation Plan Emissions Categories .....	4.14-10
4.14-5	Summary of Diesel Particulate Matter Emissions from Dredging in the Lower Missouri River under the Proposed Action and Alternatives (tons/year) .....	4.14-12
4.14-6	Summary of Greenhouse Gas Emissions from Dredging in the Lower Missouri River under the Proposed Action and Alternatives (metric tons/year CO <sub>2</sub> e) .....	4.14-15
4.14-7	Conformity Analysis for Alternative A (tons/year) .....	4.14-21
4.14-8	Conformity Analysis for Alternative B (tons/year) .....	4.14-27
4.14-9	Conformity Analysis for Alternative C (tons/year) .....	4.14-33
4.14-10	Summary of Potential Impacts for Air Quality and Climate Change .....	4.14-38
5.3-1	Missouri River Recovery Program Activities Started or Completed in the Project Area .....	5-20
5.3-2	Annual Project-Level Greenhouse Gas Emissions in U.S. and Global Contexts .....	5-34

List of Figures

	<u>Page</u>
1.3-1	Project Overview ..... 1-5
1.5-1	Annual Commercial Dredging – Lower Missouri River ..... 1-12
1.5-2	Commercial Sand and Gravel Dredging by River Mile and Company (1998–2008) ..... 1-12
2.2-1	Dredging Sand Plant Locations – Sheet 1 – St. Joseph Segment ..... 2-5
2.2-1	Dredging Sand Plant Locations – Sheet 2 – Kansas City Segment ..... 2-7
2.2-1	Dredging Sand Plant Locations – Sheet 3 – Waverly Segment ..... 2-9
2.2-1	Dredging Sand Plant Locations – Sheet 4 – Jefferson City Segment ..... 2-11
2.2-1	Dredging Sand Plant Locations – Sheet 5 – St. Charles Segment ..... 2-13
2.2-2	Cutter-Head Dredge with Onboard Processing Equipment (view of the stern of the dredge with a loaded barge on the left and an empty barge on the right) ..... 2-16
2.2-3	Dredge Boom ..... 2-17
2.2-4	Cutter Head ..... 2-17
2.2-5	Suction-Head Dredge Showing Boom with Suction Head ..... 2-17
2.2-6	Suction-Head Dredge with Barges ..... 2-18
2.2-7	Screening and Sorting Dredged Materials ..... 2-18
2.2-8	Empty Transport Barge ..... 2-19
2.2-9	Unloading a Barge ..... 2-19
2.2-10	Rotary Stacker at a Sand Plant ..... 2-20
2.3-1	Existing Regional Open-Pit Sand and Gravel Mines and Sand Plants ..... 2-31
2.3-2	Hydraulically Excavated Sand and Gravel Open-Pit Mine (Simpson Construction Materials, Eureka, Missouri) ..... 2-34
2.3-3	Conventional Open-Pit Sand and Gravel Mine (Williams Materials Company, Popular Bluff, Missouri) ..... 2-35
2.3-4	Typical Instream Sand and Gravel Mining Operation ..... 2-37
3.2-1	Missouri River Drainage Basin ..... 3.2-3
3.4-1	Geologic Setting ..... 3.4-3
3.4-2	Geomorphic Features of the Lower Missouri River by Segment – Sheet 1 – St. Joseph Segment ..... 3.4-7
3.4-2	Geomorphic Features of the Lower Missouri River by Segment – Sheet 2 – Kansas City Segment ..... 3.4-9
3.4-2	Geomorphic Features of the Lower Missouri River by Segment – Sheet 3 – Waverly Segment ..... 3.4-11

List of Figures (continued)

3.4-2	Geomorphic Features of the Lower Missouri River by Segment – Sheet 4 – Jefferson City Segment .....	3.4-13
3.4-2	Geomorphic Features of the Lower Missouri River by Segment – Sheet 5 – St. Charles Segment .....	3.4-15
3.4-3	Map of the Missouri River at the Confluence with the Kansas River (RM 367.5) from the Time of the Lewis and Clark Expedition (1804–1806), with an Overlay of the Modern Missouri River .....	3.4-19
3.4-4	Number of Dikes Constructed below Rulo, Nebraska and Cumulative Percent of Total .....	3.4-21
3.4-5	Time Series of Photos from RM 517 Showing Construction and Filling of Dike Field.....	3.4-23
3.4-6	Typical Cross Section before and after the Missouri River Bank Stabilization and Navigation Project .....	3.4-27
3.4-7	Cumulative Drainage Area and Mean Annual Flows for the Lower Missouri River .....	3.4-31
3.4-8	Annual Precipitation and Long-Term Trends for Kansas City and St. Louis, Missouri (1948–2005).....	3.4-32
3.4-9	Mean Monthly Precipitation for Kansas City and St. Louis, Missouri (1948–2005).....	3.4-33
3.4-10	Mean Monthly Discharge for 1929–1955 and 1956–1978 on the Missouri River at Kansas City and Hermann, Missouri.....	3.4-34
3.4-11	Flow Duration Curves on the Missouri River Measured at Kansas City, Missouri .....	3.4-35
3.4-12	Monthly Flow Statistics Measured on the Missouri River at Kansas City, Missouri (1929–2008).....	3.4-36
3.4-13	Mean Daily Discharge and Annual Flow Peaks Measured on the Missouri River at Kansas City, Missouri (1929–2008) .....	3.4-37
3.4-14	Mean Annual Flow and Long-Term Trends Measured on the Missouri River at St. Joseph, Kansas City, and Hermann, Missouri (1929–2008).....	3.4-38
3.4-15	Sediment Transport Mechanisms and Sediment Sources .....	3.4-48
3.4-16	Cumulative Frequency Particle Sizes in Bed Material at Three Locations on the Lower Missouri River and Nebraska City .....	3.4-52
3.4-17	Particle Sizes of D10 and D50 for the Lower Missouri River (1994) .....	3.4-53
3.4-18	Representative Suspended Particle Size Gradations at Three Gage Locations on the Lower Missouri River and at Nebraska City .....	3.4-54
3.4-19	Total Suspended Sediment Load, Suspended Sand Load, and Annual Mean Flow at Hermann, Missouri (1994–2008) .....	3.4-58

List of Figures (continued)

3.4-20	Change in CRP Water Surface Elevations between 1990 and 2005 (RM 750 to Rulo – shown in green) and Change in CRP-Adjusted Low-Flow Water Surface Profiles between 1990 and 2005 (Rulo, NE to the mouth – shown in blue) .....	3.4-69
3.4-21	Change in Average River Bed Elevation between 1998 and 2007–2009 Using a 5-Mile Moving Average.....	3.4-70
3.4-22	Missouri River Stage and Average Bed Trends at Rulo, Nebraska (RM 498.1) .....	3.4-73
3.4-23	Missouri River Stage and Average River Bed Trends at St. Joseph, Missouri (RM 448.2) .....	3.4-74
3.4-24	Missouri River Stage and Average River Bed Trends at Kansas City, Missouri (RM 366.1) .....	3.4-75
3.4-25	Missouri River Stage and Average Bed Trends at Waverly, Missouri (RM 293.4) .....	3.4-78
3.4-26	Missouri River Stage and Average River Bed Trends at Boonville, Missouri (RM 197.1) .....	3.4-80
3.4-27	Missouri River Stage and Average River Bed Trends at Hermann, Missouri (RM 97.9) .....	3.4-81
3.4-28	River Bed Elevations Based on Hydraulic Depth before and after the 1993 Flood at the Kansas City Gage .....	3.4-87
3.4-29	Water Surface Slope between the Kansas City Gage and the Waverly Gage (1920–2005).....	3.4-90
3.4-30	Cumulative Dredging (1998–2007) and Changes in the CRP-Adjusted Low-Flow Water Profile between 1990 and 2005. ....	3.4-91
3.4-31	Cumulative Dredging (1998 to 2007) and Change in Average River Bed Elevation between 1998 and 2007–2009 Using a 5-Mile Moving Average. ....	3.4-92
3.4-32	Correlation between Dredging and Changes in Stage at 40,000 cfs for Gages on the Lower Missouri River (2000–2005) .....	3.4-93
3.6-1	Major Transportation Corridors in the Project Area – Sheet 1 – St. Joseph Segment.....	3.6-15
3.6-1	Major Transportation Corridors in the Project Area – Sheet 2 – Kansas City Segment.....	3.6-17
3.6-1	Major Transportation Corridors in the Project Area – Sheet 3 – Waverly Segment.....	3.6-19
3.6-1	Major Transportation Corridors in the Project Area – Sheet 4 – Jefferson City Segment.....	3.6-21
3.6-1	Major Transportation Corridors in the Project Area – Sheet 5 – St. Charles Segment.....	3.6-23
3.7-1	Cross Section of the Missouri River Alluvial Aquifer .....	3.7-17

List of Figures (continued)

3.7-2	Depth to Groundwater at a Monitoring Well in Atherton, Missouri and River Stage Data at Kansas City, Missouri (March 15 to August 28, 2008) .....	3.7-19
3.8-1	Schematic of Habitats Found in the Lower Missouri River (modified from Berry et al. 2004).....	3.8-9
3.9-1	Big Muddy National Fish and Wildlife Refuge Units .....	3.9-15
3.10-1	Pallid Sturgeon Stocking in the Missouri River (1994–2009) .....	3.10-12
3.11-1	Existing Land Use – Sheet 1 – St. Joseph Segment.....	3.11-3
3.11-1	Existing Land Use – Sheet 2 – Kansas City Segment .....	3.11-5
3.11-1	Existing Land Use – Sheet 3 – Waverly Segment.....	3.11-7
3.11-1	Existing Land Use – Sheet 4 – Jefferson City Segment.....	3.11-9
3.11-1	Existing Land Use – Sheet 5 – St. Charles Segment.....	3.11-11
3.11-2	Recreation and Access Features – Sheet 1 – St. Joseph Segment .....	3.11-13
3.11-2	Recreation and Access Features – Sheet 2 – Kansas City Segment .....	3.11-15
3.11-2	Recreation and Access Features – Sheet 3 – Waverly Segment .....	3.11-17
3.11-2	Recreation and Access Features – Sheet 4 – Jefferson City Segment .....	3.11-19
3.11-2	Recreation and Access Features – Sheet 5 – St. Charles Segment.....	3.11-21
3.12-1	Primary Market Area Served by Commercial Sand and Gravel Produced from the Lower Missouri River.....	3.12-5
3.14-1	Recreational Viewers Canoeing on the River.....	3.14-2
3.14-2	Onshore Dredging Facilities and Equipment.....	3.14-3
3.14-3	Residence on Riverbank with Views of Dredging Operations on the River.....	3.14-4
3.14-4	View of a River Access Point from River.....	3.14-18
3.14-5	Views of the Fairfax Bridge from West of RM 372 .....	3.14-19
3.14-6	Views of Holliday’s Riverside Dredging Operation at RM 372 .....	3.14-20
3.14-7	Views of Bridgeton, Interstate 70 Bridge, and Dredging on the River from Limited Leasing–Bridgeton Dredging Operation at RM 28.....	3.14-32
3.14-8	Views of Capital Sand Company, St. Louis–Washington Dredging Operation and River beyond at RM 65.5.....	3.14-33
3.14-9	Views of Limited Leasing Company–Bridgeton Dredging Operation and Large Sand Piles at RM 28.....	3.14-34
3.14-10	Views of the River, Hermann, and the Hermann Bridge from Hermann Sand & Gravel–Hermann Dredging Operations at RM 96.8.....	3.14-35
3.16-1	USEPA Air Quality Monitoring Stations.....	3.16-13
4.5-1.	Groundwater Level and River Stage at St. Joseph .....	4.5-10

List of Figures (continued)

4.8-1	Pallid Sturgeon sampled by the Population Assessment Project (2005–2009) .....	4.8-3
5.2-1	USACE Programs and Authorizations Embodied in the Missouri River Recovery Program .....	5-7
5.3-1	Locations of Emergent Sand Bar Habitat and Shallow-Water Habitat (2010) .....	5-17

## List of Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
µg/g	microgram(s) per gram
2003 Biological Opinion	<i>USFWS 2003 Amendment to the 2000 Biological Opinion on the Operation of the Missouri River Mainstem Reservoir System Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project and Operation of the Kansas River Reservoir System</i>
2009–2010 AOP	Missouri River Mainstem Reservoir System 2009–2010 Annual Operating Plan
AADT	average annual daily traffic
ACHP	Advisory Council on Historic Preservation
AD	<i>Anno domini</i>
ADCP	acoustic Doppler current profiler
ADT	average daily traffic
AIRFA	American Indian Religious Freedom Act of 1978
AOP	Annual Operating Plan
APE	area of potential effect
ASB bridge	Armor, Swift, Burlington bridge
BC	before Christ
BMP	best management practice
BNSF	Burlington Northern Santa Fe Railway
BSNP	Bank Stabilization and Navigation Project
CA	Conservation Area
CAA	Clean Air Act
Capital–Boonville	Capital Sand Company – Boonville Facility
Capital–Carrollton	Capital Sand Company – Carrollton Facility

## List of Acronyms (continued)

Capital–Glasgow	Capital Sand Company – Glasgow Facility
Capital–Jefferson	Capital Sand Company – Jefferson City Facility
Capital–Lexington	Capital Sand Company – Lexington Facility
Capital–Rocheport	Capital Sand Company – Rocheport Facility
Capital–Washington	Capital Sand Company – Washington Facility
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic foot (feet) per second
CO	carbon monoxide
CO <sub>2</sub> e	carbon dioxide equivalent
CRP	Construction Reference Plane
CSR	Code of State Regulations
CWA	Clean Water Act
CWCP	Missouri River Mainstem Reservoir Current Water Control Plan
CZMA	Coastal Zone Management Act of 1972, as amended
DA	Department of the Army
dB	decibel
DBH	diameter at breast height
DDT	dichlorodiphenyltrichloroethane
DFIRM	Digital Flood Insurance Rate Map
DO	dissolved oxygen
DPM	diesel particulate matter
EA	environmental assessment
EIS	environmental impact statement

List of Acronyms (continued)

ERDC	U.S. Army Corps of Engineers Engineer Research and Development Center
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FFPA	Farmland Protection Program Act
FHWA – KS	Federal Highway Administration – Kansas
FHWA – MO	Federal Highway Administration – Missouri
FICA	Federal Insurance Contributions Act
FIRM	Flood Insurance Rate Map
FOB	free-on-board, freight-on-board
FOCUS	Forging Our Comprehensive Urban Strategy
FONSI	Finding of No Significant Impact
FR	Federal Register
FRM	Flood Risk Management
FWCA	Fish and Wildlife Coordination Act of 1958
GAMS	General Algebraic Modeling System
GDP	gross domestic product
GHG	greenhouse gas
GIS	geographic information systems
gpm	gallon(s) per minute
gpd	gallon(s) per day
GPS	Global Positioning System
GRR	General Reevaluation Report
GSP	gross state product

## List of Acronyms (continued)

HBED	hydroacoustic bed elevation data
Hermann–Hermann	Hermann Sand & Gravel – Hermann Facility
Hermann–Jefferson City	Hermann Sand & Gravel – Jefferson City Facility
Historic Trail	The Lewis and Clark National Historic Trail
Holliday–Randolph	Holliday Sand & Gravel Company – Randolph Facility
Holliday–Riverside	Holliday Sand & Gravel Company – Riverside Facility
HPMP	Historic Properties Management Plan
HRA	health risk assessment
I-229	Interstate 229
IBA	important bird area
IDNR	Illinois Department of Natural Resources
IDOT	Illinois Department of Transportation
IEPA	Illinois Environmental Protection Agency
IMPLAN	IMpact Analysis for PLANning
Integrated Report	Integrated 303(d)/305(b) Report
I-O	input-output
IPL	Independence Power & Light
J.T.R.	Jotori, Inc.
J.T.R.–Riverview	J.T.R. – Riverview Facility
J.T.R.–St. Charles	J.T.R. – St. Charles Facility
KCP&L	Kansas City Power & Light
KCS	Kansas City Southern Railway Company
KDA	Kansas Department of Agriculture
KDHE	Kansas Department of Health and Environment
KDOR	Kansas Department of Revenue

List of Acronyms (continued)

KDOT	Kansas Department of Transportation
KDWP	Kansas Department of Wildlife and Parks
km	kilometer(s)
KSGS	Kansas Geological Survey
KSHPO	Kansas State Historic Preservation Office
KWO	Kansas Water Office
L-385	Riverside Levee
L <sub>dn</sub>	day-night level
L <sub>eq</sub>	equivalent sound level
Limited–Bridgeton	Limited Leasing Company – Bridgeton Facility
Limited–Chesterfield	Limited Leasing Company – Chesterfield Facility
Limited–Fort Belle	Limited Leasing Company – Fort Belle Facility
LOMR	lower Missouri River
LRP	Land Reclamation Program
LWCFA	Land and Water Conservation Fund Act
m	meter(s)
Master Manual Study	Missouri River Master Water Control Manual Review and Update Study
Master Manual	<i>Missouri River Reservoir Master Water Control Manual</i>
Master’s–Waldron	The Master’s Dredging Company proposed Waldron facility
MBCA	Migratory Bird Conservation Act
MBTA	Migratory Bird Treaty Act
MDC	Missouri Department of Conservation
MDNR	Missouri Department of Natural Resources
MERIC	Missouri Economic Research and Information Center
Metro Green	Kansas City Metropolitan Greenway System

List of Acronyms (continued)

mg/l	milligram(s) per liter
mm	millimeter(s)
MMPA	Marine Mammal Protection Act of 1972
MoDOT	Missouri Department of Transportation
mph	mile(s) per hour
MRAPS	Missouri River Authorized Purposes Study
MRIO	multi-region input-output
MRRIC	Missouri River Recovery Implementation Committee
MRRP	Missouri River Recovery Program
MW	megawatt(s)
NAAQS	National Ambient Air Quality Standards
NDEQ	Nebraska Department of Environmental Quality
NEPA	National Environmental Policy Act
NFEA	National Fishing Enhancement Act of 1984
NFIP	National Flood Insurance Program
ng/g	nanogram(s) per gram
NGO	non-governmental organization
NGPD	Nebraska Game and Parks Department
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NODR	Nebraska Department of Roads
NOI	notice of intent
NO <sub>x</sub>	oxides of nitrogen
NPS	National Park Service

List of Acronyms (continued)

NRCS	Natural Resources Conservation Services
NRHP	National Register of Historic Places
NSR	New Source Review
NWI	National Wetlands Inventory
O&M	operations and maintenance
OC	organochlorine pesticides
OEHHA	Office of Environmental Health Hazard Assessment
OHWM	ordinary high water mark
OTEC	ocean thermal energy conversion
PA	Programmatic Agreement
PAH	polycyclic aromatic hydrocarbon(s)
Pb	lead
PCB	polychlorinated biphenyl
PM	particulate matter
ppm	part(s) per million
PL	Public Law
PS	“Park and Scenic” (zoning district)
Rau–Washington	Edward N. Rau Contractor Company – Washington Facility
RCL	rectified channel lines
Reconnaissance Study Report	The Missouri River Bed Degradation Reconnaissance Study Report
RHA	Rivers and Harbors Act
RM	river mile
ROD	Record of Decision
RPMA	Recovery Priority Management Area

List of Acronyms (continued)

SCORP	Statewide Comprehensive Outdoor Recreation Plan
SEMEP	Series Expansion of the Modified Einstein Procedure
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO <sub>2</sub>	sulfur dioxide
STIP	Statewide Transportation Improvement Program
System	Missouri River Mainstem Reservoir System
TAC	toxic air contaminant
TMDL	total maximum daily load
TSS	total suspended solids
UPRR	Union Pacific Railroad
USBR	U.S. Bureau of Reclamation
USC	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U. S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WAP	Waterways Action Plan
WaterOne	Water District No. 1 of Johnson County, Kansas
WRP	Wetland Reserve Program
WSD	Missouri Water Services Department
WSRA	Wild and Scenic Rivers Act