

## 4.4 NAVIGATION AND TRANSPORTATION

### 4.4.1 Introduction

This section describes the environmental consequences of the Proposed Action and the alternatives on navigation and surface transportation. As described in Section 3.6, the changes in dredging operations that would occur with implementation of the Proposed Action or the alternatives have the potential to affect navigation and riverborne commerce, as well as traffic and transportation patterns.

This section includes a summary of the assessment methods used to evaluate impacts on navigation and surface transportation, followed by a description of the potential project impacts.

### 4.4.2 Assessment Methods

This section describes the methods and assumptions used to determine potential impacts on navigation and transportation associated with the Proposed Action and the alternatives.

#### 4.4.2.1 Navigation Traffic

Navigation traffic impacts were analyzed by comparing dredging-related tug/barge trips on the LOMR under existing conditions and under the Proposed Action or the alternatives. Annual tug/barge trips under existing conditions were quantified according to the method described in Appendix D, Air Quality and Climate Change Technical Information. Based on information provided by the Dredgers related to tugs and barges, this analysis assumed that these vessels operated 216 days per year. A “trip” is defined as a one-way vessel movement (e.g., a tug pushing a barge from the dredge to the onshore processing facility counts as two vessel trips).

Limited information is currently available on how implementation of the Proposed Action and alternatives would affect the operation and number of existing equipment (i.e., tugs and barges). For the purposes of this analysis, annual tug/barge trips for the Proposed Action and alternatives were assumed to be proportional to permitted sand and gravel volumes. To determine tug/barge trips for the Proposed Action and the alternatives, the estimated annual tug/barge trips under existing conditions were multiplied by the percent of change in sand and gravel volumes in each segment between the existing condition and the alternative. Calculated estimates of annual tug/barge trips under the Proposed Action and the alternatives were then compared to estimated annual tug/barge trips under existing conditions.

#### 4.4.2.2 Surface Road Traffic

Surface road traffic impacts were analyzed by comparing haul truck trips made from existing sand plants on the LOMR to established market areas under existing conditions, and haul truck trips that would be made under the Proposed Action or alternatives. Daily haul truck trips for each of the five river segments were estimated based on the annual volume of sand and gravel dredged from each segment. This estimate assumes an average truck capacity of 20 tons and 216 delivery days per year. A “trip” is defined as a one-way truck movement (e.g., a haul truck delivering sand from the processing plant to the point of delivery and back would be considered two truck trips).

As discussed in Section 3.6, this analysis assumes that sand plants would have direct (i.e., within 10 miles) access to major arterials, such as state, interstate, and U.S. highways, and that these arterials would be used to haul sand and gravel to market areas within an approximately 25-mile radius. It is not known with certainty what routes are currently used by the haul trucks or what routes would be used from the new sand plants proposed in the St. Joseph and St. Charles segments. Representative low and high ADT values (the mean daily traffic volume on a roadway over a 24-hour period) under existing conditions for the highways within a 10-mile radius of the sand plants are given by river segment in Table 3.6-5. These ADT ranges provide a basis of comparison for the changes in the number of truck trips under the Proposed Action and alternatives.

#### 4.4.3 Proposed Action

##### 4.4.3.1 Changes in Navigation Traffic

###### *St. Joseph Segment*

Under the Proposed Action, tug and barge traffic in the St. Joseph segment would increase from increased volume of dredged material from the river (Table 4.4-1). Annual tug and barge trips would increase by approximately 3,335 trips over existing conditions (a 252-percent change). This increase in river traffic could potentially limit the river area available for other navigation traffic, including commerce-related tugs and barges and recreational boats, and could result in congestion on the river. As described in Section 3.6, the majority of traffic on the LOMR is associated with commercial dredgers (i.e., tugs and barges), and is generally limited to areas on the river within a few miles (and no more than 7 to 10 miles) upstream of the onshore sand plants. Thus, any increase in dredging-related traffic and potential limitation of navigation areas would be confined to areas relatively close to these facilities. It is expected that the potential limitation would be negligible because the navigation channel is

approximately 300 feet wide. This width is assumed sufficient to allow large vessels, such as tugs, tows, or barges, and smaller recreational vessels to maneuver around the commercial dredging vessels.

### *Kansas City, Waverly, Jefferson City, and St. Charles Segments*

Under the Proposed Action, dredging-related tug and barge traffic would increase in the Kansas City, Waverly, Jefferson City, and St. Charles segments, as indicated in Table 4.4-1. Tug/barge trips in these four segments would not increase as substantially as in the St. Joseph segment. Relative to existing conditions, tug/barge trips in the Kansas City, Waverly, Jefferson City, and St. Charles segments would increase by 5,676 trips (a 53-percent change), 851 trips (a 48-percent change), 4,580 trips (a 74-percent change), and 25,557 trips (a 166-percent change), respectively. These increases in tug and barge traffic would not be considered adverse. As noted above, the 300-foot width of the river is assumed sufficient to allow large and small vessels ample room for navigation, even with substantial increases in tug and barge traffic.

### *Alternate Sources*

Under the Proposed Action, additional demand would not be placed on alternate sources of sand and gravel. Therefore, navigation traffic at alternate sources would not change.

#### 4.4.3.2 Changes in Navigation Hazards

### *St. Joseph Segment*

Continuing river bed degradation could result in hazards to navigation by exposing previously submerged structures (e.g., sunken vessels, old bridge piers, pipelines, and rock/clay outcroppings) on the river bed (USACE 2009a), and by creating conditions conducive to the formation of shoals (i.e., sandbars) in the navigation channel.

As described in Section 3.5, there are 52 pipeline crossings in the Project area. Of these, 41 pipeline crossings are located in river segments that are experiencing river bed degradation and are currently being dredged. Some of these pipelines were installed many decades ago. Recently (within the past 20 years), the USACE has required that pipelines be installed a minimum of 28 feet below the river bed. Given the ongoing river bed degradation in the LOMR, especially in substantially degraded segments where individual locations have degraded from two to seven feet in the last 20 years (USACE 2009b), there is the potential for pipelines that were installed several years ago to become exposed and present a navigation hazard.

**Table 4.4-1 Estimated Annual Dredging-Related Tug/Barge Trips on the Lower Missouri River<sup>a, b</sup>**

Segment	Existing Conditions <sup>c</sup>	Proposed Action <sup>c</sup>	No Action Alternative		Alternative A <sup>c</sup>		Alternative B <sup>c</sup>		Alternative C <sup>c</sup>		
	Trips	Trips	% Change Relative to Existing Conditions	Trips	% Change Relative to Existing Conditions	Trips	% Change Relative to Existing Conditions	Trips	% Change Relative to Existing Conditions	Trips	% Change Relative to Existing Conditions
St Joseph	1,324	4,659	252	0	-100	1,418	7	3,484	163	1,337	1
Kansas City	10,772	16,448	53	0	-100	2,188	-80	4,983	-54	10,776	0
Waverly	1,761	2,612	48	0	-100	1,299	-26	2,961	68	1,766	0
Jefferson City	6,174	10,754	74	0	-100	1,681	-73	3,832	-38	6,178	0
St. Charles	15,412	40,969	166	0	-100	3,457	-78	7,849	-49	15,418	0

<sup>a</sup> Assumes 216 delivery days per year.

<sup>b</sup> A "trip" is defined as a one-way vessel movement, and it was assumed that for every tug movement, there was a barge movement (e.g., a tug pushing a full barge from the dredge to the onshore processing facility counts as two vessel trips. Similarly, a tug pushing an empty barge from the onshore processing facility to the dredge would count as two vessel trips).

<sup>c</sup> For the purpose of this analysis, tug trips under the Proposed Action and alternatives were assumed to be proportional to permitted sand and gravel volumes for each segment, and were calculated accordingly. Tug and barge trips under existing conditions are based on information provided by permit applicants and represent the maximum number of tug and barge trips in a year.

There are numerous abandoned sunken barges and other vessels and large objects in the Missouri River (USACE 1991a, 1991b; Wheeler pers. comm. 2010). The locations of some, but not all, of these sunken vessels are known. River bed degradation may expose some of these vessels, which would result in a potential navigation hazard. In the past, rock/clay outcroppings have been exposed as a result of river bed degradation and became obstacles to navigation traffic during low water periods (Wheeler pers. comm. 2010). River bed degradation reduces the clearance over rocky outcrops and, over time, the shelves may become more exposed (Chapman pers. comm. 2010, USCG 2009).

As described in Section 4.2, under the Proposed Action, slight river bed degradation likely would occur over the short term in the St. Joseph segment, and moderate to substantial river bed degradation would take place over the long term. Thus, there is greater potential for exposure of previously submerged objects in the navigation channel in this segment. Exposure of these features could pose obstacles or hazards to navigation vessels, resulting in navigation accidents or vessel damage (USCG 2009).

#### *Kansas City, Jefferson City, and St. Charles Segments*

In the past 10 years, submerged objects have presented obstacles to navigation in the LOMR near Kansas City and in a few other locations. For example, in 2003, a submerged truck was removed at RM 378; and in 2004, bridge rubble was removed at RM 366. These objects are often found once a barge collides with them and are then subsequently removed or relocated (Chapman pers. comm. 2010). Similarly, rock/clay outcroppings in this segment have previously interfered with navigation traffic. Holliday Sand & Gravel Company has indicated that there is clay outcropping in the Kansas City segment, near the Charles B. Wheeler Downtown Airport (RM 368). This area becomes impassable during periods of low water (Wheeler pers. comm. 2010).

Under the Proposed Action, dredging in the Kansas City, Jefferson City, and St. Charles segments would increase. This increase would likely contribute to moderate additional degradation in the short term (up to 5 years) and substantial degradation in the long term (5 to 20 years). Thus, there is the potential for previously submerged objects and rock/clay outcroppings to become exposed in areas with the most dredging, which could result in navigation accidents or vessel damage.

#### *Waverly Segment*

Under the Proposed Action, slight river bed degradation or aggradation may occur in the Waverly segment in the short term. Continuing slight river bed degradation could result in hazards to navigation in the long term by exposing previously submerged structures. Submerged objects or rock/clay outcroppings are present in the Waverly segment. If river bed degradation was severe enough to

expose these objects or outcroppings, they could present a hazard to navigation. Aggradation of the river bed in the Waverly segment would improve navigation. Due to the potential for slight river bed degradation or aggradation in this segment, the Proposed Action is not likely to adversely impact navigation in the Waverly Segment.

### *Alternate Sources*

Under the Proposed Action, additional demand would not be placed on alternate sources of sand and gravel. Therefore, navigation hazards at alternate sources would not change.

#### 4.4.3.3 Changes in Truck Traffic

##### *St. Joseph Segment*

Under the Proposed Action, daily haul truck trips from the processing facilities to market areas would increase by 191 percent in the St. Joseph segment (Table 4.4-2). Representative low and high ADT values for the highways within a 10-mile radius of sand plants in the St. Joseph segment are provided in Table 3.6-5. Adding these truck trips to the ADT counts in Table 3.6-5 would result in a maximum increase in traffic in the St. Joseph segment along the state, interstate, and U.S. highways of approximately 65, 6, and 25 percent, respectively. However, these values assume that all trips are made on only one type of highway. In fact, it is likely that the haul trucks would use all three highway types and the increase in truck trips, therefore, would be divided among all highways with access from the sand plants to the various points of delivery within a 25-mile radius of the sand plants. The increase is substantial, especially on state highways. Furthermore, it is not known to what extent surface streets may be affected in the immediate vicinity of the sand plants or at points of delivery. As such, this increase in haul truck traffic is considered adverse because it could contribute to congestion and traffic delays.

##### *Kansas City Segment*

Under the Proposed Action, daily haul truck trips from the processing facilities to market areas would increase by 28 percent (Table 4.4-2). A new sand plant would be built and operated in the Kansas City segment (Master's-Waldron). Based on the volume of sand and gravel that The Master's Dredging Company has requested to dredge in this segment, approximately 26 percent of the daily truck trips anticipated under the Proposed Action in the Kansas City segment would originate from the Master's-Waldron sand plant.

**Table 4.4-2 Estimated Annual Haul Truck Trips Under the Proposed Action and Alternatives**

Segment	Facility Name (Company)	Proposed Action			No Action Alternative			Alternative A			Alternative B			Alternative C		
		Annual Tons	Estimated Tons Delivered Per Day <sup>a</sup>	Trips Per Day	Annual Tons	Estimated Tons Delivered Per Day <sup>a</sup>	Trips Per Day	Annual Tons	Estimated Tons Delivered Per Day <sup>a</sup>	Trips Per Day	Annual Tons	Estimated Tons Delivered Per Day <sup>a</sup>	Trips Per Day	Annual Tons	Estimated Tons Delivered Per Day <sup>a</sup>	Trips Per Day
St. Joseph	St. Joseph (Holliday)	950,330	4,400	440	0	0	0	350,000	1,620	162	860,000	3,981	398	330,000	1,528	153
	<b>Total</b>	<b>950,330</b>	<b>4,400</b>	<b>440</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>350,000</b>	<b>1,620</b>	<b>162</b>	<b>860,000</b>	<b>3,981</b>	<b>398</b>	<b>330,000</b>	<b>1,528</b>	<b>153</b>
Kansas City	Riverside (Holliday)	1,379,769	6,388	639	0	0	0	211,147	978	98	480,946	2,227	223	1,040,995	4,815	482
	Randolph <sup>b</sup> (Holliday)	1,429,901	6,620	662	0	0	0	354,253	1,640	164	807,306	3,737	373	1,108,753	5,133	513
	Waldron (Master's) <sup>c</sup>	1,000,000	4,630	463	0	0	0	153,031	708	71	348,570	1,614	161	753,818	3,492	349
	<b>Total</b>	<b>3,809,670</b>	<b>17,637</b>	<b>1,764</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>718,431</b>	<b>3,326</b>	<b>333</b>	<b>1,636,802</b>	<b>7,578</b>	<b>758</b>	<b>2,902,666</b>	<b>13,440</b>	<b>1,344</b>
Waverly	Lexington (Capital SL)	474,923	2,199	220	0	0	0	301,604	1,396	140	687,657	3,184	318	410,182	1,889	190
	Carrollton (Capital SL)	31,439	146	15	0	0	0	19,965	92	9	45,521	211	21	27,153	126	13
	<b>Total</b>	<b>506,362</b>	<b>2,344</b>	<b>235</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>321,569</b>	<b>1,489</b>	<b>149</b>	<b>733,178</b>	<b>3,394</b>	<b>339</b>	<b>437,335</b>	<b>2,025</b>	<b>203</b>
Jefferson City	Glasgow (Capital SL)	154,068	713	71	0	0	0	29,954	139	14	68,267	316	32	110,063	510	51
	Boonville (Capital SL)	12,819	59	6	0	0	0	2,492	12	1	5,680	26	3	9,157	42	4
	Rocheport (Capital SL)	308,321	1,427	143	0	0	0	59,944	278	28	136,616	632	63	220,258	1,020	102
	Jefferson City (Herman)	500,000	2,315	231	0	0	0	97,210	450	45	221,548	1,026	103	357,190	1,654	165
	Jefferson City (Capital SL)	1,236,501	5,725	572	0	0	0	240,400	1,113	111	547,889	2,537	254	883,331	4,089	409
	<b>Total</b>	<b>2,211,709</b>	<b>10,239</b>	<b>1,024</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>430,000</b>	<b>1,991</b>	<b>199</b>	<b>980,000</b>	<b>4,537</b>	<b>454</b>	<b>1,579,999</b>	<b>7,315</b>	<b>731</b>
St. Charles	Hermann (Hermann)	500,000	2,315	231	0	0	0	44,719	207	21	101,525	470	47	199,423	923	92
	Washington (Rau) <sup>c</sup>	100,000	463	46	0	0	0	8,944	41	4	20,305	94	9	39,885	185	18
	Washington (Capital SL)	786,930	3,643	364	0	0	0	70,382	326	33	159,785	740	74	313,864	1,453	145
	Bridgeton (Limited)	350,000	1,620	162	0	0	0	31,303	145	14	71,067	329	33	139,596	646	65
	St. Charles (J.T.R.)	1,348,775	6,244	624	0	0	0	120,632	558	56	273,868	1,268	127	537,954	2,491	249
	Chesterfield (Limited)	650,000	3,009	301	0	0	0	58,135	269	27	131,982	611	61	259,250	1,200	120
	Riverview (J.T.R.)	201,225	932	93	0	0	0	17,997	83	8	40,859	189	19	80,258	372	37
	Fort Belle (Limited)	100,000	463	46	0	0	0	8,944	41	4	20,305	94	9	39,868	185	18
	<b>Total<sup>d</sup></b>	<b>4,036,930</b>	<b>18,689</b>	<b>1,869</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>361,056</b>	<b>1,670</b>	<b>167</b>	<b>819,696</b>	<b>3,795</b>	<b>379</b>	<b>1,610,098</b>	<b>7,455</b>	<b>744</b>

<sup>a</sup> Assumes average truck capacity of 20 tons and 216 delivery days per year.

<sup>b</sup> For the purposes of determining truck trips per segment, values "annual tons delivered" for Randolph (Holliday) represent the combined total of dredging from the Kansas City and Waverly segments. A total of 308,867 tons/year are dredged by Holliday in the Waverly segment and distributed from the sand plant at Randolph.

<sup>c</sup> New proposed facility.

<sup>d</sup> Totals for the St. Charles segment do not include the Alton facility, which is located on the Mississippi River.

This page intentionally left blank.

### *Waverly and Jefferson City Segments*

Under the Proposed Action, daily haul truck trips from the processing facilities to market areas would increase by 37 percent in the Waverly segment, and by 40 percent in the Jefferson City segment (Table 4.4-2).

### *St. Charles Segment*

Under the Proposed Action, daily haul truck trips from the processing facilities to market areas would increase by 145 percent in the St. Charles segment (Table 4.4-2). A new sand plant would be built and operated (Rau-Washington). Based on the volume of sand and gravel the Edward N. Rau Contractor Company has requested to dredge in this segment, approximately 2.5 percent of the total dredging in the St. Charles segment would originate from the Rau-Washington sand plant.

Representative low and high ADT values for the highways within a 10-mile radius of sand plants in the St. Charles segment are provided in Table 3.6-5. Adding these truck trips to the ADT counts in Table 3.6-5 would result in a maximum increase in traffic in the St. Charles segment along the state, interstate, and U.S. highways of approximately 182, 4, and 7 percent, respectively. However, these values assume that all trips are made on only one type of highway. In fact, it is likely that the haul trucks would use all three highway types, and the increase in truck trips, therefore, would be divided among all highways with access from the sand plants to the various points of delivery within a 25-mile radius of the sand plants.

The increase is substantial, especially on state highways. Furthermore, it is not known to what extent surface streets may be affected in the immediate vicinity of the sand plants or at points of delivery. As such, this increase in haul truck traffic is considered adverse because it could contribute to congestion and traffic delays.

### *Alternate Sources*

Under the Proposed Action, additional demand would not be placed on alternate sources of sand and gravel. Therefore, truck traffic at alternate sources would not change.

#### 4.4.4 No Action Alternative

##### 4.4.4.1 Changes in Navigation Traffic

###### *All Segments*

Under the No Action Alternative, beneficial impacts to navigation would occur because commercial sand and gravel dredging would cease in the LOMR. Commercial dredging-related navigation traffic would be eliminated in all five river segments, and the potential for interference of dredge-related vessels with other vessels on the LOMR would be eliminated.

###### *Alternate Sources*

Any increase in dredging of alternate river sources (i.e., the Mississippi River) would result in an increase in tug/barge traffic on that river.<sup>1</sup> The potential for an adverse impact on navigation would depend on existing navigation traffic in the river and the navigable river area. No change in navigation traffic is associated with the other alternate sources.

##### 4.4.4.2 Changes in Navigation Hazards

###### *St. Joseph and Kansas City Segments*

Due to the expected aggradation of the river bed that would occur in these segments under the No Action Alternative, the potential for previously submerged objects to become exposed would decrease. This impact could be beneficial to navigation.

###### *Waverly Segment*

Slight aggradation or degradation is expected in the short term and the long term. Aggradation would decrease the potential for previously submerged objects to become exposed, which would be beneficial to navigation. Continuing river bed degradation could result in hazards to navigation in the long term by exposing previously submerged structures. However, degradation is expected to be slight and, therefore, not severe enough to expose the objects or outcroppings present in the Waverly segment. The No Action Alternative is not likely to adversely impact navigation in the Waverly segment.

---

<sup>1</sup> Kansas River dredging would not involve the use of barges (USACE pers. comm.)

### *Jefferson City and St. Charles Segments*

In these segments, slight to moderate aggradation is expected in the short term, and slight aggradation or degradation is anticipated in the long term. Aggradation would decrease the potential for previously submerged objects to become exposed, which would be beneficial to navigation. Degradation in the long term would increase the potential for previously submerged objects and rock/clay outcroppings to become exposed in areas with the most dredging, which could result in navigation accidents or vessel damage. If degradation occurs, it is expected to be slight. Therefore, the increase in navigation accidents or vessel damage due to exposed areas would be small.

### *Alternate Sources*

The potential for an increased risk of navigation hazards in the Mississippi River would depend on the amount of sand and gravel dredged, the existing river bed degradation, and whether large submerged objects in the area could be exposed and pose a hazard to navigation vessels. No navigational hazards are associated with the other alternate sources.

#### 4.4.4.3 Changes in Truck Traffic

### *All Segments*

Under the No Action Alternative, trucks would no longer haul dredging material to the market areas via existing routes (Figure 3.6-1). This would result in elimination of all truck trips currently made on an annual basis in each of the five segments (Table 3.6-4), and an overall decrease in traffic along trucking routes. This impact would benefit transportation in the Project area.

### *Alternate Sources*

Annual haul truck trips would be expected to increase on the major transportation corridors between the alternate source facilities and the market areas. Because it is not known which of the existing alternate sources would be used to replace sand and gravel otherwise dredged from the LOMR, the roadways that may be affected cannot be identified, and the extent to which traffic on these roadways would change cannot be estimated. However, these mining operations currently provide sand and gravel to urban market areas via haul trucks, and it is assumed that the trucks have direct access to the state and interstate highway system from these sites and use major transportation corridors. In general, major transportation corridors (i.e., interstate and state routes and U.S. highways) have relatively large traffic capacities; therefore, it is unlikely that any increase in haul truck traffic from these alternate source locations would adversely impact traffic circulation. As such, there would be no adverse impact.

#### 4.4.5 Alternative A

##### 4.4.5.1 Changes in Navigation Traffic

###### *St. Joseph Segment*

Under Alternative A, tug and barge traffic in the St. Joseph segment would increase (Table 4.4-1) in proportion to the increased volume of dredged material extracted from the river (seven percent). This increase in river traffic could limit the portion of the river available for other navigation traffic, including commerce-related tugs and barges and recreational boats, and may result in congestion on the river.

As described in Section 3.6, the majority of traffic on the LOMR is associated with commercial dredgers (i.e., tugs and barges), and is generally limited to areas on the river within a few miles (and no more than 7 to 10 miles) upstream of onshore sand plants. Thus, any increase in dredging-related traffic and the resultant potential limitation in navigation area would be confined to areas in proximity to these facilities. It is expected that the potential limitation in navigation area would be negligible because there would be only a seven percent increase in tug/barge trips per year (94 barge/tug trips). Furthermore, it is assumed that the 300-foot wide navigation channel would be sufficiently wide to allow large vessels, such as tugs, tows, or barges, as well as smaller recreational vessels to maneuver around the commercial dredging vessels, if necessary. As such, this impact is not considered adverse.

###### *Kansas City, Waverly, Jefferson City, and St. Charles Segments*

Because of a reduction in dredging in the Kansas City, Waverly, Jefferson City, and St. Charles segments under Alternative A, dredging-related navigation traffic would be reduced in these segments (Table 4.4-1) by 26 to 80 percent. This impact could be beneficial because it would decrease the potential for interference of dredging-related vessels with other vessels on the LOMR.

###### *Alternate Sources*

Changes in navigation traffic related to alternate sources of sand and gravel would apply only to dredging in other river locations (i.e., the Mississippi River). Any increase in dredging would result in an increase in tug/barge traffic on the river. The potential for an adverse impact would depend on existing navigation traffic and the area available for vessels to maneuver around one another in these rivers. No change in navigation traffic would be associated with the other alternate sources.

#### 4.4.5.2 Changes in Navigation Hazards

##### *St. Joseph and Jefferson City*

These segments would experience slight aggradation or degradation in the short term under Alternative A. In the long term, slight degradation could result in hazards to navigation by exposing previously submerged structures (e.g., sunken vessels, old bridge piers, pipelines, and rock/clay outcroppings) on the river bed (USACE 2009a), and by creating conditions conducive to the formation of shoals (i.e., sandbars) in the navigation channel. Due to the small potential for degradation in the long term, a substantial increase in the exposure of previously submerged objects and/or clay/rock outcroppings is unlikely.

##### *Kansas City Segment*

The Kansas City Segment would experience slight aggradation or degradation in the short term under Alternative A. In the long term, slight aggradation would decrease the potential for navigational hazards due to exposed (previously submerged) structures (e.g., sunken vessels, old bridge piers, pipelines, and rock/clay outcroppings) on the river bed (USACE 2009a).

##### *Waverly and St. Charles Segments*

The Waverly and St. Charles segments would experience slight aggradation or degradation in the short term and long term under Alternative A. Due to the small potential for degradation in the long term, a substantial increase in the exposure of previously submerged objects and/or clay/rock outcroppings is unlikely. If slight aggradation occurred, the likelihood of previously submerged structures becoming exposed and resulting in navigation hazards would decrease.

##### *Alternate Sources*

The potential for any adverse impact in the Mississippi River<sup>2</sup> related to navigation hazards would depend on the amount of sand and gravel dredged, the existing river bed degradation, and whether large submerged objects in the area could be exposed and pose a hazard to navigation vessels. Increased dredging in this river may contribute to river bed degradation, which may expose navigational hazards that are currently submerged. Changes in navigation hazards are not associated with other alternate sources.

---

<sup>2</sup> The Kansas River does not have commercial barge traffic.

### 4.4.5.3 Changes in Truck Traffic

#### *St. Joseph Segment*

Under Alternative A, there would be approximately 11 additional daily truck trips in the St. Joseph segment relative to existing conditions (Tables 3.6-4 and 4.4-2). This represents an approximately seven-percent increase in truck traffic. Representative low and high ADT values for the highways within a 10-mile radius of sand plants in the St. Joseph segment are given in Table 3.6-5. With the addition of these truck trips to the ADT counts presented in Table 3.6-5, the maximum increase in traffic in the St. Joseph segment along the state, interstate, and U.S. highways would be nominal at approximately 2 percent, 0.2 percent, and 0.9 percent, respectively. Because this increase is not substantial, it is not likely that these truck trips would contribute to congestion or traffic delays. As such, this impact would not be adverse.

#### *Kansas City, Jefferson City, and St. Charles Segments*

Net daily haul truck trips in the Kansas City, Jefferson City, and St. Charles segments would be reduced by 76 percent, 73 percent, and 78 percent, respectively, under Alternative A. The overall reduction of truck traffic in these segments would be beneficial because it would lower the likelihood of traffic delays or congestion due to haul truck traffic.

Under Alternative A, new sand plants would be built in the Kansas City and St. Charles segments, which would increase haul truck trips on surface roads and major arterials near the new facility. Construction of the Master's and Rau sand plants would result in an increase in truck traffic of approximately 71 and four daily haul truck trips, respectively. The increase in truck trips from construction of the Rau sand plant is considered nominal. The increase in truck traffic from construction of the Master's sand plant is not considered substantial because this sand plant would be near a major metropolitan area (Kansas City) and, thus, close to major transportation corridors with relatively large traffic capacities. It is unlikely that any increase in haul truck traffic from the Kansas City segment location would adversely impact traffic circulation. As such, there would be no adverse impact.

#### *Waverly Segment*

Daily haul truck trips would decrease by approximately 13 percent in the Waverly segment under Alternative A. This increase could result in a slight decrease in traffic delay or congestion.

### *Alternate Sources*

Annual haul truck trips would be expected to increase on the major transportation corridors near the alternate source facilities. Because it is not yet known which of the existing alternate sources would be used to replace sand and gravel otherwise dredged from the LOMR, the roadways that may be affected cannot be identified, and the extent to which traffic on these roadways would change cannot be estimated. In general, major transportation corridors (i.e., interstate and state routes, and U.S. highways) have relatively large traffic capacities; therefore, it is unlikely that any increase in haul truck traffic from these alternate source locations due to increased operations would adversely impact traffic circulation.

#### 4.4.6 Alternative B

##### 4.4.6.1 Changes in Navigation Traffic

#### *St. Joseph and Waverly Segments*

Under Alternative B, tug and barge trips in the St. Joseph and Waverly segments would increase by approximately 2,160 trips and 1,200 trips (Table 4.4-1), respectively, relative to existing conditions. These represent percentage increases of 163 percent and 68 percent, respectively. As previously described, this increase in river traffic could limit a portion of the river area available for other navigation traffic, including commerce-related tugs and barges and recreational boats, and could result in congestion on the river.

As described in Section 3.6, the majority of traffic on the LOMR is associated with commercial dredgers (i.e., tugs and barges), and is generally limited to areas on the river within a few miles (and no more than 7 to 10 miles) upstream of the onshore sand plants. Thus, any increase in dredger-associated traffic, and resultant limitation of navigation area, would be confined to areas close to these facilities. The 300-foot width of LOMR navigation channel is assumed sufficient to allow large vessels, such as tugs, tows, or barges, as well as smaller recreational vessels to maneuver around the commercial dredging vessels if necessary. As such, this would not be an adverse impact.

#### *Kansas City, Jefferson City, and St. Charles Segments*

Because of reduced dredging in the Kansas City, Jefferson City, and St. Charles segments under Alternative B, the dredging-related navigation traffic in these segments would be reduced (Table 4.4-1)

by 38 to 54 percent. This would decrease the potential for interference from dredging-related vessels with other vessels on the LOMR. As such, this would result in a beneficial impact to navigation.

### *Alternate Sources*

Changes in navigation traffic would apply only to dredging in other river locations (i.e., the Mississippi River). Any increase in dredging would result in an increase in tug/barge traffic in this river. The potential for an adverse impact would depend on existing navigation traffic and the area available for vessels to maneuver around one another in the river. No change in navigation traffic would be associated with the other alternate sources.

#### 4.4.6.2 Changes in Navigation Hazards

##### *St. Joseph, Jefferson City and St. Charles Segments*

Geomorphic estimates indicate that, overall, there would be slight additional river bed degradation in the short term and slight to moderate river bed degradation in the long term in these segments. Continuing river bed degradation could result in hazards to navigation by exposing previously submerged structures (e.g., sunken vessels, old bridge piers, pipelines, and rock/clay outcroppings) on the river bed (USACE 2009a), and by creating conditions conducive to the formation of shoals (i.e., sandbars) in the navigation channel. Because of slight degradation in the short term, the potential to increase navigation hazards is minimal in the short term in these segments. The slight to moderate river bed degradation in the long term would be accompanied by a slight to moderate potential to increase the frequency of navigational hazards in the long term. Alternative B would result in a potential negative impact to navigation.

##### *Kansas City Segment*

Slight degradation would occur in the short term and moderate degradation would occur in the long term in this segment. Continuing river bed degradation could result in hazards to navigation by exposing previously submerged structures (e.g., sunken vessels, old bridge piers, pipelines, and rock/clay outcroppings) on the river bed (USACE 2009a), and by creating conditions conducive to the formation of shoals (i.e., sandbars) in the navigation channel. Because of slight degradation in the short term, the potential to increase navigation hazards is minimal in the short term. The slight to moderate river bed degradation in the long term would be accompanied by a slight to moderate potential to increase the frequency of navigational hazards in the long term. Alternative B would result in a potential negative impact on navigation.

### *Waverly Segment*

Geomorphic estimates indicate the likelihood of slight degradation or slight aggradation in the short term, and slight degradation in the long term in the Waverly segment under Alternative B. Consequently, there would be a negligible increased risk of navigational hazards in the Waverly segment.

### *Alternate Sources*

The potential for any adverse impact in the Mississippi River related to navigation hazards would depend on the amount of sand and gravel dredged, existing river bed degradation, and whether large submerged objects are present in the area that could be exposed and pose a hazard to navigation vessels. Increased dredging in the Mississippi River may contribute to river bed degradation, which may expose navigational hazards.

#### 4.4.6.3 Changes in Truck Traffic

### *St. Joseph and Waverly Segments*

Alternative B would result in 398 and 339 daily haul truck trips in the St. Joseph and Waverly segments, respectively (Table 4.4-2). This represents an increase in haul truck trips in these segments by 164 percent and 98 percent, respectively. With the addition of these truck trips to the ADT counts in Table 3.6-5, the maximum increase in traffic in the St. Joseph segment along the state, interstate, and U.S. highways would be approximately 55 percent, 5 percent, and 21 percent, respectively. Similarly, the maximum increase in traffic in the Waverly segment would be approximately 74 percent, 0.9 percent, and 9 percent along the state, interstate, and U.S. highways, respectively.

This increase in truck traffic would be relatively substantial, especially on state highways. Furthermore, it is not known to what extent surface streets in the immediate vicinity of the sand plants or points of delivery may be affected. This increase in haul truck traffic could contribute to congestion and traffic delays.

### *Kansas City, Jefferson City, and St. Charles Segments*

Under Alternative B, the reduction in dredging in the Kansas City, Jefferson City, and St. Charles segments would result in an overall reduction of daily haul truck trips for each segment between 38 and 50 percent (Table 4.4-2), and traffic flow would be improved in these segments.

Haul truck trips would increase on surface roads and major arterials near the new sand plant facilities in the Kansas City and St. Charles segments. Traffic associated with the new Rau sand plant facility would represent a nominal increase of approximately nine daily haul truck trips. However, there would be approximately 161 daily haul truck trips out of the Master's facility in the Kansas City segment. This increase in truck traffic from construction of the Master's sand plant is not considered substantial because this sand plant would be close to a major metropolitan area (Kansas City) and, thus, near major transportation corridors with relatively large traffic volume capacities. Therefore, it is unlikely that this increase in haul truck traffic from the new Kansas City segment location would adversely impact traffic circulation. As such, this impact would not be adverse.

### *Alternate Sources*

Annual haul truck trips would be expected to increase on the major transportation corridors near the alternate source facilities. Because it is not yet known which of the existing alternate sources would be used to replace sand and gravel otherwise dredged from the LOMR, the roadways that may be affected cannot be identified, and the extent to which traffic on these roadways would change cannot be estimated. However, these mining operations currently provide sand and gravel to urban market areas via haul trucks, and it is assumed that the trucks have direct access to the state and interstate highway system from these sites and use major transportation corridors. In general, major transportation corridors (i.e., interstate and state routes, and U.S. highways) have relatively large traffic capacities; therefore, it is unlikely that any increase in haul truck traffic from these alternative source locations due to increased operations would adversely impact traffic circulation. As such, there would be no adverse impact.

## 4.4.7 Alternative C

Under Alternative C, the current limits on dredging would be maintained, and current dredging operations would not increase or decrease in any segment of the river, except in association with the two new sand plants in the Kansas City and St. Charles segments. Increased reliance on alternate sources for sand and gravel production would not be necessary.

### 4.4.7.1 Changes in Navigation Traffic

#### *All Segments*

Because the overall volume of dredging in the LOMR would not increase under Alternative C, the number of tug/barge trips would not increase and there would be no impact to navigation traffic.

Total tug/barge trip numbers in each segment would not increase because the total dredging in each segment would be essentially the same as existing conditions; however, tug/barge trips would shift within the Kansas City and St. Charles segments because of construction and operation of the new sand plants.

### *Alternate Sources*

Alternative C would not result in increased demand for sand and gravel from alternate sources. Therefore, no changes in navigation traffic would occur at alternate sources.

#### 4.4.7.2 Changes in Navigation Hazards

##### *St. Joseph Segment*

Geomorphic estimates indicate that under Alternative C, there is the potential for slight degradation or slight aggradation in the short term. In the long term, slight degradation is expected. Therefore, the potential for exposure of navigational hazards would be negligible in the short term. Due to the small potential for degradation in the long term, a substantial increase in the exposure of previously submerged objects and/or clay/rock outcroppings is unlikely.

##### *Kansas City Segment*

Under Alternative C, geomorphic estimates indicate the likelihood of slight to moderate degradation in the short term, and substantial degradation in the long term. As such, there would be some increases in navigational hazards in the short-term, increasing over time. The long-term potential for collisions with submerged objects poses an increased navigation hazard that could be adverse.

##### *Waverly Segment*

Geomorphic estimates indicate that under Alternative C, there is the potential for slight degradation or slight aggradation in the short term and long term. The potential for exposure of navigational hazards would be negligible.

##### *Jefferson City and St. Charles Segments*

Under Alternative C, geomorphic estimates indicate the likelihood of slight degradation in the short term, and moderate to substantial degradation in the long term in these segments. Minimal increases in navigational hazards would occur in the short term, and moderate to substantial potential for

increased exposure of hazards would take place in the long term. The long term potential for collisions with submerged objects poses an increased navigation hazard that could be adverse.

### *Alternate Sources*

Alternative C would not result in increased demand for sand and gravel from alternate sources. Therefore, no changes in navigation hazards would occur at alternate sources.

#### 4.4.7.3 Changes in Truck Traffic

##### *St. Joseph, Waverly, and Jefferson City Segments*

Because sand and gravel extraction would not increase under Alternative C, truck traffic near the existing sand plant facilities would not change. Therefore, there would be no impact to truck traffic in the St. Joseph, Waverly, and Jefferson City segments under Alternative C.

##### *Kansas City and St. Charles Segments*

Haul truck trips would increase on surface roads and major arterials near the new sand plant facilities in the Kansas City and St. Charles segments. Traffic associated with the new Rau sand plant facility would represent a nominal increase of approximately 18 daily haul truck trips; however, approximately 349 daily haul truck trips would originate from the Master's facility in the Kansas City segment. This increase in truck traffic from construction of the Master's sand plant is not considered substantial because this sand plant would be near a major metropolitan area (Kansas City) and, thus, near major transportation corridors with relatively large traffic volume capacities. Consequently, it is unlikely that the increase in haul truck traffic from the new Kansas City segment location would adversely affect traffic circulation. No impact to truck traffic in the Kansas City or St. Charles segment would occur under Alternative C.

### *Alternate Sources*

Alternative C would not result in increased demand for sand and gravel from alternate sources. Therefore, no changes in truck traffic would occur at alternate sources.

#### 4.4.8 Summary of Impacts

A summary of the potential impacts on navigation and transportation under the Proposed Action and the alternatives is provided in Table 4.4-3.

**Table 4.4-3 Summary of Potential Impacts on Navigation and Transportation**

Category of Impact	Proposed Action	No Action Alternative	Alternative A	Alternative B	Alternative C
Changes in navigation traffic	<ul style="list-style-type: none"> <li>• Increase in dredging vessels and navigation traffic in all segments.</li> </ul>	<ul style="list-style-type: none"> <li>• Benefit to navigation due to elimination of dredging vessels in all segments.</li> <li>• Potential increase in navigation traffic on the Mississippi River.</li> </ul>	<ul style="list-style-type: none"> <li>• Slight increase in dredging vessels and navigation traffic in St. Joseph segment; decrease in traffic in all other segments.</li> <li>• Potential increase in navigation traffic on the Mississippi River</li> </ul>	<ul style="list-style-type: none"> <li>• Increase in dredging vessels and navigation traffic in St. Joseph and Waverly segments; decrease in traffic in all other segments.</li> <li>• Potential increase in navigation traffic on the Mississippi River</li> </ul>	<ul style="list-style-type: none"> <li>• No change in dredging vessels and navigation traffic in all segments.</li> </ul>
Changes in navigation hazards	<ul style="list-style-type: none"> <li>• Increased potential for previously submerged objects to become exposed and become a navigation hazard in all segments.</li> </ul>	<ul style="list-style-type: none"> <li>• Decreased potential for previously submerged objects to become exposed and become a navigation hazard in St. Joseph and Kansas City segments; slight change in hazard potential in Waverly segment; slight increase in hazard potential in Jefferson City and St. Charles segments.</li> <li>• Potential increase in navigation hazards on the Mississippi River.</li> </ul>	<ul style="list-style-type: none"> <li>• Slight degradation in the long term in St. Joseph, Waverly, Jefferson City, and St. Charles segments, resulting in exposure of previously submerged objects or clay/rock outcroppings; no increase in the potential for previously submerged objects to become exposed and become a navigation hazard in Kansas City segment.</li> <li>• Potential increase in navigation hazards on the Mississippi River.</li> </ul>	<ul style="list-style-type: none"> <li>• Moderate increased potential for previously submerged objects to become exposed and become a navigation hazard in the long term in St. Joseph, Kansas City, Jefferson City, and St. Charles segments; negligible increased potential for hazards in Waverly segment.</li> <li>• Potential increase in navigation hazards on the Mississippi River.</li> </ul>	<ul style="list-style-type: none"> <li>• Increased potential for previously submerged objects to become exposed and become a navigation hazard in most segments.</li> </ul>
Changes in truck traffic	<ul style="list-style-type: none"> <li>• Substantial increase in haul truck traffic; most pronounced in St. Joseph and St. Charles segments, potentially resulting in congestion and traffic delays.</li> </ul>	<ul style="list-style-type: none"> <li>• Elimination of haul truck traffic in all segments.</li> <li>• Potential increase in truck traffic at alternate sources.</li> </ul>	<ul style="list-style-type: none"> <li>• Decrease in haul truck traffic; additional truck traffic near new sand plants.</li> <li>• Potential increase in truck traffic at alternate sources.</li> </ul>	<ul style="list-style-type: none"> <li>• Decrease in haul truck traffic in all segments except St. Joseph and Waverly segments; additional truck traffic near new sand plants.</li> <li>• Potential increase in truck traffic at alternate sources.</li> </ul>	<ul style="list-style-type: none"> <li>• No change in haul truck traffic near existing sand plants; additional truck traffic near new sand plants.</li> </ul>

#### 4.4.9 References

##### 4.4.9.1 Printed Literature

USACE (U.S. Army Corps of Engineers). 2009a. Missouri River Bed Degradation Reconnaissance Study. Section 905(b) (Water Resources Development Act of 1986) Analysis. August. Kansas City District. Kansas City, MO.

USACE (U.S. Army Corps of Engineers). 2009b. Missouri River Degradation and Causes (Lower 498 River Miles) for Committee on Missouri River Recovery and Associated Sediment Management Issues. Kansas City District. Kansas City, MO.

USACE (U.S. Army Corps of Engineers). 1991a. Missouri River Navigation Charts, Kansas City, Missouri to the Mouth. Kansas City District. Kansas City, MO.

USACE (U.S. Army Corps of Engineers). 1991b. Missouri River Navigation Charts, Sioux City, Iowa to Kansas City, Missouri. Omaha District. Omaha, NE.

USCG (U.S. Coast Guard). 2009. Mississippi River and Tributaries Waterways Action Plan-Missouri River Annex. Website ([http://www.uscg.mil/d8/sectUMR/Response/docs/mor\\_wap2009.pdf](http://www.uscg.mil/d8/sectUMR/Response/docs/mor_wap2009.pdf)) accessed on April 26, 2010.

##### 4.4.9.2 Personal Communications

Chapman, Michael. 2010. Chief, River Engineering and Restoration Section, Hydrologic Engineering Branch. U.S. Army Corps of Engineers. Electronic mail to Lesa Erecius, ICF International. March 26, 2010.

USACE (U.S. Army Corps of Engineers). 2010. Comments on the administrative draft environmental impact statement by the USACE. Electronic mail-April 26, 2010.

Wheeler, Cody. 2010. Regulatory Project Manager, U.S. Army Corps of Engineers, Kansas City District. Electronic mail to Lesa Erecius, ICF International, March 19, 2010