4.10 ECONOMICS AND DEMOGRAPHICS

4.10.1 Introduction

This section evaluates the economic-related effects associated with changes in sand and gravel production from the LOMR as defined by the various alternatives under consideration. From a market perspective, changes in sand and gravel production from the Missouri River would affect the ability of the commercial dredging industry to meet regional demand for these commodities and likely would result in shifts in production among commercial dredge operators and suppliers of sand and gravel from alternate sources located in the region. These shifts could affect the cost of sand and gravel to consumers in the short term (mainly because of changes in transportation costs from alternate sources) and in the long term (based on the relative differences in production costs between existing and potential new sources developed in the region). Additional impacts could be experienced by industries that are dependent on sand and gravel as an input to production, such as concrete and asphalt manufacturing and general construction. Changes in permitted dredging volumes would result in direct economic impacts on existing dredge operators and their employees, and would result in indirect economic effects throughout the region based on inter-industry linkages and household spending patterns. These changes would result in fiscal impacts on public agencies that realize royalties and tax revenues generated by sand and gravel production. Indirect economic impacts also are attributed to river bed degradation in the LOMR, which has been correlated, in part, with ongoing dredging activity. These degradation-related effects are focused on infrastructure damages and related operations and maintenance costs; but they may also affect agricultural production, recreation use, water supplies and water quality, and river navigation. Finally, the economic effects on select demographic groups are considered in the context of environmental justice. In summary, the following types of impacts have been analyzed for each alternative under consideration:

- Industry and market effects;
- Regional economic effects;
- Effects on tax revenues;
- Economic effects related to river bed degradation; and
- Environmental justice.

4.10.2 Assessment Methods and Results

As described above, the economic impacts considered here are multi-faceted, and the methods used in the analysis vary depending on the type of impact being evaluated. This section provides an overview of the methodologies used to evaluate economic impacts and an overview of the temporal and geographic scope of the analysis. This section also presents impact summary tables that outline the results for select economic parameters considered in the analysis.

4.10.2.1 Temporal Scope

The economic analysis is divided into short-term and long-term effects. Short-term effects are those likely to occur before any structural shifts in the sand and gravel market took place in order to achieve equilibrium, such as development of new mining operations over the long term in response to changes in permitted dredging volumes. It is anticipated that short-term effects would extend over an approximately 5-year period, which is the estimated time required for new sand and gravel mining operations to be developed and put into operation. The short-term analysis captures any shifts in production from the LOMR to existing land-based mining operations that could produce substitute supplies. Because it is not possible to predict the location or production capacity at potential new mining operations in the Project area, only short-term economic effects are quantified. Long-term effects would extend beyond the approximately 5-year period and are primarily addressed qualitatively.

To the extent that impacts are quantified, the focus is on average annual costs and benefits, which could be extrapolated over both the short term and long term, where applicable. Monetary results are presented in constant 2008 dollars.

4.10.2.2 Geographic Scope

The geographic scope of the economic analysis is driven by the locations of current and proposed sand and gravel production from the LOMR, alternate supply sources, and centers of demand. Although extraction of construction sand and gravel from the LOMR occurs within the physical confines of the river, the economic analysis is structured on the basis of individual market areas surrounding each river segment, which represent the main sources of demand for sand and gravel and include areas in Missouri, Kansas, and Illinois. As noted in Section 3.12, the “primary market area” is defined as the area encompassing an approximately 25-mile-wide radius[1] from the processing facilities (sand plants)

[1] The 25-mile radius was selected based on discussions with existing dredge operators and is indicative of the relative low-value product and high transportation costs required to ship aggregates longer distances.

associated with existing and proposed dredging operations and is comprised of the individual market areas. This area is also representative of the functional economic area associated with commercial dredging. All impacts are presented by individual market areas serving the five river segments that comprise the primary market area. A description of the primary and individual market areas is presented in Section 3.12.3 (see Table 3.12-1 and Figure 3.12-1). Some effects outside the primary market area are considered to illustrate how changes in dredging in the LOMR affect other areas throughout Missouri and adjacent states.

From a supply perspective, the locations of future dredging activity are outlined in the dredging permit applications. Of more concern for this analysis, however, are the locations of existing and proposed sand and gravel processing plants along the LOMR, which would serve as the distribution points to customers. Therefore, the location of supplies provided by dredging in the LOMR is based on distribution points rather than where material is extracted from the river. In addition, the geographic scope captures most alternate supply sources within Missouri, as well as areas in eastern Kansas and western Illinois. These alternate sources are located both inside and outside the primary market area.

From the perspective of market demands, the analysis is focused on counties along the LOMR corridor that are currently served by existing dredging operations, including the urban areas of St. Louis, Jefferson City, Kansas City, and St. Joseph. The analysis of the construction sand and gravel market covers all counties within the primary market area, including areas outside the state of Missouri in Kansas and Illinois. For the regional economic analysis, which evaluates economy-wide effects, the geographic scope is limited to areas within Missouri; the regional economic effects outside the state are addressed qualitatively.

4.10.2.3 Data Sources

To estimate the direct economic impacts on dredge operators and their employees, interviews were conducted with existing operators to obtain a range of financial and operations information. Information on alternate supplies was collected from multiple sources, including MDNR, IDNR, and the Kansas State Conservation Commission. The expansion capacity of existing supply sources was based on different factors depending on the type of supply, including information from existing permits and historical production levels; refer to Section 2.3.2 for more information. USGS information was used in estimating existing and projected freight-on-board (FOB)[2] prices for construction sand and gravel. The demand for construction sand and gravel from the LOMR was based on production data provided by

[2] FOB prices reflect the cost of the good plus the services of loading those goods onto a vehicle or vessel at a named location but exclude shipping costs. FOB is also referred to as “free on board.”

the Dredgers to the USACE. Dredging amounts in the LOMR between 2004 and 2008 are considered representative of existing market demand because dredging was generally unconstrained prior to 2007 and since 2007 (when dredging limits were put into effect), dredging occurred below authorized levels. The allocation of demand across market areas was based on population data from the U.S. Census Bureau. For the regional economic modeling, IMPLAN (IMpact Analysis for PLANning) software and data were used, which quantify trade flows among regions, regional purchase coefficients, and other industry-specific information. Finally, multiple industry representatives and mining operators were contacted to discuss industry operations and validate data parameters.

4.10.2.4 Transportation Cost Model

The market analysis for construction sand and gravel is based on a transportation cost model that simulates the market for LOMR sand and gravel within the study area, which includes Missouri and parts of Kansas and Illinois. The model simulates the existing demand for the approximately 6.9 million tons of LOMR sand and gravel produced annually between 2004 and 2008; it is not a supply-and-demand model for the entire sand and gravel market in the region. The model estimates the current transportation costs of shipping the approximately 6.9 million tons of LOMR sand and gravel; then, as necessary for the various alternatives, the model predicts production levels at alternate supply sources based on available supplies, relative prices, and transportation costs.

Based on the assumption that demand centers will purchase sand and gravel from the least expensive sources (including transportation costs), the model estimates the quantity of sand and gravel delivered from each supply source to each demand center and the associated average cost to each demand center. Specifically, the model minimizes the cost to supply sand and gravel to each demand center subject to recent levels of demand, available supplies, and minimum requirements for sand and gravel that meet MoDOT and KDOT specifications.

The model selects the amount of sand ($Sand_{sd}$) to be transported from each supply source to each demand center such that cost is minimized, where cost is equivalent to:

$$Cost = \sum_{s=1}^{S} \sum_{d=1}^{D} Sand_{sd} * (Travelcost_{sd} + Price_{s})$$

based on the following notation:

Notation	Description	Unit	Range and Values
S	Supply sources, includes river- and land-based operations	index	s = 1,..., S
D	Demand centers for sand and gravel	index	d= 1,..., D
$Sand_{sd}$	Quantity of sand shipped from s to d	tons per year	--
$Distance_{sd}$	Transport distance between s and d	miles	--
Costpermile	Unit cost of transporting sand and gravel	$0.20/mile	--
$Travelcost_{sd}$	Costpermile * $Distance_{sd}$	$ per ton	--
$Price_s$	Price of sand and gravel from supply source s	$ per ton	--
Cost	Total cost of all delivered product	$	--

Key parameters in the model include demand for LOMR sand and gravel by various demand points within the study area, the supply of LOMR sand and gravel under each alternative, and the available supplies from alternate sources in the region. It also considers the location of supply and demand centers and associated transportation distances, FOB prices, and shipping costs. For the analysis, supply sources include existing and proposed dredging operations and alternate mining operations that are currently in production in the three-state region (see Section 2.3.2 for more information on alternate sources of sand and gravel in the region). Because only existing supply sources are considered, the analysis represents a short-term evaluation of the sand and gravel market. The demand centers are defined as the population centers in the counties that comprise the primary market area (see Table 3.12-1 and Figure 3.12-1). The transportation cost model is run on General Algebraic Modeling System (GAMS) software, which consists of a language compiler and solvers for mathematical programming and optimization problems.[3]

A set of modeling assumptions were developed to simulate the sand and gravel market in the region. These assumptions include:

- The historical demand for construction sand and gravel from the LOMR of approximately 6.9 million tons per year was assumed to remain static in the future. This estimate is based on production data between 2004 and 2008, which covers periods of both economic expansion and recession.

[3] Additional information about GAMS software can be found on their webpage (www.gams.com).

- The demand for sand and gravel was limited to the counties identified in the primary market area. Demand was allocated to these counties based on the relative size of their population within each market area.
- The demand for sand and gravel from the LOMR by the MoDOT and the KDOT was based on data provided directly by these agencies. The combined demand by these agencies is approximately 553,000 tons per year, or approximately 8.0 percent of total demand.
- The supply of sand and gravel from the LOMR from existing and proposed dredge operators was based on volumes allowed under the Proposed Action and alternatives and existing patterns of production across individual sand plants. It was assumed that permit applicants would realize a proportional change in permitted dredging volumes in line with changes between requested dredging volumes and total allowed dredging volumes across the Proposed Action and alternatives.[4]
- Only existing alternate mining operations would affect the market for sand and gravel in the short term. It was assumed that no new mines would be developed.
- The available supply of sand and gravel from alternate supply sources was based on estimates of excess capacity. For sources permitted by the USACE, "excess capacity" was defined as the difference between existing production levels and permitted volumes. For all other sources, excess capacity was calculated based on estimates of existing production relative to peak production levels as outlined in USGS reports.
- A limited set of supply sources was assumed to be able to meet MoDOT and KDOT material specification requirements. These include all river-based sources (i.e., Missouri, Mississippi, and Kansas Rivers), floodplain open-pit mines in Kansas, and those mining operations in Missouri designated as approved sources of Class A sand and gravel by the MoDOT.
- The transportation distance between supply sources and demand sources was based on straight-line distance rather than the distance travelled along the existing road network.
- Transportation options were limited to truck shipping at an estimated cost of $0.20 per mile.

The results derived from the transportation-cost model are presented in Tables 4.10-1 and 4.10-2, which focus on the production and costs of construction sand and gravel, respectively. These tables

[4] The analysis does not take into account the financial feasibility of individual mining operations in response to potential reductions in permitted dredging volumes. It is acknowledged that threshold volumes of production are required for certain mining operations to be financially viable, below which business may fail. As a planning-level analysis, it is beyond the scope of this study to evaluate the financial feasibility of individual operators.

show results for existing conditions, the Proposed Action, and the alternatives. These results are discussed below under the Proposed Action and the alternatives.

Table 4.10-1 Production of Construction Sand and Gravel (tons/year)[a]

Market Area	Existing Conditions	Proposed Action[c]	No Action Alternative	Alternative A	Alternative B	Alternative C
St. Joseph	327,000	327,000	14,000	364,000	860,000	327,000
Dredging from LOMR[b]	327,000	327,000	0	350,000	860,000	327,000
Alternate sources	0	0	14,000	14,000	0	0
Kansas City	2,659,000	2,369,000	237,000	777,000	1,467,000	2,657,000
Dredging from LOMR[b]	2,659,000	2,369,000	0	540,000	1,230,000	2,657,000
Alternate sources	0	0	237,000	237,000	237,000	0
Waverly	678,000	968,000	0	500,000	1,140,000	680,000
Dredging from LOMR[b]	678,000	968,000	0	500,000	1,140,000	680,000
Alternate sources	0	0	0	0	0	0
Jefferson City	1,579,000	1,579,000	27,000	457,000	1,007,000	1,579,000
Dredging from LOMR[b]	1,579,000	1,579,000	0	430,000	980,000	1,579,000
Alternate sources	0	0	27,000	27,000	27,000	0
St. Charles	1,649,000	1,649,000	2,453,000	2,385,000	1,799,000	1,649,000
Dredging from LOMR[b]	1,649,000	1,649,000	0	370,000	840,000	1,649,000
Alternate sources	0	0	2,453,000	2,015,000	959,000	0
Outside primary market area[d]	0	0	4,161,000	2,409,000	619,000	0
Dredging from LOMR	0	0	0	0	0	0
Alternate sources	0	0	4,161,000	2,409,000	619,000	0
Total	6,892,000	6,892,000	6,892,000	6,892,000	6,892,000	6,892,000
Dredging from LOMR	6,892,000	6,892,000	0	2,190,000	5,050,000	6,892,000
Alternate sources	0	0	6,892,000	4,702,000	1,842,000	0

Notes:

LOMR = Lower Missouri River.
N/A = Not applicable.

[a] Based on meeting 2004–2008 average annual demand for construction sand and gravel from the LOMR.

[b] Represents location of dredging in the LOMR based on river segments.

[c] Results shown for the Proposed Action are based on volumes to meet existing and historical demand; the analysis of the entire permit request is evaluated qualitatively in the text.

[d] The "primary market area" represents the total of the five individual market areas serving each segment.

Source: ENTRIX 2010.

Table 4.10-2 Short-Term Costs of Construction Sand and Gravel ($/ton)[a, b]

Market Area	Existing Conditions	Proposed Action[b]	No Action Alternative	Alternative A	Alternative B	Alternative C
St. Joseph	$7.39	$7.39	$34.77	$7.80	$7.39	$7.39
Kansas City	$7.98	$7.72	$31.27	$16.46	$8.45	$7.97
Waverly	$9.53	$7.72	$42.91	$24.40	$8.39	$8.97
Jefferson City	$9.25	$8.69	$28.09	$16.71	$9.86	$9.35
St. Charles	$7.34	$7.10	$8.60	$7.63	$7.14	$8.58

[a] Represents cost to end user; including freight-on-board (FOB) price and transportation costs.

[b] Based on volumes meeting 2004–2008 average annual demand for construction sand and gravel from the lower Missouri River; the analysis of the entire permit request is evaluated qualitatively in the text.

Source: ENTRIX 2010.

4.10.2.5 Regional Economic Model (IMPLAN)

The regional economic analysis measures total economic impacts in the study area based on inter-industry linkages across affected economic sectors. The regional economic analysis was conducted using IMPLAN, a regional economic model that is based on the principles of input-output (I-O) analysis. I-O analysis is a means of measuring the flow of commodities and services among industries, institutions, and final consumers within an economy. An I-O model captures all the monetary market transactions for consumption in a given time period accounting for inter-industry linkages and the availability of regionally produced goods and services. The primary input for I-O analysis is the dollar change in purchases of products or services for final use; this is referred to as “final demand.” Industries respond to meet demands directly, or indirectly (by supplying goods and services to those industries responding directly to final demand changes). The primary metrics estimated by the IMPLAN model are output (or value of production), employment, and income across affected industries within a study area. In estimating impacts, the model considers direct,[5] indirect,[6] and induced[7] effects, which are based on the “multiplier” effect. In this context, a multiplier is a factor of proportionality that measures the additional economic activity generated in response to the initial influx of money within an economy. For example, a theoretical output multiplier of 1.5 in the mining industry indicates that every $100,000 of mining production (the direct output of this industry) supports a total of $150,000 in economic production throughout the economy (total output of all industries), including the initial

5 Direct effects represent the impacts for the expenditures and/or production values specified as direct final demand changes.

6 Indirect effects represent the impacts caused by the iteration of industries purchasing from industries resulting from the direct final demand changes.

7 Induced effects represent the impacts on all local industries caused by the expenditures of new household income generated by the direct and indirect effects resulting from the direct final demand changes.

$100,000 in mining output. Several types of multipliers are produced by an I-O model, including output, employment, and income multipliers.

For this Project, three main drivers were considered in the analysis of regional economic effects, as described below.

- Changes in sand and gravel production – Changes in construction sand and gravel production would result directly from the Proposed Action and alternatives based on proposed dredging. Changes in production, which account for shifts in production from alternate sources, would cause a ripple effect on all support industries that provide inputs to the mining industry. The value of changes in sand and gravel production was calculated using the quantity of production across supply sources and current FOB prices as estimated by the USGS.

- Changes in truck shipping volumes – Shifts in construction sand and gravel production also would result in an ancillary effect on the truck shipping industry, which provides the mechanism to transport sand and gravel from sellers to buyers. In turn, changes in truck shipping volumes would affect support industries via inter-industry linkages. The value of shipping output was calculated using estimates of transportation distance and representative shipping costs.

- Changes in consumer income – Changes in the cost of sand and gravel also would affect household income levels of consumers of construction sand and gravel products. These effects reflect changes in the disposable income of consumers of sand and gravel products based on the assumption that any changes in wholesale costs incurred by the manufacturing and construction industries would be passed on to end users in the form of higher product costs. Household income effects at the consumer level were calculated based on the quantity and cost of sand and gravel delivered across demand centers.

Estimates of direct effects for all three types of impacts were derived from the results of the transportation cost model; these direct effects represent the primary inputs to the regional economic model

For this analysis, a multi-region input-output (MRIO) modeling framework was utilized according to the delineation of individual market areas. The MRIO framework allows the trade flows among market areas to be tracked and quantified. Because some alternatives would result in displacement of sand and gravel production from proximity to the LOMR to other parts of the state, an additional area was integrated into the modeling, which captures all areas outside the primary market area within Missouri.

For the purposes of the regional economic modeling, only areas within Missouri were evaluated quantitatively because it represents the core area of potential impacts. Further, structuring the regional economic models this way allows for a statewide perspective on potential impacts and avoids the difficulties with discerning impacts across multiple states. Regional economic impacts outside the state are addressed qualitatively. Impact summary tables for the regional economic analysis are presented under each alternative below.

4.10.2.6 Approach to Fiscal Effects

Based on changes in local economic activity, fiscal impacts are also anticipated with and without continued dredging activity. The fiscal analysis focuses on changes in royalty payments paid to the State of Kansas; royalty payments are not required in Missouri. Changes in royalty payments were calculated based on changes in the value of sand production by supply sources within and adjacent to Kansas and the applicable royalty rate of $0.15 per ton. The fiscal analysis also qualitatively addresses other tax revenues generated by sand and gravel production based on changes in spending and production in the study area. Table 4.10-3 shows estimated short-term sand royalty payments to the State of Kansas under the Proposed Action and alternatives.

Table 4.10-3 Short-Term Annual Royalty Payments to the State of Kansas[a]

Market Area[b]	Existing Conditions	Proposed Action	No Action Alternative	Alternative A	Alternative B	Alternative C
St. Joseph[c]	$49,000	$49,000	$0	$53,000	$129,000	$49,000
Kansas City[c]	$64,000	$57,000	$22,000	$35,000	$52,000	$64,000
Waverly	$0	$0	$0	$0	$0	$0
Jefferson City	$0	$0	$0	$0	$0	$0
St. Charles	$0	$0	$0	$0	$0	$0
Outside primary market area[d]	$0	$0	$97,000	$97,000	$44,000	$0
Total	$113,000	$106,000	$119,000	$185,000	$224,000	$113,000

[a] Based on meeting 2004–2008 average annual demand for construction sand and gravel from the lower Missouri River (LOMR).

[b] Represents location of dredging within the LOMR based on river segments.

[c] Sand production data and royalty payments paid to the State of Kansas are not available by market area. For this analysis it was assumed that all sand production from the St. Joseph market area and approximately 16 percent of sand production from the Kansas City market area are subject to sand royalties.

[d] The "primary market area" represents the total of the five individual market areas serving each segment.

Source: ENTRIX 2010.

4.10.2.7 Approach to Economic Effects Associated with River Bed Degradation

Several potential economic impacts are attributed to the effects of river bed degradation in the LOMR. Potential economic impacts could be realized if continued river bed degradation leads to changes in infrastructure replacement and maintenance levels or infrastructure failure (see Section 4.3), agricultural production and costs (see Section 4.9), recreation use and spending (see Section 4.9), water supply availability and quality (see Section 4.5), and river navigation (see Section 4.4). The analysis presented in this EIS establishes a linkage between commercial dredging and river bed degradation, although it is acknowledged that dredging is only one contributing factor. Due to the difficulty in estimating system-wide economic impacts associated with river bed degradation, this analysis uses a case study approach to quantifying impacts based on existing research on this topic, particularly for infrastructure-related impacts. In cases where information is not readily available, the economic effects associated with river bed degradation are addressed qualitatively.

4.10.2.8 Approach to Environmental Justice Effects

"Environmental justice" is generally defined as the "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (USEPA 2010). The purpose of an environmental justice analysis is to identify the range of human health, environmental, and economic impacts that could result in significant and disproportionate adverse effects on low-income or minority populations potentially affected by proposed federal actions.

This environmental justice analysis was prepared in compliance with EO 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations) dated February 11, 1994, and Title VI of the Civil Rights Act of 1964. EO 12898 requires each federal agency to "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

The environmental justice analysis focuses on whether minority and low-income communities in the study area would be disproportionately affected from an economic standpoint because of changes in dredging from the LOMR. The presence of minority and low-income communities of interest in the study area are identified based on demographic data on race and ethnicity and various income parameters. The economic effects of the Proposed Action and alternatives have been reviewed to

qualitatively determine whether these groups would be disproportionately affected relative to the general population.

The physical effects of the Proposed Action and alternatives, including impacts on air quality and noise from sand plant operations, would not result in environmental justice impacts. The existing and proposed sand plants are generally located in agricultural or industrial areas, and not in proximity to residential areas (see Table 2.2-4). Therefore, potential air quality and noise impacts would be concentrated in areas with similar land uses and low population densities. Because these effects would not be realized in residential areas, which could contain minority and/or low-income populations, the related environmental justice effects would be negligible.

To determine whether the Project would result in environmental justice impacts, the racial and socioeconomic characteristics of the affected population were reviewed. As shown in Table 3.12-4, the population in the primary market area is predominantly white (80.1 percent). Racial minorities make up the remaining 19.9 percent of the population, including the Black/African American population (accounting for 15.3 percent of the population in the primary market area). As expected, the racial composition of the population in the primary market area is slightly more diverse, but comparable, to that across Missouri based on the location of major urban centers along the river corridor. Across market areas, the racial diversity is greatest around the St. Charles and Kansas City market areas; however, no individual market area appears to include considerably greater minority populations relative to the primary market area or Missouri as a whole.

Key economic indicators of social well-being are presented in Table 3.12-5. Relative to figures for the state of Missouri, these indicators show that the primary market area has lower unemployment rates (6.6 percent compared to 8.3 percent), higher per-capita income levels ($38,707 compared to $33,964), and lower poverty rates (11.2 percent compared to 13.3 percent). At the segment market area level, the Jefferson City, Waverly, and St. Joseph market areas have slightly lower income levels compared to state levels, and only the Jefferson City market area has a higher poverty rate (14.3 percent). Overall, the extent of low-income populations in the Project area appears to be limited.

4.10.3 Proposed Action

Under the Proposed Action, up to approximately 11.6 million tons per year of construction sand and gravel would be authorized to be dredged from the LOMR by existing and new dredge operators. The requested volume exceeds existing demand, which is estimated at approximately 6.9 million tons per year. Because permitted dredging would be substantially higher than existing and historical demand, it

is estimated that production would generally come from dredging operations with lowest costs, based primarily on proximity to demand centers.

The analysis of the Proposed Action assumes that production would occur only up to existing demand levels as there would be no market for sand and gravel beyond that point (holding production outside the LOMR constant). Under this assumption, however, the Proposed Action provides added flexibility to commercial dredge operators to meet demand because permitted volumes would exceed market demands. The economic effects of this assumption have been quantified and included in the results tables. In order to evaluate the full range of economic impacts associated with the Proposed Action, this analysis also considers production occurring up to fully permitted volumes although existing demand may not warrant this level of production. Because commercial dredging is unlikely to exceed recent demands and represents a theoretical maximum only, the economic effects of this alternative assumption are evaluated qualitatively.

The key findings of the economic analysis of the Proposed Action are:

- Overall, commercial dredging of sand and gravel from the LOMR would remain constant at levels consistent with existing demand (6.9 millions tons per year). There would be relatively minor shifts in production across market areas and individual sand plants.
- Due to the added flexibility provided by permitted dredging, commercial dredging within the LOMR would shift to locations that are most proximate to demand centers, resulting in a decrease in the delivered costs of construction sand and gravel in most market areas.
- Regional economic activity attributed to mining production would be relatively unchanged within the primary market area and the state of Missouri.
- Shipping requirements would be reduced in response to a more optimal distribution pattern between suppliers and consumers, resulting in regional economic impacts on the truck shipping and related support industries, including a loss of $3.9 million in production value annually and nearly 30 jobs in the state of Missouri.
- The estimated decrease in costs of construction sand and gravel would increase income levels of consumers, which would stimulate economic activity and partially offset potential impacts associated with the reduced demand for truck shipping.

- Net regional economic activity at the state level would be comparable to existing conditions accounting for minor changes in sand and gravel production, decreases in shipping requirements, and increases in consumer income levels.
- Because production would remain relatively stable in the Kansas City and St. Joseph market areas, estimated sand royalty payments paid to the State of Kansas would be largely unchanged.

4.10.3.1 Industry and Market Area Effects

Under the Proposed Action, commercial sand and gravel production within the LOMR would continue into the future. If dredging activity continues at levels to meet existing demand, the total overall quantity of sand and gravel produced from the LOMR would not change—a total of approximately 6.9 million tons of construction sand and gravel would be produced annually. As shown in Table 4.10-1, however, the locations of production across river segments would change based on the requested volumes and locations of dredging by permit applicants. In addition, new sand and gravel processing facilities would be developed to serve new dredging operations, thereby providing new options to meet recent demand levels. Because requested dredging volumes exceed recent demand under the Proposed Action, it is assumed that the market would dictate that dredging production would occur at locations most proximate to demand centers, resulting in overall reductions in the cost of sand and gravel across market areas in the short term.

On the other hand, if it is assumed that sand and gravel production reaches maximum permit levels under the Proposed Action (approximately 11.6 million tons annually), two outcomes would be likely. One is that dredge operators would attempt to sell their product in the open market—including new markets that are not currently served by LOMR supplies—which could displace existing land-based mining operations that currently serve these markets. The ability for dredge operators to compete in these new markets would depend on the relative price and quality differential between sand and gravel dredged from the LOMR and material that is mined from other sources. If the delivered price for dredged material is substantially lower than other sources or the difference in quality is sought by end users, the LOMR supplies could force other sand and gravel producers out of their existing markets. This would result in economic benefits to dredge operators and their employees, and adverse economic effects on other mining operators in the region.

Under maximum production, the other outcome is that dredge operators produce their full permit amount but elect to stockpile the excess sand and gravel that cannot be sold to the existing markets

they serve. This would provide operating reserves and added flexibility for dredge operators to meet future demands, and would not affect other sand and gravel producers in the region in the short term.

Based on the results of the transportation cost model presented in Table 4.10-2, dredging activity under the Proposed Action would result in minor effects on the cost of construction sand and gravel in the individual market areas; the costs include FOB prices and transportation costs.

Under the Proposed Action, the average FOB price of construction sand and gravel across all market areas is approximately $4.91 per ton, as estimated by the transportation cost model based on FOB values reported by USGS across the Project area. As shown in the table, however, the delivered cost of sand and gravel ranges from $7.10 to $8.69 per ton;[8] this is lower than existing conditions in all market areas, except for St. Joseph where price is expected to remain constant. The anticipated reductions in cost are attributed to projected shifts in production to sand plants that are relatively closer to demand centers in an effort to minimize costs, thereby resulting in a more cost-efficient pattern of distribution from suppliers to consumers. In the case of full production of requested permit levels, the influx of new supplies would tend to result in downward pressures on the FOB prices for sand and gravel and the related costs to customers, based on supplies exceeding demand. These downward pressures could be compounded if the production costs for dredge operators are lower than those for non-river mining operations. The non-river mining operations could be displaced from the market if they became uncompetitive from a cost and pricing standpoint.

The cost of construction sand and gravel also affects the production costs for industries that use sand and gravel as an input to production; these costs may ultimately be passed on to the consumers and the general public. The construction industry would be primarily affected, including road construction projects implemented by state and local transportation agencies. These projects require substantial amounts of concrete and asphalt that is produced with sand and gravel from the LOMR. Similarly, residential and commercial developments with large demands for concrete would be affected. Based on the expected decrease in the cost of sand and gravel throughout the market area under the Proposed Action, a minor reduction in construction costs could be realized as a cost savings to the public, either in the form of reduced taxes (for public sector projects) or relatively less expensive homes and goods and services supported by commercial development.

[8] Transportation costs account for the difference between total cost and average FOB price.

St. Joseph Market Area

Construction sand and gravel production in the St. Joseph market area would remain constant at approximately 327,000 tons annually under the Proposed Action, which is unchanged relative to existing conditions. Based on requested volumes, existing dredging operations in the St. Joseph market area would have sufficient capacity to meet the demand for sand and gravel in the St. Joseph market area using similar transportation patterns to deliver materials from distribution facilities to customers. Further, additional production in the St. Joseph market area would not be required to meet demands in other market areas (e.g., Kansas City) as production levels in the other market areas would be sufficient to meet local demand and are closer than the sand plant facility at St. Joseph. Accordingly, the delivered cost of sand and gravel in the St. Joseph market area is expected to remain constant at an estimated $7.39 per ton under the Proposed Action in the short term, with no cost-related effects to the construction industry.

Kansas City Market Area

Under the Proposed Action, construction sand and gravel production in the Kansas City market area is estimated at nearly 2.4 million tons per year, a decline of 290,000 tons per year relative to existing conditions. The decline in dredging in the Kansas City market area is attributed to a shift in production from the Kansas City segment to the Waverly segment, where additional production would be used to meet the demand in the eastern Kansas City market area. More specifically, the need for sand and gravel production in the Kansas City market area would decline because excess supplies from the Waverly market area (i.e., supplies beyond what are needed to meet local demand) would be distributed at sand plants in the Kansas City area and help to meet demands in the Kansas City market, thereby reducing the sand and gravel production needs from the Kansas City segment. Although a minor decrease in production is expected, development of new production capacity at the proposed Waldron sand plant would provide for a more optimal distribution of sand and gravel to customers in the Kansas City market, resulting in a minor decline in costs. Specifically, the cost of sand and gravel in the Kansas City market area is an estimated $7.72 per delivered ton under the Proposed Action in the short term, compared to $7.98 per ton under existing conditions. The resultant cost-related benefits in the construction industry would be minor.

Waverly Market Area

Construction sand and gravel production in the Waverly market area is expected to increase from 678,000 to 968,000 tons per year under the Proposed Action, which is attributed to meeting local demands in the Waverly market area by local sand plants, as well as helping to meet demands in the

Kansas City market with excess supplies from the area, as described above. The cost of sand and gravel in the Waverly market area in the short term is expected to fall to $7.72 per ton compared to $9.53 under existing conditions, a decline of 19.0 percent. The reduction in cost is attributed to increased supplies and a more cost-efficient pattern of production from existing sand plants based on transportation costs between points of supply and demand. The reduction in the cost of sand and gravel would generate moderate cost savings in the construction industry.

Jefferson City Market Area

Sand and gravel production in the Jefferson City market area is expected to remain stable under the Proposed Action, at approximately 1.6 million tons annually. At the same time, the cost of sand and gravel is expected to decrease from $9.25 per delivered ton under existing conditions to $8.69 per ton under the Proposed Action in the short term, a 6.1-percent decline that is attributed to a more cost-efficient pattern of production across sand plants. Nevertheless, the average per-ton cost in the Jefferson City market area would continue to be the highest in the study area. The reduction in cost would result in minor cost-related benefits in the construction industry.

St. Charles Market Area

Construction sand and gravel production in the St. Charles market area would remain constant under the Proposed Action at approximately 1.6 million tons annually. If production shifts to sand plants most proximate to demand points, the cost of sand and gravel in the St. Charles market area is expected to fall to an estimated $7.10 per ton under the Proposed Action in the short term, an approximately 3.2-percent decline relative to existing conditions. This decrease would result in minor cost-related benefits in the construction industry.

4.10.3.2 Regional Economic Effects

Changes in the quantity of construction sand and gravel produced by commercial dredgers operating in the LOMR, in conjunction with price effects, would result in direct economic impacts on commercial dredge operators, notwithstanding any economic benefits and impacts accruing to alternate suppliers in the region. Because additional dredgers would operate in the LOMR under the Proposed Action, shifts in production across operators is expected. Accordingly, the economic benefits associated with dredging activity would shift from certain operators to others. If market demand for sand and gravel remains constant, the shift in production across operators could force smaller or less efficient dredgers out of business. However, the net economic benefits across all commercial dredge operators and employees are expected to remain relatively stable under the Proposed Action. Specifically, the value

of sand and gravel production by commercial dredgers under the Proposed Action based on volumes to meet existing demand would be an estimated $33.8 million annually, which would directly support approximately 196 jobs and $13.9 million in labor income in the mining industry. The direct benefits would be concentrated in Missouri, as most of the sand plants utilized by proposed dredging operations would be located in the state.[9] If dredging reaches full allocation under the Proposed Action (up to 11.6 million tons per year), which would exceed demand, an increase in economic benefits would be realized by commercial dredging operations—potentially at the expense of other sand and gravel producers in the region.

The benefits of sand and gravel production extend beyond the mining industry into other parts of the regional economy based on inter-industry linkages. Further, changes in mining production drive changes in the truck shipping industry and household income levels, which also generate regional economic effects. The short-term regional economic effects under the Proposed Action are summarized in Table 4.10-4; the effects are based on the locations of sand and gravel distribution rather than dredging locations.

Within Missouri, the total value of output (including indirect and induced effects in related industries) generated by sand and gravel production under the Proposed Action in the short term would be an estimated $59.4 million annually; total labor income would be $22.0 million; and 374 total jobs would be supported. Because total sand and gravel production levels under the Proposed Action would be relatively constant compared to existing conditions, the statewide values for total output, income, and employment also would be relatively stable. The regional economic effects associated with truck shipping activity in the short term include $20.5 million in total output, $7.6 million in total labor income, and 165 jobs; these amounts are lower than existing conditions based on a more cost-effective pattern of production resulting in less shipping required to meet demand. Last, because the cost of sand and gravel would be relatively lower under the Proposed Action, the public would have more disposable income to spend in the regional economy. These incremental income benefits include $2.5 million in total output, $785,000 in total labor income, and approximately 23 new jobs in the short term.

[9] The exception is the existing sand plant located in Alton, Illinois, which serves the St. Charles market area.

Table 4.10-4 Short-Term Regional Economic Effects under the Proposed Action [a, b, c]

	Output (Annual)		Labor Income (Annual)		Employment	
Market Area[d]	Direct	Total[e]	Direct	Total[e]	Direct	Total[e]
St. Joseph						
Sand and gravel production	$1,615,000	$2,360,000	$489,000	$709,000	9	15
Truck transportation	$382,000	$608,000	$133,000	$204,000	3	5
Household income (change)[f]	$0	$6,000	$0	$1,000	0	0
Kansas City						
Sand and gravel production	$12,679,000	$24,190,000	$5,268,000	$8,976,000	74	145
Truck transportation	$4,915,000	$8,426,000	$1,940,000	$3,250,000	34	64
Household income (change)[f]	$0	$604,000	$0	$203,000	0	5
Waverly						
Sand and gravel production	$3,289,000	$4,404,000	$1,195,000	$1,517,000	19	29
Truck transportation	$687,000	$926,000	$236,000	$313,000	6	9
Household income (change)[f]	$0	$597,000	$0	$160,000	0	6
Jefferson City						
Sand and gravel production	$8,244,000	$13,782,000	$3,165,000	$4,894,000	48	91
Truck transportation	$3,045,000	$4,859,000	$1,088,000	$1,721,000	25	43
Household income (change)[f]	$0	$786,000	$0	$241,000	0	8
St. Charles						
Sand and gravel production	$7,428,000	$13,592,000	$3,493,000	$5,586,000	43	86
Truck transportation	$2,808,000	$5,282,000	$1,092,000	$2,006,000	20	41
Household income (change)[f]	$0	$414,000	$0	$137,000	0	3
Outside Primary Market Area[g]						
Sand and gravel production	$0	$1,108,000	$0	$360,000	0	9
Truck transportation	$0	$385,000	$0	$139,000	0	4
Household income (change)[h]	$0	$136,000	$0	$43,000	0	1
Total (State of Missouri)						
Sand and gravel production	$33,255,000	$59,437,000	$13,611,000	$22,041,000	193	374
Truck transportation	$11,837,000	$20,486,000	$4,489,000	$7,633,000	89	165
Household income (change)	$0	$2,543,000	$0	$785,000	0	23

Table 4.10-4 Short-Term Regional Economic Effects under the Proposed Action [a, b, c]

[a] Monetary values are reported in 2008 dollars and represent annualized effects.

[b] Regional economic effects are limited to changes in final demands in Missouri; changes in economic activity in adjacent states are excluded from the results.

[c] Based on meeting 2004–2008 average annual demand for construction sand and gravel from the lower Missouri River (LOMR).

[d] Represents the individual market area served by sand and gravel production from the LOMR and captures the economic activity associated with sand and gravel distribution rather than location (river segment) of production.

[e] Includes direct, indirect, and induced effects resulting from activity in the target market area and linkages to other market areas.

[f] Represents regional economic effects attributed to changes in household income resulting from changes in the cost of construction sand and gravel.

[g] The "primary market area" represents the total of the five individual market areas serving each segment.

[h] Household income effects were not considered for areas outside the primary market area because no changes in the cost of sand and gravel are anticipated; the results shown are based on linkages with the primary market area.

Source: ENTRIX 2010.

St. Joseph Market Area

The short-term regional economic effects in the St. Joseph market area under the Proposed Action are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Increase in total output to $2.4 million annually (+$44,000),
  - Increase in total labor income to $709,000 annually (+$13,000), and
  - Increase in total employment to 15 jobs (increase of less than one job).
- Truck transportation activity
  - Increase in total output to $608,000 annually (+$3,000),
  - Increase in total labor income to $204,000 annually (+$1,000), and
  - Increase in total employment to five jobs (increase of less than one job).
- Change in household income
  - Increase in total output by $6,000 annually,
  - Increase in total labor income by $1,000 annually, and
  - Increase in total employment by less than one job.

Kansas City Market Area

The short-term regional economic effects in the Kansas City market area under the Proposed Action are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Decrease in total output to $24.2 million annually (-$2.2 million),
  - Decrease in total labor income to $9.0 million annually (-$849,000), and
  - Decrease in total employment to 145 jobs (-13 jobs).
- Truck transportation activity
  - Decrease in total output to $8.4 million annually (-$2.8 million),
  - Decrease in total labor income to $3.3 million annually (-$1.1 million), and
  - Decrease in total employment to 64 jobs (-21 jobs).
- Change in household income
  - Increase in total output by $604,000 annually,
  - Increase in total labor income by $203,000 annually, and
  - Increase in total employment by five jobs.

Development of a new sand plant at Waldron also would generate short-term economic benefits in the Kansas City market area from new construction activity.

Waverly Market Area

The short-term regional economic effects in the Waverly market area under the Proposed Action are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Increase in total output to $4.4 million annually (+$1.9 million),
  - Increase in total labor income to $1.5 million annually (+$668,000), and
  - Increase in total employment to 29 jobs (+13 jobs).
- Truck transportation activity
  - Increase in total output to $926,000 annually (+$345,000),
  - Increase in total labor income to $313,000 annually (+$117,000), and
  - Increase in total employment to nine jobs (+3 jobs).

- Change in household income
  - Increase in total output by $597,000 annually,
  - Increase in total labor income by $160,000 annually, and
  - Increase in total employment by six jobs.

Jefferson City Market Area

The short-term regional economic effects in the Jefferson City market area under the Proposed Action are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Increase in total output to $13.8 million annually (+$301,000),
  - Increase in total labor income to $4.9 million annually (+$106,000), and
  - Increase in total employment to 91 jobs (+2 jobs).
- Truck transportation activity
  - Decrease in total output to $4.9 million annually (-$770,000),
  - Decrease in total labor income to $1.7 million annually (-273,000), and
  - Decrease in total employment to 43 jobs (-7 jobs).
- Change in household income
  - Increase in total output by $786,000 annually,
  - Increase in total labor income by $241,000 annually, and
  - Increase in total employment by eight jobs.

St. Charles Market Area

The short-term regional economic effects in the St. Charles market area under the Proposed Action are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Decrease in total output to $13.6 million annually (-$162,000),
  - Decrease in total labor income to $5.6 million annually (-$66,000), and
  - Decrease in total employment to 86 jobs (-1 job).

- Truck transportation activity
  - Decrease in total output to $5.3 million annually (-$706,000),
  - Decrease in total labor income to $2.0 million annually (-$268,000), and
  - Decrease in total employment to 41 jobs (-5 jobs).
- Change in household income
  - Increase in total output by $414,000 annually,
  - Increase in total labor income by $137,000 annually, and
  - Increase in total employment by three jobs.

Development of a new sand plant at Washington, Missouri also would generate short-term economic benefits in the St. Charles market area from new construction activity.

4.10.3.3 Tax Revenue Effects

Mining operations, both in-river dredging and land-based mines, generate multiple forms of tax revenue that provide fiscal benefits to all levels of government. Representative sources of tax revenues include, but are not limited to:

- Sales taxes (paid to states based on the value of taxable goods and services used in the sand and gravel production process),
- Franchise taxes (business taxes paid to states by corporations),
- Income taxes (paid to state and federal governments based on income received by operators and employees of sand and gravel operations),
- Payroll taxes (FICA) (paid to the federal government by employees and employers of sand and gravel operations) ,
- Property taxes (paid to local governments based on the value of real property holdings, such as sand and gravel processing facilities),
- Value of Waterway fuel taxes (fuel tax paid by commercial waterway operators, including commercial dredgers on the LOMR, to the Inland Waterways Trust Fund), and
- Royalty payments (paid to the State of Kansas for sand production in the state or adjacent to the state in the LOMR).

Generally, the level of mining activity and production drives the level of tax revenues generated by mining operations. Under the Proposed Action, commercial sand and gravel dredging along the LOMR likely would remain unchanged if production remains at levels to meet existing demand. Under this scenario, tax revenues are expected to remain fairly stable in the short term, except for royalty payments, which are based on the location of production. Table 4.10-3 shows estimated sand royalty payments to the State of Kansas under the Proposed Action and alternatives. Under the Proposed Action, dredging production would shift from the Kansas City market area (to the Waverly market area) and dredging would not change in the St. Joseph market area; these are the two market areas that are subject to royalty payments on production from the LOMR.[10] Overall, it is expected that royalty payments to the State of Kansas would decrease to approximately $106,000 per year under the Proposed Action in the short term, a 6.2-percent decline relative to existing conditions. This represents a minor economic impact of the Proposed Action.

St. Joseph Market Area

Sand and gravel production from the St. Joseph market area under the Proposed Action is expected to remain stable at 327,000 tons annually to meet existing demand; therefore, tax revenues realized by local, state, and federal governments are expected to remain stable. Because dredging in the St. Joseph market area would not change, sand royalty payments to the State of Kansas would continue at approximately $49,000 per year in the short term.

If sand and gravel production occurs at maximum permitted levels (1.2 million tons per year under the Proposed Action), tax revenues and sand royalties would be substantially higher.

Kansas City Market Area

Under the Proposed Action, sand and gravel production from the Kansas City market area to meet the existing demand would decrease to 2.4 million tons annually from 2.7 million tons annually under existing conditions. This decrease in sand and gravel production would decrease tax revenues realized by local, state, and federal governments. A decrease in production in the Kansas City market area would generate approximately $57,000 annually in royalties to the State of Kansas in the short term, compared to $64,000 under existing conditions.

If sand and gravel production occurs at maximum permitted levels (4.1 million tons per year under the Proposed Action), tax revenues would be substantially higher.

[10] It was assumed that all dredging production in the St. Joseph market area and approximately 16 percent of dredging production in the Kansas City market area would be subject to State of Kansas royalty payments.

Waverly Market Area

Sand and gravel production in the Waverly market area would increase under the Proposed Action to approximately 968,000 tons per year if production remains at levels to meet existing demand; therefore, tax revenues realized by local, state, and federal governments are expected to increase accordingly. No sand royalty payments are generated by production in the Waverly market area.

If sand and gravel production occurs at maximum permitted levels (1.0 million tons per year under the Proposed Action), tax revenues would be slightly higher.

Jefferson City Market Area

Sand and gravel production in the Jefferson City market area would remain largely unchanged under the Proposed Action (approximately 1.6 million tons per year) if production remains at levels to meet existing demand; therefore, tax revenues realized by local, state, and federal governments are expected to remain stable. No sand royalty payments are generated by production in the Jefferson City market area.

If sand and gravel production occurs at maximum permitted levels (2.8 million tons per year under the Proposed Action), tax revenues would be substantially higher.

St. Charles Market Area

Sand and gravel production in the St. Charles market area is expected to remain constant under the Proposed Action (1.6 million tons per year) if production remains at levels to meet existing demand; therefore, no change is expected in tax revenues realized by local, state, and federal governments. No sand royalty payments are generated by production in the St. Charles market area.

If sand and gravel production occurs at maximum permitted levels (4.4 million tons per year under the Proposed Action), tax revenues would be substantially higher.

4.10.3.4 Economic Effects Related to River Bed Degradation

River bed degradation in the LOMR could result in a range of economic impacts associated with costs of infrastructure maintenance and replacement and infrastructure failure; water supply and treatment costs; and changes in agricultural production, recreation use levels and associated spending, and river navigation. A description of ongoing economic effects related to river bed degradation is presented in the Affected Environment (Section 3.12.7.8), and additional information concerning potential impacts on infrastructure is presented in Section 4.3. It is anticipated that potential economic effects related to

river bed degradation under the Proposed Action and alternatives would be similar to those described in Section 3.12, as discussed generally below.

Under the Proposed Action, with the volume of sand and gravel production at levels to meet existing demand, the existing economic effects related to river bed degradation likely would continue. These potential economic effects include:

- Costs of infrastructure maintenance and replacement (in response to damage to infrastructure related to river bed degradation, including impacts on water intakes that serve municipal and/or industrial water users, levees and dikes, bridge and pipeline crossings, and wharf and dock facilities).
- Costs associated with reductions in flood control benefits provided by the regional levee system that may be compromised by the adverse effects of river bed degradation, including the potential for catastrophic levee failure that would result in loss of life and disruption of business operations.
- Costs related to water supply and water quality (in response to the potential need to secure alternative water sources due to declining well productivity and/or inoperability of water supply intakes, and increased treatment costs if water quality deteriorates below threshold levels).
- Incremental costs to farmers (in response to increased groundwater pumping costs if groundwater levels are lowered).
- Reduction in recreation spending benefits (in response to reduced recreational boating access and navigability, reductions in the quality of fishing opportunities in the river, and the presence of commercial barges that may compromise the overall recreational quality of the river).
- Avoided costs associated with river channel maintenance (in response to maintenance dredging performed by commercial dredge operators).

The general types of river bed degradation effects discussed above apply to all market areas considered in this analysis.

St. Joseph, Jefferson City, and St. Charles Market Areas

Based on recent levels of demand, dredging is expected to continue at historical levels under the Proposed Action in the St. Joseph, Jefferson City and St. Charles market areas—resulting in a continuation of existing river bed degradation and related economic impacts as referenced above and described in Section 3.12.7.8. Continued river bed degradation could compromise the integrity of

regional levee systems along the LOMR. It has been estimated that federal levees protect investment values of approximately $2.4 billion in the St. Joseph area, $67 million in the Jefferson City area, and $11 million in the St. Charles area. At this time, however, the change in the probability of levee failure under the Proposed Action and alternatives is unknown; therefore, it is not possible to quantify changes in flood control benefits.

If production occurs at maximum permitted levels, the potential economic impacts attributed to river bed degradation could be more severe relative to existing conditions, including a higher probability of levee failure and associated damages.

Kansas City Market Area

The production level in the Kansas City market area is expected to decline under the Proposed Action based on recent levels of demand. A reduction in dredging could result in less river bed degradation and related economic impacts under this alternative compared to existing conditions, although residual economic impacts are expected. Specifically, under the Proposed Action, the risk of levee failure would continue in the Kansas City area, where levees provide protection to about $19 billion in investment value. If production occurs at maximum permitted levels, the potential economic impacts associated with river bed degradation could be more severe than under existing conditions, including a higher probability of levee failure and associated damages.

Waverly Market Area

Based on recent levels of demand, dredging is expected to increase under the Proposed Action in the Waverly market area—resulting in the potential for increased river bed degradation and related economic impacts compared to existing conditions. An increase in river bed degradation would increase the risk of levee failure in the Waverly area, where levees protect approximately $15 million in investment value. If production occurs at maximum permitted levels, these potential adverse impacts could be more severe, including a higher probability of levee failure and associated damages.

4.10.3.5 Environmental Justice Effects

The analysis of environmental justice impacts takes into account the extent of minority and low-income populations in the study area, and the types and magnitude of socioeconomic effects anticipated under the Proposed Action and alternatives based on production levels anticipated to meet existing demand for sand and gravel in the primary market area.

St. Joseph Market Area

Under the Proposed Action, changes in economic activity are expected to be negligible in the St. Joseph market area. Therefore, no adverse economic effects would be realized by minority or low-income populations, and no adverse environmental justice impacts would occur.

Kansas City Market Area

In the Kansas City market area, implementation of the Proposed Action would result in a minor decrease in employment and income based on reductions in dredging and shipping requirements. To the extent that minority or low-income populations comprise these industries, the Project could result in loss of jobs and income in minority and low-income populations. From a regional perspective, the economic impacts in the mining and transportation industries would be partially offset by the potential economic benefits attributed to reductions in sand and gravel costs, which would be realized by the general population including minority and low-income populations. Overall, the magnitude of net economic impacts in the Kansas City region would be negligible relative to the size of local economy. For example, estimated net reduction of jobs in the Kansas City market area under the Proposed Action is 30 jobs, compared to an employment base of nearly 1.2 million jobs. Moreover, it is unlikely that the economic impacts in this region would fall disproportionately on minority or low-income populations. No adverse environmental justice impacts are anticipated in the Kansas City market area from an economic standpoint. Potential risks of levee failure in the Kansas City area attributed to river bed degradation could affect minority and low-income populations; however, these risks have not been quantified.

Under the Proposed Action, employment and personal income would increase in the Waverly market area, primarily for workers in the mining and transportation industries. Similarly, the regional economic benefits attributed to the lower sand and gravel costs would extend to the general population in the Waverly market area, which could provide economic benefits to the general population. No adverse environmental justice impacts are anticipated.

Jefferson City Market Area

In the Jefferson City market area, the Proposed Action would result in a minor increase in employment and income based on dredging production and sand and gravel costs, while the decrease in shipping requirements would adversely affect employment and income levels. To the extent that minority and low-income populations comprise the transportation industry, the Proposed Action could result in loss of jobs and income in minority and low-income populations. From a regional perspective, the net

economic impacts of the Proposed Action would be positive. Therefore, no adverse environmental justice impacts are anticipated.

St. Charles Market Area

In the St. Charles market area, a minor decrease in employment and income would be associated with the decline in the value of dredging production and reduced shipping requirements. To the extent that minority and low-income populations comprise these industries, the Proposed Action could result in loss of jobs and income in minority and low-income populations. From a regional perspective, the net economic effects would be negative, with a slight decrease in employment and income levels. However, these impacts would be negligible relative to the size of local economies. In the St. Charles market area, the net loss of approximately three jobs would be relative to a total employment base of nearly 1.7 million jobs. Moreover, it is unlikely that the economic impacts expected in these regions would fall disproportionately on minority and low-income populations. No adverse environmental justice impacts are anticipated.

4.10.4 No Action Alternative

Under the No Action Alternative, commercial dredging permits would not be renewed and production of construction sand and gravel from the LOMR would cease. Recent demand for sand and gravel from the river would need to be met by alternate sources in the region in the short term, including non-river mining operations inside and outside the primary market area. A comprehensive review of alternate sand and gravel mining operations in the region is presented in Section 2.3.2. The analysis of short-term economic effects has been quantified below. Long-term economic effects, which consider development of new mining operations in the region, are evaluated qualitatively.

The key findings of the economic analysis of the No Action Alternative include the following:

- Commercial dredging of sand and gravel from the LOMR would cease, but production at alternate sources are expected to make up the difference to meet existing demand. Alternate sources include commercial dredging in the Kansas and Mississippi River systems and land-based mines in the state of Missouri.

- Because the location of alternate sand and gravel sources are relatively more distant to demand centers, the No Action Alternative would result in substantial increases in the delivered costs of construction sand and gravel, except in the St. Charles area, where the availability of nearby sources would result in only minor increases in cost.

- Regional economic activity attributed to mining production would be substantially affected in the primary market area, resulting in a loss of $40.6 million in economic output and approximately 273 total jobs. These impacts would be partially offset by regional economic benefits attributed to production increases occurring outside the primary market area in other parts of Missouri, including increases of $23.8 million in annual output and 175 jobs. Shifts in production to other states, including Kansas and Illinois, represent economic leakages outside Missouri.

- Shipping requirements would increase substantially in order to transport materials from alternate sources to demand centers. The regional economic benefits in the truck shipping and related support industries in Missouri would include an increase of $150.3 million in production value annually and approximately 1,305 jobs, which outweigh the regional impacts in the mining industry.

- Estimated increases in construction sand and gravel costs would decrease income levels of consumers, which would reduce economic activity in Missouri, including a loss of approximately $91.3 million in output value and 813 total jobs.

- Net regional economic activity at the state level would be higher relative to existing conditions based on the shift from the mining sector to the transportation sector. Overall, economic output and employment at the state level are expected to increase by $42.3 million annually and 395 jobs, respectively.

- Estimated sand royalty payments paid to the State of Kansas would be slightly higher based on shifts in production to mining operations in Kansas.

4.10.4.1 Industry and Market Effects

As shown in Table 4.10-1, although sand and gravel would not be produced from the LOMR under the No Action Alternative, excess capacity across existing alternate sources in the region likely would be sufficient to meet existing demand over the short term. These alternate sources include the Mississippi and Kansas Rivers; open-pit mines in Missouri, Kansas, and Illinois, including floodplain production off of the Meramec River; and in-stream mining operations in Missouri. The effects of shifting sand and gravel production from the LOMR to alternate supply sources in the short term would be an increase in the cost of sand and gravel to end users resulting primarily from an increase in transportation costs. The short-term costs of construction sand and gravel across market areas are presented in Table 4.10 2. Under the No Action Alternative, the average FOB price is estimated at $5.13 per ton, but accounting for transportation costs, total delivered costs could reach as high as $42.91 per ton in

the short term. It is anticipated that the greatest cost impacts would occur in the Waverly market area, followed by the St. Joseph, Kansas City, Jefferson City, and St. Charles market areas. In addition, there could be quality differences between natural river sand from the LOMR compared to some alternate sources, potentially requiring additional processing in the production of concrete and asphalt (e.g., more cement or asphalt oil), thus further increasing costs. Overall, the anticipated increase in the cost of construction sand and gravel under the No Action Alternative likely would result in a general increase in constructions costs in the region.

In the long term, it is likely that new floodplain open-pit mining operations would be developed in proximity to existing demand centers. Development of new floodplain operations would reduce transportation distances and costs, and would restore equilibrium in the sand and gravel industry in response to market forces. However, development of new mining operations involves substantial capital investment and planning costs that would factor into the cost of sand and gravel. Representative types of expenditures associated with new floodplain operations include up-front costs, such as site exploration and testing, planning and permitting, and land acquisition and development. Operational costs are attributed to stripping and wasted fines. Lastly, off-river mining operations are subject to land reclamation requirements, which could require substantial expenditures in the future. It has been estimated that the net added costs of new floodplain mines is over $4 per ton, which could make it relatively less cost effective compared to river dredging (Holliday Sand & Gravel Company 2010). Beyond costs, other issues associated with floodplain mine developments include lack of willing sellers of land, public opposition, and lengthy planning and permitting processes.

St. Joseph Market Area

Although no sand and gravel would be produced from the LOMR in the St. Joseph market area under the No Action Alternative, production by alternate sources would increase in the St. Joseph market area in the short term. Increased production at alternate sources in the St. Joseph market area is estimated at approximately 14,000 tons per year, which could help offset losses in production from the LOMR in the region that totaled 327,000 tons annually under existing conditions. Other sand and gravel supplies from outside the primary market area would need to be imported from outside the region to meet existing demands. With added transportation costs, the cost of sand and gravel in the St. Joseph market area is expected to increase to an estimated $34.77 per ton under the No Action Alternative in the short term, which is nearly five times as high as costs under existing conditions. This increase would result in substantial short-term cost-related impacts in the construction industry.

Kansas City Market Area

No sand and gravel would be produced from the LOMR in the Kansas City market area under the No Action Alternative; however, production by alternate sources would increase in the Kansas City market area in the short term. Under the No Action Alternative, construction sand and gravel production in the Kansas City market area is estimated at 237,000 tons per year, which is substantially less than the existing demand of nearly 2.7 million tons annually. Other sand and gravel supplies would be imported from outside the region to meet existing demands. The short-term cost of sand and gravel in the Kansas City market area is an estimated $31.27 per delivered ton under the No Action Alternative, compared to $7.98 per ton under existing conditions—a nearly four-fold increase. The resultant cost-related impacts in the construction industry would be substantial in the short term.

Waverly Market Area

No sand and gravel would be produced from the LOMR in the Waverly market area under the No Action Alternative. In addition, there are no alternate supply sources in the Waverly market area. Therefore, sand and gravel production in the region would be zero, and the region would need to rely on sand and gravel imported from outside the primary market area. Consequently, the short-term cost of sand and gravel in the Waverly market area is expected to increase to $42.91 per ton under the No Action Alternative compared to $9.53 under existing conditions. With the lack of alternate sources nearby, the Waverly market area would be subject to the highest delivered cost of sand and gravel of all the market areas. Further, the short-term impacts on costs in the construction industry would be substantial.

Jefferson City Market Area

No sand and gravel would be produced from the LOMR in the Jefferson City market area under the No Action Alternative, but production by alternate sources would increase in the Jefferson City market area in the short term. It is estimated that production at alternate sources in the Jefferson City market area would increase by 27,000 tons annually, which is substantially below the existing demand of nearly 1.6 million tons per year in the area. Based on the cost of importing sand and gravel to the region, the delivered cost of sand and gravel is expected to increase from $9.25 per ton under existing conditions to $28.09 per ton under the No Action Alternative in the short term. The short-term impacts on costs in the construction industry would be substantial.

St. Charles Market Area

No sand and gravel would be produced from the LOMR in the St. Charles market area under the No Action Alternative, but production by alternate sources would increase in the St. Charles market area in the short term. In fact, it is estimated that increased production of sand and gravel from alternate supply sources in the region, including the Mississippi River, would not only fully offset lost production from the LOMR (approximately 1.6 million tons per year under existing conditions) but also would serve other nearby market areas (e.g., Jefferson City). Overall, total production of sand and gravel by alternate sources in the St. Charles market area would be an estimated 2.5 million tons annually. Consequently, the cost impacts in the St. Charles market area are the lowest of all the market areas because the incremental transportation costs are relatively low. The short-term cost of sand and gravel in the St. Charles market area is expected to increase to $8.60 per ton under the No Action Alternative, an approximately 17.2-percent increase relative to existing conditions. This increase represents a moderate cost-related impact to the construction industry in the short term.

4.10.4.2 Regional Economic Effects

Under the No Action Alternative, sand and gravel production would shift from commercial dredging operations to alternate supply sources in the region. Accordingly, no economic activity would be supported by commercial dredging in the short term and the long term. Existing dredging operations would experience substantial adverse economic impacts in the form of lost revenues and profits at the firm level and lost income and jobs for dredging employees. Specifically, commercial dredging operations would incur annual losses of $33.7 million in economic output (or gross revenues), $13.9 million in labor income, and approximately 196 jobs; these effects would extend indefinitely. Under the No Action alternative, the adverse economic impacts in the mining industry would be partially offset at the regional level by direct economic benefits accruing to alternate mining operations and their employees in some market areas. In the short term, these benefits would be realized by existing mining operations; in the long term, these benefits could extend to new mining operations developed in the region.

As explained above, the direct benefits of sand and gravel production extend beyond the mining industry. Mining production has ancillary effects on the truck shipping industry and household income levels, which also generate regional economic effects. The short-term regional economic effects under the No Action Alternative are presented in Table 4.10-5, which account for shifts in production to alternate supply sources both inside and outside the primary market area, including areas outside of Missouri. The total value of output (including indirect and induced effects in related industries)

generated by sand and gravel production under the No Action Alternative is an estimated $42.5 million annually, total labor income is $15.4 million, and 273 total jobs would be supported across the state. Many of these benefits would be realized by mining operations outside the primary market area in the short term. Due to the shift in economic benefits to areas outside Missouri, these figures are considerably lower than statewide economic benefits under existing conditions. In the long term, anticipated development of new mining operations in proximity to the LOMR would serve to retain these benefits within the primary market area.

Table 4.10-5 Short-Term Regional Economic Effects under the No Action Alternative[a ,b, c]

	Output (Annual)		Labor Income (Annual)		Employment	
Market Area[d]	Direct	Total[e]	Direct	Total[e]	Direct	Total[e]
St. Joseph						
Sand and gravel production	$68,000	$97,000	$21,000	$29,000	1	1
Truck transportation	$22,000	$43,000	$8,000	$14,000	0	0
Household income (change)[f]	$0	-$5,925,000	$0	-$1,814,000	0	-58
Kansas City						
Sand and gravel production	$433,000	$928,000	$180,000	$340,000	2	5
Truck transportation	$225,000	$1,232,000	$89,000	$474,000	2	10
Household income (change)[f]	$0	-$42,517,000	$0	-$14,143,000	0	-347
Waverly						
Sand and gravel production	$0	$12,000	$0	$4,000	0	0
Truck transportation	$0	$32,000	$0	$10,000	0	0
Household income (change)[f]	$0	-$11,034,000	$0	-$2,961,000	0	-110
Jefferson City						
Sand and gravel production	$139,000	$352,000	$54,000	$124,000	1	2
Truck transportation	$99,000	$527,000	$36,000	$180,000	1	4
Household income (change)[f]	$0	-$25,549,000	$0	-$7,821,000	0	-246
St. Charles						
Sand and gravel production	$9,210,000	$16,463,000	$4,332,000	$6,780,000	32	83
Truck transportation	$21,922,000	$40,628,000	$8,529,000	$15,423,000	156	312
Household income (change)[f]	$0	-$3,018,000	$0	-$1,012,000	0	-23
Outside Primary Market Area[g]						
Sand and gravel production	$17,105,000	$24,644,000	$5,946,000	$8,173,000	119	182
Truck transportation	$87,619,000	$132,281,000	$32,162,000	$47,752,000	693	1,174
Household income (change)[h]	$0	-$3,271,000	$0	-$1,009,000	0	-30

Table 4.10-5 Short-Term Regional Economic Effects under the No Action Alternative[a ,b, c]

	Output (Annual)		Labor Income (Annual)		Employment	
Market Area[d]	Direct	Total[e]	Direct	Total[e]	Direct	Total[e]
Total (State of Missouri)						
Sand and gravel production	$26,956,000	$42,495,000	$10,532,000	$15,449,000	155	273
Truck transportation	$109,888,000	$174,744,000	$40,823,000	$63,853,000	852	1,501
Household income (change)	$0	-$91,313,000	$0	-$28,760,000	0	-813

[a] Monetary values are reported in 2008 dollars and represent annualized effects.

[b] Regional economic effects are limited to changes in final demands in Missouri; changes in economic activity in adjacent states are excluded from the results.

[c] Based on meeting 2004–2008 average annual demand for construction sand and gravel from the lower Missouri River (LOMR).

[d] Represents the market area served by sand and gravel production from the LOMR and captures the economic activity associated with sand and gravel distribution rather than location (segment) of production.

[e] Includes direct, indirect, and induced effects resulting from activity in the target market area and linkages to other market areas.

[f] Represents regional economic effects attributed to changes in household income resulting from changes in the cost of construction sand and gravel.

[g] The "primary market area" represents the total of the five individual market areas serving each segment.

[h] Household income effects were not considered for areas outside the primary market area because no changes in the cost of sand and gravel are anticipated; the results shown are based on linkages with the primary market area.

Source: ENTRIX 2010.

Conversely, increased transportation requirements under the No Action Alternative would generate substantial benefits in the truck shipping industry in the short term. The regional economic benefits attributed to truck shipping activity include $174.7 million in total output, $63.9 million in total labor income, and approximately 1,501 jobs. These figures are substantially higher relative to existing conditions; however, most of the benefits would occur outside the primary market area. Within the primary market area, transportation-related effects vary considerably depending on proximity of demand centers to alternate supply sources. In the long term, the transportation benefits outside the primary market area would dissipate as new mines were developed near demand centers, thereby reducing the need for long-distance shipping.

The substantial increases in the short-term cost of sand and gravel across market areas would result in a reduction in household income levels if costs are passed through to the public. The anticipated reduction in household income would adversely affect regional economic conditions, including a loss of $91.3 million in total output, $28.8 million in total labor income, and approximately 813 jobs throughout Missouri. In the long term, the cost of sand and gravel is expected to decrease relative to short-term levels in response to development of new mining operations in proximity to demand centers; this would minimize income-related impacts on consumers.

No short-term construction-related economic impacts would be associated with development of new sand plants by permit applicants under the No Action Alternative. In the long term, however, it is anticipated that the region could realize substantial construction benefits from development of new land-based mining operations. Because it is not possible to predict the location, size, or required expenditures for new mining developments, the temporary construction benefits that would occur over the long term have not been quantified.

St. Joseph Market Area

The short-term regional economic effects in the St. Joseph market area under the No Action Alternative are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Decrease in total output to $97,000 annually (-$2.2 million),
  - Decrease in total labor income to $29,000 annually (-$667,000), and
  - Decrease in total employment to one job (-14 jobs).
- Truck transportation activity
  - Decrease in total output to $43,000 annually (-$561,000),
  - Decrease in total labor income to $14,000 annually (-$189,000), and
  - Decrease in total employment to less than one job (-5 jobs).
- Change in household income
  - Decrease in total output by $5.9 million annually,
  - Decrease in total labor income by $1.8 million annually, and
  - Decrease in total employment by 58 jobs.

Kansas City Market Area

The short-term regional economic effects in the Kansas City market area under the No Action Alternative are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Decrease in total output to $928,000 annually (-$24.5 million),
  - Decrease in total labor income to $340,000 annually (-$9.5 million), and

  - Decrease in total employment to five jobs (-153 jobs).

- Truck transportation activity
  - Decrease in total output to $1.2 million annually (-$10. million),
  - Decrease in total labor income to $474,000 annually (-$3.9 million), and
  - Decrease in total employment to 10 jobs (-75 jobs).
- Change in household income
  - Decrease in total output by $42.5 million annually,
  - Decrease in total labor income by $14.1 million annually, and
  - Decrease in total employment by 347 jobs.

Under the No Action Alternative, no new sand plant would be developed at Waldron and there would be no short-term construction benefits in the Kansas City market area.

Waverly Market Area

The short-term regional economic effects in the Waverly market area under the No Action Alternative are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Decrease in total output to $12,000 annually (-2.4 million),
  - Decrease in total labor income to $4,000 annually (-$845,000), and
  - Decrease in total employment to less than one job (-16 jobs).
- Truck transportation activity
  - Decrease in total output to $32,000 annually (-$549,000),
  - Decrease in total labor income to $10,000 annually (-$186,000), and
  - Decrease in total employment less than one job (-5 jobs).
- Change in household income
  - Decrease in total output by $11.0 million annually,
  - Decrease in total labor income by $3.0 million annually, and
  - Decrease in total employment by 110 jobs.

Jefferson City Market Area

The short-term regional economic effects in the Jefferson City market area under the No Action Alternative are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Decrease in total output to $352,000 annually (-$13.1 million),
  - Decrease in total labor income to $124,000 annually (-$4.7 million), and
  - Decrease in total employment to two jobs (-86 jobs).
- Truck transportation activity
  - Decrease in total output to $527,000 annually (-$5.1 million),
  - Decrease in total labor income to $180,000 annually (-$1.8 million), and
  - Decrease in total employment to four jobs (-45 jobs).
- Change in household income
  - Decrease in total output by $25.5 million annually,
  - Decrease in total labor income by $7.8 million annually, and
  - Decrease in total employment by 246 jobs.

St. Charles Market Area

The short-term regional economic effects in the St. Charles market area under the No Action Alternative are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Increase in total output to $16.5 million annually (+$2.7 million),
  - Increase in total labor income to $6.8 million annually (+$1.1 million), and
  - Decrease in total employment to 83 jobs (-4 jobs).
- Truck transportation activity
  - Increase in total output to $40.6 million annually (+$34.6 million),
  - Increase in total labor income to $15.4 million annually (+$13.1 million), and
  - Increase in total employment to 312 jobs (+266 jobs).

- Change in household income
  - Decrease in total output by $3.0 million annually,
  - Decrease in total labor income by $1.0 million annually, and
  - Decrease in total employment by 23 jobs.

Under the No Action Alternative, no new sand plant would be developed at Washington, and there would be no short-term construction benefits in the St. Charles market area.

4.10.4.3 Tax Revenue Effects

The types of tax revenues generated by mining activity under the No Action Alternative would be similar to those listed for the Proposed Action (see Section 4.10.3.3). However, certain types of tax revenues realized by local governments in Missouri would be reduced in response to production shifts outside the state to adjacent states (i.e., Kansas and Illinois), including state franchise and income taxes. In addition, county-level property taxes may decline if existing dredge operators sell their land holdings or idle existing sand plants. Value of Waterway fuel taxes from LOMR dredging also would decline to zero under the No Action Alternative. At the federal level, income and payroll taxes should not be affected as losses from the state of Missouri likely would be offset by increases in other states. In the long term, anticipated development of new mining operations in Missouri would generate a range of new tax revenues.

In the context of sand royalty payments paid to the State of Kansas, it is anticipated that royalties generated under the No Action Alternative would be largely unchanged in the short term relative to existing conditions (see Table 4.10-3). In lieu of royalty payments from commercial dredging operations on the LOMR, royalties would be paid by alternate sources located in Kansas—including dredging operations in the Kansas River and other floodplain open-pit mine operations—that are expected to increase production in response to displaced supplies from the LOMR. Overall, royalty payments paid to the State of Kansas are estimated at $119,000 per year under the No Action Alternative in the short term, a 5.4-percent increase relative to existing conditions. This would be a minor economic benefit of the No Action Alternative. In the long term, sand royalties likely would decrease as new mining operations were developed in Missouri to offset displaced supplies from the LOMR; new sources in Missouri outside the LOMR would not be subject to royalty payments.

St. Joseph Market Area

Sand and gravel production from the St. Joseph market area is expected to decrease to 14,000 tons annually under the No Action Alternative, reflecting the lack of alternate sources in the region. A decrease in sand and gravel production in the St. Joseph market area would decrease tax revenues realized by local, state, and federal governments in the short term; but these losses may be offset by increased mining activity elsewhere in Missouri. Because none of the production in the St. Joseph market area would be subject to sand royalty payments, sand royalties generated from the region would fall from approximately $49,000 per year to $0 in the short term. The loss in sand royalties would be offset by increased sand and gravel production outside the primary market area in other parts of Kansas.

Kansas City Market Area

Under the No Action Alternative, sand and gravel production from the Kansas City market area would decrease to 237,000 tons per year in the short term, a decline from approximately 2.7 million tons annually under existing conditions. The decrease in production would reduce tax revenues realized by local, state, and federal governments. Sand and gravel production in the Kansas City market area that would be subject to royalties includes increased dredging from the Kansas River and floodplain open-pit mine production elsewhere in Kansas. Sand royalty payments from the Kansas City market area are expected to decline to approximately $22,000 annually in the short term, down from $64,000 under existing conditions. The loss in sand royalties would be offset from increased sand and gravel production outside the primary market area in other parts of Kansas.

Waverly and Jefferson City Market Areas

Under the No Action Alternative, there would be no sand and gravel production in the Waverly market area and production in the Jefferson City market area would decline to 27,000 tons per year. Consequently, tax revenues realized by local, state, and federal governments would be substantially reduced in the short term. No sand royalty payments are generated by production in the Waverly or Jefferson City market areas.

St. Charles Market Area

Sand and gravel production at alternate sources in the St. Charles market area is expected to increase to nearly 2.5 million tons annually under the No Action Alternative, up from approximately 1.6 million tons in dredging production under existing conditions. Consequently, tax revenues realized by local,

state, and federal governments are expected to increase in the short term. No sand royalty payments are generated by production in the St. Charles market area.

4.10.4.4 Economic Effects Related to River Bed Degradation

The general types of economic impacts associated with bed degradation are presented in Section 4.10.3.4. Because dredging of commercial sand and gravel throughout the LOMR would cease under the No Action Alternative, river bed degradation associated with dredging would stop. Therefore, no incremental economic impacts related to river bed degradation are expected under the No Action Alternative. In fact, the potential economic costs associated with river bed degradation would be avoided over the long term (current degradation impacts could continue into the short term), which is considered an economic benefit of the No Action Alternative. These benefits may include avoided costs with infrastructure repair, maintenance, and replacement (e.g., water supply intakes), as well as substantially decreasing the probability of failure of the major urban levees that protect approximately $21.4 billion in investment along the LOMR.

All Market Areas

No incremental economic effects related to river bed degradation associated with dredging are expected under the No Action Alternative as commercial dredging in the LOMR would cease in all river segments. The economic benefits (i.e., avoided costs) described above would apply to all market areas.

4.10.4.5 Environmental Justice Effects

Section 4.10.3.5 presents a general overview of environmental justice and the social and demographic characteristics of the primary market area. The analysis of environmental justice effects under the No Action Alternative is presented below by market area.

St. Joseph and Jefferson City Market Areas

Under the No Action Alternative, reductions in sand and gravel production, reductions in truck transportation, and related increases in the cost of sand and gravel in the St. Joseph and Jefferson City market areas would result in adverse economic impacts. The direct impacts would be concentrated on people working in the commercial dredging and transportation industries. To the extent that employees in these industries are comprised of significant minority or low-income populations, environmental justice impacts could occur. At the regional scale, anticipated declines in household income levels could affect low-income populations in these market areas, which are slightly more prevalent relevant to

the state overall; however, these income effects would tend to affect the general population and would not fall disproportionately on low-income groups. As a result, no adverse environmental justice impacts are anticipated.

Kansas City Market Area

Reductions in sand and gravel production and related cost increases in the Kansas City market area would result in adverse economic impacts under the No Action Alternative. The direct impacts would be concentrated on people working in the commercial dredging and transportation industries. To the extent that employees in these industries are comprised of significant minority or low-income populations, environmental justice impacts could occur. The percentage of minority population in the Kansas City market area is higher relative to the percentage for the state, but it is unlikely that the economic impacts occurring at the regional level would fall disproportionately on minority groups. No adverse environmental justice impacts are anticipated. In fact, the reduced probability of levee failure in the Kansas City area under the No Action Alternative could benefit minority and low-income populations; however, these risks have not been quantified.

Waverly Market Area

Under the No Action Alternative, reductions in sand and gravel production, reductions in truck transportation, and related increases in the cost of sand and gravel in the Waverly market area would result in adverse economic impacts. The direct impacts would be concentrated on people working in the commercial dredging and transportation industries. To the extent that employees in these industries are comprised of significant minority or low-income populations, environmental justice impacts could occur. At the regional scale, anticipated economic impacts could affect the general population in the Waverly market area; however, this area is not characterized by significant minority or low-income populations, and these effects are not expected to fall disproportionately on these groups. Therefore, no adverse environmental justice impacts are anticipated.

St. Charles Market Area

Under the No Action Alternative, the St. Charles market area would experience a substantial decline in dredging production from the LOMR, which would be offset by increased production by alternate sources. The direct impacts would be concentrated on people working in the commercial dredging industry. To the extent that employees in these industries are comprised of significant minority or low-income populations, environmental justice impacts could occur. From a regional perspective, reductions in household income levels attributed to the increase in the cost of sand and gravel would

affect the general population, which includes a relatively larger minority population than the state overall, but it is unlikely that these regional economic impacts would fall disproportionately on minority groups. No adverse environmental justice impacts are anticipated.

4.10.5 Alternative A

Under Alternative A, commercial sand and gravel dredging in the LOMR would be permitted up to a maximum of approximately 2.2 million tons annually. Because permitted volumes would be less than recent demand levels (approximately 6.9 million tons per year), it is anticipated that alternate sources in the region would increase production to offset losses from the LOMR. The analysis of short-term economic effects has been quantified below. Long-term economic effects, which consider development of new mining operations in the region, are evaluated qualitatively.

The key findings of the economic analysis of Alternative A include the following:

- Commercial dredging of sand and gravel from the LOMR would decline to nearly 2.2 million tons per year, while production at alternate sources would increase by approximately 4.7 million tons in order to satisfy existing demand. Production would shift substantially across market areas and individual sand plants.
- Based primarily on higher transportation requirements, the delivered costs of construction sand and gravel would increase in all market areas.
- Regional economic activity attributed to mining production would be substantially affected in the primary market area, resulting in a loss of $25.0 million in economic output and approximately 171 total jobs. These impacts would be partially offset by regional economic benefits attributed to production increases occurring outside the primary market area in other parts of Missouri, including increases of $13.7 million in annual output and 101 jobs. Shifts in production to other states, including Kansas and Illinois, represent economic leakages outside Missouri.
- This alternative would increase shipping requirements and generate economic benefits in the truck shipping industry. The regional economic benefits associated with increased truck shipping include an increase of $54.5 million in annual production value and approximately 475 jobs in Missouri, which outweigh the regional impacts in the mining industry.
- Estimated increases in construction sand and gravel costs would decrease income levels of consumers, which would reduce economic activity, including a loss of approximately $32.8 million in output value and 292 total jobs in Missouri.

- Net regional economic activity at the state level would be higher relative to existing conditions based on the shift from the mining sector to the transportation sector. Overall, economic output and employment at the state level are expected to increase by $10.3 million annually and 112 jobs, respectively.
- Estimated sand royalty payments paid to the State of Kansas would increase substantially under Alternative A in response to continuation of commercial dredging in the St. Joseph and Kansas City market areas and shifts in production to mining operations in Kansas.

4.10.5.1 Industry and Market Effects

It is anticipated that sand and gravel production from the LOMR under Alternative A would reach maximum permitted levels (approximately 2.2 million tons annually), a decline of 68 percent relative to existing conditions (Table 4.10-1). In response to market pressures, alternate sources in the region likely would increase production, resulting in an increase in the delivered cost of sand and gravel due primarily to increased transportation costs. The short-term costs of construction sand and gravel across market areas are presented in Table 4.10-2. Under Alternative A, the average FOB price is an estimated $5.08 per ton, and all market areas would realize an increase in the delivered cost of sand and gravel costs relative to existing conditions. Based on the differences in quality between natural river sand from the LOMR and sand from some alternate sources, additional processing may be required in the production of concrete and asphalt, thereby further increasing costs to end users. The anticipated increase in the cost of sand and gravel under Alternative A likely would result in an overall increase in construction costs in the region.

In the long term, it is likely that new floodplain open-pit mining operations would be developed in proximity to existing demand centers, restoring equilibrium in the sand and gravel market, which would serve to minimize potential cost increases anticipated in the short term. However, floodplain open-pit mining would not be as cost effective as river dredging (see Section 4.10.4.1 for more information on the issues and costs associated with floodplain open-pit mining).

St. Joseph Market Area

Approximately 350,000 tons of sand and gravel would be produced annually from the LOMR in the St. Joseph market area under Alternative A, supplemented by an increase of approximately 14,000 tons by alternate sources in the St. Joseph market area. Production in the St. Joseph market area would exceed existing demand in the region (approximately 327,000 tons annually). However, the short-term cost of sand and gravel in the St. Joseph market area is expected to increase slightly (to $7.80 per ton)

under Alternative A, an increase of approximately 5.5 percent relative to existing conditions. Despite increased production in the St. Joseph market area, the estimated higher cost reflects lower production volumes in the Kansas City market area, which would draw sand and gravel produced in the St. Joseph market area in the short term. Therefore, the St. Joseph market area would be required to import sand and gravel from more distant areas, which would result in added transportation costs and an increase in the overall delivered cost of sand and gravel in the short term. Alternative A would result in minor cost-related effects for the construction industry.

Kansas City Market Area

In the Kansas City market area, sand and gravel production from the LOMR is expected to reach the maximum permitted volume (540,000 tons annually) under Alternative A. It is estimated that alternate sources in the region would increase production by an additional 237,000 tons per year. However, total production in the Kansas City market area would fall substantially short of recent levels of demand (nearly 2.7 million tons per year). The imported sand and gravel supplies from outside the market area would result in higher transportation costs; therefore, the delivered cost of sand and gravel in the Kansas City market area is expected to increase to $16.46 per ton under Alternative A in the short term, an increase of approximately 106 percent relative to existing conditions. The resultant cost-related impacts in the construction industry would be substantial in the short term.

Waverly Market Area

Approximately 500,000 tons of sand and gravel would be produced annually from the LOMR in the Waverly market area under Alternative A, which is less than existing demand levels (678,000 tons per year). In response to declines in production in the Waverly market area and in conjunction with supplies likely being drawn out of the region in response to substantial reductions in dredging in the Kansas City market area, the Waverly market area would need to rely on more distant alternate sources in the region in the short term. Accordingly, the cost of sand and gravel in the Waverly market area under Alternative A is expected to increase from 9.53 per ton under existing conditions to $24.40 per ton—the highest delivered cost of sand and gravel across market areas. The increased cost would cause a substantial short-term impact on the construction industry.

Jefferson City Market Area

Approximately 457,000 tons of sand gravel would be produced annually in the Jefferson City market area under Alternative A, of which 430,000 tons would come from commercial dredging operations in the LOMR and 27,000 tons would be produced by alternate sources in the region. Total production in

the Jefferson City market area would not meet existing demand in the region (approximately 1.6 million tons annually), thereby requiring sand and gravel to be imported to the area at higher costs. Under Alternative A, the cost of sand and gravel in the Jefferson City market area is expected to increase to $16.71 per ton in the short term, an 81-percent increase relative to existing conditions. The resultant increase in construction costs in the region would be a substantial adverse effect in the short term..

St. Charles Market Area

Sand and gravel production from the St. Charles market area is expected to reach 370,000 tons annually under Alternative A, and an additional approximately 2.0 million tons would be produced by alternate sources in the region. Total supplies would exceed existing demand (approximately 1.6 million tons per year) in response to demands in other nearby market areas (e.g., Jefferson City). Based on the relative abundance of alternate sources in the St. Charles market area, the cost of sand and gravel is estimated to increase to only $7.63 per ton under Alternative A in the short term, an approximately 4.1-percent increase relative to existing conditions. The increase would cause minor cost-related effects in the construction industry.

4.10.5.2 Regional Economic Effects

Sand and gravel production would shift in part from in-river dredging to alternate sources in the region under Alternative A. As a result, existing dredging operations would incur direct economic losses over the long term in the form of lost revenues and profits at the firm level and lost income and jobs for employees. Estimated impacts include a loss of $23.0 million in economic output (or gross revenues), $9.7 million in labor income, and approximately 134 jobs. Although adverse economic impacts are associated with Alternative A, these impacts would be partially offset at the industry level in the short term by direct economic benefits accruing to alternate mining operations currently in operation and their employees. In the long-term, these benefits would accrue to new mining operations developed in the region to offset the displaced supplies from the LOMR.

The short-term regional economic effects under Alternative A are presented in Table 4.10-6; the estimates account for shifts in production to alternate supply sources both inside and outside the primary market area, including areas outside Missouri. Within Missouri, the total value of output generated by sand and gravel production under Alternative A would be $48.0 million annually, total labor income would be $17.6 million, and a total of 301 total jobs would be supported. Many of these benefits would be realized by mining operations outside the primary market area in the short term and

by new mining operations in the long term. These figures are lower than the statewide economic benefits under existing conditions based on leakages of economic benefits to areas outside the state.

Table 4.10-6 Short-Term Regional Economic Effects under Alternative A [a, b, c]

	Output (Annual)		Labor Income (Annual)		Employment	
Market Area[d]	Direct	Total[e]	Direct	Total[e]	Direct	Total[e]
St. Joseph						
Sand and gravel production	$1,797,000	$2,561,000	$544,000	$770,000	11	17
Truck transportation	$473,000	$750,000	$165,000	$251,000	4	7
Household income (change)[f]	$0	-$135,000	$0	-$39,000	0	-1
Kansas City						
Sand and gravel production	$3,843,000	$7,632,000	$1,597,000	$2,818,000	22	45
Truck transportation	$1,241,000	$2,682,000	$490,000	$1,035,000	9	21
Household income (change)[f]	$0	-$15,566,000	$0	-$5,180,000	0	-127
Waverly						
Sand and gravel production	$1,589,000	$2,138,000	$577,000	$736,000	9	14
Truck transportation	$598,000	$815,000	$205,000	$275,000	5	7
Household income (change)[f]	$0	-$4,909,000	$0	-$1,317,000	0	-49
Jefferson City						
Sand and gravel production	$2,385,000	$4,327,000	$915,000	$1,535,000	14	29
Truck transportation	$1,074,000	$1,928,000	$384,000	$680,000	9	17
Household income (change)[f]	$0	-$10,106,000	$0	-$3,094,000	0	-97
St. Charles						
Sand and gravel production	$9,356,000	$16,792,000	$4,401,000	$6,913,000	37	89
Truck transportation	$12,483,000	$23,068,000	$4,856,000	$8,756,000	89	177
Household income (change)[f]	$0	-$850,000	$0	-$287,000	0	-6
Outside Primary Market Area[g]						
Sand and gravel production	$9,704,000	$14,507,000	$3,373,000	$4,809,000	67	107
Truck transportation	$32,732,000	$49,660,000	$12,015,000	$17,928,000	259	441
Household income (change)[g]	$0	-$1,278,000	$0	-$396,000	0	-12
Total (State of Missouri)						
Sand and gravel production	$28,674,000	$47,957,000	$11,407,000	$17,581,000	160	301
Truck transportation	$48,601,000	$78,904,000	$18,115,000	$28,927,000	375	670
Household income (change)	$0	-$32,844,000	$0	-$10,313,000	0	-292

Table 4.10-6 Short-Term Regional Economic Effects under Alternative A [a, b, c]

[a] Monetary values are reported in 2008 dollars and represent annualized effects.

[b] Regional economic effects are limited to changes in final demands in Missouri; changes in economic activity in adjacent states are excluded from the results.

[c] Based on meeting 2004–2008 average annual demand for construction sand and gravel from the lower Missouri River (LOMR).

[d] Represents the market area served by sand and gravel production from the LOMR and captures the economic activity associated with sand and gravel distribution rather than location (segment) of production.

[e] Includes direct, indirect, and induced effects resulting from activity in the target market area and linkages to other market areas.

[f] Represents regional economic effects attributed to changes in household income resulting from changes in the cost of construction sand and gravel.

[g] The "primary market area" represents the total of the five individual market areas serving each segment.

[h] Household income effects were not considered for areas outside the primary market area because no changes in the cost of sand and gravel are anticipated; the results shown are based on linkages with the primary market area.

Source: ENTRIX 2010.

Conversely, increased transportation requirements under Alternative A would result in substantial benefits in the truck shipping industry. The regional economic benefits in Missouri associated with truck shipping activity include $78.9 million in total output, $28.9 million in total labor income, and 670 jobs. At the state level, these figures are substantially higher relative to existing conditions; however, most of these benefits would occur outside the primary market area. Across the individual market areas, transportation-related effects would vary considerably depending on proximity to alternate supply sources. In the long term, these transportation benefits would decline as new mines were developed in closer proximity to demand centers.

Increases in the cost of sand and gravel under Alternative A would result in household income effects assuming that costs are passed through to the public. Potential reductions in household income would result in estimated losses of $32.8 million in total output, $10.3 million in total labor income, and approximately 292 jobs throughout Missouri. In the long term, income-related impacts would be minimized as new mining operations were developed and sand and gravel costs declined relative to short-term levels.

Similar to the Proposed Action, temporary construction benefits would be associated with development of new sand plants by the permit applicants. In addition, the region could realize temporary construction benefits from development of new off-river mining operations in the long term, in response to reductions in allowable dredging. Because it is not possible to predict the size, cost, or reliance on the local construction industry for new mining developments, these construction benefits have not been quantified.

St. Joseph Market Area

The short-term regional economic effects in the St. Joseph market area under Alternative A are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Increase in total output to $2.6 million annually (+$245,000),
  - Increase in total labor income to $770,000 annually (+$74,000), and
  - Increase in total employment to 17 jobs (+2 jobs).
- Truck transportation activity
  - Increase in total output to $750,000 annually (+$146,000),
  - Increase in total labor income to $251,000 annually (+$49,000), and
  - Increase in total employment to 7 jobs (+1 job).
- Change in household income
  - Decrease in total output by $135,000 annually,
  - Decrease in total labor income by $39,000 annually, and
  - Decrease in total employment by 1 job.

Kansas City Market Area

The short-term regional economic effects in the Kansas City market area under Alternative A are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Decrease in total output to $7.6 million annually (-$18.8 million),
  - Decrease in total labor income to $2.8 million annually (-$7.0 million), and
  - Decrease in total employment to 45 jobs (-112 jobs).
- Truck transportation activity
  - Decrease in total output to $2.7 million annually (-$8.5 million),
  - Decrease in total labor income to $1.0 million annually (-$3.3 million), and
  - Decrease in total employment to 21 jobs (-64 jobs).

- Change in household income
  - Decrease in total output by $15.6 million annually,
  - Decrease in total labor income by $5.2 million annually, and
  - Decrease in total employment by 127 jobs.

Development of a new sand plant at Waldron also would generate short-term economic benefits in the Kansas City market area from new construction activity.

Waverly Market Area

The short-term regional economic effects in the Waverly market area under Alternative A are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Decrease in total output to $2.1 million annually (-$330,000),
  - Increase in total labor income to $736,000 annually (-$113,000), and
  - Increase in total employment to 14 jobs (-2 jobs).
- Truck transportation activity
  - Increase in total output to $815,000 annually (+$234,000),
  - Increase in total labor income to $275,000 annually (+$79,000), and
  - Increase in total employment to 7 jobs (+2 jobs).
- Change in household income
  - Decrease in total output by $4.9 million annually,
  - Decrease in total labor income by $1.3 million annually, and
  - Decrease in total employment by 49 jobs.

Jefferson City Market Area

The short-term regional economic effects in the Jefferson City market area under Alternative A are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Decrease in total output to $4.3 million annually (-$9.1 million),

  - Decrease in total labor income to $1.6 million annually (-$3.3 million), and
  - Decrease in total employment to 29 jobs (-60 jobs).
- Truck transportation activity
  - Decrease in total output to $1.9 million annually (-$3.7 million),
  - Decrease in total labor income to $680,000 annually (-$1.3 million), and
  - Decrease in total employment to 17 jobs (-33 jobs).
- Change in household income
  - Decrease in total output by $10.1 million annually,
  - Decrease in total labor income by $3.1 million annually, and
  - Decrease in total employment by 97 jobs.

St. Charles Market Area

The short-term regional economic effects in the St. Charles market area under Alternative A are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Increase in total output to $16.8 million annually (+$3.0 million),
  - Increase in total labor income to $6.9 million annually (+$1.3 million), and
  - Increase in total employment to 89 jobs (+2 jobs).
- Truck transportation activity
  - Increase in total output to $23.1 million annually (+$17.0 million),
  - Increase in total labor income to $8.8 million annually (+$6.5 million), and
  - Increase in total employment to 177 jobs (+131 jobs).
- Change in household income
  - Decrease in total output by $850,000 annually,
  - Decrease in total labor income by $287,000 annually, and
  - Decrease in total employment by 6 jobs.

Development of a new sand plant at Washington, Missouri also would generate short-term construction benefits in the St. Charles market area.

4.10.5.3 Tax Revenue Effects

The types of tax revenues generated by mining activity under Alternative A would be similar to those listed for the Proposed Action in Section 4.10.3.3. However, some types of tax revenues realized by local governments in Missouri, including state franchise and income taxes, would be reduced in response to production shifts to adjacent states in the short term. In addition, county-level property taxes may decline if existing dredge operators sell their land holdings or idle existing sand plants. Value of Waterway fuel taxes from dredging in the LOMR also would decline in proportion to reductions in dredging under Alternative A. At the federal level, income and payroll taxes should not be affected, as losses from Missouri likely would be offset in other states. In the long term, new tax revenues would be generated by the anticipated development of new mining operations in Missouri.

It is anticipated that sand royalties generated under Alternative A would be higher relative to existing conditions in the short term, as shown in Table 4.10-3. In this case, royalties would be paid based on production from commercial dredging in the St. Joseph and Kansas City market areas, as well as from alternate sources located in Kansas. Under Alternative A, total royalties paid to the State of Kansas resulting from changes in dredging activity are an estimated $185,000 per year in the short term, an 86-percent increase relative to existing conditions; this is an economic benefit. In the long term, sand royalties would decline relative to short-term levels as production shifted to new land-based mining operations in Missouri.

St. Joseph Market Area

An increase in sand and gravel production in the St. Joseph market area would increase tax revenues realized by local, state, and federal governments in the short term. In addition, sand royalties generated from production in this region would increase slightly, from approximately $49,000 to $53,000 per year.

Kansas City Market Area

The decrease in sand and gravel production in the Kansas City market area would decrease tax revenues realized by local, state, and federal governments in the short term. Some of the sand and gravel production in the Kansas City market area would be subject to royalties. Sand royalties generated by production in the Kansas City market area are expected to decline to approximately

$35,000 annually, down from $64,000 annually under existing conditions. The short-term loss in sand royalties would be offset from increased sand and gravel production outside the primary market area in other parts of Kansas.

Waverly and Jefferson City Market Areas

The decrease in sand and gravel production in the Waverly and Jefferson City market areas would decrease tax revenues realized by local, state, and federal governments in the short term. No sand royalty payments are generated by production in the Waverly or Jefferson City market area.

St. Charles Market Area

An increase in sand and gravel production in the Waverly and St. Charles market areas would increase tax revenues realized by local, state, and federal governments. No sand royalty payments are generated by production in the St. Charles market area.

4.10.5.4 Economic Effects Related to River Bed Degradation

The general types of river bed degradation effects discussed in Section 4.10.3.4 apply to all market areas considered in this analysis. Because the volume of commercial dredging of sand and gravel would fall to approximately 2.2 million tons annually, down from approximately 6.9 million tons annually under existing conditions, potential economic impacts attributed to river bed degradation caused by dredging would be reduced considerably under Alternative A, which could result in a range of avoided costs such as infrastructure repair, maintenance, and replacement costs and potential flood damages associated with levee failures.

St. Joseph Market Area

Dredging in the St. Joseph market area is expected to be slightly higher under Alternative A relative to existing conditions; therefore, the potential exists for increased river bed degradation and related economic impacts under this alternative.

Kansas City, Waverly, Jefferson City, and St. Charles Market Areas

Dredging in the Kansas City, Waverly, Jefferson City and St. Charles market areas is expected to be substantially lower under Alternative A relative to existing conditions; therefore, the potential exists for reduced river bed degradation, which could result in a range of economic benefits (i.e., avoided costs).

4.10.5.5 Environmental Justice Effects

Section 4.10.3.5 presents a general overview of environmental justice and social and demographic characteristics of the primary market area. The short-term analysis of environmental justice effects for Alternative A is presented below by market area.

St. Joseph Market Area

In the St. Joseph market area, the minor increase in sand and gravel production under Alternative A would generate limited benefits to people working in the mining and transportation industries, including commercial dredgers. However, the minor increase in the cost of sand and gravel would result in reductions in household income levels. Because these effects are minor (loss of one total job) and would affect the population generally (i.e., are not expected to fall disproportionately on low-income populations) in the St. Joseph market area, no environmental justice impacts are anticipated.

Kansas City Market Area

Reductions in sand and gravel production and related cost increases in the Kansas City market area would result in adverse economic impacts under Alternative A. The direct impacts would be concentrated on concentrated on people working in the commercial dredging and transportation industries. To the extent that these industries are comprised of minority or low-income populations, environmental justice impacts could occur. At the regional level, reductions in employment and income throughout the Kansas City economy would adversely affect the general population, which is characterized by a relatively larger minority population compared to the state overall. It is unlikely, however, that these regional economic impacts would fall disproportionately on minority groups. Therefore, no adverse environmental justice impacts are anticipated. In addition, the reduced risk of levee failure in the Kansas City area would result in avoided flood damages that could affect minority and low-income populations; however, these risks have not been quantified.

Waverly Market Area

In the Waverly market area, commercial dredging is expected to decrease, which would result in economic impacts to commercial dredgers and their employees, while limited economic benefits would accrue to the transportation industry. To the extent that the mining industry is comprised of minority or low-income populations, environmental justice impacts could occur. At the same time, the cost of sand and gravel would substantially increase, which would result in reductions in household income and related decreases in income and employment throughout the region. Because the Waverly market

area is not characterized by large minority or low-income population groups, no adverse environmental justice impacts are anticipated.

Jefferson City Market Area

Reductions in sand and gravel production and related cost increases in the Jefferson City market area would result in adverse economic impacts under Alternative A, including reductions in income and employment levels. The direct impacts would be concentrated on people working in the mining and transportation industries. To the extent that these industries are comprised of minority or low-income populations, environmental justice impacts could occur. At a regional level, anticipated declines in household income and other economy-wide impacts would affect the general population, including low-income populations that are more prevalent in the Jefferson City market area relative to the state overall. These impacts are minor when compared to the size of the regional economy, however, and are not expected to fall disproportionately on low-income groups. No adverse environmental justice impacts are anticipated.

St. Charles Market Area

Under Alternative A, production by commercial dredgers would decrease substantially in the St. Charles market area, which would be fully offset by increases in sand and gravel production at alternate sources away from the river. To the extent that employees in the commercial dredging industry are comprised of significant minority or low-income populations, environmental justice impacts could occur. Economic benefits are also expected elsewhere in the mining industry and in the transportation industry. Anticipated increases in the cost of sand and gravel would result in economy-wide reductions in household income levels. These effects are minor, however, and would not fall disproportionately on the relatively large minority population in the St. Charles market area or on low-income groups. No adverse environmental justice impacts are anticipated.

4.10.6 Alternative B

Commercial sand and gravel dredging in the LOMR would be permitted up to a maximum of approximately 5.1 million tons annually under Alternative B. Because permitted volumes are less than recent demand levels (approximately 6.9 million tons per year), it is anticipated that alternate sources in the region would increase production to offset losses from the LOMR. The analysis of short-term economic effects has been quantified below. Long-term economic effects, which consider development of new mining operations in the region, are evaluated qualitatively.

The key findings of the economic analysis of Alternative B include the following:

- Commercial dredging of sand and gravel from the LOMR would meet most of the existing demand for sand and gravel from the LOMR, and alternate sources would be able to accommodate displaced supplies. There would be substantial shifts in production across market areas and individual sand plants.

- Based on production shifts across market areas, changes in the delivered costs of construction sand and gravel would vary by market area. Cost increases are expected in the Kansas City and Jefferson City market areas. Cost decreases are anticipated in the Waverly and St. Charles market areas. Costs in the St. Joseph market area would remain constant.

- Regional economic activity attributed to mining production decline in the primary market area, including losses of $9.5 million in economic output and approximately 63 total jobs. These impacts would be partially offset by regional economic benefits attributed to production increases occurring outside the primary market area in other parts of Missouri, including $2.8 million in annual output and 21 jobs. Shifts in production to other states, including Kansas and Illinois, represent economic leakages outside Missouri.

- Based on anticipated transportation patterns, total shipping requirements would decrease under Alternative B. The regional economic impacts in the truck shipping and related support industries in Missouri include a decrease of $1.7 million in annual production value and approximately seven jobs. These impacts would be incremental to regional impacts in the mining industry.

- Estimated changes in costs of construction sand and gravel would generate a net overall decrease in consumer income levels, which would reduce economic activity, including a loss of approximately $719,000 in output value and seven total jobs.

- Net regional economic activity at the state level would decline relative to existing conditions based on the simultaneous reductions in the mining and transportation sectors. In total, economic output is expected to decrease by $9.2 million annually, and employment would fall by 55 total jobs.

- Estimated sand royalty payments paid to the State of Kansas would be highest under Alternative B based primarily on shifts in production to the St. Joseph market area.

4.10.6.1 Industry and Market Effects

Under Alternative B, sand and gravel production from the LOMR is expected to reach maximum permitted levels (5.1 million tons annually), a 27-percent reduction compared to existing conditions (Table 4.10-1). Alternate sources in the region would be expected to increase production levels in some market areas, which would cause the delivered cost of sand and gravel to increase in areas where shipping distances are increased. Conversely, transportation requirements in other market areas would decrease in response to new sand plants being developed close to alternate sources. The short-term costs of sand and gravel under Alternative B are summarized in Table 4.10-2. Under this alternative, the average FOB price is estimated to be $4.95 per ton. When considering transportation costs, the effect on total costs varies across market areas. Based on quality differences between natural river sand from the LOMR and from some alternate sources, additional processing may be required in the production of concrete and asphalt, thereby further increasing costs to end-users in areas served by alternate sources. Anticipated increases in the short-term cost of sand and gravel in some market areas under Alternative B likely would result in an increase in construction costs in those areas.

In the long term, it is likely that new floodplain open-pit mining operations would be developed in proximity to existing demand centers and would restore equilibrium in the sand and gravel market, thereby reducing costs relative to short-term levels. However, floodplain open-pit mining is not likely as cost effective as river dredging, potentially resulting in long-term increases in sand and gravel costs relative to existing conditions (see Section 4.10.4.1 for more information on the issues and costs associated with floodplain open-pit mining).

St. Joseph Market Area

Under Alternative B, approximately 860,000 tons of sand and gravel would be produced annually from the St. Joseph market area. Production in the St. Joseph market area would exceed existing demand in the region (approximately 327,000 tons annually); therefore, production by alternate sources would not increase and excess supplies likely would be exported to other market areas. Overall, the short-term cost of sand and gravel in the St. Joseph market area is expected to remain stable at $7.39 per ton under Alternative B, with no cost-related effects in the construction industry.

Kansas City Market Area

In the Kansas City market area, sand and gravel production under Alternative B is expected to reach the maximum permitted volume, approximately 1.2 million tons per year, which would be supplemented

by an additional 237,000 tons produced by alternate sources in the region. Supply levels, however, would still not be able to meet the recent level of demand (nearly 2.7 million tons per year), and sand and gravel would need to be imported to the region, resulting in higher transportation costs. The delivered cost of sand and gravel in the Kansas City market area is expected to increase to $8.45 per ton under Alternative B in the short term, an increase of 5.9 percent relative to existing conditions. This would cause construction costs in the region to increase.

Waverly Market Area

Under Alternative B, approximately 1.1 million tons of sand and gravel would be produced from the Waverly market area, which is greater than existing demand (678,000 tons per year). Production by alternate sources would not increase in the market area as dredging would be sufficient to meet local demand. Based on increased supplies and a more cost-efficient pattern of distribution from sand plants to consumers, the cost of sand and gravel in the Waverly market area is expected to decrease to $8.39 per ton under Alternative B in the short term, down from $9.53 under existing conditions. This would lower costs in the construction industry.

Jefferson City Market Area

In the Jefferson City market area, approximately 980,000 tons of sand and gravel would be produced by commercial dredging operations on the LOMR, and an additional 27,000 tons would be produced by alternate sources in the area under Alternative B. Total production in the Jefferson City market area, however, would not meet existing demand (approximately 1.6 million tons annually), thereby requiring sand and gravel to be imported at higher costs. Under Alternative B, the cost of sand and gravel in the Jefferson City market area is expected to increase to $9.86 per ton in the short term, a 6.6 -percent increase relative to existing conditions. This would result in increased construction costs in the region.

St. Charles Market Area

Sand and gravel production from the St. Charles market area is expected to reach 840,000 tons annually under Alternative B, and an additional 959,000 tons would be produced by alternate sources in the region. Total supplies would be sufficient to meet existing demand (approximately 1.6 million tons per year). Based on the proximity of existing mining operations, including alternate sources, to demand centers in the St. Charles market area, the cost of sand and gravel is estimated to decrease slightly to $7.14 per ton under Alternative B in the short term, an approximately 2.7-percent decline relative to existing conditions. This would result in lower construction costs in the region.

4.10.6.2 Regional Economic Effects

Under Alternative B, sand and gravel production by commercial dredging operations would decline from 6.9 million to 5.1 million tons per year. This would result in direct economic impacts realized by dredge operators and their employees, including declines in revenues and profits, labor income, and jobs. Specifically, commercial dredging operations would realize annual losses of $8.9 million in economic output (or gross revenues), $4.2 million in labor income, and approximately 52 jobs in the long term. The direct economic impact to commercial dredging operations is an adverse economic impact under Alternative B. At the industry level, however, these impacts would be partially offset by economic benefits accruing to alternate mining operations and their employees in the short term and to new mining operations in the long term.

Table 4.10-7 presents the short-term regional economic effects in Missouri under Alternative B. The total annual value of output generated by sand and gravel production under Alternative B is $52.6 million, total labor income is $19.1 million, and a total of 329 jobs would be supported. Because much of the sand and gravel production would remain in the LOMR, only a small portion of these benefits would accrue to mining operations outside the primary market area. Overall, the statewide economic benefits anticipated under Alternative B are lower than existing conditions based on shifts in production to areas outside the state. In the long term, anticipated development of new mining operations in proximity to the LOMR would serve to retain these benefits within the primary market area.

In the short term, increased transportation requirements under Alternative B would generate benefits in the truck shipping industry; however, some of these benefits would be exported to adjacent states. In Missouri, the regional economic activity associated with truck shipping activity includes $22.7 million in total annual output, $8.3 million in total labor income, and 188 jobs, which are lower higher than existing conditions and concentrated within the primary market area. In the long term, the transportation benefits outside the primary market area would decline as new mines are developed near demand centers, resulting in decreased demand for truck shipping.

As indicated above, changes in the cost of sand and gravel would vary by market area. Overall, the net effect would be a decline in household income levels across the state, assuming that costs are passed through to the public. Reductions in household income would result in estimated annual losses of $719,000 in total output, $241,000 in total labor income, and approximately seven jobs throughout Missouri. In the long term, the cost of sand and gravel is expected to decline relative to short-term

levels with the development of new mining operations, thereby minimizing income-related impacts on consumers.

Table 4.10-7 Short-Term Regional Economic Effects under Alternative B [a,b, c]

	Output (Annual)		Labor Income (Annual)		Employment	
Market Area[d]	Direct	Total[e]	Direct	Total[e]	Direct	Total[e]
St. Joseph						
Sand and gravel production	$4,249,000	$6,048,000	$1,287,000	$1,820,000	25	39
Truck transportation	$2,363,000	$3,702,000	$825,000	$1,243,000	20	33
Household income (change)[f]	$0	$3,000	$0	$1,000	0	0
Kansas City						
Sand and gravel production	$8,203,000	$16,214,000	$3,408,000	$5,990,000	47	97
Truck transportation	$3,067,000	$5,719,000	$1,210,000	$2,207,000	21	44
Household income (change)[f]	$0	-$710,000	$0	-$234,000	0	-6
Waverly						
Sand and gravel production	$3,622,000	$4,861,000	$1,317,000	$1,674,000	21	32
Truck transportation	$952,000	$1,286,000	$326,000	$435,000	8	12
Household income (change)[f]	$0	$374,000	$0	$100,000	0	4
Jefferson City						
Sand and gravel production	$5,257,000	$9,429,000	$2,018,000	$3,346,000	31	63
Truck transportation	$2,200,000	$3,680,000	$786,000	$1,302,000	18	32
Household income (change)[f]	$0	-$736,000	$0	-$223,000	0	-7
St. Charles						
Sand and gravel production	$6,817,000	$12,380,000	$3,206,000	$5,091,000	33	72
Truck transportation	$2,992,000	$5,586,000	$1,164,000	$2,120,000	21	43
Household income (change)[f]	$0	$302,000	$0	$99,000	0	2
Outside Primary Market Area[g]						
Sand and gravel production	$1,678,000	$3,619,000	$583,000	$1,196,000	12	27
Truck transportation	$1,447,000	$2,709,000	$531,000	$980,000	11	25
Household income (change)[h]	$0	$48,000	$0	$17,000	0	0
Total (State of Missouri)						
Sand and gravel production	$29,826,000	$52,552,000	$11,819,000	$19,117,000	168	329
Truck transportation	$13,021,000	$22,682,000	$4,843,000	$8,287,000	101	188
Household income (change)	$0	-$719,000	$0	-$241,000	0	-7

Table 4.10-7 Short-Term Regional Economic Effects under Alternative B [a,b, c]

[a] Monetary values are reported in 2008 dollars and represent annualized effects.

[b] Regional economic effects are limited to changes in final demands in the State of Missouri; changes in economic activity in adjacent states are excluded from the results.

[c] Based on meeting 2004–2008 average annual demand for construction sand and gravel from the lower Missouri River (LOMR).

[d] Represents the market area served by sand and gravel production from the LOMR and captures the economic activity associated with sand and gravel distribution rather than location (segment) of production.

[e] Includes direct, indirect, and induced effects resulting from activity in the target market area and linkages to other market areas.

[f] Represents regional economic effects attributed to changes in household income resulting from changes in the cost of construction sand and gravel.

[g] The "primary market area" represents the total of the five individual market areas serving each segment.

[h] Household income effects were not considered for areas outside the primary market area because no changes in the cost of sand and gravel are anticipated; the results shown are based on linkages with the primary market area.

Source: ENTRIX 2010.

Similar to the Proposed Action, temporary construction benefits would be associated with development of new sand plants by the permit applicants. The short-term construction benefits would include increases in economic output, labor income, and employment. Although not quantified as part of this study, the magnitude of these indirect benefits would be driven by the extent of construction expenditures in the local area and availability of local construction workers to serve the project.

In addition, the region could realize temporary construction benefits from development of new off-river mining operations in the long term. Because it is not possible to predict the size, cost, or reliance on the local construction industry for new mining developments, these construction benefits have not been quantified.

St. Joseph Market Area

The short-term regional economic effects in the St. Joseph market area under Alternative B are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Increase in total output to $6.0 million annually (+$3.7 million),
  - Increase in total labor income to $1.8 million annually (+$1.1 million), and
  - Increase in total employment to 39 jobs (+24 jobs).
- Truck transportation activity
  - Increase in total output to $3.7 million annually (+$3.1 million),

  - Increase in total labor income to $1.2 million annually (+$1.0 million), and
  - Increase in total employment to 33 jobs (+27 jobs).
- Change in household income
  - Increase in total output by $3,000 annually,
  - Increase in total labor income by $1,000 annually, and
  - Increase in total employment by less than one job.

Kansas City Market Area

The short-term regional economic effects in the Kansas City market area under Alternative B are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Decrease in total output to $16.2 million annually (-$10.2 million),
  - Decrease in total labor income to $5.9 million annually (-$3.8 million), and
  - Decrease in total employment to 97 jobs (-61 jobs).
- Truck transportation activity
  - Decrease in total output to $5.7 million annually (-$5.5 million),
  - Decrease in total labor income to $2.2 million annually (-$2.1 million), and
  - Decrease in total employment to 44 jobs (-41 jobs).
- Change in household income
  - Decrease in total output by $710,000 annually,
  - Decrease in total labor income by $234,000 annually, and
  - Decrease in total employment by six jobs.

Development of a new sand plant at Waldron also would generate short-term construction benefits in the Kansas City market area.

Waverly Market Area

The short-term regional economic effects in the Waverly market area under Alternative B are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Increase in total output to $4.9 million annually (+$2.4 million),
  - Increase in total labor income to $1.7 million annually (+$825,000), and
  - Increase in total employment to 32 jobs (+16 jobs).
- Truck transportation activity
  - Increase in total output to $1.3 million annually (+$705,000),
  - Increase in total labor income to $435,000 annually (+$238,000), and
  - Increase in total employment to 12 jobs (+7 jobs).
- Change in household income
  - Increase in total output by $374,000 annually,
  - Increase in total labor income by $100,000 annually, and
  - Increase in total employment by four jobs.

Jefferson City Market Area

The short-term regional economic effects in the Jefferson City market area under Alternative B are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Decrease in total output to $9.4 million annually (-$4.0 million),
  - Decrease in total labor income to $3.3 million annually (-$1.4 million), and
  - Decrease in total employment to 63 jobs (-26 jobs).
- Truck transportation activity
  - Decrease in total output to $3.7 million annually (-$1.9 million),
  - Decrease in total labor income to $1.3 million annually (-$692,000), and
  - Decrease in total employment to 32 jobs (-17 jobs).

- Change in household income
  - Decrease in total output by $736,000 annually,
  - Decrease in total labor income by $223,000 annually, and
  - Decrease in total employment by seven jobs.

St. Charles Market Area

The short-term regional economic effects in the St. Charles market area under Alternative B are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Decrease in total output to $12.4 million annually (-$1.4 million),
  - Decrease in total labor income to $5.1 million annually (-$561,000), and
  - Decrease in total employment to 72 jobs (-15 jobs).
- Truck transportation activity
  - Decrease in total output to $5.6 million annually (-$403,000),
  - Decrease in total labor income to $2.1 million annually (-$154,000), and
  - Decrease in total employment to 43 jobs (-3 jobs).
- Change in household income
  - Increase in total output by $302,000 annually,
  - Increase in total labor income by $99,000 annually, and
  - Increase in total employment by two jobs.

Development of a new sand plant at Washington, Missouri also would generate short-term construction benefits in the St. Charles market area.

4.10.6.3 Tax Revenue Effects

The types of tax revenues generated by mining activity under Alternative B would be similar to those described for the Proposed Action in Section 4.10.3.3. However, some types of tax revenues realized by local governments in Missouri, including state franchise and income taxes, would be reduced in response to production shifts to adjacent states in the short term. In addition, county-level property taxes may decline if existing dredge operators sell their land holdings or idle existing sand plants.

Value of Waterway fuel taxes from dredging in the LOMR also would decline in proportion to reductions in dredging under Alternative B. At the federal level, income and payroll taxes should not be affected, as losses from Missouri likely would be offset in other states. In the long term, development of new mining operations in Missouri would generate tax revenues.

Sand royalties paid to the State of Kansas would be the highest under Alternative B in the short term (Table 4.10-3). Increased sand royalties are expected in response to increased dredging in the St. Joseph market area and additional production by alternate sources in Kansas outside the primary market area. Under Alternative B, total royalties paid to the State of Kansas resulting from changes in dredging activity is an estimated $224,000 per year in the short term, up from $113,000 per year under existing conditions. This is an economic benefit of Alternative B. In the long term, development of new mining operations in Missouri would reduce sand royalties paid to the State of Kansas relative to short-term levels.

St. Joseph Market Area

An increase in sand and gravel production in the St. Joseph market area would increase tax revenues realized by local, state, and federal governments. In addition, sand royalties generated from production in this region would increase substantially, from approximately $49,000 to $129,000 per year in the short term.

Kansas City Market Area

The decrease in sand and gravel production in the Kansas City market area would decrease tax revenues realized by local, state, and federal governments. Some of the gravel production in the Kansas City market area would be subject to royalties. Sand royalties generated by production in the Kansas City market area are expected to decline to approximately $52,000 annually in the short term, down from $64,000 under existing conditions. The loss in sand royalties would be offset by increased sand and gravel production outside the primary market area in other parts of Kansas.

Waverly and St. Charles Market Areas

An increase in sand and gravel production in the Waverly and St. Charles market areas would increase tax revenues realized by local, state, and federal governments. No sand royalty payments are generated by production in the Waverly or St. Charles market areas.

Jefferson City Market Area

The decrease in sand and gravel production in the Jefferson City market area would decrease tax revenues realized by local, state, and federal governments. No sand royalty payments are generated by production in the Jefferson City market area.

4.10.6.4 Economic Effects Related to River Bed Degradation

The general types of river bed degradation effects discussed in Section 4.10.3.4 apply to all market areas in considered in this analysis. Because the volume of commercial sand and gravel dredging would fall to approximately 5.1 million tons annually, down from 6.9 million tons under existing conditions, potential economic impacts attributed to dredging-related river bed degradation would be reduced under Alternative B. These avoided costs are considered a beneficial impact of Alternative B, including avoided expenditures on infrastructure repair, maintenance, and replacement and potential flood damages.

St. Joseph and Waverly Market Areas

Dredging in the St. Joseph and Waverly market areas is expected to be substantially higher under Alternative B relative to existing conditions; therefore, the potential exists for increased river bed degradation and related economic impacts.

Kansas City, Jefferson City, and St. Charles Market Areas

Dredging in the Kansas City, Jefferson City, and St. Charles market areas is expected to be substantially lower under Alternative B relative to existing conditions; therefore, river bed degradation could be reduced, which could generate economic benefits (i.e., avoided costs).

4.10.6.5 Environmental Justice Effects

Section 4.10.3.5 presents a general overview of environmental justice and social and demographic characteristics of the primary market area. The analysis of environmental justice effects by market area is presented below.

St. Joseph Market Area

Under Alternative B, sand and gravel production in the St. Joseph market area would substantially increase, generating a range of economic benefits to commercial dredge operators and their employees, as well as benefits to workers in the transportation industry. In addition, the cost of sand

and gravel in the region would not change, with no effect on regional household income levels. No adverse economic effects are expected in the St. Joseph market area; therefore, there would be no adverse environmental justice impacts.

Kansas City Market Area

Reductions in sand and gravel production and related cost increases in the Kansas City market area would result in adverse economic impacts under Alternative B. The direct impacts would be concentrated on the commercial dredging and transportation industries. To the extent that these industries are characterized by minority or low-income populations, environmental justice impacts could occur. At the regional level, reductions in employment and income throughout the Kansas City economy would adversely affect the general population, which has a larger minority population than the state overall. However, it is unlikely that these regional economic impacts would fall disproportionately on minority groups. Therefore, no adverse environmental justice impacts are anticipated. In addition, the reduced probability of levee failure in the Kansas City area from reductions in dredging would avoid potential impacts on low-income and minority populations in the region; however, these risks have not been quantified.

Waverly Market Area

In the Waverly market area, commercial dredging is expected to increase substantially under Alternative B, which would generate economic benefits for commercial dredge operators and their employees and workers in the transportation industry. Further, the slight decrease in the cost of sand and gravel in the region would result in higher household income levels and related increases in income and employment throughout the region. No adverse economic effects are expected in the Waverly market area; therefore, there would be no adverse environmental justice impacts.

Jefferson City Market Area

Reductions in sand and gravel production and related cost increases in the Jefferson City market area would result in adverse economic impacts under Alternative B, including reductions in income and employment levels. The direct impacts would be concentrated on the commercial dredging and transportation industries. To the extent that these industries are characterized by minority or low-income populations, environmental justice impacts could occur. At a regional level, anticipated declines in household income and other economy-wide impacts would affect the general population, including low-income populations in the Jefferson City market area. However, these impacts are minor when

compared to the size of the economy in the region and are not expected to fall disproportionately on low-income groups. No adverse environmental justice impacts are anticipated.

St. Charles Market Area

Under Alternative B, production by commercial dredgers would decline substantially in the St. Charles market area and would not be fully offset by increases in sand and gravel production outside the river. The direct impacts on dredgers and their employees and transportation workers could represent an environmental justice issue to the extent that these groups are characterized by large minority or low-income populations. Conversely, a minor decrease in the cost of sand and gravel would result in economy-wide increases in household income levels. The net economic effect in the St. Charles market area is negligible in the context of the size of the regional economy. Further, any adverse economic impacts are not expected to fall disproportionately on the minority or low-income populations in the St. Charles market area. No adverse environmental justice impacts are anticipated.

4.10.7 Alternative C

Alternative C would allow commercial sand and gravel dredging in the LOMR up to recent levels of production, approximately 6.9 million tons per year. In addition, production levels across river segments would remain stable. Accordingly, sand and gravel production levels from alternate sources in the region would not change, and no long-term impacts are likely to be associated with development of new mining operations in the regions.

The key findings of the economic analysis of Alternative C include the following:

- Commercial dredging of sand and gravel from the LOMR would remain constant at levels consistent with existing demand (6.9 millions tons per year). There would be negligible shifts in production across market areas; however, shifts in production across individual sand plants could occur based on the presence of new dredging operations.
- For analytical purposes, dredging allocations to individual operators under Alternative C does not offer the flexibility to meet recent demands as is the case under the Proposed Action. As a result, allocations under this alternative would not result in a cost-efficient transportation pattern in some market areas. Accordingly, the delivered cost of construction sand and gravel would increase slightly in some market areas (i.e., Jefferson City and St. Charles). Other areas (i.e., Kansas City and Waverly) would experience a minor decrease in costs. No cost effects are expected in the St. Joseph market area.

- Regional economic activity attributed to mining production would be relatively unchanged within the primary market area and the state of Missouri.
- Shipping requirements would increase slightly in response to a less optimal distribution pattern between suppliers and consumers, resulting in regional economic benefits in the truck shipping and related support industries. These benefits include an increase of $2.9 million in annual production value and approximately 22 jobs in Missouri.
- Estimated changes in construction sand and gravel costs would result in a net decline in consumer income levels, which would decrease economic activity and partially offset potential benefits associated with mining production and truck shipping activity.
- Total regional economic activity at the state level would be slightly higher relative to existing conditions accounting for regional benefits in the mining and truck shipping industries, which outweigh declines in consumer income levels. Overall, there would be a net increase of $1.4 million in annual output and 11 additional jobs.
- Because production would remain relatively stable in the Kansas City and St. Joseph market areas, estimated sand royalty payments paid to the State of Kansas would remain stable.

4.10.7.1 Industry and Market Effects

Under Alternative C, total sand and gravel production from the LOMR would be the same as existing conditions, approximately 6.9 million tons per year (Table 4.10-1). However, the number of commercial dredge operators would increase based on new permit applicants, and new sand plants would be developed to serve these new operations. In addition, although estimated production levels are constant across river segments, assumed dredging levels by individual operators would differ relative to existing conditions because estimates of dredging production were developed based on requested permit volumes. Therefore, the transportation requirement for delivering sand and gravel from supply sources to demand centers would be different, which would affect the delivered costs of sand and gravel in certain market areas. The short-term costs of sand and gravel under Alternative C are summarized in Table 4.10-2, which includes an average FOB price of $4.89 per ton. Because all sand and gravel produced under this alternative would come from the LOMR, the quality of product used by customers would not change, and no incremental processing costs would be incurred. Anticipated increases (decreases) in the cost of sand and gravel across market areas under Alternative C likely would result in an increase (decrease) in construction costs in those areas. Finally, no new floodplain open-pit mining operations would be developed in the region in response to reduced supplies from the

LOMR. As a result, the short-term effects on the cost of construction sand and gravel described below are representative of long-term conditions.

St. Joseph Market Area

Approximately 327,000 tons of sand and gravel produced from the St. Joseph market area under Alternative C would be sufficient to meet recent demand. Consequently, the delivered cost of sand and gravel ($7.39 per ton) would not change in the short term, with no cost-related effects in the construction industry.

Kansas City Market Area

Under Alternative C, the estimated 2.7 million tons of sand and gravel that would be produced from the Kansas City market area would be sufficient to meet recent demand. Based on a more cost-efficient distribution pattern, in part due to the proposed sand plant in the Kansas City market area, transportation costs would decline, and the delivered cost of sand and gravel would fall slightly to $7.97 per ton (from $7.98 per ton) in the short term. Impacts on construction costs in the region would be negligible.

Waverly Market Area

Approximately 680,000 tons of sand and gravel would be produced annually from the Waverly market area under Alternative C, which would be sufficient to meet recent demand. The cost of sand and gravel in the region would decline to $8.97 per ton in the short term, a 5.9-percent reduction. There would be minor cost-related benefits in the construction industry.

Jefferson City Market Area

In the Jefferson City market area, an estimated 1.6 million tons of sand and gravel would be produced under Alternative C, which would be sufficient to meet recent demand. Based on the reallocation of permitted production levels across commercial dredge operators, transportation costs would be higher and the delivered cost of sand and gravel would increase in the short term from $9.25 per ton under existing conditions to $9.35 per ton, an approximately 1.1-percent increase. This would result in minor cost-related benefits in the construction industry.

St. Charles Market Area

Approximately 1.6 million tons of sand and gravel would be produced from the St. Charles market area under Alternative C, which would be sufficient to meet recent demand. Based on development of a

new sand plant and reallocation of permitted volumes across dredge operators, transportation costs are expected to increase and drive the delivered cost of sand and gravel in the short term from $7.34 per ton under existing conditions up to $8.58 per ton, an approximately 17-percent increase. This would result in increased costs in the construction industry.

4.10.7.2 Regional Economic Effects

Under Alternative C, sand and gravel production by commercial dredging operations would stay constant at 6.9 million tons per year. Therefore, any changes in net economic activity realized by commercial dredge operators, as a group, would be negligible. However, individual operators could be affected based on potential changes in permitted levels of production. It is not possible to evaluate impacts at the individual dredger level.

At the regional level, there would be only minor changes in economic activity supported by commercial dredging operations in the LOMR under Alternative C; these short-term effects are summarized in Table 4.10-8. Because no new mining operations are anticipated to be developed (as no supplies would be displaced from the LOMR), the short-term effects on the regional economy are representative of long-term conditions.

The total annual value of output generated by commercial dredging is $59.7 million, total labor income is $22.2 million, and a total of 374 jobs would be supported within Missouri. Only a small portion of these benefits would accrue to locations outside the primary market areas. Overall, the statewide economic benefits of sand and gravel production anticipated under Alternative C are slightly higher than, but comparable to, benefits realized under existing conditions.

Table 4.10-8 Short-Term Regional Economic Effects under Alternative C [a, b, c]

	Output (Annual)		Labor Income (Annual)		Employment	
Market Area[d]	Direct	Total[e]	Direct	Total[e]	Direct	Total[e]
St. Joseph						
Sand and gravel production	$1,615,000	$2,326,000	$489,000	$699,000	9	15
Truck transportation	$382,000	$605,000	$133,000	$203,000	3	5
Household income (change)[f]	$0	$2,000	$0	$1,000	0	0
Kansas City						
Sand and gravel production	$13,763,000	$25,916,000	$5,718,000	$9,630,000	80	155
Truck transportation	$6,309,000	$10,653,000	$2,490,000	$4,107,000	44	81
Household income (change)[f]	$0	$56,000	$0	$19,000	0	0

Table 4.10-8 Short-Term Regional Economic Effects under Alternative C [a, b, c]

Waverly						
Sand and gravel production	$2,161,000	$2,913,000	$785,000	$1,002,000	13	19
Truck transportation	$475,000	$646,000	$163,000	$218,000	4	6
Household income (change)[f]	$0	$185,000	$0	$50,000	0	2
Jefferson City						
Sand and gravel production	$8,244,000	$13,551,000	$3,165,000	$4,813,000	48	89
Truck transportation	$3,657,000	$5,783,000	$1,306,000	$2,049,000	30	51
Household income (change)[f]	$0	-$113,000	$0	-$34,000	0	-1
St. Charles						
Sand and gravel production	$7,716,000	$14,114,000	$3,629,000	$5,800,000	45	89
Truck transportation	$4,917,000	$9,170,000	$1,913,000	$3,481,000	35	70
Household income (change)[f]	$0	-$2,063,000	$0	-$679,000	0	-16
Outside Primary Market Area[g]						
Sand and gravel production	$0	$896,000	$0	$285,000	0	7
Truck transportation	$0	$388,000	$0	$139,000	0	4
Household income (change)[h]	$0	$27,000	$0	$9,000	0	0
Total (State of Missouri)						
Sand and gravel production	$33,499,000	$59,716,000	$13,787,000	$22,230,000	195	374
Truck transportation	$15,739,000	$27,246,000	$6,006,000	$10,198,000	116	218
Household income (change)	$0	-$1,906,000	$0	-$634,000	0	-15

[a] Monetary values are reported in 2008 dollars and represent annualized effects.

[b] Regional economic effects are limited to changes in final demands in the State of Missouri; changes in economic activity in adjacent states are excluded from the results.

[c] Based on meeting 2004–2008 average annual demand for construction sand and gravel from the lower Missouri River (LOMR).

[d] Represents the market area served by sand and gravel production from the LOMR and captures the economic activity associated with sand and gravel distribution rather than location (segment) of production.

[e] Includes direct, indirect, and induced effects resulting from activity in the target market area and linkages to other market areas.

[f] Represents regional economic effects attributed to changes in household income resulting from changes in the cost of construction sand and gravel.

[g] The "primary market area" represents the total of the five individual market areas serving each segment.

[h] Household income effects were not considered for areas outside the primary market area because no changes in the cost of sand and gravel are anticipated; the results shown are based on linkages with the primary market area.

Source: ENTRIX 2010.

Increases in transportation requirements under Alternative C would generate limited benefits in the truck shipping industry. Regional economic activity in Missouri that is supported by truck shipping activity includes $27.2 million in total annual output, $10.2 million in total labor income, and 218 jobs. These benefits are higher than existing conditions and would be concentrated in the primary market area.

As indicated above, changes in the cost of sand and gravel would vary by market area. Overall, the net effect is a decline in household income levels across the state, assuming that increased costs are passed through to the public. Reductions in household income would result in estimated annual losses of $1.9 million in total output, $634,000 in total labor income, and approximately 15 jobs throughout Missouri.

The short-term construction benefits associated with development of new sand plants along the LOMR would include increases in economic output, labor income, and employment. Although not quantified as part of this study, the magnitude of these indirect benefits would be driven by the extent of construction expenditures in the local area and the availability of local construction workers to serve the project.

St. Joseph Market Area

The short-term regional economic effects in the St. Joseph market area under Alternative C are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Increase in total output to $2.3 million annually (+$10,000),
  - Increase in total labor income to $699,000 annually (+$3,000), and
  - Increase in total employment to 15 jobs (increase of less than 1 job).
- Truck transportation activity
  - Increase in total output to $605,000 annually (+$1,000),
  - Increase in total labor income to $203,000 annually (increase of less than $1,000), and
  - Increase in total employment to five jobs (increase of less than 1 job).
- Change in household income
  - Increase in total output by $2,000 annually,
  - Increase in total labor income by $1,000 annually, and
  - Increase in total employment by less than one job.

Kansas City Market Area

The short-term regional economic effects in the Kansas City market area under Alternative C are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Decrease in total output to $25.9 million annually (-$515,000),
  - Decrease in total labor income to $9.6 million annually (-$195,000), and
  - Decrease in total employment to 155 jobs (-3 jobs).
- Truck transportation activity
  - Decrease in total output to $10.7 million annually (-$569,000),
  - Decrease in total labor income to $4.1 million annually (-$219,000), and
  - Decrease in total employment to 81 jobs (-4 jobs).
- Change in household income
  - Increase in total output by $56,000 annually,
  - Increase in total labor income by $19,000 annually, and
  - Increase in total employment by less than 1 job.

Development of a new sand plant at Waldron also would generate short-term construction benefits in the Kansas City market area.

Waverly Market Area

The short-term regional economic effects in the Waverly market area under Alternative C are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Increase in total output to $2.9 million annually (+$445,000),
  - Increase in total labor income to $1.0 million annually (+$154,000), and
  - Increase in total employment to 19 jobs (+3 jobs).
- Truck transportation activity
  - Increase in total output to $646,000 annually (+$65,000),

  - Increase in total labor income to $218,000 annually (+$22,000), and
  - Increase in total employment to six jobs (+1 job).
- Change in household income
  - Increase in total output by less than $185,000 annually,
  - Increase in total labor income by less than $50,000 annually, and
  - Increase in total employment by two jobs.

Jefferson City Market Area

The short-term regional economic effects in the Jefferson City market area under Alternative C are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Increase in total output to $13.6 million annually (+$70,000),
  - Increase in total labor income to $4.8 million annually (+ $25,000), and
  - Increase in total employment to 89 jobs (increase of less than 1 job).
- Truck transportation activity
  - Increase in total output to $5.8 million annually (+$156,000),
  - Increase in total labor income to $2.0 million annually (+$55,000), and
  - Increase in total employment to 51 jobs (+1 job).
- Change in household income
  - Decrease in total output by $113,000 annually,
  - Decrease in total labor income by $34,000 annually, and
  - Decrease in total employment by one job.

St. Charles Market Area

The short-term regional economic effects in the St. Charles market area under Alternative C are as follows (values in parentheses represent changes relative to existing conditions):

- Construction sand and gravel production
  - Increase in total output to $14.1 million annually (+$360,000),

  - Increase in total labor income to $5.8 million annually (+$148,000), and
  - Increase in total employment to 89 jobs (+2 jobs).
- Truck transportation activity
  - Increase in total output to $9.2 million annually (+$3.2 million),
  - Increase in total labor income to $3.5 million annually (+$1.2 million), and
  - Increase in total employment to 70 jobs (+24 jobs).
- Change in household income
  - Decrease in total output by $2.1 million annually,
  - Decrease in total labor income by $679,000 annually, and
  - Decrease in total employment by 16 jobs.

Development of a new sand plant at Washington, Missouri also would generate short-term construction benefits in the St. Charles market area.

4.10.7.3 Tax Revenue Effects

The types and magnitude of tax revenues generated by commercial sand and gravel dredging under Alternative C would be similar to those described for the Proposed Action. Similarly, sand royalties paid to the State of Kansas would remain unchanged under Alternative C at $113,000 per year in the short term (Table 4.10-3). Because no new mining operations are anticipated to be developed (as supplies from the LOMR would not be displaced), the short-term effects on the tax revenues are representative of long-term conditions.

St. Joseph and Kansas City Market Areas

Sand and gravel production in the St. Joseph and Kansas City market areas would not change; therefore, tax revenues realized by local, state, and federal governments would not change. In addition, sand royalties generated from production in the St. Joseph and Kansas City market areas would stay constant at approximately $49,000 and $64,000 per year, respectively.

Waverly, Jefferson City, and St. Charles Market Areas

Sand and gravel production in the Waverly, Jefferson City, and St. Charles market areas would not change; therefore, tax revenues realized by local, state, and federal governments would not change. No sand royalty payments are generated by production in these market areas.

4.10.7.4 Economic Effects Related to River Bed Degradation

Under Alternative C, the volume of commercial sand and gravel dredging would be unchanged relative to existing conditions, approximately 6.9 million tons annually. Therefore, Alternative C would result in a continuation of degradation-related economic impacts, as described in Section 3.12.7.8.

All Market Areas

The general types of river bed degradation effects discussed in Section 4.10.3.4 apply to all market areas. The volumes of commercial sand and gravel dredged in the St. Joseph, Kansas City, Waverly, Jefferson City, and St. Charles market areas would not change under Alternative C. Therefore, existing economic effects related to river bed degradation would continue over the long term.

4.10.7.5 Environmental Justice Effects

Section 4.10.3.5 presents a general overview of environmental justice and social and demographic characteristics of the primary market area. The analysis of environmental justice effects by market area is presented below.

St. Joseph, Kansas City, Waverly, and Jefferson City Market Areas

There would be negligible changes in regional economic activity in the St. Joseph, Kansas City, Waverly, and Jefferson City market areas under Alternative C. Therefore, no environmental justice impacts are anticipated. Continued river bed degradation in the LOMR has the potential to contribute to levee failure—particularly in the Kansas City area—which could adversely affect low-income and minority populations; however, these risks have not been quantified.

St. Charles Market Area

Under Alternative C, production levels would remain constant in the St. Charles market area, but the cost of sand and gravel would increase due to increased transportation requirements. This would result in benefits to the transportation industry but decreased household income levels in the region. The net economic effect attributed to income changes is minor in the context of the size of the regional economy. Further, any adverse economic impacts are not expected to fall disproportionately on the minority or low-income populations in the St. Charles market area. No adverse environmental justice impacts are anticipated.

4.10.8 Summary of Impacts

Overall, the sand and gravel resources in the region appear to be sufficient as a substitute for displaced supplies from the LOMR in the short term, including resources that would meet material specification requirements for road construction maintained by the MoDOT and KDOT. However, the proximity of these alternate sources to demand centers varies substantially across market areas and directly affects the short-term cost of sand and gravel to consumers based on changes in transportation costs. Generally, for alternatives that decrease dredging in the LOMR, the delivered costs of construction sand and gravel would increase in response to higher transportation costs. Conversely, increased dredging in certain market areas would increase available supplies and provide more flexibility in meeting regional demands, thereby reducing costs. In the long term, development of new mining operations in response to displaced supplies from the LOMR would minimize potential increases in the cost of construction sand and gravel in the region.

From a regional perspective, increases in sand and gravel production levels, whether from dredging in the LOMR or from alternate sources, would benefit local economic conditions, including increased output, income, and employment. Conversely, decreases in sand and gravel production would adversely affect the local economy. Regional economic effects associated with changes in sand and gravel production need to be considered in conjunction with the benefits and impacts associated with changes in transportation activity and household income levels. A summary of short-term regional economic effects for the Proposed Action and alternatives is presented in Table 4.10-9. In the long term, regional economic impacts would depend the location, size, and production levels of new mining operations developed in the region.

Tax revenue impacts, specifically impacts on sand royalties, are location specific; increases in dredging from the LOMR and other production in Kansas would result in increased royalties.

Potential economic impacts associated with river bed degradation are difficult to quantify but would be proportional to the amount of dredging allowed under the alternatives. Continued dredging in the LOMR could result in ongoing expenditures for infrastructure repair, maintenance, and replacement. In addition, the potential for levee failure could jeopardize billions of dollars in investment protected by regional levee systems.

Finally, environmental justice impacts are not expected under the Proposed Action or any alternative based on racial and socioeconomic characteristics of the population in the study area. The potential for levee failure with continued dredging from the LOMR could result in levee failure, thereby affecting low-

income and minority populations residing in the floodplain; however, these risks have not been quantified.

No mitigation measures are proposed for socioeconomic impacts. Table 4.10-10 presents a summary comparison of the potential short-term economic impacts and benefits for the Proposed Action and alternatives.

4.10.9 References

ENTRIX. 2010. IMPLAN (IMpact Analysis for PLANning) software modeling results. Modeling completed June 10, 2010.

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Table 4.10-9 Short-Term Regional Economic Effects Proposed Action and Alternatives ($ millions) [a, b, c]

	Existing Conditions[e]			Proposed Action[f]			No Action Alternative[f]			Alternative A[f]			Alternative B[f]			Alternative C[f]		
Market Area[d]	Output (Annual)	Labor Income (Annual)	Jobs	Change in Output (Annual)	Change in Labor Income (Annual)	Change in Jobs	Change in Output (Annual)	Change in Labor Income (Annual)	Change in Jobs	Change in Output (Annual)	Change in Labor Income (Annual)	Change in Jobs	Change in Output (Annual)	Change in Labor Income (Annual)	Change in Jobs	Change in Output (Annual)	Change in Labor Income (Annual)	Change in Jobs
St. Joseph																		
Sand and gravel production	$2.316	$0.696	15	$0.044	$0.013	0	-$2.219	-$0.667	-14	$0.245	$0.074	2	$3.732	$1.123	24	$0.010	$0.003	0
Truck transportation	$0.604	$0.203	5	$0.003	$0.001	0	-$0.561	-$0.189	-5	$0.146	$0.049	1	$3.098	$1.040	27	$0.001	$0.000	0
Household income (change)	$0.000	$0.000	0	$0.006	$0.001	0	-$5.925	-$1.814	-58	-$0.135	-$0.039	-1	$0.003	$0.001	0	$0.002	$0.001	0
Total – St. Joseph Market Area	$2.920	$0.899	20	$0.053	$0.016	0	-$8.705	-$2.670	-77	$0.255	$0.084	2	$6.832	$2.164	51	$0.013	$0.004	0
Kansas City																		
Sand and gravel production	$26.431	$9.825	158	-$2.241	-$0.849	-13	-$25.503	-$9.486	-153	-$18.799	-$7.007	-112	-$10.217	-$3.835	-61	-$0.515	-$0.195	-3
Truck transportation	$11.222	$4.327	85	-$2.796	-$1.077	-21	-$9.990	-$3.853	-75	-$8.540	-$3.292	-64	-$5.503	-$2.119	-41	-$0.569	-$0.219	-4
Household income (change)	$0.000	$0.000	0	$0.604	$0.203	5	-$42.517	-$14.143	-347	-$15.566	-$5.180	-127	-$0.710	-$0.234	-6	$0.056	$0.019	0
Total – Kansas City Market Area	$37.653	$14.152	243	-$4.432	-$1.724	-30	-$78.010	-$27.482	-574	-$42.905	-$15.480	-304	-$16.430	-$6.189	-108	-$1.027	-$0.395	-7
Waverly																		
Sand and gravel production	$2.467	$0.849	16	$1.937	$0.668	13	-$2.455	-$0.845	-16	-$0.330	-$0.113	-2	$2.394	$0.825	16	$0.446	$0.154	3
Truck transportation	$0.581	$0.196	5	$0.345	$0.117	3	-$0.549	-$0.186	-5	$0.234	$0.079	2	$0.705	$0.238	6	$0.065	$0.022	1
Household income (change)	$0.000	$0.000	0	$0.597	$0.160	6	-$11.034	-$2.961	-110	-$4.909	-$1.317	-49	$0.374	$0.100	4	$0.185	$0.050	2
Total – Waverly Market Area	$3.048	$1.045	21	$2.879	$0.945	22	-$14.038	-$3.992	-131	-$5.005	-$1.351	-49	$3.473	$1.164	26	$0.695	$0.225	5
Jefferson City																		
Sand and gravel production	$13.481	$4.788	88	$0.301	$0.106	2	-$13.129	-$4.665	-86	-$9.154	-$3.253	-60	-$4.052	-$1.442	-26	$0.070	$0.025	1
Truck transportation	$5.628	$1.994	50	-$0.769	-$0.273	-7	-$5.101	-$1.814	-45	-$3.699	-$1.314	-33	-$1.947	-$0.692	-17	$0.155	$0.055	1
Household income (change)	$0.000	$0.000	0	$0.786	$0.241	8	-$25.549	-$7.821	-246	-$10.106	-$3.094	-97	-$0.736	-$0.223	-7	-$0.113	-$0.034	-1
Total – Jefferson City Market Area	$19.109	$6.782	138	$0.318	$0.074	3	-$43.779	-$14.300	-377	-$22.960	-$7.662	-190	-$6.736	-$2.357	-50	$0.113	$0.046	1
St. Charles																		
Sand and gravel production	$13.754	$5.652	87	-$0.162	-$0.066	-1	$2.709	$1.128	-4	$3.038	$1.261	2	-$1.374	-$0.561	-15	$0.360	$0.148	2
Truck transportation	$5.988	$2.274	46	-$0.706	-$0.268	-5	$34.640	$13.149	266	$17.080	$6.483	131	-$0.403	-$0.154	-3	$3.182	$1.207	24
Household income (change)	$0.000	$0.000	0	$0.414	$0.137	3	-$3.018	-$1.012	-23	-$0.850	-$0.287	-6	$0.302	$0.099	2	-$2.063	-$0.679	-16
Total – St. Charles Market Area	$19.742	$7.926	133	-$0.454	-$0.198	-3	$34.330	$13.266	239	$19.269	$7.457	126	-$1.474	-$0.616	-16	$1.479	$0.677	10
Primary Market Area (LOMR)[g]																		
Sand and gravel production	$58.449	$21.811	364	-$0.121	-$0.129	1	-$40.598	-$14.535	-273	-$25.000	-$9.039	-171	-$9.517	-$3.890	-63	$0.371	$0.134	3
Truck transportation	$24.024	$8.994	192	-$3.923	-$1.500	-30	$18.439	$7.107	135	$5.220	$2.004	37	-$4.051	-$1.687	-28	$2.834	$1.065	22
Household income (change)	$0.000	$0.000	0	$2.407	$0.742	22	-$88.042	-$27.751	-783	-$31.566	-$9.918	-281	-$0.767	-$0.258	-7	-$1.932	-$0.643	-15
Total – Primary Market Area	$82.473	$30.805	556	-$1.636	-$0.887	-8	-$110.201	-$35.178	-921	-$51.346	-$16.952	-414	-$14.335	-$5.834	-98	$1.273	$0.557	10

Table 4.10-9 Short-Term Regional Economic Effects Proposed Action and Alternatives ($ millions) [a, b, c]

	Existing Conditions[e]			Proposed Action[f]			No Action Alternative[f]			Alternative A[f]			Alternative B[f]			Alternative C[f]		
Market Area[d]	Output (Annual)	Labor Income (Annual)	Jobs	Change in Output (Annual)	Change in Labor Income (Annual)	Change in Jobs	Change in Output (Annual)	Change in Labor Income (Annual)	Change in Jobs	Change in Output (Annual)	Change in Labor Income (Annual)	Change in Jobs	Change in Output (Annual)	Change in Labor Income (Annual)	Change in Jobs	Change in Output (Annual)	Change in Labor Income (Annual)	Change in Jobs
Outside Primary Market Area																		
Sand and gravel production	$0.831	$0.263	7	$0.277	$0.097	2	$23.813	$7.911	175	$13.676	$4.547	101	$2.788	$0.933	21	$0.065	$0.023	1
Truck transportation	$0.370	$0.132	4	$0.014	$0.007	0	$131.911	$47.620	1,170	$49.290	$17.796	437	$2.339	$0.848	21	$0.018	$0.007	0
Household income	$0.000	$0.000	0	$0.136	$0.043	1	-$3.271	-$1.009	-30	-$1.278	-$0.396	-12	$0.048	$0.017	0	$0.027	$0.009	0
Total – Outside Primary Market Area	$1.202	$0.395	10	$0.427	$0.147	4	$152.453	$54.521	1,315	$61.688	$21.947	526	$5.175	$1.797	42	$0.109	$0.038	1
Total (State of Missouri)																		
Sand and gravel production	$59.280	$22.073	371	$0.156	-$0.032	3	-$16.785	-$6.624	-97	-$11.324	-$4.492	-70	-$6.729	-$2.957	-42	$0.436	$0.157	3
Truck transportation	$24.394	$9.126	195	-$3.908	-$1.493	-30	$150.350	$54.727	1,305	$54.510	$19.801	475	-$1.712	-$0.839	-7	$2.852	$1.072	22
Household income (change)	$0.000	$0.000	0	$2.543	$0.785	23	-$91.313	-$28.760	-813	-$32.844	-$10.313	-292	-$0.719	-$0.241	-7	-$1.906	-$0.634	-15
Total – State of Missouri	$83.675	$31.200	566	-$1.209	-$0.740	-4	$42.252	$19,343	395	$10.342	$4.995	112	-$9.160	-$4.037	-55	$1.382	$0.595	11

[a] Monetary values are reported in 2008 dollars.

[b] Values in the table represent total impacts, which include direct, indirect, and induced effects.

[c] Based on meeting 2004–2008 average annual demand for construction sand and gravel from the lower Missouri River (LOMR).

[d] Represents the market area served by sand and gravel production from the LOMR and captures the economic activity associated with sand and gravel distribution rather than location (segment) of production.

[e] Values for existing conditions are reported in absolute terms.

[f] Values for the Proposed Action and alternatives represent changes relative to existing conditions.

[g] The "primary market area" represents the total of the five individual market areas.

Source: ENTRIX 2010.

Table 4.10-10 Summary of Potential Short-Term Economic Impacts

Category of Impact	Proposed Action	No Action Alternative	Alternative A	Alternative B	Alternative C
St. Joseph Market Area					
Regional sand and gravel production	• No change in dredging from LOMR (327,000 MM tons annually) • No change in production from alternate sources	• Decrease in dredging from LOMR (0 tons annually) • Increase in production from alternate sources (14,000 tons annually)	• Increase in dredging from LOMR (350,000 tons annually) • Increase in production from alternate sources (14,000 tons annually)	• Increase in dredging from LOMR (860,000 annually) • No change in production from alternate sources	• No change in dredging from LOMR (327,000 tons annually) • No change in production from alternate sources
Cost of sand and gravel	• No change in total cost ($7.39/ton)	• Increase in total cost ($34.77/ton)	• Increase in total cost ($7.80/ton)	• No change in total cost ($7.39/ton)	• No change in total cost ($7.39/ton)
Economic impacts on commercial dredge operators and employees	• No change in direct benefits to dredging operations	• Decrease in direct benefits to dredging operations	• Increase in direct benefits to dredging operations	• Increase in direct benefits to dredging operations	• No change in direct benefits to dredging operations
Regional economic effects – sand and gravel production	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output and labor income (see Table 4.10-9)
Regional economic effects – transportation	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output and labor income (see Table 4.10-9)
Regional economic effects – household income levels	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output and labor income (see Table 4.10-9)	• Increase in total output and labor income (see Table 4.10-9)
Tax revenues (other than sand royalties)	• No change in tax revenues to local, state, or federal governments	• Decrease in tax revenues to local, state, and federal governments	• Increase in tax revenues to local, state, and federal governments	• Increase in tax revenues to local, state, and federal governments	• No change in tax revenues to local, state, or federal governments

Table 4.10-10 Summary of Potential Short-Term Economic Impacts

Category of Impact	Proposed Action	No Action Alternative	Alternative A	Alternative B	Alternative C
St. Joseph Market Area (continued)					
Sand royalties	• No change in sand royalties to State of Kansas ($49,000 annually)	• Decrease in sand royalties to State of Kansas ($0 annually)	• Increase in sand royalties to State of Kansas ($53,000 annually)	• Increase in sand royalties to State of Kansas ($129,000 annually)	• No change in sand royalties to State of Kansas ($49,000 annually)
Economic effects associated with river bed degradation	• Potential for continued river bed degradation and related economic impacts	• Potential decrease in river bed degradation resulting in economic benefits (avoided costs)	• Potential for increase in river bed degradation and related economic impacts	• Potential for increase in river bed degradation and related economic impacts	• Potential for continued river bed degradation and related economic impacts
Environmental justice impacts	• Negligible economic impacts anticipated, including environmental justice impacts on minority and low-income groups	• Potential environmental justice impacts on employees in the mining and transportation industries; negligible impacts on minority and low-income groups in the general population	• Negligible environmental justice impacts on minority and low-income groups in the general population	• No environmental justice impacts on minority or low-income groups in the general population	• Negligible economic impacts anticipated, including environmental justice impacts on minority and low-income groups
Kansas City Market Area					
Regional sand and gravel production	• Decrease in dredging from LOMR (2.4 MM tons annually) • No change in production from alternate sources	• Decrease in dredging from LOMR (0 tons annually) • Increase in production from alternate sources (237,000 tons annually)	• Decrease in dredging from LOMR (540,000 tons annually) • Increase in production from alternate sources (237,000 tons annually)	• Decrease in dredging from LOMR (1.2 MM tons annually) • Increase in production from alternate sources (237,000 tons annually)	• Negligible change in dredging from LOMR (2.7 MM tons annually) • No change in production from alternate sources
Cost of sand and gravel	• Decrease in total cost ($7.72/ton)	• Increase in total cost ($31.27/ton)	• Increase in total cost ($16.46/ton)	• Increase in total cost ($8.45/ton)	• Decrease in total cost ($7.97/ton)
Economic impacts on commercial dredge operators and employees	• Decrease in direct benefits to dredging operations	• Decrease in direct benefits to dredging operations	• Decrease in direct benefits to dredging operations	• Decrease in direct benefits to dredging operations	• Decrease direct benefits to dredging operations

Table 4.10-10 Summary of Potential Short-Term Economic Impacts

Category of Impact	Proposed Action	No Action Alternative	Alternative A	Alternative B	Alternative C
Kansas City Market Area (continued)					
Regional economic effects – sand and gravel production	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)
Regional economic effects – transportation	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)
Regional economic effects – household income levels	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)
Tax revenues (other than sand royalties)	• Decrease in tax revenues to local, state, and federal governments	• Decrease in tax revenues to local, state, and federal governments	• Decrease in tax revenues to local, state, and federal governments	• Decrease in tax revenues to local, state, and federal governments	• Negligible decrease in tax revenues to local, state, and federal governments
Sand royalties	• Decrease in sand royalties to State of Kansas ($57,000 annually)	• Decrease in sand royalties to State of Kansas ($22,000 annually)	• Decrease in sand royalties to State of Kansas ($35,000 annually)	• Decrease in sand royalties to State of Kansas ($52,000 annually)	• No change in sand royalties to State of Kansas ($64,000 annually)
Economic effects associated with river bed degradation	• Potential decrease in river bed degradation resulting in economic benefits (avoided costs)	• Potential decrease in river bed degradation resulting in economic benefits (avoided costs)	• Potential decrease in river bed degradation resulting in economic benefits (avoided costs)	• Potential decrease in river bed degradation resulting in economic benefits (avoided costs)	• Potential for continued river bed degradation and related economic impacts

Table 4.10-10 Summary of Potential Short-Term Economic Impacts

Category of Impact	Proposed Action	No Action Alternative	Alternative A	Alternative B	Alternative C
Environmental justice impacts	• Potential environmental justice impacts on employees in the mining and transportation industries; negligible impacts on minority and low-income groups in the general population	• Potential environmental justice impacts on employees in the mining industry; negligible impacts on minority and low-income groups in the general population	• Potential environmental justice impacts on employees in the mining and transportation industries; negligible impacts on minority and low-income groups in the general population	• Potential environmental justice impacts on employees in the mining and transportation industries; negligible impacts on minority and low-income groups in the general population	• Negligible economic impacts anticipated, including environmental justice impacts on minority and low-income groups in the general population
Waverly Market Area					
Regional sand and gravel production	• Increase in dredging from LOMR (968,000 tons annually) • No change in production from alternate sources	• Decrease in dredging from LOMR (0 tons annually) • No change in production from alternate sources	• Decrease in dredging from LOMR (500,000 tons annually) • No change in production from alternate sources	• Increase in dredging from LOMR (1.1 MM tons annually) • No change in production from alternate sources	• Negligible increase in dredging from LOMR (680,000 tons annually) • No change in production from alternate sources
Cost of sand and gravel	• Decrease in total cost ($7.72/ton)	• Increase in total cost ($42.91/ton)	• Increase in total cost ($24.40/ton)	• Decrease in total cost ($8.39/ton)	• Decrease in total cost ($8.97/ton)
Economic impacts on commercial dredge operators and employees	• Increase in direct benefits to dredging operations	• Decrease in direct benefits to dredging operations	• Decrease in direct benefits to dredging operations	• Increase in direct benefits to dredging operations	• Increase in direct benefits to dredging operations
Regional economic effects – sand and gravel production	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)
Regional economic effects – transportation	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)

Table 4.10-10 Summary of Potential Short-Term Economic Impacts

Category of Impact	Proposed Action	No Action Alternative	Alternative A	Alternative B	Alternative C
Waverly Market Area (continued)					
Regional economic effects – household income levels	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)
Tax revenues (other than sand royalties)	• Increase in tax revenues to local, state, and federal governments	• Decrease in tax revenues to local, state, and federal governments	• Decrease in tax revenues to local, state, and federal governments	• Increase in tax revenues to local, state, and federal governments	• Negligible increase in tax revenues to local, state, and federal governments
Sand royalties	• No change in sand royalties to State of Kansas ($0 annually)	• No change in sand royalties to State of Kansas ($0 annually)	• No change in sand royalties to State of Kansas ($0 annually)	• No change in sand royalties to State of Kansas ($0 annually)	• No change in sand royalties to State of Kansas ($0 annually)
Economic effects associated with river bed degradation	• Potential for increase in river bed degradation and related economic impacts	• Potential decrease in river bed degradation resulting in economic benefits (avoided costs)	• Potential decrease in river bed degradation resulting in economic benefits (avoided costs)	• Potential for increase in river bed degradation and related economic impacts	• Potential for continued river bed degradation and related economic impacts
Environmental justice impacts	• Potential economic benefits resulting in benefits on minority and low-income groups	• Potential environmental justice impacts on employees in the mining and transportation industries; negligible impacts on minority and low-income groups in the general population	• Potential environmental justice impacts on employees in the mining industry; negligible impacts on minority and low-income groups in the general population	• Potential economic benefits resulting in benefits on minority and low-income groups	• Negligible economic impacts anticipated, including environmental justice impacts on minority and low-income groups in the general population
Jefferson City Market Area					
Regional sand and gravel production	• No change in dredging from LOMR (1.6 MM tons annually) • No change in production from alternate sources	• Decrease in dredging from LOMR (0 tons annually) • Increase in production from alternate sources (27,000 tons annually)	• Decrease in dredging from LOMR (430,000 tons annually) • Increase in production from alternate sources (27,000 tons annually)	• Decrease in dredging from LOMR (980,000 tons annually) • Increase in production from alternate sources (27,000 tons annually)	• No change in dredging from LOMR (1.6 MM tons annually) • No change in production from alternate sources

Table 4.10-10 Summary of Potential Short-Term Economic Impacts

Category of Impact	Proposed Action	No Action Alternative	Alternative A	Alternative B	Alternative C
Jefferson City Market Area (continued)					
Cost of sand and gravel	• Decrease in total cost ($8.69/ton)	• Increase in total cost ($28.09/ton)	• Increase in total cost ($16.71/ton)	• Increase in total cost ($9.86/ton)	• Increase in total cost ($9.35/ton)
Economic impacts on commercial dredge operators and employees	• No change in direct benefits to dredging operations	• Decrease in direct benefits to dredging operations	• Decrease in direct benefits to dredging operations	• Decrease in direct benefits to dredging operations	• No change in direct benefits to dredging operations
Regional economic effects – sand and gravel production	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)
Regional economic effects – transportation	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)
Regional economic effects – household income levels	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)
Tax revenues (other than sand royalties)	• No change in tax revenues to local, state, or federal governments	• Decrease in tax revenues to local, state, and federal governments	• Decrease in tax revenues to local, state, and federal governments	• Decrease in tax revenues to local, state, and federal governments	• No change in tax revenues to local, state, or federal governments
Sand royalties	• No change in sand royalties to State of Kansas ($0 annually)	• No change in sand royalties to State of Kansas ($0 annually)	• No change in sand royalties to State of Kansas ($0 annually)	• No change in sand royalties to State of Kansas ($0 annually)	• No change in sand royalties to State of Kansas ($0 annually)
Economic effects associated with river bed degradation	• Potential for continued river bed degradation and related economic impacts	• Potential decrease in river bed degradation resulting in economic benefits (avoided costs)	• Potential decrease in river bed degradation resulting in economic benefits (avoided costs)	• Potential decrease in river bed degradation resulting in economic benefits (avoided costs)	• Potential for continued river bed degradation and related economic impacts

Table 4.10-10 Summary of Potential Short-Term Economic Impacts

Category of Impact	Proposed Action	No Action Alternative	Alternative A	Alternative B	Alternative C
Jefferson City Market Area (continued)					
Environmental justice impacts	• Potential environmental justice impacts on employees in the transportation industry; beneficial economic effects on minority and low-income groups in the general population	• Potential environmental justice impacts on employees in the mining and transportation industries; negligible impacts on minority and low-income groups in the general population	• Potential environmental justice impacts on employees in the mining and transportation industries; negligible impacts on minority and low-income groups in the general population	• Potential environmental justice impacts on employees in the mining and transportation industries; negligible impacts on minority and low-income groups in the general population	• Negligible economic impacts anticipated, including environmental justice impacts on minority and low-income groups in the general population
St. Charles Market Area					
Regional sand and gravel production	• No change in dredging from LOMR (1.6 MM tons annually) • No change in production from alternate sources	• Decrease in dredging from LOMR (0 tons annually) • Increase in production from alternate sources (2.5 MM tons annually)	• Decrease in dredging from LOMR (370,000 tons annually) • Increase in production from alternate sources (2.0 MM tons annually)	• Decrease in dredging from LOMR (840,000 tons annually) • Increase in production from alternate sources (959,000 tons annually)	• No change in dredging from LOMR (1.6 MM tons annually) • No change in production from alternate sources
Cost of sand and gravel	• Decrease in total cost ($7.10/ton)	• Increase in total cost ($8.60/ton)	• Increase in total cost ($7.63/ton)	• Decrease in total cost ($7.14/ton)	• Increase in total cost ($8.58/ton)
Economic impacts on commercial dredge operators and employees	• Negligible increase in direct benefits to dredging operations	• Decrease in direct benefits to dredging operations	• Decrease in direct benefits to dredging operations	• Decrease in direct benefits to dredging operations	• Negligible decrease in direct benefits to dredging operations
Regional economic effects – sand and gravel production	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output and labor income; decrease in employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)
Regional economic effects – transportation	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)

Table 4.10-10 Summary of Potential Short-Term Economic Impacts

Category of Impact	Proposed Action	No Action Alternative	Alternative A	Alternative B	Alternative C
St. Charles Market Area (continued)					
Regional economic effects – household income levels	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)	• Increase in total output, labor income, and employment (see Table 4.10-9)	• Decrease in total output, labor income, and employment (see Table 4.10-9)
Tax revenues (other than sand royalties)	• No change in tax revenues to local, state, or federal governments	• Increase in tax revenues to local, state, and federal governments	• Increase in tax revenues to local, state, and federal governments	• Increase in tax revenues to local, state, and federal governments	• No change in tax revenues to local, state, or federal governments
Sand royalties	• No change in sand royalties to State of Kansas ($0 annually)	• No change in sand royalties to State of Kansas ($0 annually)	• No change in sand royalties to State of Kansas ($0 annually)	• No change in sand royalties to State of Kansas ($0 annually)	• No change in sand royalties to State of Kansas ($0 annually)
Economic effects associated with river bed degradation	• Potential for continued river bed degradation and related economic impacts	• Potential decrease in river bed degradation resulting in economic benefits (avoided costs)	• Potential decrease in river bed degradation resulting in economic benefits (avoided costs)	• Potential decrease in river bed degradation resulting in economic benefits (avoided costs)	• Potential for continued river bed degradation and related economic impacts
Environmental justice impacts	• Potential environmental justice impacts on employees in the mining and transportation industries; negligible impacts on minority and low-income groups in the general population	• Potential environmental justice impacts on employees in the mining industry; negligible impacts on minority and low-income groups in the general population	• Potential environmental justice impacts on employees in the mining industry; negligible impacts on minority and low-income groups in the general population	• Potential environmental justice impacts on employees in the mining and transportation industries; negligible impacts on minority and low-income groups in the general population	• Negligible economic impacts anticipated, including environmental justice impacts on minority and low-income groups in the general population

Notes:

LOMR = Lower Missouri River.
MM = Million.