

# Viburnum Trend Lead Mining District Natural Resource Damage Assessment and Restoration

Final Restoration Plan/Environmental Assessment



April 17, 2020  
prepared by:



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## **List of Acronyms**

BMP	Best Management Practice
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
C.F.R.	Code of Federal Regulations
DOI	U.S. Department of the Interior
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
FONSI	Finding of No Significant Impact
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NRDAR	Natural Resource Damage Assessment and Restoration
RP/EA	Restoration Plan/Environmental Assessment
SEMORRP	Southeast Missouri Ozarks Regional Restoration Plan
U.S.C.	U.S. Code
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

## EXECUTIVE SUMMARY

From 1960 to the present, lead and other metals have been mined in the Viburnum Trend Mining District (Viburnum Trend or Trend) of southeast Missouri near the town of Bixby, MO. Releases of hazardous substances from the mines, mills, smelters, and tailings impoundments at facilities located in Viburnum Trend have impacted soil, sediments, and surface water on-site, and downstream to tributaries of the Black, Meramec, and St. Francis Rivers. Natural resources (*e.g.*, sediments, invertebrates, fish, amphibians, birds, and mammals) have been exposed to and adversely affected by these releases of hazardous substances, including lead and other associated metals, to the environment.

Response activities to protect human health under the direction of the U.S. Environmental Protection Agency (EPA) have focused on replacing residential yard soils contaminated by the transport of lead ores and concentrates. As of the date of this Final Restoration Plan and Environmental Assessment (Final RP/EA), there are no ongoing response activities occurring or planned in the Viburnum Trend by EPA. However, the U.S. Forest Service is investigating releases from mining, milling and smelting activities onto Mark Twain National Forest and evaluating potential response actions. The Missouri Department of Natural Resources has regulatory authority over operating mining, milling, and smelting activities and are overseeing clean-up of recent spills from mine and mill facilities, as well as compliance with other applicable environmental laws, such as the National Pollutant Discharge Elimination System permits and the Metallic Minerals Waste Management Act.

Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), through the Natural Resource Damage Assessment and Restoration (NRDAR) process, natural resource trustees are authorized to assess and recover damages resulting from injuries to natural resources attributable to hazardous substance releases. 42 U.S.C. § 9607(f). The trustees then utilize these recovered damages to plan and implement actions to restore, replace, rehabilitate, and/or acquire the equivalent of injured natural resources and the services they provide pursuant to a restoration plan. 42 U.S.C. § 9611(i). The Trustees in this case, the State of Missouri, acting through Missouri Department of Natural Resources, the United States Department of Agriculture acting through the U.S. Forest Service, and the United States Department of the Interior acting through U.S. Fish and Wildlife Service, developed this Final RP/EA in accordance with CERCLA Section 111(i) and its implementing regulations (43 C.F.R. § 11.93) to inform the public as to the types and amount of restoration that are expected to partially compensate for injuries to natural resources and the services they provide associated with the releases of heavy metals from the facilities in the Viburnum Trend. Restoration actions selected in this Final RP/EA will be implemented by Potentially Responsible Parties as per the terms of a Consent Decree filed concurrently with the Draft Restoration Plan/EA.

Under the National Environmental Policy Act (NEPA; 42 U.S.C. § 4321 *et seq.*), federal agencies must identify and evaluate environmental impacts that may result from federal actions. This Final RP/EA describes the purpose and need for action, identifies potential restoration alternatives, including a No Action alternative (Alternative A), summarizes the affected environment, and describes the potential environmental consequences of proposed

restoration activities. The restoration alternatives described and evaluated in this Final RP/EA include Stream Enhancement (Alternative B), Enhanced Closure of Tailings Areas, Soil Treatment, and Revegetation (Alternative C), Property Transfer and Protection (Alternative D), and the Trustees' Selected Alternative (Alternative E). The Selected Alternative includes all the components of Alternatives B – D, including stream restoration; enhanced closure, soil restoration and re-vegetation of terrestrial habitats; and property transfer and protection. The Trustees opened a 45-day public comment period (February 20, 2020 through April 6, 2020) for the Draft RP/EA, which resulted in no comments being received from the public. The Trustees have selected Alternative E in this Final RP/EA.

## **1.0 INTRODUCTION AND SUMMARY**

### **1.1 Introduction**

The United States Department of the Interior (DOI), acting through the U.S. Fish and Wildlife Service (USFWS), the U.S. Department of Agriculture, acting through the U.S. Forest Service (USFS), and the State of Missouri, represented by Missouri Department of Natural Resources, (collectively the Viburnum Trend Trustee Council (Trustees)) initiated a natural resource damage assessment and restoration (NRDAR) process to determine and quantify injuries to natural resources and their services resulting from the releases of hazardous substances at and from facilities within the Viburnum Trend (Trend) into the terrestrial and aquatic environment. As part of the NRDAR process, the Trustees must also identify and select restoration actions that will compensate for the injured resources and services and seek to recover compensation from the entities responsible for the injuries to natural resources and lost services.

For decades, hazardous substances, including but not limited to lead (Pb), zinc (Zn), copper (Cu), and silver (Ag), have been and continue to be mined, milled, and smelted at a number of facilities within the Trend. Natural resources, including surface water, sediments, fish, and migratory birds, have been exposed to and adversely affected by releases of hazardous substances from these facilities into nearby soils, sediments, and surrounding waters, including tributaries of the Black, Meramec, and St. Francis Rivers. As a result, the Trustees undertook a NRDAR process for the Trend to determine injuries to natural resources and associated lost services and identification of appropriate compensation.

### **1.2 Purpose and Need for Restoration**

As described in Section 2 of the [Southeast Missouri Ozarks Regional Restoration Plan](#) (SEMORRP), the Trustees developed the SEMORRP to identify a preferred alternative to restore injured natural resources and to establish criteria for selecting projects to implement such restoration alternatives in the Southeast Missouri Lead Mining District, including the Viburnum Trend. The Trustees selected an alternative (Alternative D), which included a combination of restoration activities and projects to accomplish restoration goals at or near the sites of injury.

The geographic boundaries of the SEMORRP include portions of the Big River, Black River, Bourbeuse River, Current River, Eleven Point River, Meramec River, and St. Francis River (Figure 1 of SEMORRP). The purpose of this Final Restoration Plan and Environmental Assessment (Final RP/EA), in accordance with the analysis contained in the SEMORRP, is to address injured natural resources and services lost due to hazardous substances releases. The need for this Final RP/EA is to describe the restoration actions or projects that have been proposed to be performed by the settling parties pursuant to the terms of the Consent Decree (CD) among the United States and State of Missouri, The Doe Run Resources Corporation, Buick Resource Recycling Facility, LLC, and the Homestake Lead Company of Missouri relating to the Viburnum Trend<sup>1</sup> and to select an alternative for implementation.

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<sup>1</sup> A separate Final Restoration Plan and Environmental Assessment is available for proposed restoration actions or projects relating to the Herculaneum Smelter Site, which is also covered by the Consent Decree.



Future restoration planning for activities in the Trend, including Trustee-led restoration activities, are anticipated to be considered in future restoration plans. In this document, the Trustees evaluate a range of alternatives in order to identify the alternative(s) that best meet the NRDAR objectives to restore, replace, rehabilitate or acquire the equivalent of natural resources injured or lost while minimizing any adverse impacts from the implementation of restoration projects themselves.

The Trustees prepared this Final RP/EA in accordance with CERCLA Section 111(i) and its implementing regulations, 43 C.F.R. § 11.93, to inform the public as to the types and scale of restoration to be undertaken to compensate for injuries to natural resources and ecological services lost due to releases of hazardous substances, including metals from mines, mills, smelters, and tailings impoundments of the Viburnum Trend. Consistent with the CERCLA NRDAR regulations, this Final RP/EA includes a reasonable number of restoration alternatives and identifies a Preferred Alternative (Alternative E).

### **1.3 Restoration Goals**

Based on the nature of the natural resource injuries and losses, the restoration goals listed below were identified by the Trustees and guided development of this plan. These goals are in alignment with the project types described under the Preferred Alternative of the SEMORRP.

Goal 1: to enhance or restore portions of the adversely affected stream segments and associated fish, wildlife, and supporting habitats;

Goal 2: to enhance or restore portions of the adversely affected terrestrial habitat, particularly those supportive of migratory birds and sensitive species; and

Goal 3: enhance and protect, via land transfer, the conservation value of upland or aquatic habitats supportive of species injured by hazardous substances originating from the Viburnum Trend.

### **1.4 Natural Resource Trustee Authority**

Under federal law, the trustees are authorized to act on behalf of the public to assess injuries to natural resources and services resulting from the release of hazardous substances into the environment. The NRDAR process for the Viburnum Trend followed the CERCLA regulations (43 C.F.R. Part 11), which allows Trustees to pursue claims against potentially responsible parties for damages based on these injuries in order to compensate the public for the loss of natural resources and their services. The goal of this process is to plan and implement actions to restore, replace, or rehabilitate the natural resources that were injured or lost as a result of the release of a hazardous substance, or to acquire the equivalent resources or the services they provide.

The Trustees for the Viburnum Trend NRDAR are the State of Missouri, represented by

Missouri Department of Natural Resources, the U.S. Department of Agriculture, represented by the USFS, and DOI, represented by the USFWS. See also the National Contingency Plan 40 C.F.R. §§ 300.600 *et seq.* A Trustee Memorandum of Understanding (MOU) was executed in April 2004, formalizing this collaborative process between DOI and the State of Missouri. The MOU was amended to include the USFS in 2009.

## **1.5 National Environmental Policy Act Considerations**

NEPA applies to federal agency actions that affect the human environment. Federal agencies are obligated to comply with NEPA regulations adopted by the Council on Environmental Quality (CEQ). NEPA requires that an Environmental Assessment be prepared in order to determine whether the proposed restoration actions will have a significant effect on the quality of the human environment. If an impact is considered significant, then an Environmental Impact Statement is prepared. If the impact is considered not significant, then a Finding of No Significant Impact (FONSI) is issued. For a proposed CERCLA restoration plan, if a FONSI determination is made, the Trustees may then issue a final restoration plan describing the selected restoration action(s). In accordance with NEPA and its implementing regulations, this Final RP/EA summarizes the current environmental setting; describes the purpose and need for restoration actions; identifies alternative actions; assesses their applicability and potential impact on the quality of the physical, biological, and cultural environment; and outlines public participation in the decision-making process.

In 2014, the Trustees produced the SEMORRP, which provides a process framework that governs the approach for restoration project identification, evaluation, selection and implementation. In the SEMORRP, the Trustees selected Alternative D as the Preferred Alternative (see Section 3.5, pages 23 and 24 of SEMORRP for a description), where the Trustees will consider a combination of primary and compensatory restoration actions and projects to accomplish restoration goals at or near the site(s) of injury. This Final RP/EA tiers<sup>2</sup> from and incorporates by reference<sup>3</sup> portions of the SEMORRP for expediency and efficiency, as appropriate. Tiering is permissible under NEPA provided that the proposed activity is within the range of alternatives and nature of potential environmental consequences considered in the programmatic document. 40 C.F.R. §1502.20. The proposed activities associated with this Final RP/EA are in alignment with the goals of the SEMORRP, and compliant with the Preferred Alternative selected in the SEMORRP.

Consistent with federal laws, the Federal Trustees are continuing to evaluate the projects

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<sup>2</sup> The NEPA regulations define “tiering” as referring to “the coverage of general matters in broader environmental impact statements (such as national program or policy statements) with subsequent narrower statements or environmental analyses (such as regional or basinwide program statements or ultimately site-specific statements) incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared.” 40 C.F.R. §1508.28.

<sup>3</sup> The NEPA regulations state the following regarding “incorporation by reference”: “Agencies shall incorporate material into an environmental impact statement by reference when the effect will be to cut down on bulk without impeding agency and public review of the action. The incorporated material shall be cited in the statement and its content briefly described. No material may be incorporated by reference unless it is reasonably available for inspection by potentially interested persons within the time allowed for comment. Material based on proprietary data which is itself not available for review and comment shall not be incorporated by reference.” 40 C.F.R. §1502.21.

included in the Selected Alternative in this Final RP/EA for compliance with other applicable laws, including those listed in the Appendix.

## 1.6 Site History

Seeger (2008) provides a summary of mining activity in the Viburnum Trend. As stated in that document:

*Declining reserves in the Old Lead Belt led to exploration for additional orebodies in the late 1940s. Exploration was conducted on the northern and western margins of the St. Francois Mountains. St. Joe discovered an isolated orebody, Indian Creek, north of the St. Francois Mountains in 1948; the mine began production in 1953 and closed in 1982.*

*Exploration extended southwestward from Indian Creek toward Viburnum, where St. Joe drilled the discovery hole for the Viburnum Trend in 1955. Further drilling defined the orebody for what was to become the Viburnum No. 27 Mine. Continued exploration by St. Joe and other companies, including Amax Inc., Cominco, Kennecott Copper, and Asarco, Inc., led to the eventual opening of 10 mines along the 60-mi long ore trend in Crawford, Washington, Iron, Dent, Reynolds, and Shannon Counties. The Viburnum Trend produces lead, zinc, copper, and silver, and the ore deposits also contain substantial cobalt and nickel mineralization. Construction began on smelters near the Buick Mine and at Glover in 1966, and both smelters were opened in 1967.*

Mining in the Viburnum Trend (Figure 2) is ongoing, and the district remains a major producer of metals. Missouri's mines have yielded much of the United States' national production of lead (e.g., USGS 2018), and since 1997, all the metals produced in Missouri originated in The Doe Run Company's Viburnum Trend mines (MDNR 2004). In addition to lead, the mines produce substantial amounts of zinc and lesser quantities of copper and silver.

Mining in the Viburnum Trend has consisted entirely of the room and pillar method along the ore trend (Seeger 2008). Ore is first crushed within the mine, then removed to the surface for beneficiation, including further crushing. Following the crushing, the slurried fine material is sent to flotation cells and separated into mineral concentrates through circuits specific to each metal (lead and zinc at all mills, copper as well at all except Sweetwater and West Fork). The mineral concentrates are settled and dewatered before further action (either transport to the smelter or to a buyer). The resultant waste is collected in tailings ponds along with all process water. Unlike earlier operations in southeast Missouri, the Viburnum Trend operations never used density separation methods, which result in chat piles. Figure 1 (reproduced from Seeger 2008) presents summary information about Viburnum Trend mining complexes.

[NPDES, National Pollution Discharge Elimination System; NA, not applicable; L, lead; Z, zinc; C, copper]

Mine	Year production began	Mill onsite	Tailings impoundments onsite	Mill circuits	Permitted NPDES outfalls	Receiving stream	Year closed
Viburnum No. 27 Mine	1960	No <sup>a</sup>	No	NA	NA	NA	<sup>b</sup> 1978
Viburnum No. 28 Mine	1962	Yes	Yes	L,Z,C	4	Indian Creek	2004
Viburnum No. 29 Mine	1964	No <sup>c</sup>	No	NA	1	Indian Creek	NA
Fletcher Mine	1966	Yes <sup>d</sup>	Yes	L,Z,C	3	Bee Fork	NA
Magmont Mine	1968	Yes	Yes	L,Z,C	2	Neals Creek Crooked Creek	<sup>b,e</sup> 1994
Sweetwater Mine	1968	Yes	Yes	L,Z	<sup>f</sup> 4	Adair Creek	NA
Buick Mine <sup>g</sup>	1969	Yes	Yes	L,Z,C	2	Strother Creek	NA
Brushy Creek Mine	1973	Yes	Yes	L,Z,C	3	Lick Creek Hollow Bills Creek	NA
Casteel Mine (Viburnum No. 35 Mine)	1983	No <sup>c</sup>	Yes	NA	3	Crooked Creek	NA
West Fork Mine <sup>h</sup>	1985	Yes	Yes	L,Z	4	West Fork Black River	NA

<sup>a</sup> Ore shipped to Central Mill at Viburnum No. 28 Mine.  
<sup>b</sup> Surface reclamation activity performed.  
<sup>c</sup> Ore shipped to Buick Mill.  
<sup>d</sup> Ore shipped to Brushy Creek Mill.  
<sup>e</sup> Production underground continues as part of Buick operation.  
<sup>f</sup> Four permits were issued, but only two permits are used.  
<sup>g</sup> Smelter considered a separate facility from mine and mill and operated by different entity within The Doe Run Company.  
<sup>h</sup> Currently (2008) part of Fletcher Mine.

Figure 1. Environmental statistics obtained for the Viburnum Trend mine complexes.

The Trustees completed a Damage Assessment Plan in 2009, summarizing existing information on natural resource injuries and describing proposed studies to evaluate past, current, and future impacts to natural resources and the services they provide. In addition, the Damage Assessment Plan outlined how information gathered from the studies would be used to determine the types and scale of restoration needed to address these injuries. Since 2009, the Trustees have conducted a series of site-specific studies assessing the exposure of natural resources, such as songbirds, sediments, plant communities, and mammals, to hazardous substances and potential effects resulting from that exposure. The results of these assessment studies indicated that releases of heavy metals likely caused injuries to geologic resources (sediment and soil), aquatic resources (crayfish, other macro invertebrates, and benthic fish), and terrestrial resources (songbirds and floristic quality of plants).

In general, this Final RP/EA focuses on restoration of aquatic and terrestrial resources and resource services injured by hazardous substances releases at and from the following mining, milling, and smelting facilities:

- Viburnum #27 mine;
- Viburnum #28 mine and Central Mill;
- Viburnum #29 mine;

- Casteel mine;
- Magmont mine;
- Buick mine/mill;
- Brushy Creek mine/mill
- Fletcher mine/mill;
- West Fork mine/mill;
- Sweetwater mine/mill;
- Buick Smelter; and
- Glover Smelter.

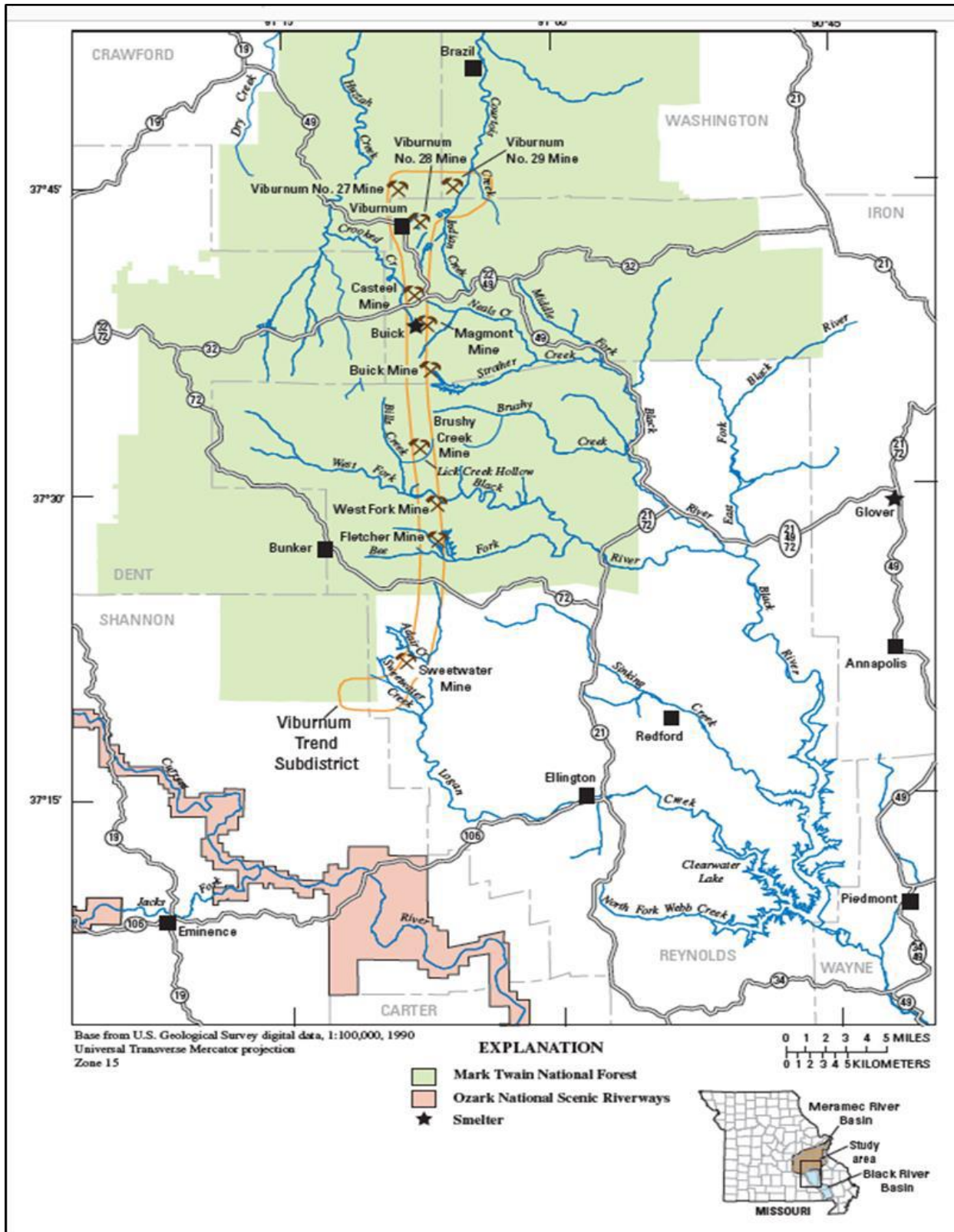


Figure 2. The Viburnum Trend, adapted from Seeger, 2008.

## **1.7 Relationship to Response and Other Enforcement Activities**

Response activities to protect human health under the direction of the U.S. Environmental Protection Agency (EPA) have focused on replacing residential yard soils contaminated by the transport of lead ores and concentrates. As of the date of this Final RP/EA, there are no ongoing remedial activities occurring in the Viburnum Trend planned by EPA. The USFS is investigating releases of hazardous substances from mining, milling and smelting activities onto Mark Twain National Forest and evaluating potential response actions. The Missouri Department of Natural Resources has regulatory authority on operating mining, milling, and smelting activities and are overseeing clean-up of recent spills from mine and mill facilities as well as compliance with other applicable environmental laws, such as the National Pollutant Discharge Elimination System permits and the Metallic Minerals Waste Management Act.

For the Viburnum Trend NRDAR process, the Trustees coordinate with the USFS as it evaluates potential response actions on Mark Twain National Forest and the Missouri Department of Natural Resources as it conducts permitting and clean-up operations at facilities and spill sites, respectively. This coordination provides an understanding of the likely outcome of clean-up or other regulatory processes and helps the Trustees estimate residual injury to natural resources. The restoration actions described in this Final RP/EA and in the Selected Alternative are unique to the NRDAR process; in other words, there is no other legal requirement for the settling parties to conduct these activities other than to resolve potential NRD liability. Additionally, the proposed restoration actions consider, as appropriate, planned activities required under other regulatory schemes, such as closure under the Metallic Minerals Waste Management Act.

## **1.8 Summary of Proposed Settlement Agreement**

A proposed settlement agreement among the Trustees and Doe Run Resources Corporation (Doe Run) and Homestake Lead Company of Missouri (Homestake) is documented in a consent decree, which was lodged with the federal court on February 11, 2020, and open for a forty-five (45) day public comment period concurrent with the Draft RP/EA. Nothing in this Final RP/EA alters any provision of that consent decree. A Notice of Availability for the Consent Decree and Draft RP/EA was published in the Federal Register on February 20, 2020. Under the terms of the settlement, the Trustees will provide covenants not to sue to Doe Run and Homestake for NRD under CERCLA, the Clean Water Act, and applicable state laws. Doe Run will perform, and Homestake will partially fund, several restoration projects to compensate for the injured, lost, or destroyed resources and services resulting from the releases of lead, cadmium and zinc from the Viburnum Trend facilities. During the public comment period, the proposed consent decree was made available for public review and comment at <https://www.justice.gov/enrd/consent-decrees>.

According to the terms of the settlement agreement, Doe Run will: 1) donate to the USFS (Mark Twain National Forest) and the State of Missouri a combined total of 1,000 acres of property; 2) restore up to 10 miles of contaminated streams over the eight years after the consent decree is entered; 3) conduct Enhanced Closure on approximately 1,000 acres of tailings impoundments and 240 acres of Transition Zone soils; 4) restore up to 810 acres of contaminated habitat in the vicinity of the operating area of the Buick Resource Recycling Facility; 5) perform vegetation restoration by establishing native grasses and forbs on 30 acres of land at the Sweetwater

Facility; and 6) reimburse the Trustees up to \$25,000 per year for Trustee oversight and monitoring of restoration. Homestake has agreed to 1) provide \$2 million in financial assurance for work at the Buick Resource Recycling Facility; 2) provide \$1.44 million in a restoration work trust account for Doe Run to access to perform work agreed to; 3) pay \$1.8 million in past assessment costs to the Trustees; 4) pay \$100,000 for Trustees' future oversight and monitoring of restoration to be implemented by Doe Run pursuant to the Consent Decree and the Final RP/EA.

## **1.9 Public Participation**

Public participation and review is an integral part of the restoration planning process, and is specifically required in the CERCLA NRDAR regulations (*e.g.*, 43 C.F.R. §11.81(d)(2)). In addition, NEPA and its implementing regulations require that federal agencies fully consider the environmental impacts of their proposed decisions and that such information is made available to the public.

The Draft RP/EA was open for public comment for 45 days from the date of publication of the Notice of Availability in the Federal Register. No comments were received from the public; therefore, the Trustees intend to proceed with restoration actions as described herein.

Copies of this document are available online at:

<https://www.fws.gov/Midwest/es/ec/nrda/SEMONRDA/index.html>

and <https://dnr.mo.gov/env/hwp/sfund/nrda.htm>

Physical copies of the document are also available for review by interested members of the public at the USFWS Missouri Field Office in Columbia, MO, the Missouri Department of Natural Resource's office in Jefferson City, MO and the USFS office in Rolla, MO. Arrangements must be made in advance to review or obtain copies of physical records at the USFWS Missouri Field Office by contacting 573-234-2132.

The Trustees may amend the Final RP/EA if significant changes are made to the type, scope, or impact of the projects. In the event of a significant modification to the RP/EA, the Trustees will provide the public with an opportunity to comment on that amendment.

The Trustees have also maintained records documenting the information considered and actions taken during this NRDAR process. These records are available on the Southeast Missouri Lead Mining District NRDAR website, found at <https://www.fws.gov/Midwest/es/ec/nrda/SEMONRDA/index.html>.

## **1.10 Organization of the Viburnum Trend Final RP/EA**

The chapters that follow describe the affected environment of the proposed restoration projects and a summary of potential alternatives considered (Chapters 2 and 3, respectively); the probable



consequences on the human environment that may result from the implementation of the proposed restoration activities (Chapter 4); the potential cumulative impacts from the proposed activities, including past, current, and foreseeable future projects (Chapter 4); and a general monitoring framework for the projects in the Selected Alternative (Chapter 5).

## **2.0 SUMMARY OF INJURIES**

The Trustees and others have conducted a variety of studies at or near the Viburnum Trend to document natural resource exposure to lead, zinc and/or cadmium released from the facilities in the Viburnum Trend and the presence of injury to natural resources and their supporting habitats. The results of these studies indicated that releases of heavy metals likely caused injuries to geologic resources (sediment and soil), aquatic resources (crayfish, macro invertebrates, and benthic fish), and terrestrial resources (songbirds, mammals, and plants). Metals concentrations in sediments exceeded the Probable Effects Concentrations<sup>4</sup> in many of the waterbodies in the Viburnum Trend, evidence that supports a finding that the sediments are injured (Pavlowsky et al. 2016). Additional studies found that crayfish experience toxicity when exposed to sediment and pore water from these same water bodies (Allert et al. 2008; Besser et al. 2009). Results of surface water sampling indicated exceedances of aquatic life criteria, and other studies have documented a reduction in macroinvertebrate community in waterbodies where mining-related hazardous substances have come to be located (Femmer 2008; Poulton et al 2009).

Studies also have demonstrated that birds utilizing the Viburnum Trend area have elevated tissue concentrations of lead and delta aminolevulinic acid dehydratase inhibition (Beyer 2013). In addition, hepatic lesions were detected in robins collected from the Viburnum Trend (Beyer 2013). Another study found that elevated soils metals concentrations adversely affect native floristic quality, one measure of the quality of supporting habitat for birds and mammals (Struckhoff 2013).

## **3.0 PROPOSED RESTORATION ALTERNATIVES**

To compensate the public for injuries (to natural resources and associated lost services resulting from releases of metals from facilities in the Viburnum Trend, the Trustees are required to develop alternatives for the “restoration, rehabilitation, replacement, and/or acquisition of the equivalent of the natural resources and the services those resources provide” (42 C.F.R. §11.82 (a)). The Trustees developed the SEMORRP and identified broad categories of restoration types. As described in Alternative D (Preferred Alternative) of the SEMORRP, the Trustees presented a suite of restoration project types that would be considered for implementation, including upland resource restoration and preservation, enhancement, and creation; wetland, floodplain, and riparian corridor restoration or enhancement; surface water quality and aquatic resource improvement; groundwater quality and resource improvement; and public education and

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<sup>4</sup> Probable Effects Concentration is defined as the concentration for a specified contaminant above which toxicity to sediment-dwelling organisms is expected to occur “more likely than not” based on a national database of matched sediment chemistry and toxicity data (MacDonald et al. 2000).

enjoyment projects. Except for Alternative A, the No action alternative, all the restoration alternatives proposed by the Trustees in this Final RP/EA are consistent with the Preferred Alternative in the SEMORRP and fall into categories of upland resource preservation, restoration, or enhancement; floodplain and riparian corridor enhancement; or surface water quality and aquatic resource improvement. Table 2 identifies the following alternatives: No Action/Natural Recovery (A); Stream Enhancement (B); Enhanced Closure and related activities (C); Property Transfer and Protection (D); and the Selected Alternative (E), which is the combination of Alternatives B-D.

Table 1. Brief description of proposed alternatives.

Alternative	Description
A	No Action/Natural Recovery; No projects implemented
B	Stream Enhancement: Projects to improve sediment and water quality and aquatic fish and wildlife habitat
C	Enhanced closure of tailings impoundments, soil treatment, and upland habitat restoration and enhancement activities at four locations
D	Property transfer and protection of five properties
E	Selected Alternative – Combination of Alternatives B, C, and D

Trustees evaluated the alternatives to determine if they provide sufficient type, quality, and quantity of ecological services to compensate for those lost due to contamination in the context of both site-specific and regulatory evaluation criteria (43 C.F.R. § 11.82 (d)). The Trustees also evaluated whether significant effects may be associated with the proposed alternatives to restore the natural resources and services injured or lost due to the releases hazardous substances as required by NEPA (40 C.F.R. §1508.9(b)).

### 3.1 Restoration Evaluation Criteria

To ensure the appropriateness and acceptability of restoration options addressing ecological losses, the Trustees evaluated each option against Restoration Evaluation Criteria. The criteria were developed through discussions with natural resource managers at each of the Trustee agencies and are consistent with the criteria identified in Sections 6.4 and 6.5 of the SEMORRP, incorporated by reference herein.

Below are the criteria used to evaluate potential restoration projects as part of the Viburnum Trend

NRDAR. The criteria reflect the “factors to consider when selecting the alternative to pursue” (NRDAR factors) as described in 43 C.F.R. § 11.82(d)(1-10).

Relationship to Injured Resources and Services:

Alternatives that restore the resources and services injured by the release are preferred to alternatives that benefit other comparable resources or services. The Trustees considered the types of resources or services injured, the location of the resources, and the connection or nexus of project benefits to those injured resources.

Technical Feasibility (43 CFR 11.82(d)(1)):

The preferred restoration alternative(s) must be technically sound. The Trustees considered the level of risk or uncertainty involved in implementing the project alternatives. A proven record of accomplishment demonstrating the success of projects utilizing similar or identical restoration techniques can be used to satisfy this evaluation criterion.

Compliance with Laws, Regulations, and Policies (43 CFR 11.82(d)(9-10)):

Development of this Final RP/EA requires consideration of a variety of legal authorities and their potentially applicability to the Preferred Alternative. As part of restoration planning process the Trustees initiated steps to ensure compliance with applicable laws, regulations, and policies. Implementation of the Preferred Alternative remains subject to complying with all applicable laws and regulations, which for this Final RP/EA may include:

- Clean Water Act,
- Endangered Species Act
- National Historic Preservation Act

Work performed as part of the Preferred Alternative would remain subject to meeting all permitting and other environmental compliance requirements to ensure the projects are implemented in accordance with all applicable laws and regulations.

Consistency with the Trustees’ Restoration Goals:

The preferred alternative(s) should meet the Trustee's intent to directly restore the injured resources or the services those resources provide. Included in this criterion is the potential for success (meeting restoration goals listed in Section 1.2) and the level of expected return of resources and resource services.

Public Health and Safety (43 CFR 11.82(d)(8)):

The preferred alternative(s) ideally should not pose a threat to the health and safety of the public.

Avoidance of Further Injury (43 CFR 11.82(d)(5)):

The preferred alternative(s) should avoid or minimize adverse impacts to the environment and the associated natural resources. The Trustees considered the future short- and long-term injuries when evaluating projects.

Time to Provide Benefits:

The Trustees considered the time expected for the project to begin providing benefits to the

target ecosystem and/or public. A more rapid time to delivery of benefits is favorable.

#### Duration of Benefits:

The Trustees considered the expected duration of benefits from the restoration alternatives. Projects expected to provide longer-term benefits were regarded more favorably.

Additionally, actions undertaken to restore natural systems are anticipated to have long-term beneficial and sometimes short-term adverse impacts to the physical, biological, socio-economic, and/or cultural environments. In the analysis below, the likely beneficial and adverse impacts of Alternatives A, B, C, D and E on the quality of the human environment are examined. The Trustees will continue to evaluate environmental impacts as project details are identified, designed and implemented, and determine whether additional analysis under NEPA is warranted. The following sections evaluate the restoration alternatives using the Restoration Evaluation Criteria and evaluate anticipated environmental. Table 3 provides a comparative analysis of alternatives using the Restoration Evaluation Criteria.

### **3.2 Alternative A: No Action Alternative (Natural Recovery)**

Pursuant to CERCLA and NEPA, the Trustees considered a No Action alternative. Under this alternative, the Trustees would rely on natural recovery and would take no direct action to restore injured natural resources or compensate for interim lost natural resource services. This alternative would include the continuance of ongoing monitoring programs, such as those initiated by the Missouri Department of Natural Resources for benthic macroinvertebrates, but would not include additional activities aimed at reducing contamination, reducing potential exposure to contaminants, or enhancing ecosystem biota or processes. Under this alternative, no compensation would be provided for interim losses in resource services.

Under the No Action alternative, no habitats would be preserved, restored, or enhanced beyond what agencies and organizations are already doing in the area with limited existing resources. Aquatic and riparian habitats would continue to be degraded along streams in the Black, Meramec, and St. Francis River watersheds and in adjacent habitats. Water and sediment quality would continue to be impaired. Migratory bird individuals and/or populations would continue to be adversely impacted because of continued contamination and subsequent exposure and toxicological effects, and degradation of resting, foraging, and nesting habitat. Local citizens and visitors recreating in the affected areas would not benefit from improved ecological resources, such as fish populations and wildlife habitat providing wildlife viewing opportunities.

### **3.3 Alternative B: Stream Enhancement<sup>5</sup>**

The Stream Enhancement Alternative, referred to as the Aquatic Restoration Project in Appendix A of the Consent Decree, involves the removal of sediment contaminated with heavy metals in up to 10 miles of streams in the Viburnum Trend (e.g., Crooked Creek, West Fork Crooked Creek, Indian Creek, Strother Creek, Bill's Creek and others) to reduce the metals concentrations and potential for exposure to aquatic life. Annual sediment excavations will occur in stream

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<sup>5</sup> For additional details about this Alternative, see Paragraphs 26-39 of Appendix A to the Consent Decree.

segments in each and every year until sampling results for the stream segment confirms that the <2 mm sediment fraction contains <192 mg lead/kg sediment, or the termination condition for the stream segment has otherwise been met. In addition, any single gravel bar with concentrations >256 mg lead/kg sediment will be excavated unless vegetation on the bar is judged to immobilize the sediment from further transport by the stream.

To aid in guiding implementation of this alternative, Doe Run will develop and carry out a Sediment Excavation Master Plan (Master Plan) subject to the Trustees' approval. The Master Plan will contain map locations and physical descriptions of sediment excavation areas and sampling and analysis methodologies of sediment samples. The Master Plan will also describe excavation details and best management practices (BMPs) for excavating and managing contaminated sediment, provide for stream bank stabilization and re-vegetation measures, and other information relevant to stream sediment excavation. Annual sediment excavation plans for each excavation location will tier from the Master Plan and be developed by Doe Run after assessing recent field conditions. Annual sediment excavation plans will include detailed maps, previous year sampling results, planned dates of excavations, excavation methods description, sediment disposal locations, and other relevant details for each excavation location.

Sediment excavation will rely on techniques that remove contaminated sediments without significantly disturbing the natural fluvial processes of the stream. For example, gravel bars will be excavated only above the water line during low flow conditions, which will minimize disturbance to the stream. Any excavation in-stream would be conducted above low water crossings that provide grade control. Equipment will be used that is appropriate to stream-specific conditions. Site-specific conditions will be taken into account in the detailed sediment excavation design process in order to maintain and/or improve the stream's ability to support native flora and fauna. The goal of sediment restoration is to remove the contaminated material in a way that minimizes disturbance of the remaining aquatic communities and their supporting habitat, reduces the quantity of contaminated material in the stream, and minimizes erosion and head-cutting in streams.

As indicated above, BMPs will include restricting excavation to times of low water and only exposed areas of gravel bars to reduce the potential for stream impacts during excavation. One exception would be excavation of sediment deposition zones formed by low water crossings or other areas with obstructions to flow. These areas provide grade control that will also minimize negative consequences from excavating sediment. Additional site specific BMPs will be established in the Master Plan, and will likely include erosion control fabric, filter strips, staked straw bales, silt curtains, minimizing points of entry into streams, staging equipment away from riparian zones, revegetation of entry points, tracking and reporting of excavated sediment, and other BMPs commonly implemented for the type of proposed work. Stream banks associated with sediment removal entry points will be reviewed prior to selection to ensure ESA compliance and following implementation, approved entry point will be revegetated and restored as needed.

### **3.4 Alternative C: Enhanced Closure of Tailings Areas, Terrestrial Restoration, Soil Treatment, and Revegetation<sup>6</sup>**

This alternative involves upland habitat restoration and enhancement activities at a minimum of four tailings impoundment locations at closure. A minimum of 1,000 acres in total including the Brushy Creek Mine tailings area (~350 acres), West Fork (~150 acres), and Fletcher tailings area (~500 acres) are subject to enhanced closure requirements. These additional requirements include a minimum of 12 inches of soil, sediment, and other rooting mediums for growth of native vegetation; a threshold of 345 mg/kg of lead in the top six inches of material; using a native species mix of forbs and grasses on all seeded areas; and other details related to sufficient vegetation requirements and corrective action should vegetation growth and cover not meet expectations.

Also, under this alternative, oak savannah habitat at an additional 240 acres of tailings impoundment transition zones near the three sites mentioned above and approximately 810 acres near the Buick Resource Recycling Facility and 30 acres at the Sweetwater facility will be restored and rehabilitated. Restoration activities at the BRRF will be guided by a Soil Restoration Plan outlining analysis of soil samples, plans for excavation or treatment of soils and revegetation, methods of restoration, best management practices for minimizing erosion of soils, and provisions to ensure ESA compliance, among other pertinent information. Within the additional 240 acres and the BRRF, the Trustees will work with Doe Run to ensure soil lead concentrations are protective of ecological receptors and that restoration of habitat proceeds towards the intended target, an oak savannah community dominated by native grasses and forbs. Excavation of lead- contaminated soils may be required in some areas or soil amendments may be necessary to reduce lead bioavailability and support growth of native plants. Soil amendments would consist of four to six tons of high phosphate fertilizer and three to five tons of lime per acre followed by mulching with natural material. The Soil Restoration Plan will also require management of exotic species and on-going monitoring of seeded and planted areas to ensure sufficient vegetation growth and cover has been obtained.

### **3.5 Alternative D: Property Transfer and Protection<sup>7</sup>**

Under this alternative, Doe Run will donate approximately 1,000 acres of property (See Table 2). All transferred properties will be managed in accordance with Sections 3.4 and 3.5 of the SEMORRP, which are incorporated by reference herein, as well as other applicable land management plans, by the USFS or State of Missouri respectively. The State of Missouri designee will ensure the maintenance of contiguous forest and woodland cover to provide a diversity of habitat for native plants and animals, maintain and enhance water quality in the Black River Watershed.

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<sup>6</sup> For additional details about this Alternative, see Paragraphs 40-53 of Appendix A to the Consent Decree.

<sup>7</sup> For additional details about this Alternative, including maps of the properties, see Paragraphs 17-25 of Appendix A to the Consent Decree

Table 2. Summary of property recipient and donations.

Name of Property	Approximate acres
U.S. Forest Service	
Irish Wilderness in Oregon County	68 acres
Silvey Glade Top Trail in Ozark County	280 acres
West Fork River East in Reynolds County	91 acres
Chandler Cemetery in Iron County	41 acres
State of Missouri	
Sweetwater East in Reynolds County	518 acres

### 3.6 Alternative E: Selected Alternative

Under this Alternative, each of the action alternatives (B-D) would be implemented in combination to form the Trustees' Selected Alternative. Specifically, the Selected Alternative includes stream restoration; enhanced closure, soil restoration and re-vegetation of terrestrial habitats; and property transfer and protection. Details of these activities are described in Sections 3.3 through 3.5, above.

Table 3. Comparative analysis of alternatives using Restoration Evaluation Criteria.

Restoration Criteria	Alternative A: No Action	Alternative B: Stream Enhancement	Alternative C: Enhanced Closure of Tailings Areas, Soil Treatment, and Revegetation	Alternative D: Property Transfer and Protection	Alternative E: Preferred Alternative
<b>Technical Feasibility</b>	The No Action alternative is technically feasible.	Restoration activities included in Alternative B are technically feasible and likely to result in a desired condition, including improved sediment and water quality capable of supporting aquatic life.	The Trustees have been involved with planning and implementing similar projects where soil amendments and other surface manipulations are used to improve soil fertility, native plant growth, and general terrestrial ecological condition. Additionally, there is published literature and gray literature describing success of similar types of projects. Such experience and completion of projects demonstrates proposed restoration activities are technically feasible.	Property transfer and protection are technically feasible. Federal or state management plans are currently in place or will be developed to ensure properties are managed in accordance with applicable laws, regulations, and statutes and for the purposes of restoring injured resources.	Stream enhancement, soil treatment, enhanced closure, revegetation, and property acquisition included within the preferred alternative are all technically feasible.
<b>Relationship to Injured Resources and Services</b>	The No Action alternative would not provide for restoration, replacement, enhancement or acquisition of resources that were injured from releases of hazardous substances.	This Alternative would involve attempting to enhance sediment and water quality in areas affected by releases of hazardous substances. This alternative is likely to accomplish this goal and support fish, wildlife, and plant species.	This alternative would focus on improving habitat conditions and increasing the ecological productivity of terrestrial habitats that currently do not provide good supporting habitat thus increasing foraging and nesting grounds for the benefit of migratory birds.	This alternative would focus on conserving similar types of biological resources adversely affected by releases of hazardous substances. Properties to be received and protected by USFS and State of Missouri are in or near locations of injured natural resources.	Stream restoration, soil restoration and enhanced closure directly restore habitat for resources exposed to hazardous substances released from the facilities. Property to be transferred has similar habitats to those that have been injured and are contained within the southeast Missouri Ozarks as described by the SEMORRP. Since both terrestrial and aquatic restoration is included the Preferred Alternative, a more complete relationship to injured resources and services is established as compared to the other alternatives.
<b>Compliance with Laws and Policies</b>	The No Action alternative does not meet the requirements and goals of CERCLA NRDAR process to provide for restoration that compensates the public for the injury and loss of the natural resources and services caused by releases of hazardous substances.	Alternative B meets the requirements and goals of CERCLA NRDAR process to provide for restoration that compensates the public for the injury and loss of the natural resources and services caused by releases of hazardous substances. Proposed activities under this restoration plan would be subject to requirements of other laws, regulations, and statutes. Required permits will be obtained and all project activities will be conducted in accordance with local, stated, and federal laws.		Same as analysis for Alternative B.	



<b>Consistency with the Trustees Restoration Goals and Objectives</b>	The No Action alternative would not provide for restoration, replacement, enhancement or acquisition of injured natural resources, making this alternative inconsistent with Trustee restoration goals.	This alternative is consistent with Goal #1 and preferred project types described in the SEMORRP.	This alternative is consistent with Goal #2 and preferred project types described in the SEMORRP.	This alternative is consistent with Goal #3 and preferred project types described in the SEMORRP.	This alternative is consistent with Goals #1 through 3 and preferred project types described in the SEMORRP.
<b>Avoidance of Further Injury</b>	The No Action alternative would allow injuries to natural resources to continue into the future, and will also provide no benefit to offset interim losses.	This alternative will not cause further long-term injury in proposed project areas but it may cause short-term, adverse, and minor to moderate adverse impacts during construction periods.	This alternative will not cause significant injury in the in the proposed project areas, but has the potential to result in short-term, minor to moderate, adverse impacts in nearby areas. This alternative reduces future injury to natural resources that have been and may continue to be exposed to hazardous substances.	This alternative will not cause additional injuries to natural resources since it involves passive restoration through land protection.	Same as analysis for B, C, and D, collectively. No additional injury will occur due to a combination of activities within the Preferred Alternative.
<b>Public Health and Safety</b>	Any potential public health and safety issues or concerns that exist under current and future natural resource management activities would likely remain the same.	This alternative uses heavy equipment to remove contaminated from stream segments. Restoration activities would not pose elevated public health and safety issues.	Restoration activities and long-term management would not pose elevated risk to workers or any other people accessing restoration areas from exposure to contaminated soil. BMPs will be used to reduce potential risk of water and air contamination that may occur as a result of soil restoration activities.	This alternative would not pose elevated risk to workers and any other people accessing newly acquired properties.	Same as analysis for B, C, and D, collectively. No additional public health and safety concerns develop due to a combination of activities within the Preferred Alternative.
<b>Time to Provide Benefits</b>	The time to provide natural resource benefits under the No Action alternative is greater than if the Trustees were to pursue restoration under the Preferred Alternative. Under the No Action alternative, natural recovery would be relied upon to improve ecological services.	The time to provide natural resource benefits under this alternative is likely less than 10 years. As contaminated sediment is removed from impacted stream segments, aquatic biota are anticipated to recover over time. However, recovery time to for all stream biota to baseline condition is unknown.	The time to provide natural resource benefits under this alternative in comparison with the No Action Alternative is relatively short to moderate when taking into consideration the improved soil fertility following implementation of the Soil Restoration Plan.	The time to provide natural resource benefits under this alternative is relatively short in comparison with the No Action alternative when taking into consideration the management activities that will be used to protect and enhance on-site conditions following transfer.	The time to provide the full potential of natural resource benefits by implementing all activities contained within the Preferred Alternative is extended due to the greater magnitude of activities to be implemented. However, resource benefits will begin at the same time as the earliest period described in Alternatives B,C, or D.
<b>Duration of Benefits</b>	The duration of benefits under the No Action alternative is unknown. Perpetual conservation easements and other mechanisms to conserve habitat would not occur under this alternative.	The duration of benefits from this alternative are assumed to be long-term as long as recontamination of the stream segments do not occur.	Natural resource restoration or enhancement of terrestrial habitats, monitoring, and adaptive management in the proposed project areas will ensure long-term benefits are being provided.	Transfer and protection of properties will ensure long-term benefits will be provided.	The duration of benefits may be increased in the Preferred Alternative as compared to the other alternatives due to synergistic effects between activities and the larger magnitude of restoration. Synergistic effects would occur due to greater areas of the watershed enhanced or protected that would translate into less runoff of heavy metals and sediment into streams. Therefore, restored streams will have greater long-term capacity for ecological health. Greater areas of enhanced or protected land afforded by the Preferred Alternative will be more beneficial to migratory birds and large terrestrial mammals that require large undisturbed areas to thrive and reproduce.

## 4.0 ENVIRONMENTAL ASSESSMENT

In accordance with CERCLA NRDAR regulations (43 C.F.R. § 11.93), the Trustees' primary goal in this section is to evaluate restoration alternatives that compensate the public for natural resource injuries and associated service losses resulting from releases of hazardous substances from facilities in the Viburnum Trend. In this section, the Trustees also assess the environmental consequences of Alternatives A, B, C, D, and E to determine whether implementation of any of these alternatives may significantly affect the quality of the human environment, particularly with respect to physical, biological, socio-economic, or cultural environments. In the SEMORRP, the Trustees selected Alternative D as the Preferred Alternative (see Section 3.5, pages 23 and 24 of SEMORRP for a description), where the Trustees will consider a combination of primary and compensatory restoration actions and projects to accomplish restoration goals at or near the site(s) of injury. Alternative E selected in this Final RP/EA is consistent with the Preferred Alternative of the SEMORRP in that it provides a multifaceted approach of primary and compensatory restoration alternatives. Lastly, the Trustees make a conclusion at the end of the evaluation for each alternative identifying whether it is the selected alternative and should be implemented in the event the USFWS issues a Finding of No Significant Impact.

The following definitions will be used to characterize the nature of the various environmental consequences evaluated in this Final RP/EA:

- *Short-term or long-term impacts.* In general, short-term impacts are those that would occur only with respect to a particular activity or for a finite period. Long-term impacts are those that are more likely to be persistent and chronic.
- *Direct or indirect impacts.* A direct impact is caused by a proposed action and occurs contemporaneously at or near the location of the action. An indirect impact is caused by a proposed action and might occur later in time or be farther removed in distance but still be a reasonably foreseeable outcome of the action.
- *Negligible, minor, moderate, or major impacts.* These relative terms are used to characterize the magnitude of an impact. Negligible impacts are generally not quantifiable and do not have perceptible impacts on the human environment. Minor impacts are generally those that might be perceptible but, in their context, are not amenable to measurement because of their relatively inconsequential effect. Moderate impacts are those that are more perceptible and, typically, more amenable to quantification or measurement. Major impacts are those that, in their context and due to their intensity (severity), have the potential to meet the thresholds for significance set forth under NEPA (40 C.F.R. § 1508.27) and, thus, warrant heightened attention and examination for potential means for mitigation to fulfill the requirements of NEPA.
- *Adverse or beneficial impacts.* An adverse impact is one having unfavorable or undesirable outcomes on the man-made or natural environment. A beneficial impact is one having positive outcomes on the man-made or natural environment. A single act might result in adverse impacts on one environmental resource and beneficial impacts on another resource.

- *Cumulative impacts.* Cumulative impacts are defined as the “impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions” (40 C.F.R. § 1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time within a geographic area.

## **4.1 Affected Environment**

This Final RP/EA evaluates restoration options to compensate the public for the natural resource injuries and associated losses in ecological services resulting from exposure to Trend-related hazardous substances. As part of the evaluation, the Trustees assessed the current physical, biological, socio-economic, and cultural resources of the area within which restoration is likely to occur (the Black, St. Francis, and Meramec River watersheds). This information will ensure that potential restoration projects are designed to maximize ecological benefits while minimizing or eliminate project-related adverse environmental consequences.

### *4.1.1 Watersheds*

There a number of areas in the three watersheds in which restoration activities may occur, the Black, the Meramec, and the St. Francis Rivers (Figure 3), are affected by one more or more environmental stressors. Stressors in the lower part of the Trend, but for the most part not in the mining-affecting areas, include not only hazardous substances released from hard rock mining, but also sedimentation and erosion from agricultural and logging practices.

When evaluating restoration projects and areas, it is important to identify stressors in order to identify the locations and types of projects to prioritize (e.g., areas by watershed; areas most in need of restoration; areas most at risk; areas where restoration will be most likely to succeed, etc.) The existing stressors are also considered in the evaluation of injury when establishing the baseline conditions of the area.

### *4.1.2 Black River Watershed*

Summary information about Southeast Missouri Ozarks’ physical, biological, and socioeconomic resources is contained in Section 4 of the SEMORRP. Summary information about the Black River Watershed of the Southeast Missouri Ozarks, including physical resources (geology, topography, soil, surface water, and groundwater), aquatic habitat, and biological resources, including sensitive species, is contained in Appendix D of the SEMORRP (see pages 4 – 7, 21, 25 and 28). These sections of the SEMORRP are incorporated by reference herein. Areas particularly relevant to the proposed restoration projects in the Black River Watershed include:

- Strother Creek
- Bills Creek
- Adair Creek
- Sweetwater Creek (and its tributary draining the mine/mill facility)

#### 4.1.3 *Meramec River Watershed*

Summary information about Southeast Missouri Ozarks' physical, biological, and socioeconomic resources are contained in Section 4 of the SEMORRP. Summary information about the Meramec River Watershed of the Southeast Missouri Ozarks, including physical resources (geology, topography, soil, surface water, and groundwater), aquatic habitat, and biological resources, including sensitive species, is contained in Appendix D of the SEMORRP (see pages 14 – 17, 22, 25, 26, 27, and 32). These sections of the SEMORRP are incorporated by reference herein. The Viburnum Trend is located south of the Meramec River. Five streams that are headwaters of the Meramec River are located in the northern portion of the Viburnum Trend mining district:

- Crooked Creek
- Mill Rock Creek
- Huzzah Creek
- Indian Creek
- Courtois Creek

#### 4.1.4 *St. Francis River Watershed*

Summary information about Southeast Missouri Ozarks' physical, biological, and socioeconomic resources is contained in Section 4 of the SEMORRP. Summary information about the Upper St. Francis River Watershed of the Southeast Missouri Ozarks, including physical resources (geology, topography, soil, surface water, and groundwater), aquatic habitat, and biological resources, including sensitive species, is contained in Appendix D of the SEMORRP (see pages 17 - 20, and 26). These sections of the SEMORRP are incorporated by reference herein.

Areas particularly relevant to the proposed restoration projects in the St. Francis River Watershed include Big Creek and Scoggins Branch. Big Creek is a tributary of the St. Francis River and originates in Iron County, north of the town of Hogan, Missouri. The Viburnum Trend Mining District is west of this area. Scoggins Branch, a small tributary of Big Creek, flows approximately 0.4 miles from where the former Glover Smelter is located at which point it drains into Big Creek. From where Scoggins Branch flows into Big Creek, the creek flows in a generally south-southeasterly direction through the town of Annapolis, Missouri and then another approximate 19 miles, at which point it drains into the St. Francis River.

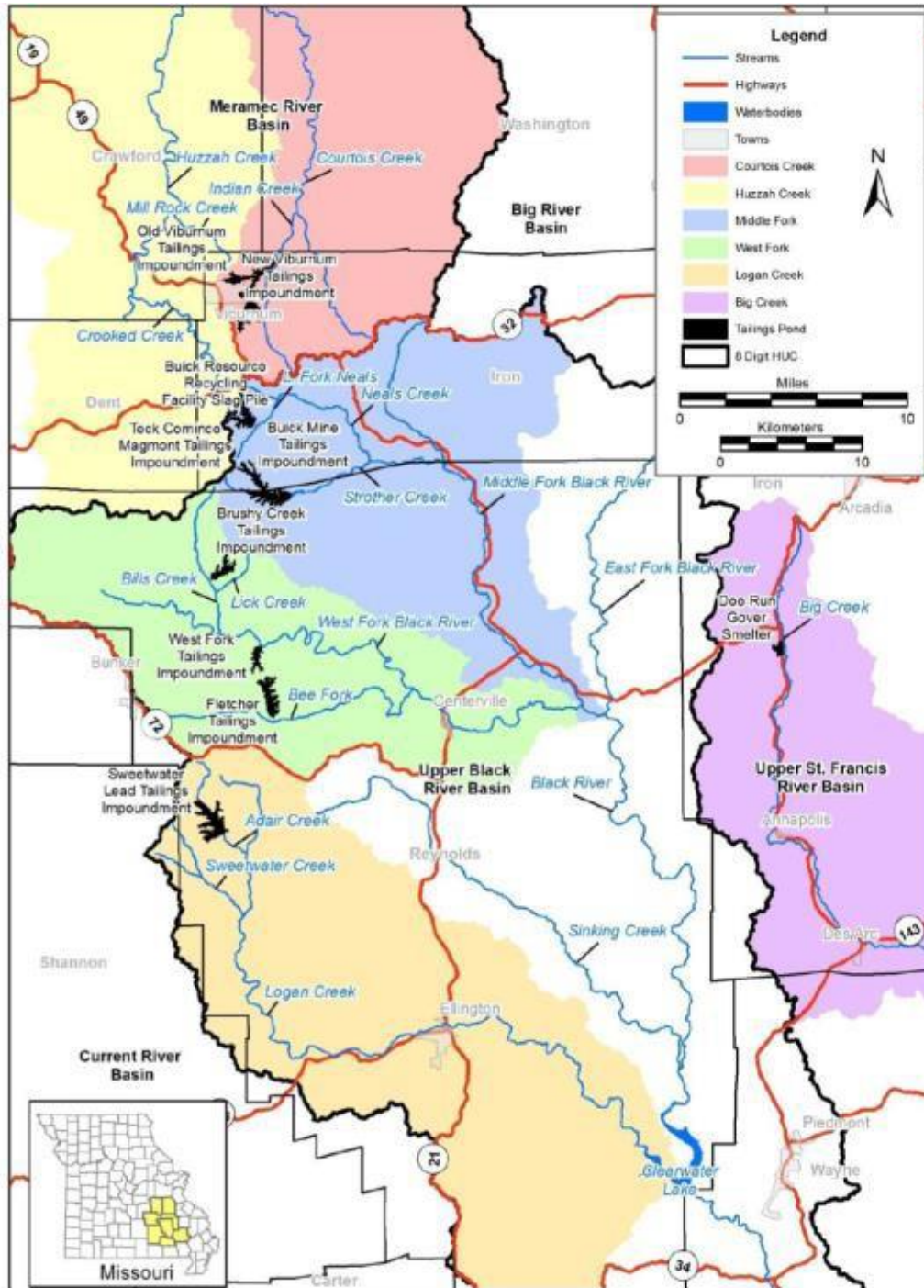


Figure 3. Southeastern Missouri watersheds in proximity to mining tailings impoundments. Source: Pavolwsky, R.T. and M.R. Owen. July 1, 2016. Stream Sediment Contamination in the Viburnum Trend in Crawford, Dent, Iron, Reynolds, and Washington Counties in Southeast Missouri. Submitted to U.S. Fish and Wildlife Service by Missouri State University Ozarks Environmental and Water Resources Institute. OEWR-EDR-15-002

#### 4.1.5 Terrestrial Environments

Terrestrial restoration projects are proposed within the Meramec and Black River watersheds. These projects will be planned for upland areas (ridgetops and on top of or adjacent to tailings impoundments). Summary information about physical and biological resources of terrestrial environments is contained in Section 4 of the SEMORRP and in Appendix D. These sections of the SEMORRP are incorporated by reference herein. Tailings impoundments that will undergo restoration/revegetation are flat, largely barren or sparsely vegetated areas covering hundreds of acres with sand-sized dolomite particles. Transition zones that are adjacent to the tailings impoundments are wooded and contain gentle slopes. The smelter zone is located within one mile of the Buick Resource Recycling Facility in Reynolds County and is also wooded with variable slopes, ridgetops and small stream valleys.

## 4.2 Demographics

A summary of demographic data is provided in Table 1. In general, the proposed projects areas are rural where agriculture, including pastured cattle, hay cropping, and timber, produce jobs for local populations. Areas of fastest growth are in commercial and services sector along major road transportation corridors and larger cities.

Table 4. Project area demographics by county.

Demographic Category	Iron County	Oregon County	Ozark County	Reynolds County
Population (2017 estimate)	10,226	10,558	9,186	6,275
Minority Population	468	607	403	263
Percent Minority	6%	6%	4%	5%
Low Income Population**	48%	51%	55%	45%
% persons in poverty (estimate)	22.6	24.3	21.5	20.4
Households	4,050	4,339	4,267	2,652
Population per square mile	19.3	13.8	13.1	8.3

\* Statistics generated using 2010 U.S. Census Bureau data and EPA's Environmental Justice Screening and Mapping Tool (Version 2018) <https://ejscreen.epa.gov/mapper/>

\*\* State average is 35%

#### 4.2.1 *Executive Order 12898 Analysis*

Executive Order 12898 (Feb. 11, 1994) requires each federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. In a memorandum to heads of departments and agencies that accompanied Executive Order 12898, the President specifically recognized the importance of procedures under NEPA for identifying and addressing environmental justice concerns. The memorandum states that “each federal agency shall analyze the environmental effects, including human health, economic and social effects, of federal actions, including effects on minority communities and low-income communities, when such analysis is required by [NEPA]” and emphasizes the importance of NEPA’s public participation process in particular, directing that “each federal agency shall provide opportunities for community input in the NEPA process.” The CEQ has oversight of the federal government’s compliance with Executive Order 12898 and NEPA.

For the purpose of evaluating environmental justice issues associated with implementation of the Preferred Alternative, demographic data were obtained from the U.S. Census Bureau and the State of Missouri. In this analysis, a county is considered to have a minority population if its non-white population is greater than 50 percent or is meaningfully larger than the general (statewide) non-white population. Low-income areas are defined as counties in which the percentage of the population below poverty status exceeds 50 percent, or is meaningfully greater than the general population (average statewide poverty level).

To make a finding that disproportionately high and adverse effects would likely fall on minority or low-income populations, three conditions must be met simultaneously:

- There must be a minority or low-income population in the impact zone.
- A high and adverse impact must exist.
- The impact must be disproportionately high and adverse on the minority or low-income population

Based on the census data for the counties of Iron, Oregon, Ozark, and Reynolds, the minority population in the areas of the proposed projects does not meet the condition of being classified having a minority population since the minority population comprises only 4 to 6% of the population for each county. The project areas could be considered low-income because approximately half of the population in counties where projects will occur are classified as low income. In addition, poverty levels exceed the statewide average (estimate of 14%) for each county where projects will occur.

### **4.3 Recreation**

Recreational resources are highlighted in the SEMORRP in Section 4.3.1 and a list of public lands in the SEMO provided in Appendix F. These sections of the SEMORRP are incorporated by reference herein.

#### **4.4 Cultural and Historic Resources**

The proposed projects are located in Oregon, Ozark, Reynolds, and Iron Counties of Missouri. Significant historical and cultural resources, including Civil War battlefields and related historic sites, many of which are protected through Missouri State Parks system are found in the vicinity of the restoration areas; however, there are no known cultural or historic resources within the boundaries of the proposed restoration sites.

Prior to the implementation of the proposed restoration projects, potential impacts to historic and archaeological resources will be reviewed. Section 106 of the National Historic Preservation Act requires federal agencies to consider the effects of preferred alternatives on historic properties.

Historic properties must also be given consideration under NEPA. The National Register of Historic Places is a federally-maintained list of districts, sites, buildings, structures, objects, and landscapes significant in American history, prehistory, architecture, archaeology, engineering, and culture. Archaeological sites are places where past peoples left physical evidence of their occupation. Sites may include ruins and foundations of historic-era buildings and structures.

Native American cultural resources may include human skeletal remains, funerary items, sacred items, and objects of cultural patrimony. Historic properties can also include traditional cultural properties.

The Trustees will consult with the USFWS Regional Historic Preservation Office (RHPO) or the Missouri State Historic Preservation Office to complete Section 106 review and compliance prior to taking on-the-ground restoration actions.

#### **4.5 Components Not Affected or Not Analyzed in this Document**

The following components, identified as not being present, affected, or analyzed are not brought forward for additional analysis in this Final RP/EA:

- **Social/Economic/Environmental Justice** – No social or economic impacts are expected from the proposed restoration projects because of the remote location and types of projects proposed. There are low-income populations near proposed project areas but these populations will not be adversely affected due to the intended beneficial environmental outcomes of the projects and use of some of the areas for recreation. The restoration projects proposed are expected to be performed by Doe Run or their contractors. It is uncertain whether there would be additional employment opportunities through the companies to conduct restoration activities.

The area currently experiences a fairly high truck traffic volume due to mining and milling activities. However, the restoration is not expected to add significantly to the existing traffic patterns and there are no known existing traffic congestion issues in the area.

- **Recreation** – Impacts to recreation are anticipated to be beneficial at project areas where public access will be allowed, such as additions to the Mark Twain National Forest and



potentially state conservation areas. Types of recreation to be benefited include forest-based recreation, such as hunting, where allowed, other wildlife-associated activities, and hiking.

- Cultural and Historic Resource Concerns – The Trustees will consult with the RHPO or the Missouri State Historic Preservation Office prior to implementing any restoration activities.
- Air and Climate – Proposed activities, including operation of heavy construction equipment, are not expected to produce air pollutants at levels to exceed state air quality standards.

#### **4.6 Evaluation of Alternative A: No Action/Natural Recovery**

The No Action/Natural Recovery Alternative is described on page 16 of the SEMORRP and compared to other SEMORRP alternatives pages 25 and 26 of that plan. Environmental consequences of the No Action alternative are described on pages 35 and 36 of the SEMORRP, incorporated by reference herein.

##### *Conclusion on Alternative A*

The Trustees found that the No Action Alternative would not meet the purpose and need for restoration under this Final RP/EA, the Restoration Evaluation Criteria, or CERCLA, including as defined by CERCLA NRDAR procedures. Therefore, the No Action Alternative is not a preferred restoration alternative when evaluated against the NRDAR Restoration Evaluation Criteria.

#### **4.7 Evaluation of Alternative B: Stream Enhancement**

Environmental consequences associated with implementation of Alternative B have been evaluated at a programmatic level on pages 36 through 40 of the SEMORRP. Because the SEMORRP did not include a more-detailed analysis of the proposed project type (stream sediment excavation), this document provides a more in-depth analysis as the alternative is described in Section 3.3. These sections of the SEMORRP are incorporated by reference herein.

##### *4.7.1 Physical and Biological Environment Impacts*

Removal of contaminated sediments would accelerate the return of injured streams to baseline conditions. Sediment removal is technically feasible, is highly likely to improve ecological services, and has been applied at other contaminated sediment sites. Risks for adverse collateral impacts of this technique exist, however, and these actions would need to be carefully designed to minimize these risks. The Trustees assume that the removed sediments would be disposed into an existing local repository such as a tailings impoundment.

Some restoration activities within this category may cause minor to moderate, short-term, direct or indirect adverse impacts; however, the long-term benefits listed above are expected to outweigh any of these adverse impacts. During project implementation, there would be minor to

moderate short-term, direct disruptions to habitat due to the movement of sediments and soils as a result of sediment excavation, grading activities, and other related actions. These impacts are expected to be localized and limited to the project area through the use of best management practices. Further, project implementation would appropriately adhere to all federal, state, and local laws, regulations, and policies. The use of heavy machinery or other equipment would likely increase noise and diesel emissions in the surrounding area during construction. However, these disturbances would be temporary and minor. In addition, fish and wildlife may be disturbed by the increase in turbidity and noise but could avoid the area during construction, and are likely to resume normal patterns of movement shortly after implementation is complete. Though these construction-related impacts would be adverse, they are anticipated to be minor to moderate, and short-term in nature. Long-term beneficial impacts to aquatic resources and riparian plants and animals would occur due to the reduced contaminant burdens, reduced erosion, and increased shelter provided by new plantings, and beneficial impacts would span a large geographic area downstream.

#### *4.7.2 Conclusion on Alternative B*

The Trustees found Alternative B to meet the purpose and need for this Final RP/EA and all of the Restoration Evaluation Criteria, including alignment of the proposed project and the Trustees' restoration goal of improving stream condition and supporting native aquatic communities. The Trustees have found Alternative B to have negligible to moderate short-term adverse impacts to the human environment, with the majority of anticipated effects being beneficial and long-term. For these reasons, Alternative B, taken together with the other alternatives described herein, is a component of the Selected Alternative (Alternative E).

### **4.8 Alternative C: Enhanced Closure of Tailings Areas, Soil Treatment, and Revegetation**

Environmental consequences associated with implementation of Alternative C have been evaluated at a programmatic level on pages 36 through 40 of the SEMORRP. These sections of the SEMORRP are incorporated by reference herein. Because the SEMORRP did not include a more-detailed analysis of the proposed project type (terrestrial restoration), this document provides a more in-depth analysis as the alternative is described in Section 3.4.

#### *4.8.1 Physical and Biological Environment Impacts*

Soil restoration activities as proposed are expected to cause minor to moderate, short-term, localized adverse impacts to existing natural resources, and result in moderate long-term benefits across a localized area. Removal of highly contaminated soils will reduce the risk of effects associated with wildlife exposure to hazardous substances in the environment, and result in enhanced condition of local wildlife populations, including migratory birds and sensitive species.

Some of the soil restoration activities will result in direct and indirect, short-term, localized adverse impacts on natural resources such as soil, sediment, soil-dwelling organisms, and vegetation. Existing habitat may in some cases be substantially modified to create the vegetation necessary for the successful development of terrestrial habitats supportive of native plants and

wildlife. This will likely involve the use of heavy forestry machinery and other equipment, which may result in soil compaction, localized emissions from heavy equipment, removal or crushing of understory vegetation, and increased soil erosion in the immediate area of construction operations. However, the long-term direct and indirect benefits expected from soil excavation, regrading, and soil restoration activities outweigh the potential adverse impacts. Further, project implementation will appropriately adhere to all federal, state, and local laws, regulations, and policies.

In some areas where soil lead concentrations remain relatively high (>1,000 mg/kg), phosphate in the form of triple superphosphate may be added along with lime to reduce soil lead bioavailability. Phosphate amendments have been shown to reduce soil lead leaching and plant lead uptake while having negligible to minor adverse effects on the environment (Tang et al. 2009; Weber et al. 2015). The Trustees will use best available science to inform the soil amendment process to increase likelihood of success for reducing soil lead bioavailability, while minimizing likelihood of potentially adverse environmental consequences.

Other restoration actions associated with Alternative C, including planting upland forest species, invasive species control, and erosion reduction, will have negligible to minor short-term, direct and indirect adverse effects on the environment. Minor to moderate long-term benefits across a broad geographic scope are anticipated though, including reduction of invasive species, reduced sediment transport into local waterways, and increases in local native wildlife species. Long-term, moderate beneficial impacts to resources and associated flora and fauna are expected due to the reduced erosion and increased shelter provided by plantings.

#### *4.8.2 Conclusion on Alternative C*

The Trustees found Alternative C to meet the purpose and need of this Final RP/EA and all of the Restoration Evaluation Criteria, including alignment of the proposed project and the Trustees' restoration goal of improving habitat conditions for migratory birds and sensitive species. The Trustees have found Alternative C to have negligible to moderate short-term adverse impacts to the human environment, with the majority of anticipated effects being beneficial and long-term. For these reasons, Alternative C, taken together with the other alternatives described herein, is a component of the Selected Alternative (Alternative E).

### **4.9 Alternative D: Property Transfer and Protection**

Environmental consequences associated with implementation of Alternative D have been evaluated at a programmatic level on pages 36 through 40 of the SEMORRP. These sections of the SEMORRP are incorporated by reference herein.

Alternative D may result in new or improved access to forested and other upland areas. Depending on the plans for management by USFS and State of Missouri, new or improved access to resource-based recreational activities, such hiking and bird watching, may result from property acquisition. Land acquisition and subsequent recreational use on received properties could result in long-term minor, beneficial impacts to recreation. Alternative D would also allow the public land manager to implement monitoring and long-term stewardship activities to ensure

existing natural resource services and aesthetic values are conserved and are available into the future. Depending on the land management plans applicable to these properties and other factors, the interest and ability of the public to access these areas may be increased and result in minor increased traffic in the vicinity of the properties. Because of the remote and rural nature of potential restoration sites within the SEMO, however, any increase in site-specific recreational use is expected to be minor.

#### *4.9.1 Conclusion on Alternative D*

The Trustees found Alternative D to meet the purpose and need of this Final RP/EA and all the Restoration Evaluation Criteria, including alignment of the proposed project and the Trustees' restoration goal to preserve and/or enhance conservation value of upland or aquatic habitats supportive of injured natural resources. The Trustees anticipate Alternative D to have primarily beneficial direct and indirect long-term impacts in the form of improved land management activities enhancing fish and wildlife populations and recreation opportunities. For these reasons, Alternative D, taken together with the other alternatives, is a component of the Selected Alternative (Alternative E).

#### **4.10 Alternative E: Selected Alternative**

The Trustees have identified a combination of three alternatives (B, C, and D) as the Selected Alternative, which includes stream restoration; enhanced closure, soil restoration and revegetation of terrestrial habitats; and property transfer and protection. Specifically, the Selected Alternative would include a variety of activities, taken as a whole, provide the most benefits to the public by restoring and compensating for injured resources. Stream restoration will involve excavation of contaminated sediment at exposed gravel bars or depositional zones above low water crossings or other obstructions to flow. This activity will benefit fish, crayfish and other aquatic invertebrates that are negatively affected by heavy metals. Enhanced closure of tailings impoundments and revegetation will convert approximately 1,000 acres of contaminated mill waste areas to non-toxic terrestrial habitat. Soil restoration with revegetation will involve treatment of contaminated soil to reduce its toxicity and provide over 1,000 acres of non-toxic terrestrial habitat. Property donation and protection will insure long-term protection of an additional 1,000 acres of terrestrial habitat for public use. Collectively these activities combine to form the Selected Alternative, which will provide 3,000 acres of improved terrestrial habitat and several miles of improved stream habitat for public use and natural resource benefits. This range of restoration alternatives is consistent with the Preferred Alternative selected within the SEMORRP.

#### **4.11 Cumulative Impacts**

Cumulative impacts associated with the Selected Alternative of the SEMORRP can be found in Section 5.5.1 of that restoration plan, incorporated by reference herein. This section expands upon that analysis to a project-specific level.

Cumulatively, the Selected Alternative is anticipated to have a cumulative impact that is long-

term and beneficial. Water and sediment quality will be enhanced as a result of excavation of contaminated sediment. Improved stream conditions should enhance habitat for fish and other aquatic life, and direct and indirect benefits may also be provided to wildlife using enhanced stream segments and downstream areas. Terrestrial habitats will be restored or enhanced after potential minor to moderate short-term impacts to terrestrial natural resources and some adjacent water bodies, such as nearby creeks. Terrestrial wildlife habitat conditions will improve as a result of reduced contaminant concentration, enhanced soil fertility, and increased native plant cover. Recreational activities may also be enhanced as a result of the improved environment within and downstream of the enhanced stream segments.

The Selected Alternative is not expected to result in significant cumulative impacts on the human environment since it alone, or in combination with other current and future activities in the vicinity, would not change the larger current hydrological patterns of discharge in the Black, Meramec, and St. Francis Rivers and tributaries; recreational use; economic activity or land-use in the proposed project areas. Future activities within the scope of the Selected Alternative, either completed by Trustee agencies or other organizations, agencies, or groups, will enhance habitat that exists naturally in the areas. For example, future stream restoration actions completed near the proposed sediment excavation areas may also enhance ecological conditions as a result of the reduced stream sediment contaminant load in tributaries to the Black, Meramec, and St. Francis Rivers.

There are several environmental regulatory activities ongoing in the Viburnum Trend that in combination with the proposed restoration activities described herein will provide additional cumulative benefits to the environment. Missouri Department of Natural Resources is overseeing air pollution control actions at Buick mine/mill, hazardous waste clean-up actions at Glover and Sweetwater mines/mills, and tailings closure at all the tailings impoundments. Doe Run has also implemented additional waste water treatment measures that are expected to improve water quality to Viburnum Trend streams under the oversight of the Missouri Department of Natural Resources Water Protection Program. Restoration projects have been designed to integrate or complement these planned environmental controls. Other ongoing non-regulatory land-use activities that will likely have cumulative impacts on the area would include continued mining, milling, and smelting activities, and limited logging and cattle grazing operations.

## **5.0 AGENCIES, ORGANIZATIONS, AND PARTIES CONSULTED FOR INFORMATION**

Missouri Department of Natural Resources  
Environmental Remediation Program  
P.O. Box 176  
Jefferson City, MO 65102

U.S. Forest Service  
Mark Twain National Forest  
401 Fairgrounds Road  
Rolla, MO 65401

U.S. Fish and Wildlife Service  
Columbia Ecological Services Field  
Office 101 Park DeVille Drive, Suite A  
Columbia, MO 65203

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