US Army Corps
of Engineers
Louisville District®

# Town of Avon, Indiana South County Road 625 East

## Section 14

**Detailed Project Report and Environmental Assessment**
**3/26/2019**

# Town of Avon, Indiana
## CAP Section 14
# DRAFT Detailed Project Report (DPR)
## AND
# Environmental Assessment

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# 1 INTRODUCTION

## 1.1 PROJECT AUTHORITY

This project is being conducted under Section 14 of the Flood Control Act of 1946, as amended, which authorizes the US Army Corps of Engineers (Corps) to study, design and construct emergency streambank and shoreline works, and to protect public services including (but not limited to) streets, bridge approaches, schools, water and sewer lines, historic properties listed on the National Register of Historic Properties, and churches from damage or loss by natural erosion. The project is part of the Continuing Authorities Program (CAP) which focuses on water resource related projects of relatively smaller scope, cost and complexity.

The purpose of this study is to develop and evaluate information pertinent for the Town of Avon's request for Corps Assistance, and in concert with key stakeholder priorities, identify a viable plan that may be implemented under the above authority. Per the Corps' Engineering Regulation (ER) 1105-2-100, Appendix F, Section III, F-23, a plan is considered to be economically justified if the total costs of the preferred alternative is less than the cost of relocating the threatened facility: South County Road 625 East.

## 1.2 PROJECT OVERVIEW

Traditional Corps civil works projects are wider in scope and complexity and are specifically authorized by Congress. The CAP provides authority for the Corps to plan, design, and construct certain types of water resource and environmental restoration projects without specific Congressional authorization.

Projects conducted under the Section 14 authorization are completed in two phases. This project is currently in the first phase (Feasibility), which identifies a viable solution to stabilize and protect the eroding streambank near South County Road 625 East. This phase concludes with a Detailed Project Report (DPR) with an integrated Environmental Assessment (EA) that documents the Corps' decision to proceed with the second phase of the project (Design and Implementation). The Feasibility phase of this project is being conducted at a 50/50 percent cost share with the non-Federal sponsor above $100k, and is scheduled to conclude in June of 2019. In order to proceed with Design and Implementation (D&I), the project proposed in the DPR must be in compliance with Corps policy regarding the implementation of Section 14 projects.

Upon approval of the DPR, and subject to the availability of Federal and non-Federal funds, the project would proceed into the D&I Phase. This phase is cost-shared with the non-Federal sponsor at a 65% Federal and 35% non-Federal cost-share ratio, which is outlined in a Project Partnership Agreement (PPA) to be executed between the Corps and the non-Federal-sponsor, the Town of Avon, Indiana. The PPA defines the obligations of the Federal government and the sponsor for the construction, operation, maintenance, and cost sharing of the project. Assuming project funds, federal and non-Federal are available, the design is expected to take six months and construction is expected to take no more than 12 months between the start of the PPA and the time the project is ready for construction.

## 1.3 STUDY PURPOSE AND NEED

The project is needed to prevent the loss of a major county roadway that serves as a primary transportation route for the town of Avon, Indiana. The roadway is being threatened by streambank erosion along a bend of the White Lick Creek, and is likely to result in imminent failure of the road and associated traffic route. This study was initiated by a request from the Town of Avon's Department of

Public Works to investigate stabilization solutions for approximately 500 linear feet (lf) of the left descending bank of the White Lick Creek adjacent to South County Road 625 East in Hendricks County, Indiana. The Corps conducted an initial field inspection of the project on April 27, 2016. A second site visit was conducted on February 2, 2017 to collect data and evaluate the nature and extent of the erosion. The Federal Interest Determination (FID), an interim milestone that occurs during the feasibility study to confirm the viability of a project, was approved for this project on July 13, 2016 by the Corps' Great Lakes and Ohio River Division.

## 1.4 LOCATION

### 1.4.1 Study Area

The Town of Avon was incorporated in 1995 and is located approximately five miles west of the city of Indianapolis. U.S. Highway 36, also known as Rockville Road, and Indiana State Highway 267, also known as Avon Road, are its main thoroughfares. Most of the town is characterized by single family dwellings and community parks, the largest being the Washington Township Park which is located adjacent to the project. The most iconic landmark of the town is the "Haunted Bridge of Avon", which is an active CSX double track railroad bridge that bisects the project area. West Central Conservancy District (WCCD) is located to the north and east of project and provides wastewater and sewer treatment service to approximately 8000 households. Finally, the Thornridge subdivision is located to the east of the project along South County Road 625 east and contains approximately 100 homes (Figure 1).

### 1.4.2 Project Area

The project is located along the White Lick Creek near South County Road 625 East. South County Road 625 East is a north-south route for local residents travelling to and from the town of Avon, its businesses and public facilities. Continued erosion at this location will restrict or stop all traffic for Thornridge subdivision. The erosion could eventually threaten the water and sewer lines running along South County Road 625 East from the WCCD.

The proposed project includes a design of bank stabilization for slope failures between the road and creek. The principal cause of the erosion is scouring and undercutting of the stream bank due to the high flow events that are concentrated on the left descending side of the creek. The CSX Avon Railroad Bridge and piers near the project area do not contribute to the bank erosion. Additionally a culvert pipe protrudes from the bank to the south of the CSX Avon Bridge. The pipe catches and drains flows from the east side of the South County Road 625 east, but does not contribute significantly to the erosion occurring on the streambank.

The rate of erosion, based on historical aerial photography, is estimated to average a foot per year at this site. In a consultant's report done for the Town of Avon, IN, the current slope condition was considered to be unstable. Therefore, additional erosion further increases the risk of a large slope failure.

## 1.5 RELEVANT PRIOR STUDIES AND REPORTS

The Town of Avon conducted a safety analysis related to the erosion within the project area. Titled "Safety Analysis and Slope Analysis of CR 625 East at CSX (railroad) Crossing near White Lick Creek," the report identified a sheet pile wall as a potential solution to the erosion but did not make a definitive recommendation.


**Figure 1. Project Location**

# 2 AFFECTED ENVIRONMENT - EXISTING CONDITIONS

## 2.1 CLIMATE

Indiana's climate exhibits strongly marked seasons. Winters are often cold, and summers are often hot. The transition from cold to hot weather can produce an active spring with thunderstorms and tornadoes. Oppressive humidity and high temperatures arrive in summer. Autumn is generally marked by lower humidity than the other seasons, and mostly sunny skies (National Climatic Data Center, 1976).

A report conducted by the Institute for Water Resources (2015) summarizes the available literature for the Ohio Region, which includes the White Lick Creek basin. The report focuses on both observed climatic trends, as well as projected future findings. While the observed trends may prove to be of some importance, it is the projected findings which are of the most significance. The report finds a strong consensus supporting trends of increasing air temperatures. Average minimum temperatures are expected to experience a small increase, while temperature maximums are predicted to undergo a large increase. Projected increases of mean annual air temperature range from 0 to 8 degrees Celsius by the

latter half of the 21st century. Projections regarding precipitation and hydrologic streamflow trends are less certain, with some studies calling for increases whereas others call for decreases.

The rate of warming in the Midwest has markedly accelerated over the past few decades. Between 1900 and 2010, the average Midwest air temperature increased by more than 1.5°F. Figure 2 shows annual average temperatures (red line) across the Midwest show a trend towards increasing temperature. The trend (heavy black line) calculated over the period 1895-2012 is equal to an increase of 1.5°F (Figure source Kunkel et al. 2013). However, between 1950 and 2010, the average temperature increased twice as quickly, and between 1980 and 2010, it increased three times as quickly as it did from 1900 to 2010 (Pryor and Barthelmie, 2013) Warming has been more rapid at night and during winter.

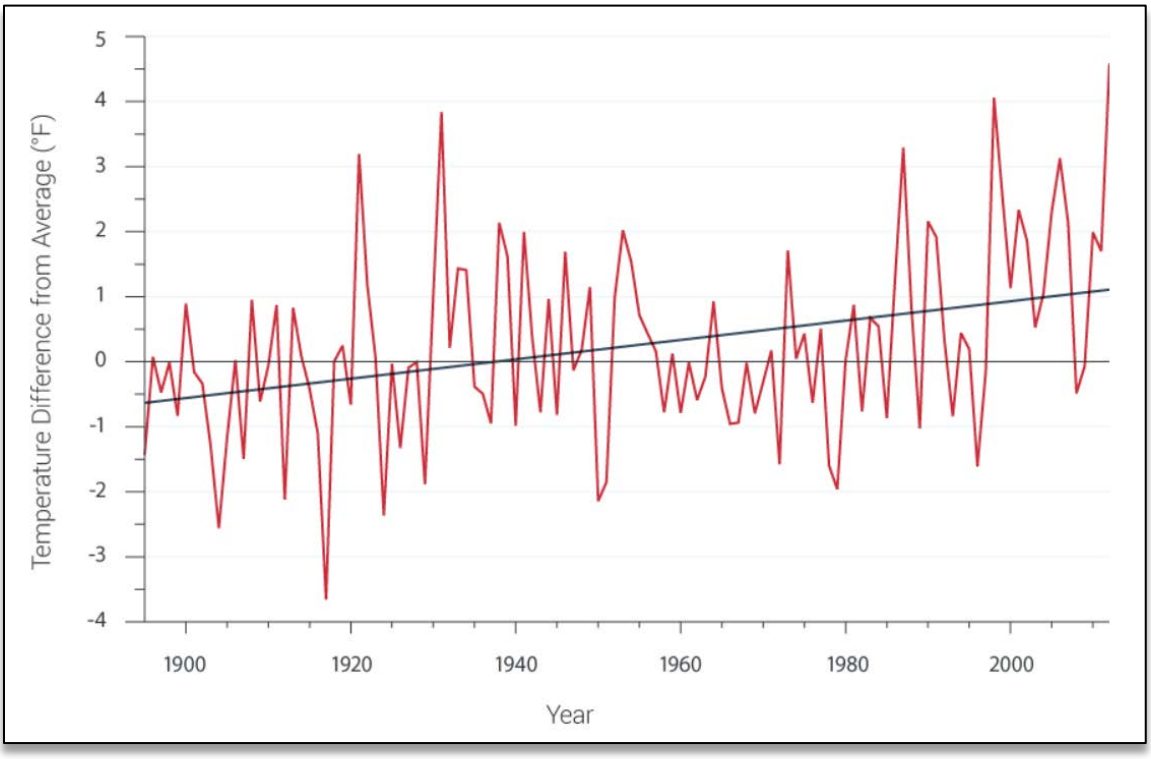


**Figure 2. Range of annual average temperatures (red line) across Midwest.**

## 2.2 SOILS AND GEOLOGY

### 2.2.1 Geology and Physiography

The project is located within the Eastern Corn Belt Plains Eco-region, a generally flat and featureless plain with low gradient streams that were laid down during the Wisconsinan glaciation (USGS 1998). In particular, the project lies on materials of the Cartersburg Till member of the Trafalgar Formation. These materials, including outwash sand and gravels, and end moraines such as the Crawfordsville and Knightsville Moraines, were brought down by advancing glaciers from northeast and south-central Indiana around 20,000 to 21,000 years ago. The thickness of the glacial deposits in the study area range from 10 to 200 ft. They overlay various bedrock deposits of limestone, dolomites, and shale from the Devonian, Silurian and Mississippian ages (Gutschick 1966).

### 2.2.2 Soil Associations

The project area lies within the Miami-Crosby-Treaty soil association. According to the Natural Resources Conservation Service (NRCS) Web Soil Survey, the project site is completely comprised of Genesee silt loam. The soils are frequently flooded albeit for brief durations. The NCRS soil map of the project area can be found in the Appendix A.

### 2.2.3 Hydric Soils

No hydric soils have been identified in the project area. Soils in the area are flooded frequently, but are well drained.

## 2.3 SURFACE WATER AND OTHER AQUATIC RESOURCES

### 2.3.1 Surface Water

The White Lick Creek watershed includes approximately 290 square miles of drainage area, and eighteen HUC14 sub-watersheds. The creek is 47.7 miles long and flows from its source near Fayette, Indiana to its confluence with the White River in Centerton, Indiana.

White Lick Creek was listed on the Draft Indiana Department of Environmental Management (IDEM) 2016 Section 303(d) List of Impaired Waters. This is a requirement of states under Sections 303(d) and 305(d) of the Clean Water Act (CWA). The causes of impairment for the creek were *E. coli* concentrations that exceeded the state's water quality standards. To date, the U.S. Environmental Protection Agency (EPA) has not issued a decision regarding Indiana's 2012 303(d) List of Impaired Waters. An active waste water treatment outfall (NPDES Permit ID: IN0051632) is approximately 220 feet upstream of the project area. The outfall was permitted in 2006.

### 2.3.2 Groundwater

The potentiometric surface is a measure of the pressure on groundwater in a water bearing formation. Potentiometric surface elevations in Hendricks County, Indiana range from a high of 1,002 feet mean sea level (msl) in the north-central section of the county, to a low of 644 feet msl in the southeastern portion. Groundwater flow direction in the northwestern section of the county is toward West Fork Big Walnut Creek. In the eastern portions of the county, groundwater flow is generally toward White Lick Creek, and in the southwest, groundwater flow is to the south-southwest (Schmidt, 2012).

### 2.3.3 Flood Plains

The project site is located within the 100-year floodplain of White Lick Creek and Zone AE as defined by the Federal Emergency Management Agency (FEMA). Most of the erosion protection would be placed within the regulatory floodway of the creek. A FEMA Flood Insurance Rate Map (FIRM) of the project area is included in the Appendix A.

### 2.3.4 Wetlands

White Lick Creek is classified by the U.S. Fish and Wildlife Service (USWFS) as a riverine wetland. The east bank of the creek, where the project is proposed, possesses a slope greater than 20 degrees and does not contain wetlands. The west side of the creek at the project site is classified as a freshwater forested/shrub wetland. No work is proposed on the west side of the creek. See the Appendix A for a National Wetlands Inventory (NWI) map of the project site.

## 2.4 FISH AND WILDLIFE HABITATS

### 2.4.1 Terrestrial and Aquatic Vegetation

Vegetation is relatively sparse on the steep, eroded streambank (Figure 3). Larger canopy trees consist of mostly of American sycamores (*Platanus occidentalis*), red maple (*Acer rubrum*), and ash (*Ulmus americana*). The right descending streambank, across from the project site, is mostly covered in scouring rush (*Equisetum hyemale affine*).

**Figure 3. Photographs looking east, across White Lick Creek at the proposed streambank to be protected (taken February 2nd, 2017).**

### 2.4.2 Fauna

Fisheries survey data for the White Lick Creek is relatively sparse. In 2001, the Indiana Department of Natural Resources (DNR) conducted a fish survey of four sites within the 11- digit HUC White Lick Creek Watershed. Results indicated that habitat scores ranged from "poor" to "very good." White Lick Creek had average species diversity compared to other major streams in Indiana, although the overall species diversity was better than the state average. The abundance of species intolerant of poor water quality such as the long-ear sunfish, northern hog sucker, and various species of red-horse suggested that water quality is "pretty good." With the exception of river mile 11.4, which has a wide riparian corridor, the remaining sampled reaches had minimal or no riparian zone.

The authors of the fish survey report recognized that fish communities in the White Lick Creek appeared to be doing well and indicated good water quality conditions; however, they state habitat improvements can be made at all stations with the expansion of riparian zones. Furthermore, the authors suggested that the water quality of White Lick Creek is in jeopardy by development occurring in the area that could bring increases in sedimentation associated with construction of residential and commercial structures (Morgan County Soil & Water Conservation District, 2005).

The development surrounding the project area consists mostly of residential and commercial development with fragmented stands of hardwood trees that offer habitat to a wide range of wildlife. Various mammals, waterfowl, amphibians, reptiles, and macroinvertebrates utilize habitat offered by White Lick Creek in some manner.

### 2.4.3 Existing Terrestrial and Aquatic Habitats

As streambank erosion continues at the proposed project sites, especially following high-water events, riparian vegetation will continue to become increasingly scarce as roots are undercut and plants are washed into the stream. The proposed project site lies on the outer bank of a sharp bend in the stream, which experiences higher water velocities and increased erosive forces as compared to the stream's opposite bank. Due to these relatively higher water velocities, severe bank erosion, and previous disturbances from development, it is not expected that there exists a thriving benthic community in the immediate project area. A large portion of the streambank is covered in riprap and concrete rubble from previous attempts to slow erosion (Figure 4).

**Figure 4. Previous attempts of erosion prevention at the project site by local entities included placement of riprap and concrete rubble (February 2, 2017).**

## 2.5 ENDANGERED AND THREATENED SPECIES

### 2.5.1 Federal

According to the USFWS official species list dated February 6, 2019 (see Appendix A), the Indiana bat (*Myotis sodalis*) and the Northern long-eared bat are the only federally threatened or endangered species that may be present within the project area. The Indiana bat is listed as endangered, which indicates that the species is in danger of extinction throughout all or a significant portion of its range. The Northern long-eared bat is listed as threatened which indicates the species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

### 2.5.2 State

The Division of Fish and Wildlife "Endangered, Threatened, and Rare Species List" lists 12 species and two natural communities as occurring in Hendricks County, Indiana. An analysis of the known ranges of the endangered species (IUCN, 2015) indicated that the project site lies within the range of the following species: upland sandpiper (*Bartramia longicauda*), cerulean warbler (*Dendroica cerulean*), evening bat (*Nycticeius humeralis*), and Indiana bat (*Myotis sodalis*). See Appendix A for the complete list of species and statuses.

### 2.5.3 Critical Habitat

No designated critical habitat exists on or near the project area.

## 2.6 RECREATIONAL, SCENIC, AND AESTHETIC RESOURCES

White Lick Creek can offer good wade fishing opportunities, as it supports good populations of popular sportfish like smallmouth and largemouth bass, sunfish, and channel catfish. Stretches of the creek further downstream of the project site can offer whitewater kayaking opportunities when flows are appropriate.

The project site is adjacent to the Washington Township Park which encompasses 160 acres of property that offers an array of recreational opportunities.

The CSX Avon Railroad Bridge that intersects the project site is locally known as the "Avon Haunted Bridge". This is a popular local attraction that plays on a few urban legends regarding rumored deaths associtated with the bridge. Figure 5 shows a sign near the bridge in Washington Township Park.

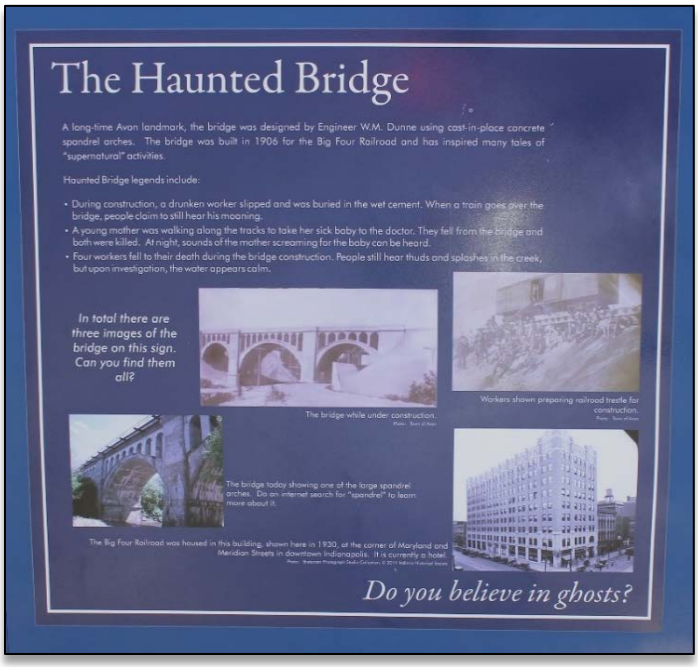


**Figure 5. Sign near the project site describing the legends of the Haunted Bridge.**

## 2.7 CULTURAL RESOURCES

A number of steps were taken in an effort to identify any cultural resources within the proposed streambank erosion project along White Lick Creek and South County Road 625 East. A background records check was conducted within a two kilometer (1.24 mile) radius of the project site. Four different sources of information were used: National Register of Historic Places, Indiana State Historic Architectural and Archaeological Research Database (SHAARD), Review of the Hendricks County Interim Report,

published by Historic Landmarks Foundation of Indiana, and previous cultural resources reports. A records search at the Indiana Division of Historic Preservation and Archaeology (DHPA), was not necessary because all the Hendricks County archaeological surveys and site forms are available on SHAARD (communication with, DHPA records check coordinator 2016). The site file search of the SHAARD database allowed the use of topographic maps, previous investigations, and historic structures and archaeological sites to collect information about the project vicinity. Reviews of the previous reports pertaining to Hendricks County were used to provide background information around the project area. The National Register of Historic Places (NRHP) online research database was used to collect information on NRHP eligible or listed properties within a two-kilometer project radius. All online research was conducted December 16, 2016 and January 9, 2017.

Two archaeological investigations have been conducted around the project area since 2009. King (2009) conducted an archaeological field reconnaissance of the 7,900 linear feet for the proposed Avon trail located along the right descending bank of White Lick Creek, adjacent to the project area. The reconnaissance consisted of pedestrian ground survey with a soil probe, as well as a bucket auger to determine soil depth. No archaeological sites were identified during the survey. In 2011, Zoll examined an additional 3,000 linear feet of land, which connected to Avon trail that was surveyed by King in 2009. Again, shovel probes were spaced at 15-meter intervals were used to determine soil depth. Soil probes were approximately 35cm in diameter and excavated until subsoil was encountered, which was approximately 20 to 25 cm (Zoll 2011). The archaeological reconnaissance revealed no archaeological sites.

In 2014, the Federal Highway Administration submitted a Categorical Exclusion Finding for a guardrail installation along County Road (CR) 625. The proposed installation consists of approximately 700 feet of guardrail along the west side of CR 625 E north and south of the CSX Avon Railroad Bridge. The Federal Highway Administration consulted with the IN-State Historic Preservation Office (SHPO) and IN-SHPO concurred the proposed undertaking would not result in an adverse effect and the guardrail will not change the characteristics of the bridge.

The Avon CSX Railroad Bridge, formally known as the Big Four Railroad Bridge, bisects the project area. The bridge was constructed in 1907 and is considered the oldest open-spandrel railroad in the state. In addition, the CSX Railroad is one of three tracks that connect to the New York Central tracks (SHAARD 2016). The CSX Avon Railroad Bridge meets the criteria of eligibility for the inclusion of the National Register of Historic Places, due to its age and architectural significance. The project design recommended in this DPR does not necessitate placement of material onto the railroad easement.

An onsite cultural resources assessment was conducted on February 2, 2017 in the project area. The area was examined by a visual pedestrian ground surface inspection. Since the project location is on terrain greater than 20 percent slope, no shovel tests were excavated (IN-SHPO Guidelines 2008). The project area is disturbed due to the construction of the road and placement of riprap in previous attempts to slow erosion of the streambank. No cultural resources were observed during the site visit.

## 2.8 AIR QUALITY

The proposed project area, located in Hendricks County, Indiana, is in attainment with both State and Federal National Ambient Air Quality Standards parameters (Indiana Department of Environmental Management, 2017 and U.S. Environmental Protection Agency, 2017).

## 2.9 NOISE

In the proposed project area vicinity, noise levels are generally low, however they can be sharply elevated by traffic on South County Road 625 East and by trains crossing the bridge.

## 2.10 HAZARDOUS AND TOXIC SUBSTANCES

The EPA Envirofacts and NEPAssist mapping tools were queried to identify the presence of EPA-regulated facilities within three miles of the proposed project area. These mapping tools contain information collected from regulatory programs and other data relating to environmental activities with the potential to affect air, water, and land resources in surrounding areas. There were 13 EPA-regulated facilities within a three-mile radius of the project site. See Appendix A for the complete list of these facilities. The West Central Conservancy District's water treatment facility, immediately upstream of the project area, likely has the greatest potential for detrimental environmental effects within the project area.

Multiple on-site inspections of the project area and surroundings have been performed by Louisville District staff. Based on the site visit on February 2nd, 2017, and an investigation of historic aerial photographs, no evidence of improperly-managed hazardous and/or toxic materials, or indicators of those materials were present in the proposed project area.

## 2.11 SOCIOECONOMIC AND ENVIRONMENTAL JUSTICE

### 2.11.1 Executive Order (EO) 12898 Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Environmental justice is defined as 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. The EPA further defines fair treatment to mean that no group of people should bear a disproportionate share of the negative human health impact from industrial, governmental, or commercial operations or policies.

According to the U.S. Census Bureau (2015), The 2010 U.S. Census indicated that race minorities made up 13.3% of the population of Fulton County, Indiana, and 3.3% of the total population earned income considered less than the poverty level threshold. The report generated by EPA's EJScreen mapping tool indicated both percentages of minority and low income populations near the project site are well below that of Indiana and the United States. The full EJScreen Report can be found in Appendix A. The EPA's EJScreen online mapping tool was utilized to generate reports on environmental and demographic indicators within the general project area. These reports are in Appendix A.

### 2.11.2 EO 13045 Protection of Children

Under this order, Federal agencies must identify and assess environmental health and safety risks that may disproportionately affect children as a result of the implementation of Federal policies, programs, activities, and standards. According to the U.S. Census Bureau (2015), the 2010 U.S. Census indicated that 30.2% of the total population of Avon, Indiana was under 18 years of age, and 8.7% was under five years of age.

# 3 PLAN FORMULATION

## 3.1 PROBLEMS AND OPPORTUNITIES

**Problem:**

- The integrity of South County Road 625 East in Hendricks County, Indiana is threatened by streambank erosion along a bend of the White Lick Creek, which is likely to result in a failure of the road and a safety concern for local travelers and residents.

**Primary Opportunities:**

- Prevent the failure of South County Road 625 East.
- Improve safety for vehicles traversing this segment of South County Road 625 East.
- Maintain response times for emergency responders.
- Reduce erosion generated by stream velocities of the White Lick Creek.

**Secondary Opportunities:**

- Remove invasive vegetation on the river bank and install native vegetation.
- Reduce sedimentation in the White Lick Creek.

## 3.2 OBJECTIVES AND CONSTRAINTS

### 3.2.1 Planning Objective

- Implement a long-term stabilization solution on White Lick Creek that protects South County Road 625 East, that is environmentally and economically acceptable
- Identify the least cost alternative that meets the purpose of this authority.

### 3.2.2 Planning Constraints

- Minimize impacts to benthic habitat and riparian corridor along White Lick Creek.
- Avoid effects to the the road, Avon CSX Railroad Bridge and surrounding area
- Avoid disturbance to utilities located adjacent to South County Road 625 East
- Restricted space to access channel and install embankment protection.
- Restricted setback distance between top of bank and building foundations.

## 3.3 MOST PROBABLE FUTURE WITHOUT PROJECT CONDITIONS-No Action Alternative

Results of a Corps site visit on April 27, 2016 determined that the cause of the erosion was the sinuous, bending nature of the creek and increased stream velocities during high flow events which undermines the supporting gravel layer of the streambank. Essentially, as the flow velocity increases so does the shear stresses on the streambank. When the shear stresses have increased to a point where they exceed the resisting forces, material from this granular layer are removed from the streambank. As material from the gravel layer is removed, the upper bank material is undermined and eventually falls into the creek. Based on the results of this study, the piers of the CSX Avon Railroad Bridge are not affected by this erosion and are not inducing erosion on the stream bank. The progression of erosion is dependent on the number and duration of high flow events that produce velocities great enough to generate the shear forces necessary to remove material from the gravel layer. However, it is likely that erosion rates will continue to accelerate resulting in a failure of the road. The approximate length of the scouring and erosion is 491 linear feet.

## 3.4 FORMULATION AND COMPARISON OF ALTERNATIVE SOLUTION SETS

### 3.4.1 Measures Array

Five structural measures and two nonstructural measure were considered to stabilize the riverbank. Only one measure, bioengineering, was excluded from further consideration. They are described below. These measures were developed into alternatives, based on preliminary information, engineering expertise, and policy. The alternatives were then compared to "No Action" alternative stated above in Section 3.3

#### *3.4.1.1 Structural Measures*

- Sheet Pile Wall: Sheet piling is an earth retention and excavation support technique that retains soils, using steel sheet sections with interlocking edges. Sheet piles are installed in sequence to a design depth along the planned excavation perimeter alignment. They are typically driven into the earth with a vibrator hammer. The interlocked sheet piles form a wall for permanent or temporary lateral earth support with reduced groundwater inflow. Anchors can be included to provide additional lateral support if required. This measure would also include removing all debris and vegetation in the excavated area and placing material in a state approved landfill.

- Riprap Stone Protection: Riprap stone protection is a method of armoring the streambank from erosion through the placement of blocky, gradated stone. Briefly, Gabion Baskets are rectangular baskets made of heavily galvanized, double twisted, hexagonal woven steel wire mesh. The length of the protection depends on the extent of the erosion. A toe is typically excavated to the depth of the scour. A revetment top and end protections are constructed to prevent erosion, wave action, floating debris, and water surface irregularities. This measure would also include removing all debris and vegetation in the excavated area and placing material in a state approved landfill.

- Gabion Basket Toe with Riprap Slope: Gabion baskets are wire mesh cages filled with stone used to armor the underlying soil. This measure would require excavating into the channel bottom to a depth that is below the calculated scour depth. This alternative would also include removing all debris and vegetation in the excavated area and placing material in a state approved landfill.

- Gravity Retaining Wall: For this measure a pre-fabricated gravity retaining wall (Redi-Rock or equivalent) would be placed for the length of the erosion to the north and south of the CSX Avon Railroad Bridge. This measure would require excavating into the channel bottom to a depth that is below the calculated scour depth. This measure would also include removing all debris and vegetation in the excavated area and placing material in a state approved landfill. The bank would be excavated and graded, and the wall would be placed along the stream bank starting at the creek's edge and progressing up the bank.

- Launched Soil Nails with Riprap Stone Protection at Toe: Launched soil nails are long steel or fiberglass rods with a steel mesh or mat facing that are installed to reinforce or strengthen the existing ground. Soil nails are inserted using high pressure air by a launcher that can be mounted on a hydraulic excavator. The soil nails reinforce the locally unstable soil mass by transferring the nail's tensile and shear resistance through the failure plane of the sliding soil. The nails maintain the resisting force because they are anchored beyond the slip plane. It is estimated that approximately 366 soil nails will be needed and installed in a systematic pattern to stabilize the existing bank slope. Riprap stone placed in the scour area is anticipated near the toe. This

measure would also include removing all debris and vegetation in the excavated area and placing material in a state approved landfill.

#### *3.4.1.2 Nonstructural Measures*

- Bioengineering: This measure includes the removal of all debris and vegetation. To avoid cutting into the existing road alignment, riprap stone and soil would be placed along the eroded embankment to a slope no steeper than 3H:1V to the north and south of the CSX Avon Railroad Bridge. Given the embankment's vertical height, the new slope would intrude into White Lick Creek approximately 12-15 feet. Soil and stone would be taken from a local commercial source. Natural fiber coils would be placed on the bank and anchored accordingly. Dead tree roots would also be anchored into the bank to provide stability. Native plant species would be placed along the bank to encourage root development and promote stability. The measure would eventually create new riparian habitat along White Lick Creek for terrestrial wildlife, including the Indiana Bat, and some fish species.

- Road Relocation: This measure would realign South County Road 625 East to avoid the current bank failure location. The road would require a complete redesign and construction of the road eastward to avoid the advancing erosion and ensure safe passage through the CSX Avon Railroad Bridge for travelers. The redesign and construction would also have to avoid the bridge abutments.

#### *3.4.1.3 Excluded Measures*

- Bioengineering: The slope necessary to accommodate the vegetative treatment would require an extension of the bank changing the geometry of the stream channel. The measure would redirect flows to the opposite bank and impact existing aquatic species within the streambank. For these reasons, the measure was determined to be unreasonable and was thus excluded from further consideration.

### 3.4.2 Alternative Plan Descriptions

The following provides a brief description of the alternatives developed from the above measures.

Alternative 1 – Launched Soil Nails with Riprap Stone Protection at Toe: For this structural alternative, soil nails will be installed in a systematic pattern to stabilize the existing bank slope to the north and south of the CSX Avon Railroad Bridge. The soil nails will be inserted using a high pressure air launcher approaching 2500 psi. As the nail comes to rest, the soil will rebound onto the surrounding strata and bond with the nail. The soil nails will reinforce the locally unstable soil mass by transferring the nail's tensile and shear resistance through the failure plane of the sliding soil. Before the soil nails are installed, a surficial reinforcing mesh or High Performance Turf Reinforcement Mat (HPTRM) will be fastened across the length of the erosion, starting at the ordinary high water mark and progressing up the bank slope. This alternative will also require the installation of a riprap stone toe from the bottom of the channel to the ordinary high water mark in order to account for the high velocity stream forces affecting the streambank. The rip rap stone toe will require excavation of the channel bottom to a depth that is below the calculated scour depth. The scour depth is estimated to be two feet or less. The alternative will require the removal of all debris and vegetation along the streambank for approximately 0.4 acres, and a modification of the bank itself through the removal of earthen material. Removed earthen material will be placed in a state approved landfill. A layer of shotcrete, gunite or sprayed concrete, will be applied to the HPTRM. Finally, top soil would be placed on the top of bank to provide an adequate soil media for reseeding of grasses. The estimated construction costs for this alternative is $1,492,000.

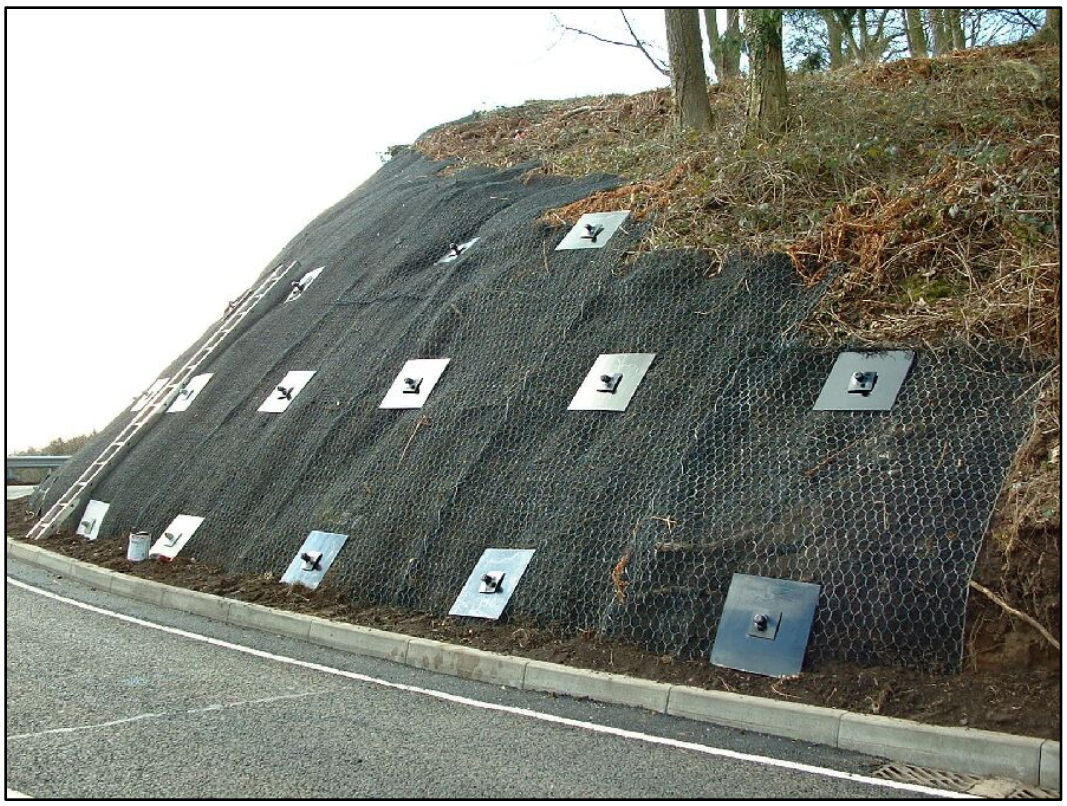

**Figure 6. Example of soil nails and matting.**

Alternative 2 – Riprap Stone Protection: This structural alternative will require the excavation and modification of the existing streambank to the north and south of the CSX Avon Railroad Bridge to form a maximum 2H:1V slope, and the placement of a 24-inch layer of 205 pound maximum riprap over the slope to an elevation of 15-feet above the channel bottom. It also will require excavation of the channel bottom to a depth that is below the calculated scour depth, and installation of a riprap stone toe to account for the high velocity stream forces effecting the streambank. The scour depth is estimated to be two feet or less. All debris and vegetation along the streambank will be removed for an area encompassing approximately 0.4 acres. Removed earthen material will be placed in a state approved landfill. The estimated construction costs for this alternative is $2,182,800.

Alternative 3 – Sheet Pile Wall: This structural alternative will require the placement of 491 feet of sheet pile wall to the north and south of the CSX Avon Railroad Bridge. The wall will be 15 feet above the channel and driven approximately 30 feet into the subsoil (the actual embedment depth will be determined in the geotechnical analysis performed in the next study phase). The wall will be driven into the ground using a vibrating hammer. Once the wall is in place, approximately 2,000 cubic yards of the existing slope will be excavated to form two benches. The benches will then be backfilled and compacted with 5,200 cubic yards of earthen material and 430 cubic yards of top soil to form a slope above the top of the wall at a maximum of 1.5H:1V. The top of the wall will be set above the 500-year flood event, eliminating the need for riprap stone to be placed on the slope. Approximately 1,100 lf of perforated pipe and 37 cubic yards of granular bedding material will be needed for the underdrain of the wall. The alternative will require a clearing of all vegetation for approximately 0.4 acres, but the new slope will be planted with native vegetation. All debris and vegetation along the streambank will be removed for an area encompassing approximately 0.4

acres. Borrow and top soil needed for the alternative will be taken from commercial haulers in the area. The estimated construction costs for this alternative is $4,760,300.

Alternative 4 – Gabion Basket Toe with Riprap Slope: This structural alternative will require the placement of 491 feet of Gabion Baskets with a riprap slope to the north and south of the CSX Avon Railroad Bridge. The single unit baskets are assembled, laced together, and then filled with stone to form a monolithic structure. For this alternative, Gabion Baskets will be aligned along the creek's edge and stacked up to the ordinary high water mark. A 24-inch layer of 205 pound maximum riprap will then be placed over the slope to an elevation of 15-feet above the channel bottom. The alternative will require some excavation and modification of the existing streambank, and excavation of the channel bottom to a depth that is below the calculated scour depth which is estimated to be two feet or less. The alternative will require the removal of all debris and vegetation along the streambank for approximately 0.4 acres. Soil will be placed on the top of the structure to facilitate the growth of native vegetation. The estimated construction costs for this alternative is $1,814,000.

Alternative 5 – Gravity Retaining Wall: This structural alternative will require the construction and placement of a gravity retaining wall (Redi-Rock wall or equivalent pre-fabricated wall) to the north and south of the CSX Avon Railroad Bridge. This alternative will require excavation of the channel bottom to a depth that is below the calculated scour depth, estimated to be two feet or less. However, during the design phase, excavations deeper than the estimated two feet scour depth may be required for the gravity retaining wall system. This alternative will require some excavation and modification of the existing streambank, as well as removal of all debris and vegetation for approximately 0.4 acres. Soil will be placed on the top of the structure to facilitate the growth of native vegetation. The estimated construction costs for this alternative is $1,959,900.

Alternative 6 – Road Relocation: This non-structural alternative would require the relocation of South County Road 625 on both sides of the CSX Avon Railroad Bridge. Relocating the road would require a complete redesign of the road, a demolition of existing pavement, clearing and grubbing of hardwood trees, excavation for ditches, and placing new asphalt pavement. There would also be mitigation costs associated with relocating the road and local traffic patterns would be permanently altered. A modification of the Bridge could be required as part of this measure, if the bridge abutments cannot be avoided. The estimated construction costs for this alternative is $11,344,200.

### 3.4.3 Comparison of Alternative Plans

The final array of alternatives considered for implementation were evaluated for their success in meeting the Planning Objectives (purpose and need, as well as sustainability) and the planning criteria (feasibility, environmental acceptability, and economic feasibility). The evaluation criteria were then considered in screening the alternatives according to their overall acceptability. As stipulated under ER 1105-2-100, formulation and evaluation should focus on the cost alternative solution that is less expensive than relocating South County Road 625 East.

Each alternative plan evaluated protecting 491 lf of bank to north and south of the CSX Avon Railroad Bridge. Such would provide long-term stabilization for South County Road 625 East. A discussion of the evaluations follows, with a summary of findings and screening results shown in Table 1. Cross-sections and site plans for the Recommended Plan are included in Appendix B and detailed on the cost estimates for all of the alternatives located in Appendix C.

Alternative 1 – Launched Soil Nails with Riprap Stone Protection at Toe: The Launched Soil Nails with Riprap Stone Protection alternative ($1,492,000) fulfills the immediate goal of stabilizing the failing bank that is threatening South County Road 625 East. It is a common method of bank stabilization that is easy and quick to install at a modest price. The primary challenge with this alternative is ensuring a good foundation for the stone protection at the toe, which will most likely require the construction of a temporary diversion structure into the creek bottom. The alternative will have a temporary impact on the riparian zone along White Lick Creek and any benthic communities within the creek. Alternative 1 is considered to be environmentally acceptable and is the least cost alternative.

Alternative 2 – Riprap Stone Protection: The Riprap Stone Protection alternative ($2,182,800) fulfills the immediate goal of stabilizing the failing bank that is threatening South County Road 625 East and is a common method of protection for eroding banks. The primary challenge with this alternative is ensuring a good foundation for the stone protection at the toe, which will most likely require the construction of a temporary diversion structure into the creek bottom. The alternative will have a temporary effect to benthic communities within the creek due to the diversion structure. The riparian zone along White Lick Creek will eventually re-establish itself along the streambank. Alternative 2 is considered to be environmentally acceptable, but is not the least cost alternative.

Alternative 3 – Sheet Pile Wall: The Sheet Pile alternative ($4,760,300) fulfills the immediate goal of stabilizing the failing bank that is threatening South County Road 625 East. Sheet pile walls are another common method of protection for eroding banks and have advantages for this project. The impact to the existing channel is minimal and there would be little to no change in the flow velocities or upstream stages of White Lick Creek. However there are also some challenges. Unknown bedrock depth and large cobbles/stone could complicate the installation process and increase the cost of the wall installation. The method of installation for the wall with a vibrating hammer could also threaten the physical integrity of existing infrastructure, namely South County Road 625 East, the CSX Avon Railroad Bridge, and nearby residences. The alternative will likely have a temporary impact on the riparian zone along White Lick Creek and any benthic communities within the creek. However once in place, the native vegetation will easily and quickly re-establish itself. Thus Alternative 3 is considered to be environmentally acceptable, but is not the least cost alternative.

Alternative 4 – Gabion Basket Toe with Riprap Slope: The Gabion Basket Toe with a Riprap Slope alternative ($1,814,000) fulfills the immediate goal of stabilizing the failing bank that is threatening South County Road 625 East, and is another common method of protection for eroding banks. The impact to the existing creek channel will be minimized with this alternative, and there would be no change in flow velocities or upstream stages for White Lick Creek. The primary challenge is ensuring a good foundation for the gabion basket toe, which will most likely require the construction of some type of temporary diversion structure and excavation into the creek bottom. There is also a risk for long term failure if the wire comprising the gabion baskets is damaged or corroded. The alternative will have a temporary effect to benthic communities within the creek due to the diversion structure. The riparian zone along White Lick Creek will eventually re-establish itself. Alternative 4 is considered to be environmentally acceptable, and is not the least cost alternative.

Alternative 5 – Gravity Retaining Wall: The Gravity Retaining Wall alternative fulfills the immediate goal of stabilizing the failing bank that is threatening South County Road 625 East ($1,959,900). With this alternative the impact to the existing channel will be minimized, and there would be little to no change in flow velocities or upstream stages. The primary challenge with this alternative is ensuring a good foundation for the wall, which most likely would require constructing some type of temporary diversion

structure and excavation into the river bottom. The alternative would likely have an impact on the riparian zone along White Lick Creek. It will also have a temporary impact to any benthic communities within the creek that will be restored with time. However once in place, the native vegetation will easily and quickly re-establish itself. Thus Alternative 5 is considered to be environmentally acceptable, but is not the least cost alternative.

Alternative 6 – Road Relocation: The Road Relocation alternative is the mostly costly alternative being considered for this project ($11,344,200). It removes the immediate threat to South County Road 625 East, but does not reduce the risk of failure to the road. At the rate of current erosion the city of Avon will have to either re-visit the threat to South County Road 625 East in the future or close the road entirely, which would permanently alter the traffic patterns for local residents and businesses. This alternative could also expand the risk of failure to the CSX Avon Railroad Bridge. Lastly, the alternative would further degrade the riparian habitat for terrestrial and aquatic species. The alternative is considered to be both economically and environmentally unacceptable.

**Table 1. Alternatives screening.**

| Avon, Indiana Alternatives - Alternative Screening | | | | | | |
|---|---|---|---|---|---|---|
| **Alternative** | **Planning Objectives** | | **Planning Constraints** | | | **Screening Result** |
| | **Meets Purpose and Need** | **Sustainable** | **Technically Feasible** | **Environmentally Acceptable** | **Estimated Construction Cost** | |
| No Action | No | No | No | No | No | Does not meet project purpose and need. |
| Launched Soil Nails with Rip Rap Stone Protection at Toe | Yes | Minimal-to-moderate level of maintenance | Yes | Yes | $1,492,000.00 | Environmentally acceptable and is the least cost alternative |
| Riprap Stone Protection | Yes | Minimal-to-moderate level of maintenance | Yes | Yes | $2,182,800.00 | Environmentally acceptable, but is not the least cost alternative |
| Sheet Pile Wall | Yes | Minimal-to-moderate level of maintenance | Yes | Yes | $4,760,300.00 | Environmentally acceptable, but is not the least cost alternative |

| | | | | | | |
|---|---|---|---|---|---|---|
| Gabion Basket Toe with Riprap Slope | Yes | Moderate level maintenance, long-term concern with corrosion associated with gabion cages | Yes | Yes | $1,814,000.00 | Environmentally acceptable, but is not the least cost alternative |
| Gravity Retaining Wall | Yes | Minimal-to-moderate level of maintenance | Yes | Yes | $1,959,900.00 | Environmentally acceptable, but is not the least cost alternative |
| Road Relocation | Yes | Moderate to significant level of maintenance | Yes | No | $11,344,200.00 | Environmentally and economically unacceptable. |

### 3.4.4 Risk and Uncertainty

Table 2 details the known risks associated with the Alternative Array, the consequence associated with them and their likelihood to occur, and recommendations to mitigate these risks.

**Table 2. Risk Matrix for the Alternatives Array.**

| Risk Description | Category | Consequence | Likelihood | Mitigation Recommendation |
|---|---|---|---|---|
| Geotechnical soil borings and analysis are shifted to D&I Phase | Technical | Impact to cost estimate | Low | Conduct geotechnical investigation and re-evaluate cost estimate early in design. |
| Land survey is shifted to D&I Phase | Technical | Impact to cost estimate | Low | Conduct survey and re-evaluate cost estimate early in design. |
| Stone Toe will overlay a small portion of the river bed | Environmental | Mitigation could be required by resource agencies | Low | Alternative identified provided least impact to the river. |
| Act of God: Road fails prior to implementation of Corps project | Other | Road could be closed or restricted to one lane of travel. Repair cost would increase | Medium-High | Continue to monitor road stability. Implement temporary repairs. |

## 3.5 RECOMMENDED PLAN (PREFERRED ALTERNATIVE)

### 3.5.1 Recommended Plan (Preferred Alternative) Description

Alternative 1 – Launched Soil Nails with Riprap Stone Protection at Toe: The launched soil nails with riprap stone protection at toe is estimated to be the least costly alternative considered during this study and fulfills the immediate goal of stabilizing the failing bank that is threatening South County Road 625 East. Soil nails are a common method of protection for eroding banks. It is also an environmentally acceptable alternative. Placement of the riprap toe, HPTRM, soil nails and shotcrete will occur on top of the slope.. Minimal modification of the embankment will be required as part of this plan, but the existing culvert pipe will need to be cut to fit the design of the recommended plan and preferred alternative. One lane of the road will need to be closed during construction activities. Existing utility lines located near the project will be avoided as part of this project, including a culvert shown in Figure 4. Cut earthen material will be repurposed along the streambank. Additional detail, including typical cross sections, is located in Engineering Appendix B. As the cost of the recommended plan and preferred alternative ($1.49m) is less than the cost for relocating the road ($11.3m), it is economically justified.

### 3.5.2 Estimated Project Costs and Schedule.

Table 3 shows a breakdown of the costs of the costs associated with the project. Additional information on the cost estimate is located in Appendix C. Table 4 shows the tentative implementation schedule for the project.

**Table 3. Total Project Cost and Federal and Non-Federal Cost Share.**

| **Avon, IN Section 14** | **Project First Cost** (Constant Dollar Basis) | **Total Project Cost** (Fully Funded) |
|---|---|---|
| Construction | $1,129,000 | $1,151,000 |
| Land and Damages | $13,000 | $13,000 |
| Planning, Engineering & Design | $250,000 | $254,000 |
| Construction Management | $100,000 | $104,000 |
| Total Investment Cost | $1,492,000 | $1,522,000 |
| **TOTAL Federal (65%)** | $969,800 | **$989,300** |
| **TOTAL Non-Federal (35%)** | $522,200 | **$532,700** |
| **TOTAL PROJECT COST** | $1,492,000 | **$1,522,000** |

**Table 4. Project Implementation Schedule.**

| **Implementation Schedule Avon, IN Section 14** | |
|---|---|
| Execute Project Partnership Agreement | October 2019 |
| Complete Design | April 2019 |
| Project Reviews (DQC, ATR, BCOES) | May 2020 |
| Contract Advertisement | June 2020 |
| Construction Contract Awards | July 2020 |

| | |
|---|---|
| Begin Construction* | August 2020 |
| Project Completion | August 2021 |

** Estimated duration for construction is nine months. The actual construction start date is dependent on creek conditions.*

### 3.5.3 Non-Federal Sponsor Responsibilities

In order to implement the Recommended Plan, the Town of Avon would be responsible for the following:

1.) Without cost to the U.S. Government, provision of legally sufficient title to real estate for all necessary land, easements, rights-of-way, and access routes necessary for project construction and subsequent operation and maintenance. Land provisions would include:

a.) construction site to accommodate all emergency streambank and shoreline erosion protection features to be constructed, and

b.) temporary staging area of acceptable location and acreage for contractor's use during construction period. Staging area will be a previously disturbed site.

2.) The cash contribution, provided during the period of implementation toward cost of the project totaling 35% of Total Project Cost, less value of the non-Federal sponsor's real estate contribution and in-kind services, as well as Feasibility Phase costs. The amount of cash contribution is currently estimated to be $522,200 of the total $1,492,000. This cash amount will vary depending on the actual real estate costs and in-kind services, but must minimally be five percent of the Total Project Cost or $74,600.

3.) Funding of 100% of the cost of Annual Operation and Maintenance required to keep the project in viable condition to satisfy its design function. This funding would not be provided for during the initial implementation of the project, but would become a yearly responsibility of the non-Federal sponsor upon completion of the construction phase.

4.) Satisfy all provisions of the Project Partnership Agreement (PPA) regarding non-Federal sponsor responsibilities in implementing the project.

# 4 ENVIRONMENTAL IMPACTS

The following subsections discuss the environmental impacts of the proposed project and reasonable alternatives, including the No Action Alternative. Alternative 6 – Road Relocation was determined to be not environmentally or economically acceptable and thus was not included in this analysis. Implementation of each of the other action alternatives would be expected to generate similar environmental impacts. For this reason, most of the alternatives are grouped together in the following analyses.

## 4.1 CLIMATE

Climate vulnerability assessments are necessary to help guide adaptation planning and implementation so that the Corps can successfully perform its missions in an increasingly dynamic physical, socioeconomic, and political environment. The USACE Climate Change Vulnerability Assessment Tool 4 (VA Tool) was used to examine the vulnerability of the Wabash River Basin (HUC 0512) to future changes in climate; the mission business line considered for this analysis was flood risk reduction, as this was the best option

provided by the modeling software. The VA tool did not identify this business line as within the top 20% of vulnerable watersheds. While the Wabash River basin was not identified as within the top 20% of vulnerable watersheds, that does not to imply that vulnerability to climate change does not exist within the watershed. Of the vulnerability indicators examined by the VA tool, there are five which reliably drive the vulnerability of the flood risk reduction business line in all scenarios and epochs. These include long-term variability in hydrology (indicator 175C), a high elasticity between increasing precipitation and streamflow (277), changes in flood runoff (568C and 568L), and a projected increase in urban area within 500-year floodplain (590).

Figure 7 shows the results of the assessment for two climate scenarios (wet and dry) over two epochs (2050 and 2085). The VA Tool was utilized to identify potential vulnerabilities in the Wabash River basin at the HUC-4 watershed level. For the dry scenario, the tool indicated the highest contributor to vulnerability was indicator 277. This indicator is calculated by dividing percent change in runoff by percent change in precipitation. For the wet scenario, the flood magnification factor (568C) - or the change in flood runoff- was the highest contributor. This factor represents how flood flow (i.e., the monthly flow exceeded 10% of the time) is predicted to change in the future. See factsheets in the Environmental Appendix for more details on these indicators.

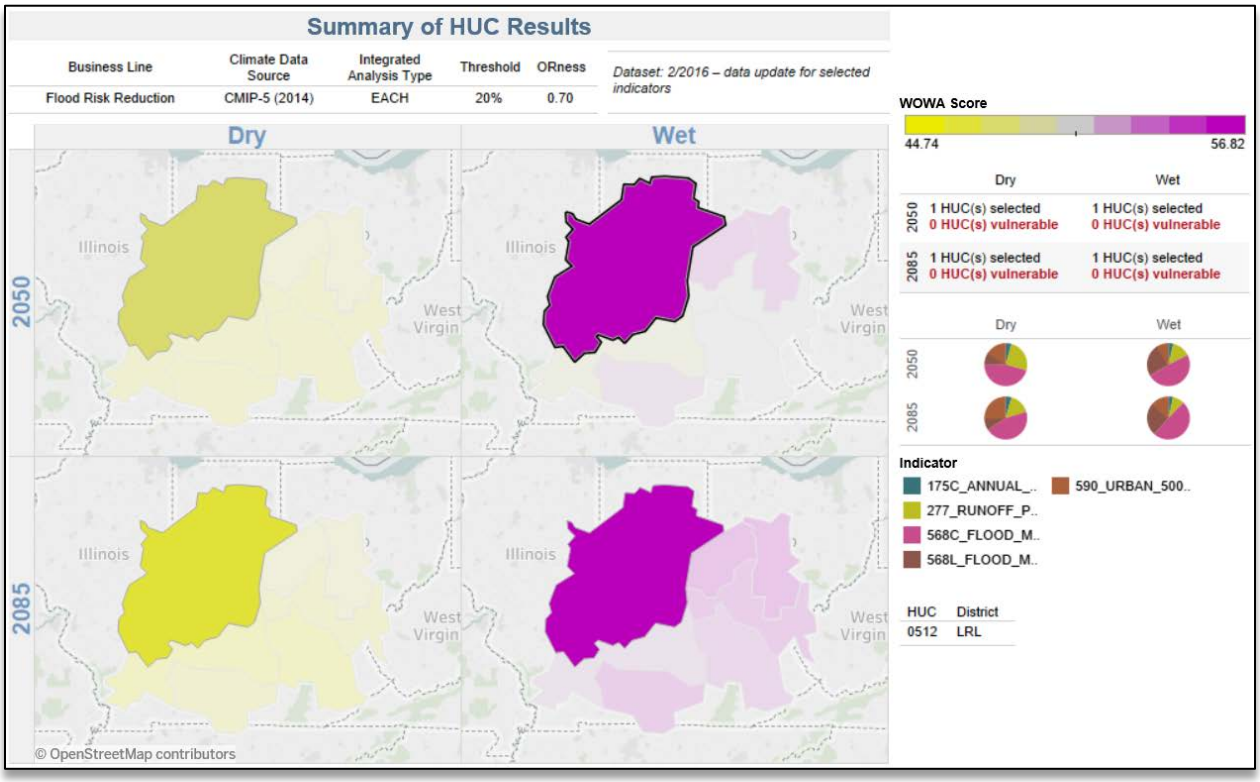


**Figure 7. USACE Vulnerability Assessment Tool Results for the Wabash River basin.**

The vulnerability assessment for the Wabash River watershed indicated that increased precipitation and precipitation runoff may be major contributors to vulnerability of the Wabash River basin in the future.

Implementation of the Preferred Alternative or any other of the other considered action alternatives would stabilize the streambank, minimizing soil erosion caused by potential increases in precipitation and runoff into White Lick Creek. Although it comprises a very minor portion of the Wabash River watershed, the bank stabilization will aid in reducing vulnerabilities to public infrastructure in the future by ensuring the stability of the adjacent highway. Implementation of any of the bank stabilization alternatives considered would be expected to produce temporary, localized, and negligible increases in greenhouse gas emissions during construction activities from use of heavy construction vehicles and equipment. This increase would not be expected to make a significant contribution to changes in regional or global climate.

## 4.2 SOILS

*Preferred Alternative 1 - Launched Soil Nails with Riprap Stone Protection at Toe*

Construction impacts of the Preferred Alternative to soils would result from excavation and grading of the streambank, allowing for proper riprap and soil nail placement. These impacts are considered to be temporary and minimal, and further reduced by implementing appropriate erosion control measures during construction to comply with the Indiana Storm and Water Quality Manual. Implementation of the Preferred Alternative would result in an overall reduction in erosion at the proposed project.

*Alternatives 2, 3, 4, and 5*

Impacts to soils from implementation of any of the other reasonable alternatives would be similar to those of the Preferred Alternative.

*No Action*

The no action alternative would result in the continued undercutting and erosion of the streambank soils, which would eventually impact the physical integrity of County Road 625 South and result in disruptions to transportation.

## 4.3 SURFACE WATERS AND OTHER AQUATIC RESOURCES

### 4.3.1 Surface Water

*Preferred Alternative 1 - Launched Soil Nails with Riprap Stone Protection at Toe*

The Preferred Alternative would be expected to have favorable long-term effects on water quality in, and downstream of, the project area by decreasing erosion and subsequent turbidity introduced to White Lick Creek following high water events. Appropriate sedimentation and erosion control measures that equal or exceed IDEM standards will be designed, installed, and maintained properly to assure compliance with the appropriate turbidity standards, although temporary increases in turbidity may occur during construction. These measures include a Type 2 DOT Turbidity Curtain to be used during in-water material placement, and silt fence use on the upland perimeter of construction activity.

A Section 401 water quality certification (WQC) will be acquired prior to implementation of the Preferred Alternative. No work will begin until IDEM has either formally approved the WQC or issued a water quality certificate that covers this project. All proposed work would be in compliance with the conditions of the appropriate water quality certificate and the Indiana Storm Water Quality Manual.

*Alternatives 2, 3, 4, and 5*

Each of these action alternatives would have a similar footprint in the stream as the Preferred Alternative, and therefore, would be expected to produce similar, insignificant and temporary impacts to surface water.

*No Action Alternative*

The no action alternative will result in the continued erosion of the streambank and subsequent long-term increases in turbidity and sedimentation downstream in White Lick Creek.

### 4.3.2 Groundwater

None of the alternatives, including the no action alternative, would be expected to have any effects on groundwater levels or quality within or outside of the project area.

### 4.3.3 Floodplains

*Action Alternatives 1 - 5*

Executive Order 11988 directs federal agencies to avoid long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development whenever practical. The proposed project site is located within the floodplain and there are no other practical alternatives than to construct within the floodplain. Due to the limited size and scope of the action alternatives, there is low potential for adverse impacts to the adjacent floodplain. Every effort will be taken to minimize potential harm to or within the floodplain by reducing the amount of material placed in the floodplain to only that which is required to stabilize the streambank. The construction of the Preferred Alternative within the established floodway and floodplain will comply with state/local floodplain protection standards for construction in a floodway and the appropriate permits will be obtained prior to the start of construction.

*No Action Alternative*

No impacts to the floodplain would be expected from the no action alternative. The White Lick Creek would continue to erode the streambank at the project site and deposit the eroded material downstream.

### 4.3.4 Wetlands

Executive Order 11990, Protection of Wetlands, requires federal agencies to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities. None of the alternative plans, including the no action alternative, would adversely affect wetlands or alter their function and each would be in full compliance with Executive Order 11990.

## 4.4 WILDLIFE HABITATS

### 4.4.1 Terrestrial and Aquatic Vegetation

*Preferred Alternative 1 - Launched Soil Nails with Riprap Stone Protection at Toe*

The Preferred Alternative would require grading of the streambank and clearing of vegetation, to approximately 0.4 acres. The clearing will be minimized to retain as much existing riparian vegetation as practicable, however most vegetation on the slope will be removed. Disturbed areas near the top of the slope would be re-vegetated with native grasses upon project completion. Herbaceous vegetation would likely grow on the upper slope, through the erosion control mat. No impacts to aquatic vegetation would be expected from implementation of the Preferred Alternative.

*Alternatives 2 and 4 – Riprap and Gabion Baskets*

Implementation of these alternatives would result in similar impacts to terrestrial vegetation as Alternative 1. These would also require grading of the streambank and removal of existing vegetation. Extremely limited growth of vegetation would be expected on the stone slopes. No impacts to aquatic vegetation would be expected from implementation of these alternatives.

*Alternatives 3 and 5 – Sheet Pile Wall and Retaining Wall*

These alternatives would also require initial clearing of vegetation along the slope and some grading of the streambank. However, these walls would allow for growth of terrestrial vegetation in the backfilled soil material behind the wall. Growth of both herbaceous and woody plants would be acceptable in these newly constructed areas.

*No Action Alternative*

The no action alternative would result in the continued erosion of the streambank, which would eventually result in the undercutting and the loss of terrestrial riparian vegetation and the habitat which it provides.

### 4.4.2 Fauna and Habitats

*Preferred Alternative 1 - Launched Soil Nails with Riprap Stone Protection at Toe*

Construction activities associated with the Preferred Alternative are expected to have negligible adverse impacts to the local fauna in and around the project site. Currently, terrestrial fauna within the immediate riparian area is limited due to the lack of vegetation on the eroded slope. Installation of the Preferred Alternative would alter current riparian habitat by removing all currently existing vegetation while providing an abundance of interstitial voids in the rocks that may be used by organisms for shelter or cover. The loss of tree canopy/shade within the project area is not expected to have long-term adverse effects to water temperatures or fish habitats. During the Design Phase of the project, options will be explored to cover the mat with soil and vegetation rather than waiting for sedimentation and the establishment of native vegetation. The feasibility and future maintenance requirements of allowing woody plant growth through the mat will also be explored during this phase.

The streambed at the toe of the slope offers marginal to poor habitat, consisting mostly of erodible soils and interspersed limestone riprap and concrete slabs from past attempts to control erosion. Implementation of this alternative would result in filling approximately 5,000 square feet of streambed with the riprap, however, the habitat within the fill area would not be significantly changed. Construction of the Preferred Alternative would protect the erodible soils in the most eroded portions of the project area and provide hard structure for utilization by benthic organisms and other aquatic fauna. For these reasons, significant adverse impacts are not anticipated to the fauna of White Lick Creek from the Preferred Alternative. The Corps would coordinate with the State of Indiana to obtain all appropriate permits and implement any possible mitigative actions required by those permits.

Aquatic resources are impacted by a number of watershed activities, including residential development, pollution sources, and wastewater discharges. White Lick Creek generally has good to average water quality and offers diverse aquatic habitats. From a watershed perspective, the benefits realized from the stabilized streambank would not be significant in the overall reduction of aquatic resource/water quality impairments due to sedimentation; however, it would provide some minor progress in reducing riverbank erosion. The cumulative impacts of the Preferred Alternative on aquatic resources would be minor. Bank

stabilization would likely provide long-term improvements in aquatic resources, water quality, and aquatic habitat

*Alternatives 2 and 4 – Riprap and Gabion Baskets*

These alternatives would limit the growth of terrestrial vegetation on the upper half of the streambank and therefore result in net loss of riparian habitat once installed. Although minor, impacts to the aquatic fauna would potentially be greater than the preferred alternative, as full stone protection may require a larger toe at the base of the slope, affecting a greater area of the stream's substrate.

*Alternatives 3 and 5 – Sheet Pile Wall and Retaining Wall*

These alternatives would allow for growth of terrestrial vegetation in the backfilled soil material behind the wall, producing an increase in the total area of vegetation over the existing condition. However, because of the sheer face of the wall, approximately 50 feet high, connection of the vegetation to the stream would be limited at best, and would not provide many of the natural functions that a naturally vegetated streambank offers.

*No Action Alternative*

The no action alternative would result in the continued erosion of the streambank, which would eventually result in the undercutting and the loss of terrestrial riparian vegetation and, subsequently, the fauna that relies on that vegetation habitat, food, and shelter.

## 4.5 ENDANGERED AND THREATENED SPECIES

### 4.5.1 Federal

*Action Alternatives 1-5*

The proposed project site lies within the range of two listed species - the endangered Indiana bat (*Myotis sodalis*) and the threatened Northern long-eared bat (*Myotis septentrionalis*). In the summer months, these species prefer to roost under loose tree bark on dead or dying trees in well-developed riparian woods. Site reconnaissance determined the project site contained trees that would not be particularly suitable for roosting Indiana or Northern long-eared bats. Regardless of the existing habitat quality, or the chosen action alternative, no trees over four inches in diameter at breast height would be removed from April 1st to September 30$^{th}$ to minimize potential impacts to roosting Indiana bats. The Corps has preliminarily determined the proposed project may affect, but is not likely to adversely affect the Indiana bat. A final determination will be made when USFWS concurs with this determination. If the USFWS determines the proposed action will affect the Indiana bat, Northern long-eared bat, or any other listed species, the Corps will prepare a biological assessment to assist in its determination of the project's effect on that species. All communication with the USFWS will be included in Appendix A.

*No Action Alternative*

The no action alternative would result in the continued erosion of the streambank, which would eventually result in the loss of terrestrial riparian habitat.

### 4.5.2 Critical Habitat

No federally designated critical habitat is located within the proposed project area. No critical habitat will be affected through the implementation of the Preferred Alternative, Alternative 1, through the other action alternatives, or through no action.

## 4.6 RECREATIONAL, SCENIC, AND AESTHETIC RESOURCES

*Action Alternatives 1 - 5*Implementation of the any of the action alternatives would not be expected to significantly impact aesthetic or recreational resources. Construction would be restricted to the immediate proposed project area and would provide stabilization to the eroding streambank. Any impacts related to construction, including noise (see Section 4.8), presence of construction equipment, and effects on traffic circulation would be temporary and short-lived. The stone and soil nail alternatives would likely have less impact to any scenic views in the area than the sheet pile or retaining wall alternatives, which would result in large, sheer walls. None of the alternatives would be expected to adversely impact recreation in the proposed project area to the CSX Avon Railroad Bridge and Washington Township Park, but would provide continued use of to South County Road 625 East.

*No Action Alternative*

Taking no action would result in maintaining the status quo and would not result in significant impacts to the recreational, scenic, and aesthetic resources of the project area.

## 4.7 CULTURAL RESOURCES

No historic properties or cultural resources will be affected by implementation of any of the reasonable action alternatives for streambank stabilization or the no action alternative.

## 4.8 AIR QUALITY

*Action Alternatives 1 - 5*

Air quality would be temporarily and insignificantly affected by implementation of the any of the action alternatives. Emissions are expected from equipment used during construction, and any other support equipment which may be on or adjacent to the proposed project area. Increases in dust emissions would occur during construction, but these impacts would be short-term, only occur while construction is active, and not impact overall air quality. Any proposed project-related emissions are not expected to contribute significantly to direct or indirect emissions and would not impact air quality within the project area.

*No Action Alternative*

The no action alternative would result no impacts to air quality.

## 4.9 NOISE

*Action Alternatives 1 - 5*

Noise levels would be temporarily elevated during construction activities of any of the action alternatives, with an expected duration of up to 180 days. Construction activities associated with the Preferred Alternative would comply with all published noise ordinances.

*No Action Alternative*

The no action alternative would result in no impacts to noise levels.

## 4.10 HAZARDOUS AND TOXIC SUBSTANCES

Implementation of any of the considered action alternatives, or the no action alternative, would not be expected to adversely impact hazardous and toxic materials in the proposed project area, nor would they produce hazardous and toxic materials.

## 4.11 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE – Executive Order 12898

Implementation of any of the considered alternatives, including the no action alternative, would not have potential for disproportionate health or environmental effects on minorities or low-income populations and communities and would be in compliance with Executive Order 12898 following completion of the NEPA process.

Further, implementation of any of the considered alternatives, including the no action alternative, would not have the potential to disproportionately affect the safety or health of children and will be in full compliance with Executive Order 13045 following completion of the NEPA process.

## 4.12 CUMULATIVE EFFECTS

The Federal Executive Branch's Council on Environmental Quality defines cumulative effects as "the impact on the environment [that] results from the incremental impact of an 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 CFR 1508.7, National Environmental Policy Act of 1969, as amended).

The Preferred Alternative provides approximately 491 LF of the White Lick Creek streambank to be armored with Soil Nails and Matting to prevent negative impacts to South County Road 625 East, which would eventually occur from taking no action. The closure of this road would disrupt local traffic patterns (including emergency response times); and county school bus routes. Streambank adjacent to the proposed project area upstream is, and would remain, unarmored. Implementation of any of the action alternatives would be expected to have negligible impacts on the overall functionality and quantity of riparian vegetation and available wildlife habitat in the proposed project area. There are no other known past projects or reasonably anticipated future projects in the area that, when considered along with the Preferred Alternative, would be expected to result in any significant adverse cumulative effects.

# 5 MITIGATION OF ADVERSE EFFECTS

Impacts to surface water and physical substrates from placement of fill material would be minimized by using appropriate erosion control measures, such as sediment fences, turbidity curtains, and by constructing the project at low water, which would further reduce erosion potential.

The removal of riparian vegetation will be limited to the absolute minimum required and will be coordinated with the appropriate state and federal agencies and properly mitigated for if necessary.

# 6 IMPLEMENTATION REQUIREMENTS

## 6.1 PROJECT PARTNERSHIP AGREEMENT

The Town of Avon, as stated in a letter dated September 3, 2015 (Appendix E), has expressed support for the project and has agreed to accept the role of non-Federal sponsor in the event of approval of a final Detailed Project Report. A PPA will be signed between the Corps and the Town of Avon prior to the initiation of the Design and Implementation phase of the project.

## 6.2 LANDS, EASEMENTS, RIGHTS-OF-WAY, RELOCATIONS AND DISPOSAL AREAS

South County Road 625 East is owned and maintained by the town of Avon, the non-Federal Sponsor. Additionally, all of the property required for access to and implementation of the bank stabilization is owned by the non-Federal Sponsor. The full real estate plan is located in Appendix D. There are water and sewer lines that runs along the west side of South County Road 625 East. Their locations have been confirmed through coordination with the Town of Avon and will not be affected by the Preferred Alternative.

## 6.3 MONITORING AND ADAPTIVE MANAGEMENT

Neither the completion of an adaptive management plan, nor monitoring of physical, chemical, or biological parameters is expected to be necessary from implementation of the Preferred Alternative. If any monitoring is required for permitting actions or otherwise, the Corps will comply as appropriate, and this Project Report and EA will be updated to reflect changes.

## 6.4 OPERATION, MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION

The town of Avon, Indiana will be responsible for operation, maintenance, repair, replacement and rehabilitation of the project. An Operation and Maintenance manual will be provided to Avon with detailed instructions on annual inspections and maintenance. The estimated cost for these inspections and minor repairs is $10,000 per year.

Inspections should be conducted on a regular basis, at least once a year (preferably at low water) and after every significant flood event. Minimal routine maintenance and prompt repairs will be necessary to ensure the project's longevity. Repair is considered to entail those activities of a routine nature that maintain the project in a well-kept condition. Replacement covers those activities taken when a worn-out element is replaced. Rehabilitation refers to activities necessary to bring a deteriorated project back to its original condition.

## 6.5 COMPLIANCE WITH FEDERAL STATUTES, EXECUTIVE ORDERS, AND EXECUTIVE MEMORANDUMS

### 6.5.1 The Historic and Archeological Preservation Act of 1974, as amended, 16 U.S.C. 469 et seq.

Compliance: Not Applicable. The project does not have an adverse effect to an archaeological site that will require the recovery, analysis, curation, or disposition of archaeological data.

### 6.5.2 American Indian Religious Freedom Act of 1978, 42 U.S.C. 1996.

Compliance: The Project is being coordinated with federally recognized tribes to discern its impact to sacred sites and/or objects. All federally recognized tribes are included in the mailing list included in Appendix F.

### 6.5.3 Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.)

Compliance: The project is being coordinated with the Indiana DNR and the USFWS. No impacts to bald or golden eagles are anticipated from project implementation.

### 6.5.4 Clean Air Act, as amended, 42 U.S.C. 7401 et seq. (CAA)

In compliance with the CAA and the 1977 and 1990 amendments, the EPA has promulgated ambient air quality standards and regulations to protect health and the environment. Areas that are below the standards are in "attainment," while those that are equal to or exceed the standards are said to be in "non-attainment." The proposed project site is within an attainment area (U.S. Environmental Protection Agency, 2017) and none of the alternatives described would impact long-term ambient air quality standards. Public notice of the availability of this report to the EPA has been initiated pursuant to Sections 176c and 309 of the CAA.5.

### 6.5.5 Clean Water Act of 1977, 33 U.S.C. 1251 et seq. (CWA)

Compliance with Section 404 of the CWA is required for discharges of dredged or fill material into waters of the United States, including adjacent wetlands. A 404(b)(1) evaluation has been prepared and is included in the Appendix A. Construction impacts would include placement of fill (in the form of riprap toe) below the ordinary high water mark of White Lick Creek along 491 feet of streambank; therefore the Corps would need to obtain a Section 401 Water Quality Certification from the State of Indiana before the start of construction.

### 6.5.6 Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq. (ESA)

The ESA requires the determination of possible harm or degradation to federally listed threatened or endangered species and critical habitat. The USFWS provided an official list of threatened or endangered species that may be present within the project vicinity. Based on available information, existing habitat conditions at the project site, and timing of construction activities to offset potential adverse impacts to Indiana bats (no trees over four inches in diameter at breast height removed from April 1st to September 30$^{th}$), the Corps made a determination of "may affect, but not likely to adversely affect" the Indiana bat and the Northern long-eared bat.

This EA will be provided to USFWS for their review and comment with regard to their determination of compliance with the ESA, 16 U.S.C. §§ 1531-1544 and the Corps determination of effects. Compliance Coordination through the USFWS Bloomington Field Office is ongoing.

### 6.5.7 Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq. (FWCA)

In compliance with the FWCA, coordination is ongoing with the USFWS and Indiana DNR regarding endangered species and other sensitive species and natural areas within the project area. This DPR and integrated EA will be provided to USFWS and DNR for their review and comment with regard to their determination of compliance with the FWCA. All correspondences will be included in the Appendix A.

### 6.5.8 Land and Water Conservation Fund Act of 1965, as amended, 16 U.S.C. 4601-4 et seq.

Compliance: Not applicable. The project would not impact any land or resources that have been established by the Land and Water Conservation Fund**.**

### 6.5.9 Migratory Bird Treaty Act (16 U.S.C. 703 et seq)

Compliance: The USFWS identifies 12 species of migratory birds that occur on the USFWS Birds of Conservation Concern list which may warrant special attention in the project area. No impacts to these species are anticipated from project implementation. Furthermore, the restriction of tree clearing from

April 1st to September 30th to minimize potential impacts to roosting Indiana bats will also protect tree nesting migratory bird species. This report is being coordinated with the USFWS and the Indiana DNR. Any recommendations received from these agencies regarding the protection of migratory birds will be considered for implementation.

### 6.5.10 National Historic Preservation Act (NHPA)

Section 106 of the NHPA, as amended, requires federal agencies to consider the effects of their undertakings on historic properties. The implementing regulations at 36 CFR 800 detail the process that requires consultation with the SHPO, tribes, local governments, the public, and others. Suitable efforts to identify historic properties must be taken and consulting parties afforded an opportunity to comment on the affects to these historic properties by the proposed undertaking. Only sites, building structures, objects, or landscapes listed on or determined eligible for listing in the National Register of Historic Places (NRHP) are afforded the safeguards of the NHPA. Archival research for this project involved consulting the Indiana SHPO, and a review of the IHSSI and the NHPA databases. A visual pedestrian survey was also performed by Louisville District personnel. As a result of this research, the Corps has determined, in accordance with 36 CFR 800. 4(d), that there will be no effect on historic properties or other cultural resources eligible for listing to the National Register of Historic Places. Coordination with the Indiana SHPO is ongoing. All correspondence related to this consultation is included in the Appendix A.

### 6.5.11 Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3000-3013, 18 U.S.C. 1170

Not Applicable: The project occurs on non-federal lands and does not involve human remains of Native American descent. However if human remains are discovered during the course of the project and are determined to be of Native American descent, regulations implementing NAGPRA and state cemetery laws will be followed to identify the patrimony of those remains and the proper course of action for their disposition with the State Historic Preservation Officer and all federally recognized tribes.

### 6.5.12 National Environmental Policy Act of 1969, as amended, 42 U.S.C 4321 et seq.

Compliance: Preparation of this EA signifies partial compliance with NEPA. Full compliance shall be noted at the time the Finding of No Significant Impact is signed by the District Engineer.

### 6.5.13 Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.

Compliance: Not applicable. The project would not include the creation of an obstruction to the navigable capacity of any of the waters of the United States.

### 6.5.14 Watershed Protection and Flood Prevention Act as amended, 16 U.S.C 1001 et seq.

Compliance: Floodplain impacts have been considered in project planning. The project will not result in the loss of floodplain.

### 6.5.15 Wild and Scenic Rivers Act, as amended, 16 U.S.C 1271 et seq.

Compliance: Not applicable. The project would not occur on a designated wild and scenic river.

***Executive Orders***

### 6.5.16 Executive Order 11593, Protection and Enhancement of the Cultural Environment, 13 May 1971

Compliance: Not Applicable. This EO deals with historic properties on federal property or under federal control. This project will not occur on federal property or property under federal control.

### 6.5.17 Executive Order 11988, Floodplain Management

Executive Order 11988, Floodplain Management, 24 May 1977 amended by Executive Order 12148, 20 July 1979; subsequently amended by Executive Order 13690, January 30, 2015, requires federal agencies to evaluate and minimize to the extent possible, impacts and modifications to the floodplain. Riverbank stabilization would inherently occur within the floodplain; therefore, there is no alternative to working in the floodplain. The proposed action does not conflict with applicable state and local standards concerning floodplain protection, nor would it have any impacts to the 100-year floodplain. Public notice of the availability of this report or public review fulfills the requirements of Executive Order 11988, Section 2(a)(2).

### 6.5.18 Executive Order 11990, Protection of Wetlands, 24 May 1977.

Compliance: Public notice of the availability of this report for public review fulfills the requirements of Executive Order 11990, Section 2 (b).

### 6.5.19 Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, 4 January 1979.

Compliance: This EO is not applicable to projects located within the United States geographical boundaries.

### 6.5.20 Executive Order 12898, Environmental Justice, 11 February 1994.

Compliance: The project will not have a significant negative impact on minority or low-income population, or any other population in the United States. See section 4.11 for more details.

### 6.5.21 Executive 13007, Accommodation of Sacred Sites, 24 May 1996

Compliance: Coordination with the SHPO and all federally recognized tribes indicates that there are no known Sacred Sites in the project footprint.

### 6.5.22 Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks. 21 April, 1997.

Compliance: The project would not create a disproportionate environmental health or safety risk for children.

### 6.5.23 Executive Order 13061, and Amendments – Federal Support of Community Efforts Along American Heritage Rivers

Compliance: Not Applicable. The project is not along an American Heritage River.

### 6.5.24 Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, 6 November 2000.

Compliance: Coordination with the SHPO and all federally recognized tribes signifies compliance.

***Executive Memoranda***

#### 6.5.25 Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA, 11 August 1980.

Compliance: There are no prime agricultural lands under or on the project. The project would be located on a steep stream bank adjacent to major suburban development.

#### 6.5.26 White House Memorandum, Government-to-Government Relations with Indian Tribes, 29 April 1994.

Compliance: Consultation with the tribes is ongoing.

# 7 PUBLIC INVOLVEMENT

## 7.1 PUBLIC VIEWS AND COMMENTS

This EA and associated 404(b)(1) Evaluation will be circulated for a 30-day public review pursuant to the requirements of 40 CFR §1501.4(e)(2) and §230.94(b). All comments from the public, agencies, and organizations received during the 30-day review period will be summarized in this section and placed in Appendix F of this report.

## 7.2 STAKEHOLDER AGENCY COORDINATION

### 7.2.1 Federal Agencies

The Natural Resources Conservation Service was contacted to confirm that there are no current projects on this segment of the White Lick Creek. This report will be provided to the USFWS and the EPA for comment and review during the standard 30-day review period.

### 7.2.2 State Agencies

Coordination with Indiana DNR and IDEM has occurred, specifically regarding permitting, as well as required real estate, and will continue through construction of the project.

### 7.2.3 Local Agencies

Local agencies will have opportunity to provide input on this project during the 30-day public and agency review period.

### 7.2.4 Non-Governmental Organizations

Non-governmental organizations will have the opportunity to provide input on this project during the 30-day public review period.

### 7.2.5 Federally Recognized Tribes

Tribes will have the opportunity to provide input on this project during the 30-day public review period. A list of contacted tribes can be found in Appendix F.

# 8 FINDING OF NO SIGNIFICANT IMPACT

The draft FONSI is located in the Appendix A.

# 9 RECOMMENDATION

After considering the engineering, economic, environmental, and social aspects relative to the construction of the proposed emergency bank stabilization project in the Town of Avon, Indiana at South County Road 625 East, it is recommended that Alternative 1 – Launched Soil Nails with Riprap Stone Protection Toe be authorized and constructed by the Great Lakes and Ohio River Division as a Federal project under the authority of Section 14 of the 1946 Flood Control Act (P.L. 79-526), as amended.

# 10 REFERENCES

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