National Park Service
U.S. Department of the Interior

Cuyahoga Valley National Park
Peninsula, Ohio

WETLAND STATEMENT OF FINDINGS FOR EXECUTIVE ORDER 11990 WETLAND PROTECTION

Stabilize Riverbank at CVSR 59.3 along the Cuyahoga River
Cuyahoga Valley National Park Peninsula, Ohio

Recommended

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Superintendent, Cuyahoga Valley National Park Date

Certified for Technical Accuracy and Service wide Consistency

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Chief, National Park Service Water Resources Division Date

Approved

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Director, Interior Region Date

Introduction

This Wetlands Statement of Findings (WSOF) characterizes the wetland resources that occur within the Cuyahoga Valley Scenic Railway (CVSR) 59.3 project site along the Cuyahoga River, Cuyahoga National Park, Cuyahoga and Summit Counties Ohio. The WSOF describes the impacts the project will likely have on the aquatic resources and documents the steps the National Park Service (NPS) will take to avoid, minimize, and offset these impacts.

The NPS proposes to implement riverbank stabilization measures at CVSR 59.3 (STA 758) along the Cuyahoga River. The CVSR 59.3 project site is located just south of River Mile (RM) 20 on the east bank of the river (Figure 1). At this location the Cuyahoga River is entrenched to the shale bedrock with limited connectivity to the adjacent low-lying floodplains. Severe erosion and sloughing are present along the bank due to the force of the river putting the integrity of the railway at risk (Figure 2). Cuyahoga Valley Scenic Railway is one of the most significant linear cultural and recreational resources within the park and sits adjacent to segments of the historic Towpath Trail.

Figure 1. Cuyahoga Valley National Park Map, CVSR 59.3 project site and staging areas.

The proximity of the CVSR to the Cuyahoga River and its tributaries results in instances where the CVSR is in jeopardy of being damaged or destroyed by river flows. Action is needed because the riverbank instability is threatening the bank integrity, visitor and NPS staff safety, and continued viability of the CVSR. Instability can develop quickly along the severely eroding bank, and excessive settling due to erosion along the CVSR can result in infrastructure failure and closures to the resource.

Because the proposed action would include work in wetlands, this Wetlands Statement of Findings is required to comply with NPS Director's Order #77-1: Wetland Protection, which establishes the policies, requirements, and standards for implementing Executive Order 11990 (Protection of Wetlands). This Statement of Findings:

- Documents the anticipated effects on wetland resources
- Describes the effects on functions associated with the proposed action
- Provides a description of minimization and compensatory mitigation measures
- Ensures "no net loss" of wetland functions or values

Figure 2. Shoreline of the project site at 59.3 with the CVSR feet from the riverbank.

A Programmatic Environmental Assessment (EA) was developed in 2003 (NPS 2004) to evaluate the potential environmental impacts of the proposed Riverbank Management Program as compared to the existing Riverbank Stabilization Program in accordance with the requirements of the National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ) regulations of 1978, NPS Management Policies, and NPS Director's Order #12.

The Purpose and Need for the Action

The purpose of the Proposed Action is to stabilize a section of the Cuyahoga riverbank for the protection of cultural resources and improve visitor experience through maintaining infrastructure and providing educational and recreational opportunities. The need for the Proposed Action is for the protection of the historic, cultural, and recreational resources, and to protect employees and the public from the erosional effects resulting from the fluvial processes of the Cuyahoga River and its tributaries within Cuyahoga Valley National Park (CUVA).

Bank erosion has accelerated in recent years along the CVSR. The rate of erosion and bank failures within the CVSR project area has evolved along this stretch of the river and monitoring by CUVA staff indicated that the project area will continue to degrade and further acceleration is likely in the near future because of the already impacted bank structure. The increasing erosion results in an increased risk of instability of the rail line. The current conditions require enhanced safety protocols to protect visitors riding the CVSR, reactive temporary maintenance and potential short-term impacts to river water quality. While temporary repairs to the CVSR have been challenging, they are no longer manageable with the increased rate of loss. This bank destabilization is largely associated with climatic changes. The area has been subject to an increase of more than 3 inches of rain per year over the last two decades with expectations that this rate of precipitation will continue and will result in river widening and further bank destabilization.

The CVSR is one of the most significant linear cultural and recreational resources within the park. The CVSR is an important resource because it is frequently used by the public and is located within protected historic districts. The CVSR is a popular means by which most visitors experience CUVA. Without the stabilization, the CVSR would be at risk and as a result, many visitors would lose the opportunity to experience the iconic views and recreational opportunities offered along the CVSR and the adjacent historic Ohio and Erie Canal Towpath Trail (Towpath). Providing safe access through the CVSR by stabilization of the adjacent stream bank would ensure access along a primary overland route adjacent to the river and allow visitors to continue experiencing and enjoying the entirety of the park and the access it provides to other areas of the park.

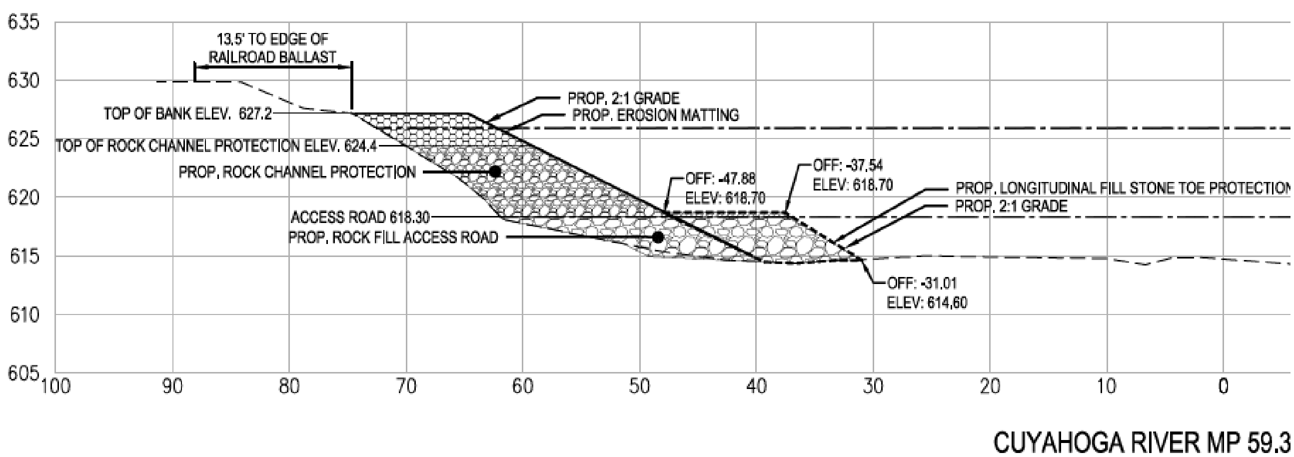

Figure 3. Selected alternative, typical construction-drawing section of the proposed armoring treatment. Note that 2 feet of fill above the rock armoring will be planted and is considered the bioengineering section of the armoring. The armoring extends 45 feet from the top-of-bank out into the river.

Proposed Action

The NPS proposes to implement riverbank stabilization measures at CVSR 59.3 along the Cuyahoga River. A riprap solution that includes live plant staking and seeding along the top of the rock fill was chosen as the preferred alternative in the Value Analysis Workshop. Alternative solutions for bank stabilization were analyzed during the Value Analysis Workshop in June 2021 and memorialized in the final Value Analysis Report from October 2021. Structural, bioengineering (planting strip 10-feet wide at the top of the bank armoring), and a combination of structural and bioengineering measures were considered in the design of bank stabilization at CVSR 59.3. Figure 3 shows the final detailed cross section of the preferred alternative.

The design for CVSR MP 59.3 was developed as a bank infill (adding rock material and some soil to an eroded bank) project to restore appropriate bank slope for stability and re-establish a 10’ minimum width shoulder along the railway ballast. Currently, sections of the project area come within 4.5 ft of the rail (Figure 2). Based on the Slope Stability analysis the infill shall be sloped no steeper than 2H:1V to the proposed toe of slope along the channel bed. The upstream extent may be extended slightly for appropriate bank tie-in.

A 150-foot gap in the shoreline armoring will be located near the downstream end of the structure that will create two sections of shoreline armoring (see figure 5). The gap will be left unaltered. The intent is to leave the established vegetation and potential underlying stable landform, rather than excavate or disturb this area. The gap in armoring is a portion along the riverbank that appears stable and not eroding toward the rail. The landform at this location also projects further into the river compared to the proposed bank build out upstream and downstream of the gap. Thus, it is best not to disturb this portion which would require removal of vegetation and excavation grading. The undisturbed gap will be flanked on each side with proposed rock bendway weir structures. The bendway features will protect the undisturbed area from erosive forces by moving the river thalweg away from the bank. In addition, in this area of stability is a storm outfall pipe. The storm outfall pipe will be maintained, protected and rock channel protection will be extended to the riverbank where the rock armoring is proposed.

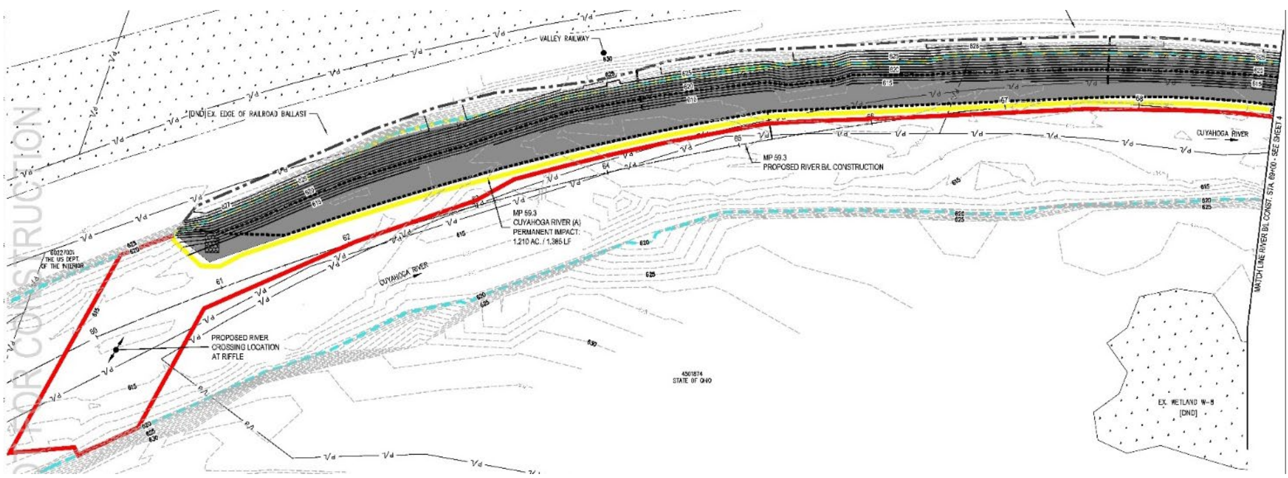

Figure 4. Upstream portion of the project showing limits of disturbance (inside the red and yellow polygons) of permanent and temporary impacts to the riverine wetland.

The stabilization project also includes implementation of rock bendway weir features (20-foot-wide and 3-foot-high) at the upstream and downstream extent of the stabilization zones within the project reach with intention to prevent flanking behind the stabilization area. In addition, bendway rock weirs on both sides of the gap will extend beyond the toe of the shoreline rock, into the river approximately 20 feet out, perpendicular to the toe of the rock fill. Bendway weirs will reduce scour and erosion along the streambank by training the river thalweg to adjust further from the riverbank. The proposed bendway lengths are elongated sufficiently beyond the rock toe material to deflect the thalweg appropriately to protect the undisturbed portion within the lower reach area. They are short enough to minimize shifting of river energies too far and creating problems on the opposite bank. Segments between bendway weirs normally become sediment traps which will further protect the bank and reduce introduction of addition sediment to downstream wetland features from other areas of instability.

Trenched keys (are 7-foot-wide sections of the shoreline armoring comprised of stone that extend to the top of the bank) are also called for at the upstream and downstream extents and spaced throughout the project reach. Seven trench key features will be designed into the length of the armoring.

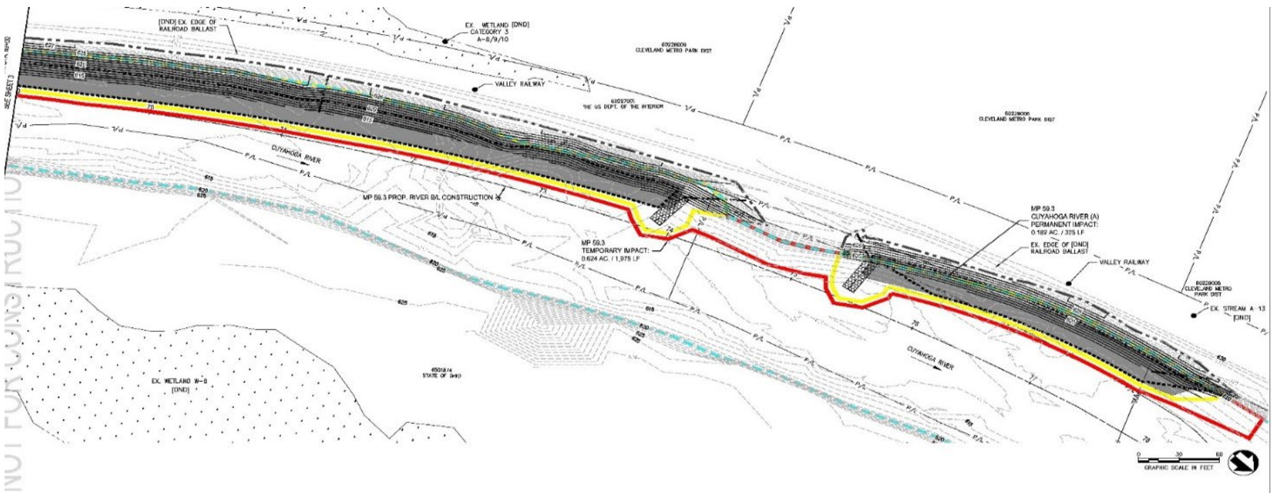

Figure 5. Downstream portion of the project showing limits of disturbance (inside the red and yellow polygons) of permanent and temporary impacts to the riverine wetland, and the gap flanked with bendway rock weirs.

A river crossing at the upstream end of the project area (please see Figure 4) will be constructed by placing rock to create a road prism. This will allow the back-and-forth transport of heavy equipment for grading and carrying rock and other material to build the armoring project. The rock road prism will be removed from the river and the river bottom will be returned to original grade once the project is complete.

The longitudinal fill stone and bank stabilization installation process will be performed using a 4-phased approach via access to the toe of bank slope. First, a stone access road approximately 15- to 20-feet wide and 2-feet thick will be built from upstream to downstream along the 1,700-foot length of armoring portion of the project; this material will remain and form the base of the new bank infill. The second phase will involve placement of the longitudinal fill stone overtop and adjacent to the river side of the access road. The third phase includes construction of the 2H:1V bank infill, live stake layer, and bank armor stone. And the fourth phase includes the remaining backfill to reach final grade using bioengineering techniques consisting of soil fill armored with a coconut fiber erosion control mat and native seed mix. Phases 2 through 4 will be conducted from downstream to upstream, working back out along the constructed access road.

Phase I – Access & Staging

All staging areas avoid wetlands and employ stormwater protection and erosion protection measures, including silt fencing which will be installed to protect wetlands that may be close to a staging location (Figure 6). Mobilization to the site will begin with staging located under the Route 82 bridge south of the CVSR 59.3 project site. The existing CVSR system will be used as access for material and equipment. An additional staging for office trailer and parking may be setup at the corner

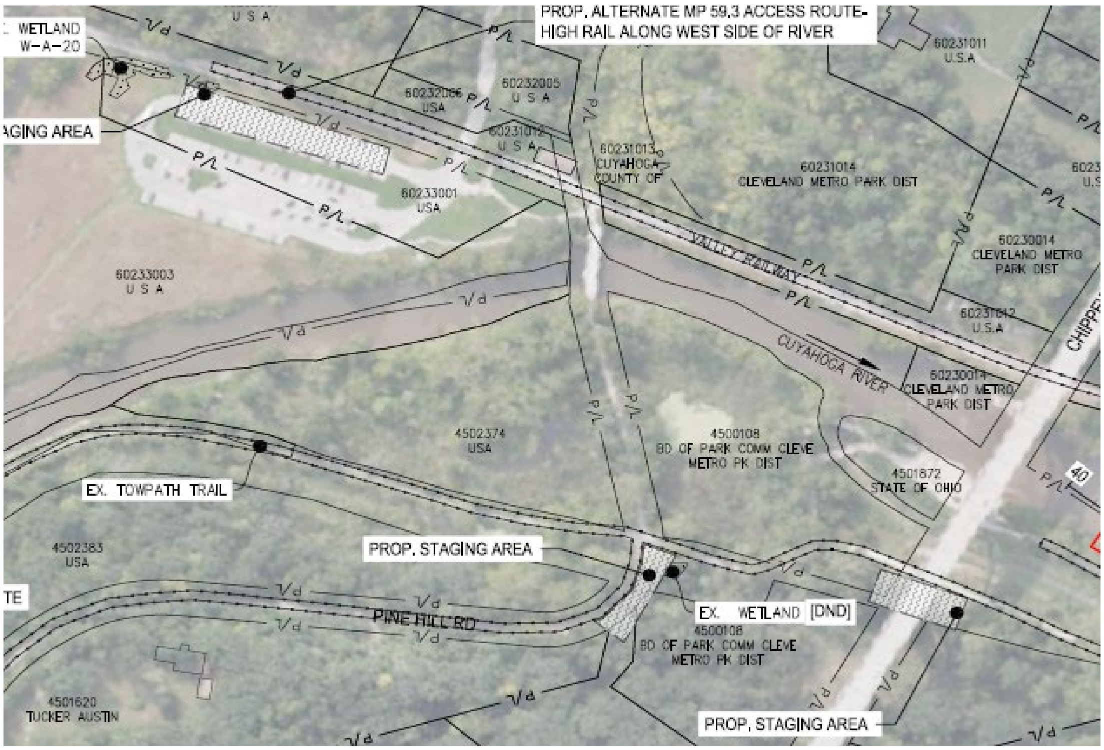

Figure 6. Two staging areas and one alternate area.

of the maintenance road and trail intersection leading to the proposed primary staging area. Orange 4-foot-high construction fencing will be used to delineate the staging area limits of disturbance that are close to palustrine wetland areas that should not be disturbed.

Access to the project area will follow the CVSR alignment west of the project site. Access points will be established on the upstream and downstream limits of the CVSR 59.3 project area for access to the toe of streambank. Minor clearing and grubbing will occur as necessary to establish access. Material will be imported to build a work platform at the bottom of the bank stabilization work area to support construction activities.

Imported backfill would be placed up to subgrade elevation for the rock bank protection. Site preparation and bank stabilization activities would start at the upstream extents of the project area and continue towards the downstream extents. A stone access road approximately 15 to 20 feet wide and 2 feet thick would be built from upstream to downstream along the length of the project. Material would remain and form the base of the new bank infill.

The source of any material that is imported from outside the park will be from a location that has been tested to be free of any contaminants above state threshold limits and free of any non-native plant parts or seeds as technology allows.

Phase II – Site Preparation

Once access and staging has been completed, additional clearing and grubbing of trees/plant material will occur along the project area bank and a rough subgrade will be established to remove any loose or unsuitable material. Imported backfill will be placed up to subgrade elevation for the rock bank protection.

Phase III – Bank Stabilization

Bank stabilization activities include placing imported sandstone material along the bank and choking (filling gaps between rocks) the area with the material. Imported bank run/fill soil material will be placed in a 6-inch lift above the rock bank protection, with limited use of on-site materials. Bank run/topsoil is to be wrapped in a coir erosion control fabric and planted with native vegetation during Phase IV activities. The balance of any additional LFSTP rock will then be placed along the base as the construction crews proceed to work their way back along the restored bank toward the upstream staging area. The source of any material that is imported from outside the park will be from a location that has been tested to be free of any contaminants above state threshold limits and free of any non-native plant parts or seeds as technology allows.

The predicted scour depth Hydraulic Modeling is in the range of 3.8’ – 13.5’. However, based on the subsurface investigation, bedrock is estimated at a depth 2- to 5-feet below the bank toe and is considered as the limiting scour depth. Using a predicted 5’ scour depth, the calculated volume of Longitudinal Fill Stone Toe Protection (LFSTP) required is 1.67-ton per lineal foot. However, to build in some conservatism due to proximity to the railway asset, the LFSTP volume has been increased by 30%. Therefore, the design includes a 2.2-ton per linear foot of LFSTP measured along the toe for the full project length to counteract potential for up to 7-feet of predicated scour depth (for a length of approximately 1,700 feet, Figures 4 and 5).

Phase IV – Site Restoration

Site restoration activities will include seeding and planting disturbed areas with park-approved native plant species. Live stakes or other planting material will be planted along the restored bank during the seasonally appropriate planting window. The project schedule should provide for revegetation immediately after completion of construction.

Alternatives Analysis

Alternative: No Action Alternative

Under the No Action Alternative, the bank adjacent to the CVSR would not be stabilized. The threat of riverbank erosion to the rail line would continue and would not be addressed. This alternative was dismissed because it would not protect the CVSR, erosion of the streambank would continue to occur, and it would not address the purpose and need for the project.

Alternative: Relocate the Rail Line

An alternative to relocate this section of the rail line to allow the river to continue natural lateral movement across the floodplain was discussed during the preparation of this document. The park response was the NPS would attempt to address wetland impacts from the armoring project within this segment, but no action may result in closures of the CVSR altogether or rerouting of the rail line. In this scenario, many cultural features that are present along the CVSR (including archaeological sites) would not be protected. This alternative was dismissed.

Alternative: Armormax and Scourlok

An alternative implementing Armormax and Scourlok was considered for CVSR 59.3 through the Value Analysis workshop in June 2021 (Figure 7). This alternative included utilizing Scourlok, a robust engineering bank stabilization system that incorporates cement block units that are filled with

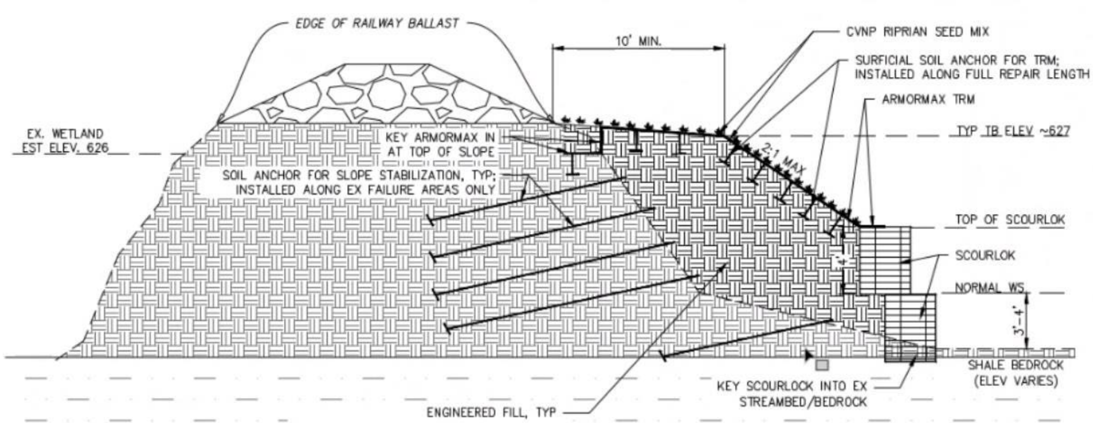

Figure 7: Armormax and Scourlok

either in-situ soils or imported materials and can be installed above and below the water line. An Armormax erosion control slope stabilization system with a soil anchor system would be utilized to keep soil in place and provide erosion control. Although this alternative included the ability to grow vegetation along the slope in the Scourlok units, this alternative was ultimately dismissed through the value analysis process as this engineering technique would provide an unnatural slope into the water, the least advantage to protecting resources compared to the other alternatives and was the costliest (NPS 2021). For these reasons, this alternative was not selected.

Alterative: Durable Riprap

The durable riprap alternative that was considered for CVSR 59.3, included the hardening of the riverbank with rock riprap (Figure 8). This alternative did not include bioengineering techniques which would incorporate natural materials.

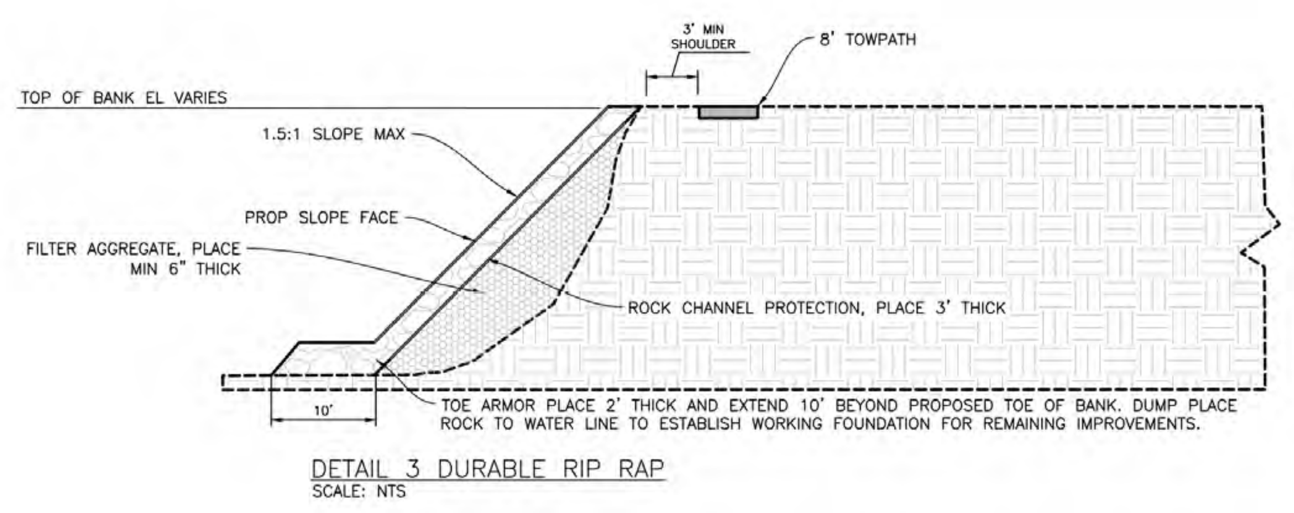

Figure 8: Durable Riprap Alternative

The durable riprap alternative does not provide for the inclusion of bioengineering, (e.g. live staking or seeding) which was a design criterion requested by the NPS.

Site Description - Wetlands

Wetland Delineation

A wetland delineation was completed in 2021. All wetlands impacted by this project are riverine (as defined in the Classification of Wetlands and Deepwater Habitats of the US, USFWS, Cowardin et.al., 2013). The boundaries were defined as the ordinary high-water mark along the bank. The wetlands in the study area around the construction zone were delineated using the methods described below. Study area field-survey limits extend 25 feet riverward and 100 feet landward, or to the nearest edge of the CVSR or Towpath Trail, of the Ordinary High-Water Mark (OHWM) along each side of the Cuyahoga River from river mile 14 - 29 (Study Area). HDR, an environmental consulting company, completed the field work for the wetland delineation in August and October 2021 (HDR, Inc. 2022). During November and December 2022, EnviroScience (ES), an environmental consulting company, performed a supplemental wetland investigation and delineation within the proposed construction limits, which included construction, staging, and access areas (EnviroScience 2023). The field work was completed by qualified wetland delineators, including two Certified Professional Soil Scientists (CPSS), a botanist, and a biologist. Described below are the wetlands identified in the project site CVSR 59.3.

Cuyahoga Riverine Wetlands

Cuyahoga River is a National Wetlands Inventory (NWI)-mapped perennial waterway located within the CVSR 59.3 construction limits. Stream A14 is in the Willow Lake – Cuyahoga River HUC 12 sub-watershed (041100020505). Potential impacts on this reach of the Cuyahoga River include CVSR stormwater outlets associated with Streams A12 and A13. The CVSR narrowly separates the river from a large palustrine wetland to the west. The riverine wetland is comprised of a well-defined channel. Substrate within the river reach includes cobble, sand, boulder slabs, boulders, gravel, and silt. The riverine habitat is classified as a lower perennial riverine system with an unconsolidated bottom that is permanently flooded (R2UBH).

Function Assessment

Active banks create and maintain diverse natural structure and habitat functions. Channel banks form a significant ecotone between aquatic and terrestrial ecosystems with diverse structure and habitat functions. The main functions of riverine/riparian zones are related to fluvial hydrology and sediment dynamics; retention and cycling of nutrients and pollutants; and maintenance of habitat for fish and wildlife, including invertebrates, amphibians, reptiles, birds, and mammals.

- Bank erosion provides a sediment source that creates riparian habitat.
- Active banks create and maintain diverse structure and habitat functions.
- Riparian vegetation promotes bank stability and contributes large woody debris.
- Bank erosion modulates changes in channel morphology and pattern.

Biotic Functions

As a transitional zone the riverine wetland and upland, riverbanks accommodate highly dynamic environmental conditions. Banks can modulate floodwater surface elevations and have variable moisture regimes that satisfy the requirements of diverse plant species. Banks provide habitat at different elevation zones needed by flora and associated fauna adapted to flood pulses rising along the bank. Habitats along the bank gradient are exposed to various flood frequencies, durations, and magnitude. Thus, plant communities closest to the channel are colonized by fast-growing, water-adapted sedges, rushes, grasses, herbs, and seedlings of shrubs and trees, whereas terrestrial vegetation is deterred because of frequent flooding. At elevations on the bank, riparian plant communities include trees such as cottonwood (Populus), willow (Salix), and alder (Alnus), whose roots are adapted to periodic floods.

Streamside trees that overhang the channel are sources of organic material that provide food and cover for fish. Additionally, organic material from riparian vegetation is a primary food source for invertebrates from all of the primary consumers including filter feeders, shredders, scrapers, and predators.

Streamside trees offer shade that modifies aquatic microclimates and maintains more desirable lower water temperatures. Since the EPA defines the Cuyahoga River as a "warmwater habitat," tree and shrub overhang provides shade and is critical to maintaining cooler water temperatures.

Three federally protected species are known to be in the area of the project site, the Indiana bat (*Myotis sodalis*), northern long-eared bat (*Myotis septentrionalis*), and the tricolored bat (*Pipistrellus subflavus*). Suitable habitat for the Indiana bat, northern long-eared bat, and tricolored bat is found within the project limits. During a special status species survey conducted on August 23-27 and September 1-3, 2021, no state or federally listed species were observed (HDR 2022b).

In August and September 2021 (MAD Scientists 2021b), a submerged aquatic vegetation (SAV) survey was conducted within the project reach of the river. Generally, the aquatic habitat was typical of those associated with large waterways in Ohio. SAV may exist along the river, but they are most likely found in slow, backwater channels where the current is not strong and therefore were not noted in the riverine project area. Curly pondweed (*Potamogeton crispus*), a non-native species to Ohio and North America, was found close to the banks of the river.

Overall, the quality of the aquatic habitat is ranked good to excellent. Ohio Environmental Protection Agency (Ohio EPA) has established a Qualitative Habitat Evaluation Index (QHEI) as a method for evaluating stream habitat quality. The index provides a measure of habitat that generally corresponds to physical factors that affects fish and other important aquatic life including invertebrates. Using the QHEI (OEPA 2006), A14 scored 70.5 and assessed within the range 'Good' Warmwater Habitat. This is comparable with other studies completed along this stretch of the river by the Ohio Environmental Protection Agency and Northeast Ohio Regional Sewer District (NEOSD). In 2017 and 2018, the Ohio EPA sampled the Cuyahoga River and 67 tributaries at 140 sites for chemical, physical, and biological monitoring. Sampling included sites within CUVA, including River Mile (RM) 20.5 where CVSR 59.3 is located, and the Cuyahoga River was deemed in full attainment, with no listed impairments. This stretch of the river has a designated aquatic life use (ALU) of warmwater habitat (WWH), an Index of Biological Integrity (IBI) score between 42 to 50 (indicating excellent stream condition), an Invertebrate Community Index (ICI) of 42 to 52 (marginally good to very good), and a QHEI of 75.50 to 82.00 (good to excellent range) (Ohio EPA 2023). In 2021, NEOSD conducted river sampling along the same stretch of the Cuyahoga and yielded similar results. NEOSD also determined full attainment status, with a IBI score of 40, an ICI score around 48, and a QHEI score between 76.00 and 77.50 (NEOSD 2022).

In terms of macroinvertebrate sampling closest to RM 20.50 at RM 20.67, the most commonly-captured aquatic invertebrate species by Ohio EPA were those considered intolerant to moderately intolerant to pollution which includes sediment deposition (Ohio EPA 2023). Invertebrate species that are intolerant of poor water quality are surviving in the river suggests that the water quality (which includes eroded soil as suspended solids) is good to excellent. Identified species included baetids which are considered pollutant intolerant mayfly species. Other species captured included *Rheotanytarsus* spp. and *Polypedilum* midges, and *Hydropsychids* all of which are considered moderately intolerant to pollution. The 2017-18 survey results from the downstream Gorge Dam (RM 44.5) to the mouth showed improvement compared to previous surveys conducted in the 1980s. Improvements to industrial facilities along the waterway, and reducing combined sewer overflows (CSO) inputs, has improved the macroinvertebrate community quality (Ohio EPA 2023). The 2021 evaluation of macroinvertebrates along RM 20.00 by NEOSD yielded similar results. A total of 60 qual taxa were collected including 16 Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa, 17 sensitive taxa, and two rare and sensitive macroinvertebrates (*Ceraclea sp. a*nd *Leuchotrichia pictipes)* yielding an "Exceptional" ICI score (NEOSD 2022).

No living mussels were found at CVSR 59.3 project area during a September 2021 survey. However, several minimally weathered shells were found. These included two large (6" and 7") pink heelsplitters (*Potamilus alatus*), a white heel splitter (*Lasmigona complanata*), and a giant floater (*Pyganodon grandis),* all which had both sides of the shell still connected with wear and discoloration only present on the umbo. One relic shell (identity unknown), living and nonliving invasive zebra mussels (*Dreissena polymorpha)* and Asian clams (*Corbicula sp*.) were also found.

Overall water quality is rated poor. Through water quality monitoring efforts, Ohio EPA found total dichloro-diphenyl-trichloroethane (DDT) and total polychlorinated biphenyl (PCBs) above the Sediment Quality Guidelines (SQGs) and concentrations above threshold effect (TEC), while NEOSD noted over enriched conditions relating to total Kjeldahl nitrogen (TKN), Nitrate-Nitrite, and Total Phosphorus (NEOSD 2022). Within the lower Cuyahoga River, three mainstem locations, including 20.5, Ohio EPA found minimum Dissolved Oxygen (DO) exceedances. These results indicate historic contaminant inputs (e.g., DDT, PCB) and ongoing anthropogenic inputs (e.g., nutrients) within the system.

Hydrologic Functions

Riverine wetlands are important in supporting a suite of physical and biological functions including flow attenuation, sediment control, nutrient retention and habitats for a variety of water-dependent species. Hydrologic conditions generally impact the structure and function of riverine, riparian, and upland systems. Hydrologic regimes influence the relationship between upland areas and the river and changes to the hydrology can result in geomorphic alterations and structure which will translate to changes in wetland vegetation and degradation of riverine and floodplain habitat.

A general fluvial geomorphology assessment of the entire Cuyahoga River was conducted in 1997. The river was classified using the Rosgen Classification System, which quantifies a stream's variables, or morphologic characteristics, in varying levels of resolution from broad characterizations to site specific descriptions. The key variables used in the analysis include gradient, bank full width and depth, sinuosity, valley confinement, and particle size. Bank full refers to the discharge that fills a stable alluvial channel up to the elevation of the active floodplain (NPS 2004). These geomorphological features have direct bearing on the hydrologic activity of the Cuyahoga River.

Based on this analysis, the Cuyahoga River is generally classified as a system that has a high sensitivity to disturbance (including increases to stream flow and timing and/or sediment increases), a fair recovery potential (assumes natural recovery once cause of instability is corrected), a very high sediment supply, high streambank erosion potential, and very high vegetation controlling influence, which are all natural conditions for this class of river.

Riverine Wetland Impacts

Stabilization of the shoreline at CVSR 59.3 would result in, localized, direct impacts on aquatic species and habitats. There would be a permanent and temporary loss of a total of 2.016 acres of riverine wetland habitat.

The bank stabilization will result in impacts to 1,900 feet of riparian shoreline considered to have moderate to high functional value. The placement of rock revetment embankment fill will have permanent and temporary impacts in the riverine wetland (please see the red polygons on Figures 4 and 5). The total length of the riverine impact zone parallel to the riverbank measures over 1,900 feet. The typical cross section (please see Figure 3) shows fill 45 feet out into the river, perpendicular to the bank and from the top of bank. The existing river width in this reach averages 122 feet.

Permanent impacts to the Cuyahoga River would result from construction activities:

- Placement of the armoring material on the right descending bank (below the ordinary highwater mark)
- Loss of woody vegetation that could provide shade and organic-matter input along the shoreline immediately adjacent to the ordinary high-water level.

The stabilized bank will have the following adverse effects to the riverine system:

- Potential for bank erosion would be eliminated in this location. The reduction in sediment supply because of bank stabilization would reduce the persistent erosion and ultimately impact the sediment transport of bank material during high water events downstream.
- Suspended solids contributed to the natural bedload transport system will be eliminated at this location, and significantly reduced along the 22-mile reach once all nine armoring projects are in place. Note: Based on the Rosgen channel assessment performed as part of the 2004 Programmatic Environmental Assessment, the Cuyahoga River generally has very high sediment supply. The cumulative reduction of the naturally occurring sediment load will likely have long-term adverse impacts to the river sediment bedload contribution and transport, and the width to depth ratio, which will likely adversely increase the hydraulic energies throughout the system and downstream.
- The bioengineering component (i.e., live planting and seeding of herbaceous plants along the top edge of the armoring) would provide limited vegetative cover/biological refugia within the 10-foot space between the top of the armoring and the rail line (please see Figure 3). Allowing woody plants to grow on or above the armoring could impact the integrity of the armoring. Therefore, the armored portion of the bank will eliminate the possibility of woody plant species colonization that could provide shade to lower water temperatures and leaf fall and other carbon or detritus-forming material input.

Long-term impacts are anticipated and include destruction of aquatic organisms including invertebrates from equipment driving in the riverine wetland and increased turbidity to water quality during construction. Silt curtains were not considered for use in the river and will not be used. Because of the changes in hydraulics, it is anticipated that most post-construction benthic invertebrates and other mobile species will not find suitable conditions to repopulate in the channel bottom adjacent to the shoreline stabilization.

Table 1 identifies and summarizes the main geomorphic and ecological effects of channel bank infrastructure, the potential habitat or ecosystem services lost, and examples of organisms affected.

Table 1. Summary of Cuyahoga River aquatic habitat effects from construction of channel bank infrastructure to control bank erosion

Geomorphic and ecological attribute	Habitat or ecosystem service influenced	Examples of organisms affected
Loss of sediment source		
Supply	Downstream sandbars that serve as resting habitat for migrating birds	Whooping crane (*Grus americana*)
Grain size	Coarse-grained substrate for attachment and interstitial space for hiding from predators	Macroinvertebrates (e.g., mayflies [*Ephemeroptera*], caddisflies [*Trichoptera*], and stoneflies [*Plecoptera*])
Loss of geomorphic processes		
Migration	Newly scoured or deposited surfaces	Riparian trees (e.g., cottonwood [*Populus*], willow [*Salix*], alder [*Alnus*])
Widening	Adjustment necessary for incised channel to evolve toward equilibrium with floodplain at elevation to support riparian plants	Riparian trees (see above)
Loss of bank substrate		
Unconsolidated sediment	Vertical banks for wildlife burrowing and nesting Filter and retention of nutrients, pollutants, water quality	Bank swallow (*Riparia riparia*) Macroinvetebrates (see above)
Natural biotic and abiotic components of land-water margin	Shoreline microhabitat: soft sediment or burrows, emergent vegetation to cling to; underwater plants, snags, roots protruding from bank	Shore-dwelling insects (e.g., *Neocurtilla*); macroinvertebrates
Roughness and irregularity in land-water margin	Variation in near-bank flow velocity, refugia during storm flows	Overwintering fish, macroinvetebrates (see above)
Undercut banks	Protection from predators	California shrimp (*Syncaris pacifica*), juvenile fish (e.g., Coho salmon [*Oncorhynchus kisutch*])
Loss of riparian forest		
Stream-side riparian ecosystem, Willow and cottonwood forests	Complex riparian vegetation, areas for wildlife: Bat habitat, bird breeding, nesting, safety from predators; probing for insects under tree bark; wildlife: food, migration corridor, and/or dispersal route; plants: structure for vines Natural banks and associated vegetation offer cover for these animals while they move back and forth between water and land.	Bats and irds (e.g., willow flycatcher [*Empidonax traillii extimus*], reptiles (e.g., riparian lizard, semiaquatic mammals (e.g., river otter [*Lontra canadensis*]), macroinvertebratres, climbing vines (e.g., river-bank grape [*Vitis riparia*])
Overhanging branches, leaves	Shade, organic material, fish food	Fish, macroinvetebrates (nymph and adult stages)
Large woody debris	Reduction in pool complexity and depth, loss of attachment sites	Fish, macroinvetebrates (see above)

In streams where riparian woody vegetation is removed from banks and precluded from being established along erosion control structures, it follows that macroinvertebrate production, essential for aquatic food webs, is often diminished. The ecological consequences of erosion control infrastructure in urbanizing rivers include the removal of vegetation and the loss of habitat for macroinvertebrates (Florsheim, et.al. 2008).

Channel complexity will be reduced by the changes that the channel bank infrastructure produces including elimination of bank irregularity and channel-width variations, homogenization of near-bank flow velocities, loss of natural bank substrate, and limitation of geomorphic adjustments. Moreover, complex riparian plant communities offer a greater variety of food sources and physical habitats than will a 10-foot-wide simple herbaceous plant community of uniform age and species, which is proposed for this stabilization project (Florsheim, et.al. 2008).

Shoreline armoring creates two important geomorphic issues: (1) channel bank infrastructure fundamentally alters geomorphic processes, and (2) structures may be ineffective, especially over the long term. Completely arresting bank erosion will disrupt the lateral channel-bank sediment exchanges that are necessary to sustain an array of aquatic habitats (table 1). Bank erosion-control structures might fail when flood magnitudes exceed the discharges for which the structures are designed, or when processes such as channel migration are ignored. Because hard structures, even when they incorporate vegetation, impede geomorphic adjustment processes, they can lead to more damaging erosion events locally or in downstream reaches. Nevertheless, bank erosion-control structures can be effective in minimizing land loss over decadal timescales, although some evidence suggests that they are ineffective over multidecadal timescales and potentially have secondary adverse effects (Florsheim, et.al. 2008).

Bank erosion modulates changes in channel morphology and pattern. As a measure of river health, numerous studies of biological indicators identified that the current river function is good to excellent under the very high sediment load. Areas disturbed by construction activities are susceptible to erosion during precipitation events. The short-term impacts on Cuyahoga River function due to the potential for increased sediment during construction is anticipated to be moderate and short term (Florsheim, et.al. 2008).

Channel bank armoring will limit the geomorphic processes that transfer sediment through dynamic natural systems and will lead to undesirable secondary effects. For example, this structure will reduce sediment supply to the river channel. In addition, the structure will shift the locus of erosion as the river adjusts to the hardened area that the structure presents. This bank structure will narrow channel width, which will likely lead to higher flow strength and thus initiating a cycle in which the increased energy or shear stress in the center of the new channel, in combination with reduced sediment supply, will lead to channel incision or deepening. The deepening may in turn increase bankfull height and accelerate erosion of unarmored banks (Florsheim, et.al. 2008).

As the majority of the proposed improvements for this particular project are along the bank, and this individual project size is small relative to the surrounding watershed, there would be no large-scale change in the hydrology or flow regime downstream. The same claim can be made for each of the eight other individual bank stabilization projects planned to be implemented when evaluated separately.

Cumulative Riverine Wetland Impacts

Over time, this armoring will be joined by eight more structures erected to armor new erosion sites all within short reaches of the same 22-mile lowland channel. There have been no studies or modeling of the cumulative effects of armoring of over 17,000 feet (3.2 miles) of the riverbank in the 22-mile lowland reach within the park. It is very likely that the hydraulics will be significantly altered with the completion of all nine armoring projects that will armor 15% of the river shoreline.

As each new structure interacts with geomorphic processes, bank erosion energy will shift to a new location, creating a chain reaction in which each new section of eroded bank is armored with new erosion control structures. Consequences of channel bank infrastructure that has long-term effects (beyond the design life of the structure) are that the series of structures may preclude future restoration attempts designed to incorporate nature-based, self-design, and self-sustaining habitats, and interfere with the potential for future restoration initiatives or with the natural river adjustments needed to maintain equilibrium. If cumulative long-term effects are not taken into consideration, the result will be progressive construction of channel bank infrastructure that, although intended to limit local bank erosion, will likely result in channel incision of the entire lowland Cuyahoga River system.

Mitigative Measures: Best Management Practices

To help minimize impacts to the riverine wetland resources the park, in cooperation with contractors, would implement the following measures. The items in this section were considered during the construction design process.

- Stormwater Management Best Management Practices (BMPs) will be used include temporary seeding, permanent seeding, silt fence, stabilized construction entrance, designated waste disposal areas, material handling, equipment fueling and maintenance requirements, stream bank erosion control matting, and placing 4-foot-high construction fencing around staging, access and construction locations as appropriate.
- Live native plant stakes, and native herbaceous seed mixes will be approved by CUVA to ensure proper native species are used.
- No equipment will disturb wetland areas beyond the limits of disturbance identified in Figures 4 and 5.
- Wetland boundaries adjacent to the staging areas will be delineated with four-foot-high orange construction fencing to designate the no-cross boundaries for contractors and eliminate potential for accidental damage.
- Site inspections will be completed weekly by the contractor and after rainfall events exceeding 0.5-inch of rainfall. All necessary repairs will be implemented immediately after such inspections.
- Removal of woody vegetation and trees will be done outside the local avian breeding season to prevent impacts to nesting birds protected under the Migratory Bird Treaty Act [16 USC 703] from March 15 through November 15.
- Woody vegetation and trees will be removed outside of the bat roosting and breeding time of year windows which is from March 15 through November 15.
- To avoid impacts to listed species, no trees would be cut during the roosting season (April 1 to September 30).
- The source of any material that is imported from outside the park will be from a location that has been tested to be free of any contaminants above State threshold limits and free of any non-native plant parts or seeds.
- The rock road prism for the temporary river crossing will be removed from the river and the

river bottom will be returned to original grade once the project is complete.

- A park staff member or a third-party representative familiar with riverine wetlands and riverbank armoring construction processes will be onsite during all construction activities to monitor compliance with the above BMP's.

Compensatory Mitigation Plan

Mitigation is proposed for all 2.016 acres of riverine wetland impacts, including the temporary and permanent impacts. The NPS preferred type of compensation is to restore degraded riverine or palustrine wetlands elsewhere in the park. However, park staff did not have any shovel ready restoration projects that could be used as compensation for the project impacts within the timeframe allotted. Consequently, compensatory mitigation for the Proposed Action will be accomplished by enhancement of degraded palustrine emergent wetlands on NPS property within the Cuyahoga Valley National Park Central Valley (Figure 9).

The compensation ratio of 30 acres of non-native plant removal enhancement for every acre of wetland impacted (30:1) was calculated based on consultation with NPS Water Resources Division. The ratio of 30:1 is standard service wide requirement when the impacted wetlands are of medium to high overall functional value and the proposed compensation is 60 acres of wetland enhancement. The requirement for enhancement includes the removal of non-native plants and re-seeding with native plant species after the non-native plants are eradicated. The proposed 760-acre compensatory mitigation area is located centrally within Cuyahoga Valley National Park between Boston Mills Road to the south and Vaughn Road to the north (see Figure 9). There are approximately 391 acres of floodplain wetlands in this area that are available for enhancement. Sixty acres of enhancement will be completed in this area as compensation for riverine impacts.

The mitigation area was originally part of the Cuyahoga River floodplain but was separated from the river in the 1820s due to construction of the Ohio and Erie Canal. During canal construction, a local creek, Standford Run, was placed into a culvert, which eventually failed. This failure resulted in further degradation of the compensation project area, which has been compounded in recent decades by increased precipitation, human-induced development, and the spread of invasive plants within the watershed.

Dominant habitats in the mitigation area include palustrine emergent wetlands, shrub wetlands, and bottomland / riparian forests. Existing vegetation in the palustrine wetlands includes invasive reed canarygrass (*Phalaris arundinacea),* common reed (*Phragmites australis*), and narrow-leaf cattail (*Typha angustifolia*). Assessments completed within nine wetlands in this area in the past using the Ohio Rapid Assessment for Wetlands (ORAM), show that wetlands in the vicinity generally fall with the poor (Category 1) to good (Category 2) quality ranges. Lower scores on the ORAM were often associated with a reduction in habitat diversity due to invasive plant invasions. Few native trees are dispersed throughout the herbaceous wetland areas, including eastern cottonwood (*Populus deltoides*) and black willow (*Salix nigra*). Surrounding vegetation at higher elevations generally supports second- growth forests dominated by a variety of oaks, hickories, and maples with understories of nonnative shrubs.

The east side of the river includes an area often referred to as Stanford Run, which is the primary tributary flowing through the area. This area includes a wetland that was designated as a Wetland of Management Concern by the Resource Management division (Stanford Wetlands, Bingham and Young 2023) and has been monitored for vegetation community health using the Vegetation Index of Biotic Integrity (VIBI) at 4 locations by the Heartland Inventory & Monitoring program. The VIBI scores at Stanford are very low, in part, due to extensive populations of the giant reed, reed canary grass, and other invasive wetland species (Figure 9).

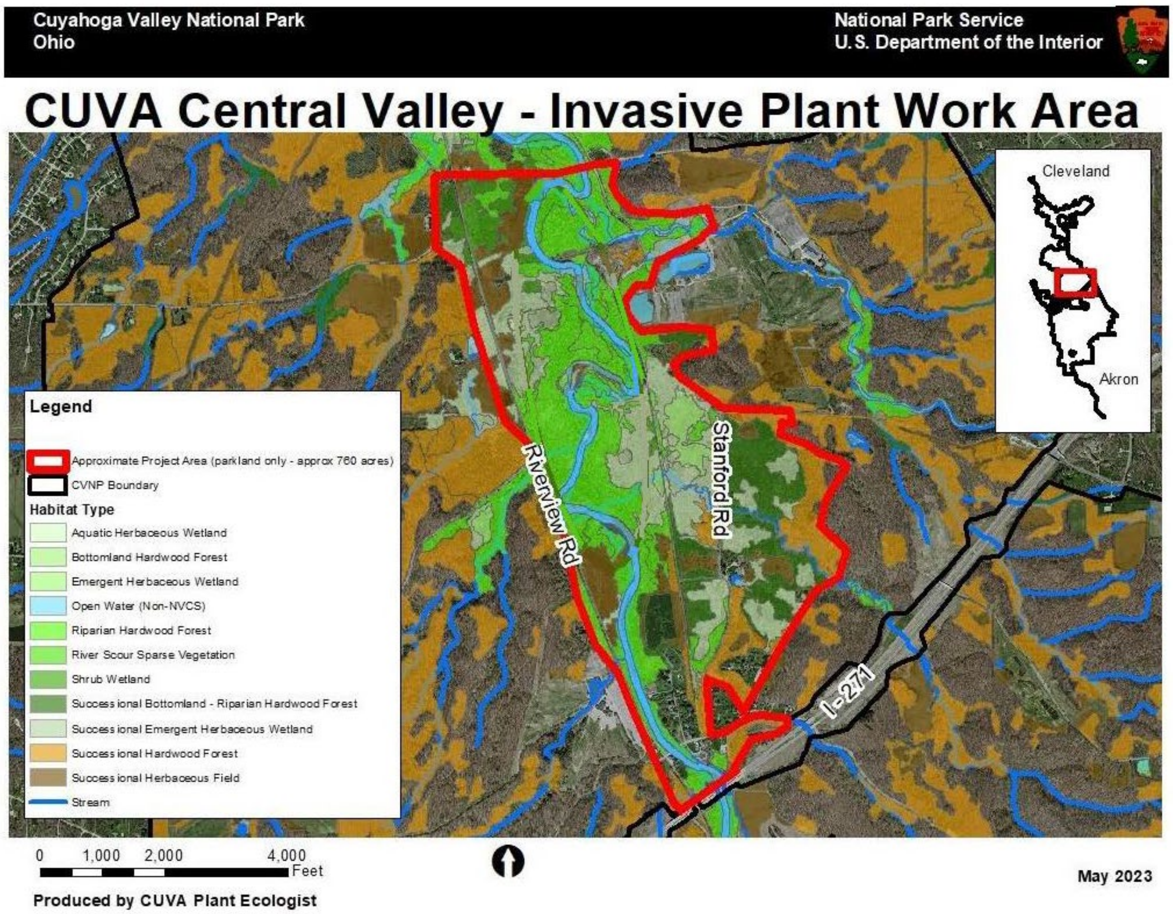

Figure 9. Proposed area location for wetland compensation, non-native plant species removal

Since 2019, Cuyahoga Valley National Park staff have restored approximately 2,200 linear feet of Standford Run and five acres of riparian forest in the middle of the mitigation area. Stream channel restoration was completed in 2019 and CUVA's exotic plant management team has attempted invasive plant control since then to help improve the chances for native species re-establishment. However, invasives are prevalent throughout the extent of the wetland and watershed, and persistent efforts will be critical for success. The designation of Stanford as a mitigation area will ensure this area continues to be prioritized for invasive plant removal efforts in the future and VIBI sampling will indicate how the plant community is responding to the invasive plant control. Enhancement of degraded wetland areas would be accomplished by 1) eradicating non-native plants within 60 acres of palustrine wetlands and 2) lightly reseeding managed areas with a native mix of emergent wetland plants.

1) Invasive Plant Management: Invasive plants would be managed in the mitigation area for at least three years to transition vegetation from patchy monocultures of non-native species to a mix of native plants. Species of primary concern in the mitigation area include reed canarygrass, common reed, and narrow-leaf cattail. Other non-native species of concern scattered throughout the area include Canada thistle (*Cirsium canadensis*), autumn olive (*Elaeagnus umbellata*), and others. Initial treatment would include foliar spray of targeted species in targeted areas using a wetland approved, glyphosate-based herbicide, such as AquaNeat or similar. Subsequent treatments would include hand-wicking or cut-stump treatment of targeted species using a similar herbicide approved for use in wetland areas.

2) Reseeding Managed Areas: After controlling invasive plants in targeted areas, regeneration of native, herbaceous, wetland plants would be accomplished by overseeding lightly with a mix of native species. A proper native seed mix will be determined based on species lists from wetlands nearby with similar habitat types, including a variety of sedges, rushes, and forbs, such as marsh-marigold (*Caltha palustris*), swamp milkweed (*Asclepius incarnata*), and swamp mallow (*Hibiscus moscheutus*). Following management and seeding, park staff within the Resource Management Division would incorporate the mitigation areas into its annual work plan to monitor and subsequently re-treat non-native vegetation in future years to support continuity of high-quality wetlands in the mitigation area.

Conclusion

The NPS has identified a Proposed Action for stabilizing the Cuyahoga riverbank along the Cuyahoga Valley Scenic Railway at CVSR 59.3. Wetland impacts have been avoided and minimized to the greatest extent practicable. The 2.016 acres of temporary and permanent wetland impacts will be compensated via non-native plant removal wetland enhancement over 60 acres in the vicinity of Stanford Run (a ratio of thirty acres of restoration for every acre impacted). Therefore, the Proposed Action at CVSR 59.3 is consistent with E.O. 11990 and NPS Director's Order #77-1, including the NPS no-net-loss of wetlands policy.

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