Valley Creek Feasibility Study, Bessemer and Birmingham, Alabama

Final Integrated Feasibility Report and Environmental Assessment

Appendix H – Habitat Modeling and Evaluation

June 2021

US Army Corps of Engineers ®

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1.0 Introduction

During the development of feasibility reports, the environmental impacts of each alternative evaluated in detail by the U.S. Army Corps of Engineers must be captured and quantified to better compare the alternatives, and if necessary, determine any compensatory mitigation that may be required. One method to evaluate the environmental impacts of alternatives is the Habitat Evaluation Procedure (HEP). HEP was developed by the U.S. Fish and Wildlife Service (USFWS) and evaluates the quality and quantity of available habitat for selected wildlife species or groups of species. HEP provides information for two general types of wildlife habitat comparisons. One, the relative value of different areas at the same point in time, and two, the relative value of the same area at future points in time. By combining these two types of comparisons, the impact of proposed land and water use changes on wildlife habitat can be quantified. HEP describes relative habitat value for selected wildlife species as a Habitat Suitability Index (HSI) with a value ranging from 0.0 (unsuitable) to 1.0 (optimal). This value is multiplied by the area of available habitat to obtain Habitat Units (HUs). To calculate habitat value over a period of time, such as a 50-year period of analysis, HUs are averaged on a yearly basis to provide Average Annual Habitat Units (AAHU).

1.1. Study Background

The Valley Creek Feasibility Study covers an approximate 20-mile length of Valley Creek, a tributary to the Black Warrior River (River Mile 170.23) located in Jefferson County, Alabama. Additionally, the study covers tributaries to Valley Creek, including approximately 1 mile of Opossum Creek, 2 miles of Halls Creek, and 1.5 miles of a tributary draining to Halls Creek. Jefferson County is located in north-central Alabama and is bordered on the north by Blount and Walker Counties, on the east by Saint Clair and Shelby Counties, on the south by Bibb County, and on the west by Tuscaloosa County. Valley Creek has an overall length of about 55 miles, originating from headwater springs, but immediately passing through an underground storm drainage system before discharging to an open channel in central Birmingham near 5th Avenue and 7th Streets. From this location, Valley Creek flows southwesterly for approximately 22 miles through the cities of Birmingham, Fairfield, Midfield, Lipscomb, Brighton, Hueytown, and Bessemer. At this point, the stream turns to flow northwesterly for approximately 33 miles, before discharging into the Black Warrior River. The Valley Creek Basin drains approximately 255 square miles; the drainage area of the study-area is about 87 square miles. The basin divide crosses the channel at approximately 31 miles upstream from the mouth, bisecting the watershed into upper and lower portions. Per the study authorization, the study area focuses on the Birmingham metropolitan area and therefore ends just downstream of the Jefferson County Wastewater Treatment facility. The study area includes what is typically referred to as “upper” Valley Creek. The length of Valley Creek applicable to this study is located entirely within the upper basin, which has an average fall of 8.4 feet per mile, and a total drainage area of 96 square miles. It is an urban watershed with land use ranging from 60 to 95 percent developed including residential, commercial, and industrial areas. The scope of the study focused on achieving National Economic Development benefits because funding was provided through the USACE flood risk management business line. The purpose of the proposed Federal action is to achieve reduction to the potential risk of loss of life as well as reduce economic damages due to flooding. The study area contains multiple repetitive-loss areas that translate into costs for the national economy as a result of flood insurance payouts.

1.2. Habitat Suitability Index Selection

Three factors were considered when selecting a Habitat Suitability Index model for the Valley Creek Feasibility Study. First, it was important to select a species that would use the existing habitat type(s) that would be impacted by the proposed project measures and alternatives. Second, the variables included within the species HSI model should also be representative of impacts to the larger group of species that may use the same habitat. Finally, only available species for which there was a certified or approved HSI model, in accordance with EC 1105-2-412 Assuring Quality of Planning Models, were considered.

The majority of the study area consists of urban development. However, the study area includes forested riparian areas, including forested wetland. Much of the length of Valley Creek in the study area is characterized by a relatively narrow band of riparian forest; however, larger forested tracts are found in several locations. Canopy tree species found in the riparian forests include water oak (*Quercus nigra)*, green ash (*Fraxinus pennsylvanica)*, winged elm (*Ulmus alata)*, sugarberry (*Celtis laevigata)*, boxelder maple (*Acer negundo)*, American elm (*Ulmus Americana)*, American hophornbeam (*Ostrya virginiana)*, Southern red oak (*Quercus falcata)*, shingle oak (*Quercus imbricaria)*, loblolly pine (*Pinus taeda)*, and Virginia pine (*Pinus virginiana)*. Proposed measures for reducing flood risk at Valley Creek included levees, bridge modifications, off-channel detention areas, and channel modification. Off-channel detention areas were considered nature-based features in accordance with implementation guidance for Section 1184 of the Water Resources Development Act of 2016 because they are features that would be created by human design, engineering, and construction that work to mimic as closely as possible conditions which would occur in the area absent human changes (i.e. the natural storage of floodwaters within the floodplain).The primary impact to fish and wildlife habitat associated with all of these measures would be the loss of riparian forest/forested wetland habitat. As a result, the barred owl (*Strix varia*) HSI model was chosen for the habitat evaluation.

The barred owl HSI model is certified for use in USACE planning studies; however, an Excel spreadsheet was developed for computation of the model. This spreadsheet required review and approval by the USACE Ecosystem Planning Center of Expertise. Documentation of that review is included in the attachment.

1.3. Barred Owl HSI Model Overview

Allen (1987) state the factors to consider for applicability of the barred owl HSI model: 1) applicable throughout the range of the species; 2) developed to evaluate reproductive habitat quality for the species; 3) suitable to evaluate habitat in the deciduous forest, evergreen forest, and palustrine, forested wetland (PFO) habitat types; and 4) minimum habitat area was not known. The study area is within the permanent resident range of the species (NatureServe 2019). The deciduous forest and palustrine forested wetland habitat present is consistent with applicable cover types included in the model. As no minimum area requirement was identified, it was determined not to be a constraint in using the model for the study area.

The model includes three variables:

- Number of trees greater than or equal to 51 cm (20 inches) diameter at breast height (dbh) per 0.4 hectare (1 acre)
- Mean dbh of overstory trees
- Percent canopy cover of overstory trees

Allen (1987) includes a full description of each habitat variable and the equations for calculation of the HSI.

2.0 Habitat Evaluation

Habitat evaluation was performed to assist with preliminary screening of structural measures. Following preliminary screening of measures, the habitat evaluation was refined for the final array of alternatives to allow for comparison of environmental impacts under the Environmental Quality (EQ) account and identification of compensatory mitigation.

2.1. Data Assumptions and Inputs

Existing condition evaluations were informed by the following information sources:

- Google Earth aerial imagery
- Freshwater Land Trust forest plot sampling data
- Best professional judgment

HSI model variables were estimated for four time-steps:

- Year 0 – Existing Conditions
- Year 1 – First year immediately following the completion of construction
- Year 25 – Twenty-five years post completion of construction. Included as intermediate time-step.
- Year 50 – Fifty years post completion of construction.

These time steps were chosen because all impacts to the habitat types were assumed to occur as of completion of construction and would last the entire life of the project or the entire 50-year period of analysis.

2.2. Measures Screening

The barred owl HSI model was used to determine potential habitat impacts associated with proposed flood risk management measures and alternatives (Table 2-1). Average annual habitat units (AAHUs) were determined for the existing and future without project (FWOP) conditions within the defined footprint of each management measure.

For the future with project condition (FWP) it was assumed that no habitat value for barred owls was provided by the areas for the 50-year period of analysis. This assumption was made because construction of the off-channel detention basins would require clearing and grubbing of the entire footprint and it was assumed trees would not be allowed to regrow in the basins because they would affect storage capacity. However, the detention basins would be re-seeded with native species following construction. The mix of species will be determined during Preconstruction Engineering and Design because geotechnical investigations have indicated a perched water table may be present at VD1. If it is determined during PED that hydrology may be appropriate to support wetland habitat, then wetland species would be planted. If appropriate hydrology to support wetland species is not present, then a mix of native herbaceous species would be planted. Construction of levees also requires clearing and grubbing of the area and it is standard operations and maintenance to not let woody growth occur on levees. Channel modification would convert riparian wooded habitat to aquatic habitat; therefore, no future bottomland hardwood values would occur in the footprint.

For the purposes of estimating mitigation requirements, all mitigation was assumed to occur with tree plantings using 1-inch caliper hard mast tree species. Trees were assumed to be planted on a 35-foot by 35-foot spacing, which equates to 36 trees per acre. Preliminary mitigation requirements associated with each measure were determined and provided to cost engineers for incorporation of potential mitigation costs into the benefit-cost evaluation for flood risk management measures (Table 2-2).

Table 2-1. Measures Evaluated for Preliminary Screening.

Measure Type	Name	Description
Off-Channel Detention	VD1	10.0 acres on left overbank downstream of Center St. One home on property and minor roadways.
	VD2	13.6 acres on left overbank downstream of Princeton Pkwy. Two sizes initially considered with largest moving forward. Area includes 3 homes and minor roadways.
	VD4	16.4 acres on left overbank at Lincoln Ave.
	VD5	55.6 acres on left overbank downstream of Alemeda Ave. SW.
	VD8	54.5 acres on left overbank immediately downstream of By Williams Sr. Dr. Area is clear of development, land held by Freshwater Land Trust.
	VD9	24.8 acres on right overbank immediately downstream of By Williams Sr. Dr. Both areas clear of development; however, VD8 held by Freshwater Land Trust.
	VD10	85.6 acres on left overbank immediately downstream of Martin Luther Ave. Area is clear of development, land held by Freshwater Land Trust.
	VD11	39.6 acres on left overbank just upstream of Jaybird Rd. Area is clear of development other than roadways.
Levee	VL2	3rd Ave. N over Valley Creek.
	VL3	RR DS 3rd Ave. N over Valley Creek.
	VL4	Fayette Ave. SW over Valley Creek.
Channel Modification	VC1	Dam as appurtenant structure to active RR embankments on Opossum Creek near Valley Creek confluence. Crest elevation at 465.0 ft-NAVD88.

Table 2-2. Summary of Measures Screening Habitat Evaluation Results.

Measure	Year 0 HSI Value	Year 25 HSI Value	Year 50 HSI Value	AAHUs	Mitigation (Acres of Tree Plantings)
VD1	0.0	0.0	0.0	0.0	0.0
VD2	0.02	0.05	0.08	0.9	2.5
VD4	0.02	0.05	0.08	0.8	2.5
VD5	0.84	0.93	1.0	51.8	132.5
VD8	0.14	0.22	0.58	16.0	41.0
VD9	0.26	0.90	0.93	20.8	53.5
VD10	0.66	0.90	0.93	72.5	185.5
VD11	0.07	0.10	0.14	4.1	10.5
VL2	0.14	0.19	0.54	1.1	3.0
VL3	0.07	0.13	0.17	0.6	1.5
VL4	0.08	0.13	0.32	1.9	5.0
VC1	0.20	0.25	0.61	8.0	20.5

2.3. Final Array Evaluation and Recommended Plan

Following identification of the final array of alternatives by the PDT, the habitat evaluation was refined for the measures included in one of the final array alternatives: channel modification (VC1) and detention basins (VD1, VD2, and VD4). The required length of the channel modification was refined during iterations of plan formulation. The final evaluation for these measures considered field sampling data provided by the Freshwater Land Trust for areas near the remaining measures, as well as refined footprints. Assumptions regarding the future with project (FWP) conditions were the same as described for the measures screening evaluation.

Tables 2-3 through 2-6 show the data inputs and HSI scores for VC1, VD1, VD2, and VD4 existing and FWOP conditions. FWP conditions were scored as zero for all habitat variables, which results in zero habitat units and AAHUs for all alternatives. Table 2-7 summarizes the AAHU impacts associated with each of the final array alternatives for purposes of EQ account comparisons. Impacts occurring in VD4 are assumed to be to forested wetland based on NWI mapping. All other impacts are assumed to be deciduous forest and treated as bottomland hardwood for impacts evaluation.

Table 2-3. VC1 Existing Condition and FWOP Variable Inputs.

Variable	Description	Year 0		Year 1		Year 25		Year 50	
		Data	HSI	Data	HSI	Data	HSI	Data	HSI
V1	number of trees >= 51 cm dbh/ 0.4 ha	0	0.10	0	0.10	0	0.10	1	0.55
V2	Mean dbh of overstory trees (inches)	13.8	0.59	13.8	0.59	15	0.67	16	0.74
V3	Percent canopy cover of overstory trees	82.5	1.00	82.5	1.00	87	1.00	90	1.00
	Final HSI		**0.24**		**0.24**		**0.26**		**0.64**

Table 2-4. VD1 Existing Condition and FWOP Variable Inputs.

Variable	Description	Year 0		Year 1		Year 25		Year 50	
		Data	HSI	Data	HSI	Data	HSI	Data	HSI
V1	number of trees >= 51 cm dbh/ 0.4 ha	0	0.10	0	0.10	0	0.10	0	0.10
V2	Mean dbh of overstory trees (inches)	8	0.20	8	0.20	10	0.34	11	0.40
V3	Percent canopy cover of overstory trees	20	0.00	20	0.00	20	0.00	20	0.00
	Final HSI		**0.00**		**0.00**		**0.00**		**0.00**

Table 2-5. VD2 Existing Condition and FWOP Variable Inputs.

Variable	Description	Year 0		Year 1		Year 25		Year 50	
		Data	HSI	Data	HSI	Data	HSI	Data	HSI
V1	number of trees >= 51 cm dbh/ 0.4 ha	1	0.55	1	0.55	1.5	0.78	2	1.00
V2	Mean dbh of overstory trees (inches)	15.5	0.71	15.5	0.71	16.5	0.77	17	0.81
V3	Percent canopy cover of overstory trees	82.5	1.00	82.5	1.00	87	1.00	90	1.00
	Final HSI		**0.62**		**0.62**		**0.77**		**0.90**

Table 2-6. VD4 Existing Condition and FWOP Variable Inputs.

Variable	Description	Year 0		Year 1		Year 25		Year 50	
		Data	HSI	Data	HSI	Data	HSI	Data	HSI
V1	number of trees >= 51 cm dbh/ 0.4 ha	1	0.55	1	0.55	1.5	0.78	2	1.00
V2	Mean dbh of overstory trees (inches)	15.5	0.71	15.5	0.71	16.5	0.77	17	0.81
V3	Percent canopy cover of overstory trees	82.5	1.00	82.5	1.00	87	1.00	90	1.00
	Final HSI		**0.62**		**0.62**		**0.77**		**0.90**

Table 2-7. Summary of AAHU Impacts by Final Array Alternative.

Alternative	Description	Acres Impacted (Deciduous Forest/Forested Wetland)	AAHUs Impacted (Deciduous Forest/Forested Wetland)
Alternative 3	Detention Basins (VD1, VD2, VD4)	5.6/3.7	4.3/2.8
Alternative 4	VD1 and VD2	5.6/0.0	4.3/0.0
Alternative 13	VC1, VB8, Residual Risk 2-yr floodplain buyout (~79)	15.2/0.0	5.3/0.0

Alternative 4 was identified as the recommended plan. As stated in Table 2-7, the recommended plan results in the loss of 5.6 acres of deciduous forest comprising 4.3 AAHUs based on evaluation with the barred owl HSI. The following section describes the evaluation of feasible alternatives to mitigate this loss of AAHUs as required by USACE planning policy (ER 1105-2-100).

3.0 Mitigation Alternatives Evaluation

It is the policy of the USACE Civil Works program to demonstrate that impacts to all significant ecological resources, both terrestrial and aquatic, have been avoided and minimized to the extent practicable, and that any remaining unavoidable impacts have been compensated to the extent possible. USACE policy also requires that justification of compensatory mitigation features included in a recommended plan be based on an incremental cost analysis that demonstrates the most cost-effective mitigation measure(s) have been selected. The recommended plan would adversely impact deciduous forest resulting in a loss of 4.3 AAHUs based on evaluation with the barred owl HSI. Based on tree species composition, the deciduous forest impacted is considered bottomland hardwood forest and is treated as such for purposes of mitigation planning. ER 1105-2-100 (Appendix C) requires that adverse impacts to bottomland hardwood forest be mitigated in-kind, to the extent practicable. In addition, implementation guidance for Section 1163 of the Water Resources Development Act of 2016 requires consideration of mitigation banks and in-lieu fee programs for mitigating impacts to wetlands and other habitats.

The first step in mitigation planning is identifying the mitigation planning objective. The following mitigation planning objective was identified for the Valley Creek Feasibility Study:

- Compensate for the loss of 4.3 barred owl AAHUs with bottomland hardwood forest.

The next step is to identify potential mitigation strategies to achieve the mitigation planning objective. The following initial strategies were identified:

- Restore bottomland hardwood forest by direct seeding.
- Restore bottomland hardwood forest by planting tree saplings.
- Acquire existing tracts of bottomland hardwood forest
- Purchase credits in a mitigation bank

Direct seeding and tree sapling plantings under the first two strategies require available lands. The planning team considered whether the mitigation could occur on-site (i.e. on lands already being acquired for the project), on lands not needed for the project but that the non-federal sponsor already owns and can make available for tree plantings, or on lands acquired for the purpose of achieving the mitigation. On-site mitigation was not determined to be feasible because the project lands to be acquired would be for construction of stormwater detention basins. Reforestation within those basins would reduce the capacity of those basins to hold stormwater and thereby negatively affect project benefits.

The upper Valley Creek floodplain is highly developed and available open areas are limited. In addition, engineering concerns were expressed about locating tree plantings within the Valley Creek floodplain in the study area because as the trees mature, they could negatively affect forecasted project benefits by increasing the roughness coefficient within the floodplain. As a result, the use of existing lands within the study area already owned by the non-federal sponsor was not considered feasible. The project team identified three candidate sites for potential acquisition for mitigation (Figure 3-1). Site A is within the floodplain; however, hydrology and hydraulics analysis indicated that tree plantings in this location would not likely negatively impact project benefits. Sites B and C are outside the floodplain.

Acquisition of existing bottomland hardwood forest within the Valley Creek floodplain was considered as a mitigation strategy. Two areas were identified of privately-owned forest stands that were adjacent to larger tracts of bottomland hardwood forest owned by the Freshwater Land Trust, a regional not-for-profit with a mission of conserving land and building trails. However, real estate identified potential access challenges associated with the parcels. It was also unclear how future management of the tracts could be improved to result in a lift in habitat quality. As a result, it was unclear if this mitigation strategy could demonstrate compliance with USACE mitigation policy and it was dropped from further consideration.

Figure 3-1. Acquisition Sites Considered for Mitigation.

The Valley Creek study area and impact location is within the Upper Black Warrior Hydrologic Unit Code (HUC)-8 watershed, which is within the larger Black Warrior-Tombigbee HUC-6 watershed. No mitigation banks are located within the Upper Black Warrior HUC-8; however, three mitigation banks with available or scheduled bottomland hardwood credits are located within neighboring HUC-8s within the Black Warrior-Tombigbee HUC-6. There are several mitigation banks located in neighboring HUC-6s. Figure 3-2 identifies the mitigation banks identified as having bottomland hardwood credits available or scheduled for release. USACE Mobile District Regulatory has established a process of applying a proximity factor to the number of base credits needed when the credits are acquired outside of the HUC-8 watershed where the impacts are located. Therefore, purchasing of bottomland hardwood mitigation credits was considered a reasonable mitigation alternative for evaluation.

In accordance with USACE policy and to support cost estimating, the barred owl HSI model was used to forecast habitat units over a 50-year period of analysis for direct seeding, tree sapling, and mitigation bank scenarios. Time stamps of Year 0, 1, 25, and 50 were evaluated. USACE policy requires that a habitat assessment of the mitigation bank using the same USACE certified habitat assessment model that was used to determine functional impacts of the proposed action be completed. USACE coordinated with Westervelt Ecological Services (Westervelt), the operator of the regional mitigation banks, to obtain enough information about the subject banks to complete the barred owl HSI model. Acreages were adjusted to determine the area required to achieve at least 4.3 AAHUs. Those acreages were then used to inform cost estimates for direct seeding and tree sapling methods of restoration. Acreage and AAHUs impacted, modeled acreage required to achieve AAHUs, and average HSI value of the impacted habitat were provided to Westervelt to facilitate a determination of the necessary mitigation credits. Based on the information provided by USACE, Westervelt determined that 3.92 base credits were required to compensate for project impacts. USACE assumed the first choice for purchasing credits would be at the Big Sandy Mitigation Bank, which is located approximately 45 miles southwest of the study area in the Lower Black Warrior HUC-8. USACE applied the appropriate proximity factor to calculate a total of 5.0 bottomland hardwood credits needed at Big Sandy to compensate for project impacts. Big Sandy has 6.0 to 12.0 bottomland hardwood credits scheduled for release in 2021. The bank is a mixture of mature bottomland hardwood forest that was preserved and younger tracts that are being restored. Tables 3-1, 3-2, and 3-3 show the variable inputs used for direct seeding, tree sapling planting, and mitigation bank, respectively. Table 3-4 summarizes the cost estimates for all mitigation alternatives that were evaluated.

Table 3-1. Mitigation Variable Inputs for Direct Seeding.

Variable	Description	Year 0		Year 1		Year 25		Year 50	
		Data	HSI	Data	HSI	Data	HSI	Data	HSI
V1	number of trees >= 51 cm dbh/ 0.4 ha	0	0.10	0	0.10	0	0.10	2	1.00
V2	Mean dbh of overstory trees (inches)	0	0.00	0	0.00	6	0.07	20	1.00
V3	Percent canopy cover of overstory trees	0	0.00	0	0.00	60	1.00	85	1.00
	Final HSI		**0.00**		**0.00**		**0.08**		**1.00**

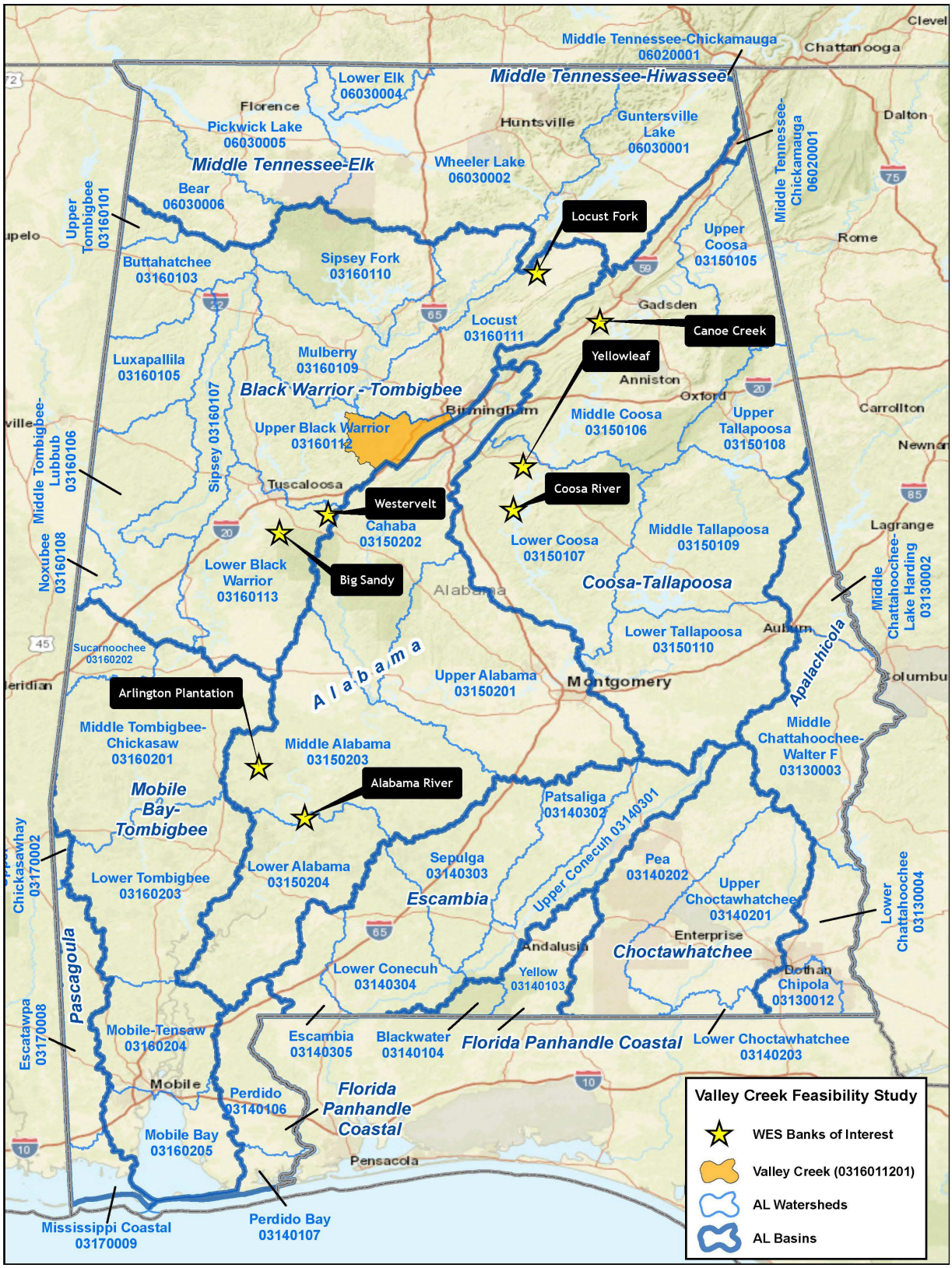

Figure 3-2. Mitigation Banks in the Vicinity of Valley Creek Study Area

Table 3-2. Mitigation Variable Inputs for Tree Sapling Plantings.

Variable	Description	Year 0		Year 1		Year 25		Year 50	
		Data	HSI	Data	HSI	Data	HSI	Data	HSI
V1	number of trees >= 51 cm dbh/ 0.4 ha	0	0.10	0	0.10	0	0.55	2	1.00
V2	Mean dbh of overstory trees (inches)	0	0.00	0	0.00	8	0.61	20	1.00
V3	Percent canopy cover of overstory trees	0	0.00	0	0.00	60	0.50	85	1.00
	Final HSI		**0.00**		**0.00**		**0.14**		**1.00**

Table 3-3. Mitigation Bank Variable Inputs.

Variable	Description	Year 0		Year 1		Year 25		Year 50	
		Data	HSI	Data	HSI	Data	HSI	Data	HSI
V1	number of trees >= 51 cm dbh/ 0.4 ha	2	1.00	2	1.00	2	1.00	2	1.00
V2	Mean dbh of overstory trees (inches)	10	0.34	10	0.34	15	0.67	20	1.00
V3	Percent canopy cover of overstory trees	80	1.00	80	1.00	85	1.00	90	1.00
	Final HSI		**0.58**		**0.58**		**0.82**		**1.00**

A review of the costs associated with the mitigation alternatives clearly indicates that purchasing bottomland hardwood credits at the Big Sandy Mitigation Bank would be the most cost-effective means of achieving the mitigation planning objective (Table 3-4). The total cost of purchasing mitigation bank credits is $225,000. The estimated real estate costs alone for all other reasonable mitigation alternatives exceeded $300,000. In accordance with USACE planning policy, when the recommended mitigation plan is purchase of credits from an approved mitigation bank, monitoring and adaptive management on behalf of the non-federal sponsor is not required. Therefore, no monitoring and adaptive management plan was developed at this time.

Per USACE policy, all costs associated with the acquisition of credits from the mitigation bank will be classified as a one-time construction cost of the Civil Works project for which the mitigation is being provided. The costs for acquisition of credits will be shared in accordance with the cost sharing applicable to construction cost for that project purpose. For all water resources development projects where purchase of in-kind credits from mitigation banks is determined to be the appropriate form of mitigation, USACE will purchase these credits concurrently with the physical construction that causes the impacts for which mitigation is required. However, where there are technical or cost-efficiencies or by request of the non-Federal sponsor, mitigation bank credits may be purchased prior to the physical construction that causes the impacts for which mitigation is required. Mitigation measures will be scheduled for accomplishment prior to or concurrently with other project features in the most efficient way.

Table 3-4. Mitigation Alternative Cost Estimates.

Cost Item	Direct Seeding ($)			Tree Sapling ($)			Mitigation Bank ($)
	Site A	Site B	Site C	Site A	Site B	Site C	
Credit Purchase[1]	NA	NA	NA	NA	NA	NA	225,000
Real Estate[2]	330,000	395,000	320,000	330,000	395,000	320,000	NA
Site Preparation	9,000	9,000	9,000	10,000	10,000	10,000	NA
Seeding and/or Planting[3]	156,000	156,000	156,000	1,358,000	1,358,000	1,358,000	NA
OMRRR[3]	317,000	317,000	317,000	370,000	370,000	370,000	NA
Total	**866,000**	**931,000**	**856,000**	**2,033,000**	**2,098,000**	**2,023,000**	**225,000**

Green Shading = Most cost-effective mitigation option.

[1] Assumes 5.0 credits at $45,000 per credit (2021 list price ranges from $40,000 to $45,000 per credit).

[2] Assumes fee simple purchase, includes estimated administration costs, 5% contingency

[3] Assumes 14.7 acres needed for direct seeding and 13.3 acres for tree sapling planting. Assumes 12 X 12 foot spacing.

[4] Operations, Maintenance, Repair, Rehabilitation, and Replacement – includes estimates monitoring and adaptive management costs.

4.0 References

Allen, A.W. 1987. Habitat suitability index models: barred owl. U.S. Fish and Wildlife Service Biological Report 82(10.143). 17pp.

Allen, J.A., B.D. Keeland, J.A. Stanturf, A.F. Clewell, and H.E. Kennedy Jr. 2001. A guide to bottomland hardwood restoration. U.S. Geological Survey, Biological Resources Division Information and Technology Report USGS/BRD/ITR-2000-0011. U.S. Department of Agriculture, Forest Service, Southern Research Station, General Technical Report SRS-40. 132 pp.

NatureServe. 2019. NatureServe Explorer: *Strix varia*. Accessed February 2020 at http://explorer.natureserve.org/servlet/NatureServe?sourceTemplate=tabular_report.wmt&loadTemplate=species_RptComprehensive.wmt&selectedReport=RptComprehensive.wmt&summaryView=tabular_report.wmt&elKey=103621&paging=home&save=true&startIndex=1&nextStartIndex=1&reset=false&offPageSelectedElKey=103621&offPageSelectedElType=species&offPageYesNo=true&post_processes=&radiobutton=radiobutton&selectedIndexes=103621

Attachment
ECO-PCX Spreadsheet Review Documentation

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MISSISSIPPI VALLEY DIVISION
P.O. BOX 80
VICKSBURG, MISSISSIPPI 39181-0080

CEMVD-PDP

03 April 2020

MEMORANDUM FOR Commander, Kansas City District, U.S. Army Corps of Engineers (Attn: Ms. Jennifer Switzer, CENWK-PMP)

SUBJECT: Regional Use Approval - Spreadsheet Calculator for Application of the Barred Owl Habitat Suitability Index (HSI) Model

1. References:
   a. Engineer Circular 1105-2-412: Assuring Quality of Planning Models, 31 Mar 2011.

   b. Planning Bulletin 2013-02, Assuring Quality of Planning Models (EC 1105-2-412), 31 Mar 2013.

   c. Memorandum to Directors of National Planning Centers of Expertise – Subject: Modification of the Model Certification Process and Delegation of Model Approval for Use, 04 Dec 2017.

   d. Memorandum to Director of the National Ecosystem Restoration Planning Center of Expertise - Subject: Recommend Regional Use Approval of the Barred Owl Habitat Suitability Index (HSI) Model Application Spreadsheet, 06 Mar 2020.

2. An independent review managed by the National Ecosystem Restoration Planning Center of Expertise evaluated the subject calculator. The spreadsheet calculator was developed by the Kansas City District. It is computationally correct, incorporates best spreadsheet practices, and is usable for Civil Works planning.

3. The barred owl spreadsheet calculator is approved for regional use throughout the range of the species. Independent technical review is complete. The model meets the criteria contained in References 1.a. and 1.b. There are no unresolved issues. This approval will expire 03 April 2027.

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Gary L. Young
Chief, MVD Planning and Policy and
Director, National Ecosystem Restoration
Planning Center of Expertise

CEMVD-PDP
SUBJECT: Regional Use Approval - Spreadsheet Calculator for Application of the Barred Owl Habitat Suitability Index (HSI) Model

CF
CEMVD-PDP [redacted]
CEMVP-PD-F [redacted]
CENWK-PMP [redacted]
CENWK-PMP-R [redacted]
CENWK-PMP-F [redacted]
CESAJ-PD-PW [redacted]