Kaskaskia River Regional Port
CAP Section 107 Study
with Integrated Environmental Assessment

Habitat Evaluation and Quantification

Kaskaskia River
Randolph County, Illinois
US Army Corps of Engineers – St. Louis District

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1. INTRODUCTION

This section provides the documentation of the habitat evaluation and quantification process that was conducted to evaluate the benefits of various alternatives for the Kaskaskia River Regional Port CAP 107 Study with an Integrated Environmental Assessment.

2. HABITAT EVALUATION METHODOLOGY

The purpose of the habitat evaluation is to evaluate and quantify, to the extent possible, environmental impacts of alternative plans for the aquatic and potential bottomland hardwood habitat to determine whether the project is beneficial or detrimental within the study area. Potential aquatic impacts were quantified through the use of a habitat suitability index (HSI) (blue book) model for the Bluegill (Stuber, 1982). Potential bottomland hardwood impacts were quantified through the use of a HSI (blue book) model for the Black-capped Chickadee (Schroeder,1982). Blue book models are approved for regional and nationwide use by the USACE Ecosystem Restoration Planning Center of Expertise. This process will evaluate the technical quality and appropriateness of the models utilized.

2.1 Quantity Component:

Traditionally, USACE has used the quantity and quality of habitat jointly, in the form of habitat units, to measure potential impacts from projects. The quantity proportion is often measured as area (acres of habitat, landform, etc.); in some systems, it is measured as length (feet of stream bank). The evaluation conducted for this study area uses acres to represent the quantity. The area associated with each proposed measure must have a clear definition for use as guidance in estimating the area component of the ecosystem output model and must be applied consistently to all actions evaluated. Quantities of each feature varied depending on those features in each alternative. Habitat was evaluated in the location in which each feature would take place. Table 1 at the end of this report provides the acres proposed for use for each alternative, and the applicable acreage for each model.

Final calculations included determining the acreage of backwater and bottomland hardwood forest habitat using topographical data, management plans, land coverage data files, and aerial photography.

Acres equate to the action footprint of each feature and were determined for each individual feature. The action footprint is a measurement of the physical footprint of the management measures, for example, the area excavated for the backwater or the surface area covered by dredged materials. When evaluation of features was conducted, the footprint equals the total of the features with no double-counting of overlap areas addressed by multiple features.

> **Applicability:** This evaluation method for each individual project feature can quantify with a high degree of certainty specific environmental and biological conditions to accurately evaluate Future With Project and Future Without Project conditions.
>
> **Limitations:** This method grossly underestimates the aerial extent of ecological impacts from each specific project feature. For example, the aerial extent of the proposed backwater footprint evaluated does not take into account impacts seen within the immediate area outside of the study area boundary.

2.2 Quality Component

The qualitative component of the analysis is rated on a 0.0 to 1.0 scale, with higher values indicating better habitat for that species. The HSI for a particular habitat type is determined by selecting values that reflect present and future study area conditions from a series of abiotic and biotic metrics. Each value corresponds to a suitability index for each species. Future values are determined using management plans, historical conditions, and best professional judgment.

As described above, the quantitative component is the number of acres of the habitat being evaluated. From the calculated qualitative and quantitative values, the standard unit of measure, the habitat unit (HU) is calculated using the formula (HSI × Acres = HUs). Habitat units are calculated for specific target years to forecast changes in habitat values over the life of the project with- and without-project conditions. When HSI scores are not available for each year of analysis, a formula that requires only target year HSI and area estimates is used (USFWS 1980). This formula is:

$$\int_0^T HU\,dt = (T_2 - T_1) = \left[\left(\frac{A_1H_1 + A_2H_2}{3}\right) + \left(\frac{A_2H_1 + A_1H_2}{6}\right)\right]$$

Where:

$\int_0^T HU\,dt$ = *Cumulative HUs*

T_1 = first target year of time interval
T_2 = last target year of time interval
A_1 = area of available habitat at beginning of time interval
A_2 = area of available habitat at end of time interval
H_1 = habitat suitability index at the beginning of time interval
H_2 = habitat suitability index at the end of time interval
3 and 6= constants derived from integration of HSI × Area for the interval between any two target years

This formula was developed to precisely calculate cumulative HUs when either HSI, or area, or both change over a time interval, which is common when dealing with the unpredictable fluctuations found in nature. HU gains or losses are annualized by summing the cumulative HUs calculated using the above equation across all target years in the period of analysis and dividing the total (cumulative HUs) by the number of years in the life of the project (i.e., 50 years). This calculation results in the Average Annual Habitat Units (AAHUs) (USFWS 1980). The calculation of the HUs and AAHUs were completed in a Microsoft Excel spreadsheet for each model containing the formula above.

The benefits of each proposed project feature (net AAHUs) are then determined by calculating the difference in AAHUs between the with-project benefits and the without-project benefits. The effects of various habitat improvement feature combinations (alternatives) can then be evaluated by comparing the net AAHUs and their associated costs for each alternative considered.

For the purpose of planning, design, and impact analysis, the period of analysis was established as 50 years. To facilitate comparison, target years were established at 0 (existing conditions), 1, 10, 25, and 50 years for both future with and without project features. Target years are used to analyze HUs and characterize habitat changes over the estimated period of analysis. Target years of 1 and 10 capture short-term changes following construction completion. While target years 25 and 50 capture ecological changes that would occur over a longer period of time. The period of analysis was determined to be 50 years based on the prediction that some project features would need a longer period of time to reach maximum benefits; and the accrual of benefits were predicted to level off after 50 years. HSIs and cumulative HUs for each evaluation species were calculated at each of these target years.

Corps guidance requires that an evaluation of features can be combined in various ways to form project alternatives. The approach used to assess the potential impacts at the Kaskaskia River Regional Port study area looked at benefits of project features and their combinations as alternatives and comparatively evaluated each alternative separately. This process is called the iterations process. To determine the HUs resulting from each feature, the habitat (aquatic, and bottomland hardwood forest) affected by the feature were evaluated using the applicable HSI spreadsheets.

This appendix contains HSI summary tables and other data derived from the spreadsheet files not included in this appendix. These spreadsheets are available upon request. Please contact, Zachary Day, 314-331-8027, email Zachary.a.day2@usace.army.mil if you would like an electronic copy of these files.

3. ASSUMPTIONS

In preparation for using the HSI models, a site visit was conducted, and aerial photography and topographic maps were reviewed. During the evaluation, assumptions were developed regarding existing conditions and Future With Project conditions relative to habitat changes over time and management practices.

The following assumptions were made when determining existing and Future Without Project conditions for the primary habitat cover types located within the study area.

3.1 Backwaters:

The USACE-approved Bluegill HSI Model (Stuber, 1982) was used to assess potential aquatic habitat impacts from the backwater excavation (dredging) measures. The bluegill (*Lepomis macrochirus*), in the family Centrarchidae, is an important game fish in the Mississippi River drainage basin. This species occurs in deep, flowing water, as well as in sloughs, oxbow lakes and other backwaters for resting, spawning, and rearing. They feed on organisms in the substrate of large rivers and backwater lakes. This species was selected because it requires backwaters and off-channel areas to complete important life history stages.

The following assumptions in applying the Bluegill HSI Model were made. For more detailed descriptions of the assumptions made for each model parameter for a given alternative, the Excel spreadsheet is available upon request.

Baseline Condition: Detailed bathymetry data was collected by USACE in 2016 and 2021. The average depth range of the backwater in the project area is approximately 9 feet deep which allows for barge traffic in and out of the oxbow. The shallow depths and barge traffic can lead to relatively poor overall conditions for bluegill due to increased summer water temperatures and decreasing availability/connectivity from sedimentation of the backwater.

Future Without Project Condition: The backwater in the south oxbow is a narrow channel. There are some isolated pockets along the shoreline that are at shallower depths.

The width of the south oxbow navigation channel is approximately 45 feet. In the past, the Kaskaskia Regional Port District (KRPD) has dredged the channel at approximately ten-year intervals. The south oxbow channel has not been dredged since 2018. Without dredging, sedimentation would cause this area to continue to become shallower. This increase in sedimentation is assumed to result in increased turbidity, especially when the sediment is disturbed by vessel traffic. Shallow depths may also result in reduced dissolved oxygen levels.

Future With Project Condition (for all action alternatives): The proposed measures for backwater habitat include excavation (dredging) to a depth of 12ft from the mouth of the oxbow to the area at the base of the dock at KRPD#2. Excavation would result in an overall increase in backwater habitat function such as increased water depths, potentially cooler summer water temperatures, increased capacity for dissolved oxygen, and conceivably improved water clarity. Benthic organisms would be removed with the dredge sediment but would repopulate over time.

3.2 Bottomland Hardwood Forest:

Potential bottomland hardwood forest impacts were quantified through the use of an HSI (blue book) model for the Black-capped Chickadee (Schroeder,1982). The bottomland hardwood forest model was applied to Dredge Disposal Area 2 (DD-2) as it was the only location with proposed measures requiring tree clearing. DD-2 (Figure 1) has been used to hold dredge sediment prior to 1974, but its tree population has since recovered. The spatial extent that the model was applied to correlates with the proposed acreage of tree clearing across each alternative, respectively.

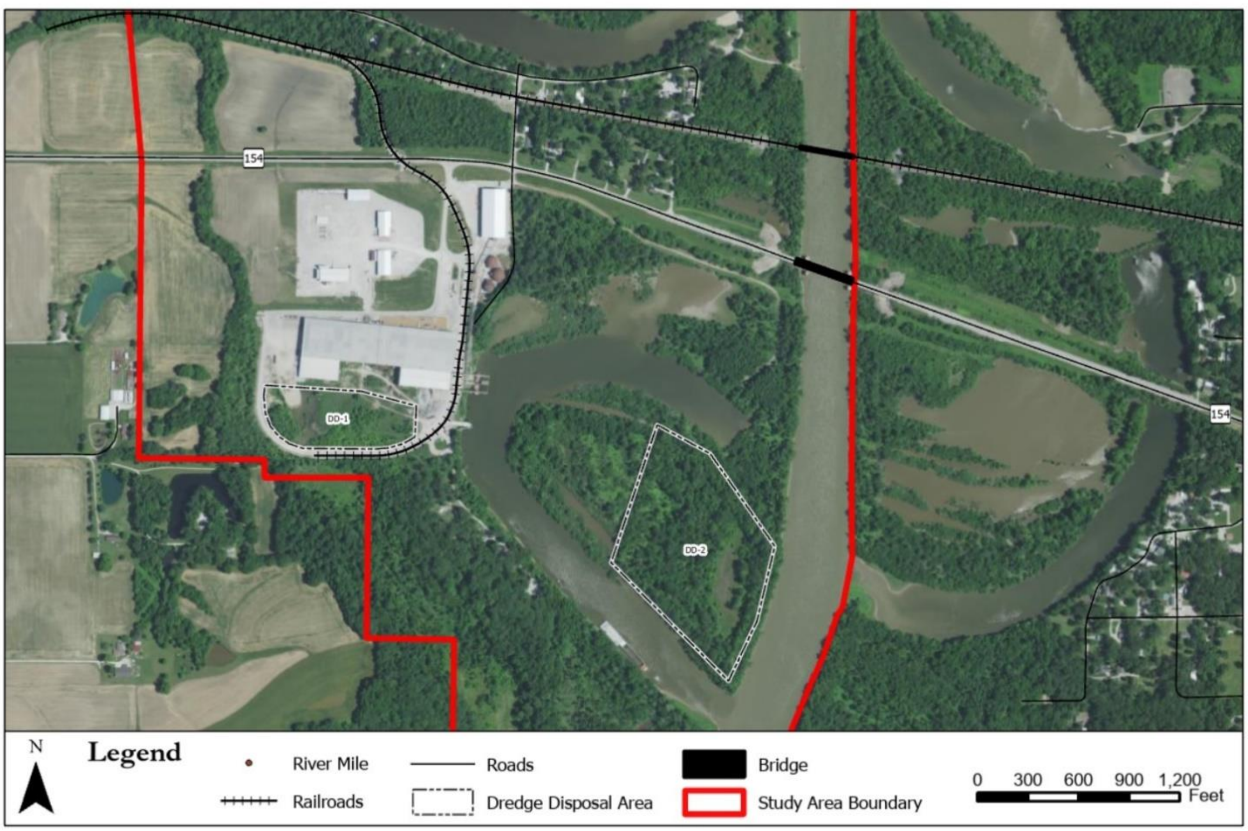

Figure 1. Dredge Disposal Areas 1 and 2 (DD-1 and DD-2)

Future Without Project Condition:
The areas identified for tree clearing were identified by USACE as bottomland hardwood forest which can consists of various species such as pecan (*Carya illinoinensis*), soft maple (*Acer spp.*), bur oak (*Quercus macrocarpa*), pin oak (*Quercus palustris*), shellbark hickory (*Carya laciniosa*), and willow (*Salix spp.*) (USFWS, 2021). In the future without the project, it is anticipated that the forest health in this area will continue its trajectory of a slow steady incline until the tree population levels out.

Future With Project Condition (for all action alternatives):
DD-2 is the area identified for tree clearing and is considered bottomland hardwood forest habitat. Terrestrial wildlife inhabiting DD-2 would be displaced into other areas but the potential impacts would be minimal. The general trend anticipated in forest health is that with the project, habitat benefits would experience a decline immediately following the tree clearing event but would rebound over time as natural regeneration takes hold. Dredge sediment placed over existing plant species could provide an opportunity for invasive species to populate although it is unlikely initially due to the physical makeup of subaqueous soils.

3.5 General Assumptions:

A. It is assumed that existing forested habitat within the study area would not be affected by the proposed alternatives outside of the small footprint of proposed tree clearing; therefore, these unimpacted acres within the study area were not evaluated for habitat impacts.

4. RESULTS

In the main report, Section 3.3 describes each potential project measure. The study team screened out several measures before this habitat quantification process began. Table 21 in the main report displays the proposed measures, screening criteria, and which measures were retained for inclusion in the initial array of alternatives. Section 3.6 in the main report displays the measures included in each alternative for the south and north oxbows. The results of the habitat evaluations used to evaluate each alternative are provided in the following section.

4.1 Total Habitat Impacts

Table 1 provides the summary of the calculated Net AAHUs and acreage applied for each action alternative by location and model by habitat type.

Table 1. Alternatives 1a, 2a, 3a Acres and Net AAHUs for the Future Without Project (FWOP) and Future With Project (FWP) Conditions

Model	Condition	Year	HSI	Acres	HU	Cumulative HU	Total Cumulative HU	AAHUs	Net AAHUs
BLH Forest (Black-capped chickadee)	FWOP	0	0.59	12.85	7.58		512.972	10.2594	- 6.1295
		1	0.65	12.85	8.35	7.97			
		10	1.00	12.85	12.85	95.41			
		25	0.75	12.85	9.64	168.66			
		50	0.75	12.85	9.64	240.94			
	FWP	0	0.59	12.85	7.58		206.50	4.1300	
		1	0.00	12.85	0.00	3.79			
		10	0.05	12.85	0.64	2.89			
		25	0.39	12.85	5.01	42.41			
		50	0.59	12.85	7.58	157.41			
Backwaters (Bluegill)	FWOP	0	0.63	13.21	8.32		214.86	4.2972	4.3421
		1	0.63	13.21	8.32	8.32			
		10	0.40	13.21	5.28	61.23			
		25	0.40	13.21	5.28	79.26			
		50	0.00	13.21	0.00	66.05			
	FWP	0	0.63	13.21	8.32		431.97	8.6393	
		1	0.61	13.21	8.06	8.19			
		10	0.63	13.21	8.32	73.71			
		25	0.67	13.21	8.85	128.80			
		50	0.67	13.21	8.85	221.27			

5. REFERENCES

Schroeder, R. (1982). *Habitat Suitability Index Models: Black-Capped Chickadee.* US Department of Interior, Fish and Wildlife Services.

Stuber, R., & Gebhart, G. & Maughan, E. (1982). *Habitat Suitability Index Models: Bluegill*. US Department of Interior, Fish and Wildlife Services.

USFWS (2021). *National Wetlands Inventory NCLD Landcover Database*. U.S. Fish and Wildlife Services. Retrieved from https://www.fws.gov/wetlands/