# Appendix D

# USFWS – PRELIMINARY HABITAT EVALUATION PROCEDURES REPORT

**DRAFT**

# PRELIMINARY HABITAT EVALUATION PROCEDURES REPORT

# BLUESTONE DAM SAFETY PROJECT

**October 2013**

U.S. Fish and Wildlife Service

West Virginia Field Office

Elkins, West Virginia

## Background

The Bluestone Dam is located on the New River, 1.5 miles upstream of the City of Hinton in Summers County, West Virginia. The Bluestone Dam is a concrete gravity structure with an overall length of 2,060 feet and maximum height of 165 feet above the streambed. The total design discharge capacity of the dam is 430,000 cubic feet per second (cfs). When the dam was planned in the 1930's, this discharge capacity was based upon a hypothetical flood created by shifting the center of the July 1916 hurricane storm to the New River drainage basin. Since the construction of the dam, new data has become available. The U.S. Army Corps of Engineers Huntington District (Corps) now estimates that the Probable Maximum Flood (PMF) for the New River Basin has a peak flow of 1,086,000 cfs, which is double the peak of the original design flow. This design flood was generated by coupling recent National Weather Service precipitation estimates with detailed terrain, soil, and runoff data (Corps 2013b).

A plan was approved as described in the 1998 Dam Safety Assurance (DSA) Evaluation Report and is currently being implemented to modify Bluestone Dam to safely withstand the PMF. When this construction project is completed it will strengthen the dam's stability and allow for increased discharge capacity through the use of hydropower penstocks (Corps 2013b). However, there was speculation as to whether or not increased discharge in the streambed would lead to scour of the dam foundation and downstream habitat leading to dam failure. A Baseline Risk Assessment, completed by the Corps in 2013, determined that scour, overtopping, and spillway gate reliability posed unacceptable risk for the dam. Given the total risk associated with these failure modes, the Corps was directed to prepare a supplemental report to formulate new alternative risk management plans. In accordance with the Fish and Wildlife Coordination Act (16 U.S.C. 661-667e) and in support of this new study, the U.S. Fish and Wildlife Service (Service) cooperated with the West Virginia Division of Natural Resources (WVDNR) and the Corps in 2013 to conduct an evaluation of terrestrial and riverine habitat types immediately downstream of the Bluestone Dam.

This document is intended to characterize current environmental conditions in the tailwater area immediately below the dam. This information will serve as the baseline environmental condition for the new supplemental DSA report and will be used to formulate alternative risk management plans. The second phase of the analysis will calculate mitigation requirements, once project alternatives for detailed study have been identified.

***Figure 1. Bluestone Dam***

## Introduction

Habitat Evaluation Procedures (HEP), as detailed in the Service's 1980 manual (ESM 102), were used for this effort. An interagency biologist team conducted a field review and collected data for this project on September 10 - 13, 2013. The HEP field team consisted of Andrew Johnson of the Corps Huntington District, Laura Hill of the Service, John Schmidt of the Service, and Tiernan Lennon of the Service. Danny Bennett of the WVDNR assisted in planning the HEP and interpreting the data. This report was prepared by Tiernan Lennon of the Service through coordination and cooperation with the above referenced HEP team.

Four sites were selected for field survey as part of this evaluation: the three riparian habitat sites (RP Sites 1, 2, and 3); and the riverine habitat site (R Site 1).

HEP requires the use of Habitat Suitability Index (HSI) models developed for indicator species that best represent groups of species that use the habitats. Species models for this evaluation were selected in collaboration with the HEP team. Species selected for habitat evaluation of the riparian sites included the mink (*Mustela vison*), black-capped chickadee (*Parus atricapillus*), and yellow warbler (*Dendroica petechia*l). The riverine site species included the smallmouth bass (*Micropterus dolomieui*) and common shiner (*Notropis cornutus*).

Riparian habitat on the right (river right) descending bank varied greatly from areas of naturalized vegetation to a managed city park lacking sufficient vegetation. In that situation, separate HSI values were calculated for each habitat type (RP Site 1 and 2). Habitat measurements were collected at each site based on the HEP model requirements for each species. Metrics for a total of 21 variables were compiled from the riparian and riverine habitats as part of this evaluation. These variables were measured or estimated along transects and/or points within each habitat type. When incorporated into

the species habitat models, the resultant metrics are used as indicators of habitat condition or value. Baseline habitat conditions are expressed as a numeric function (HSI value) ranging from 0 to 1.0, where 0 represents no suitable habitat for an indicator species and 1.0 represents optimum conditions for the species. This report provides HSI values for the indicator species in the tailwater area. The second phase of the analysis will calculate habitat units by multiplying the HSI value by the aerial extent of the assessed habitat.

## Habitat Mapping

Riverine and riparian habitat types were separated using field data and observations. The data were analyzed and maps were generated using Geographic Information System (GIS) applications (Figures 2, 3, and 4). The mapping effort was conducted by Elizabeth Stout of the Service.

The overall project area contains three riparian sites and one riverine site. Each site was divided into transects and habitat measurements were averaged due to the general homogeneity of the assessed habitat. Transect locations and habitat measurements are provided in Table 1.

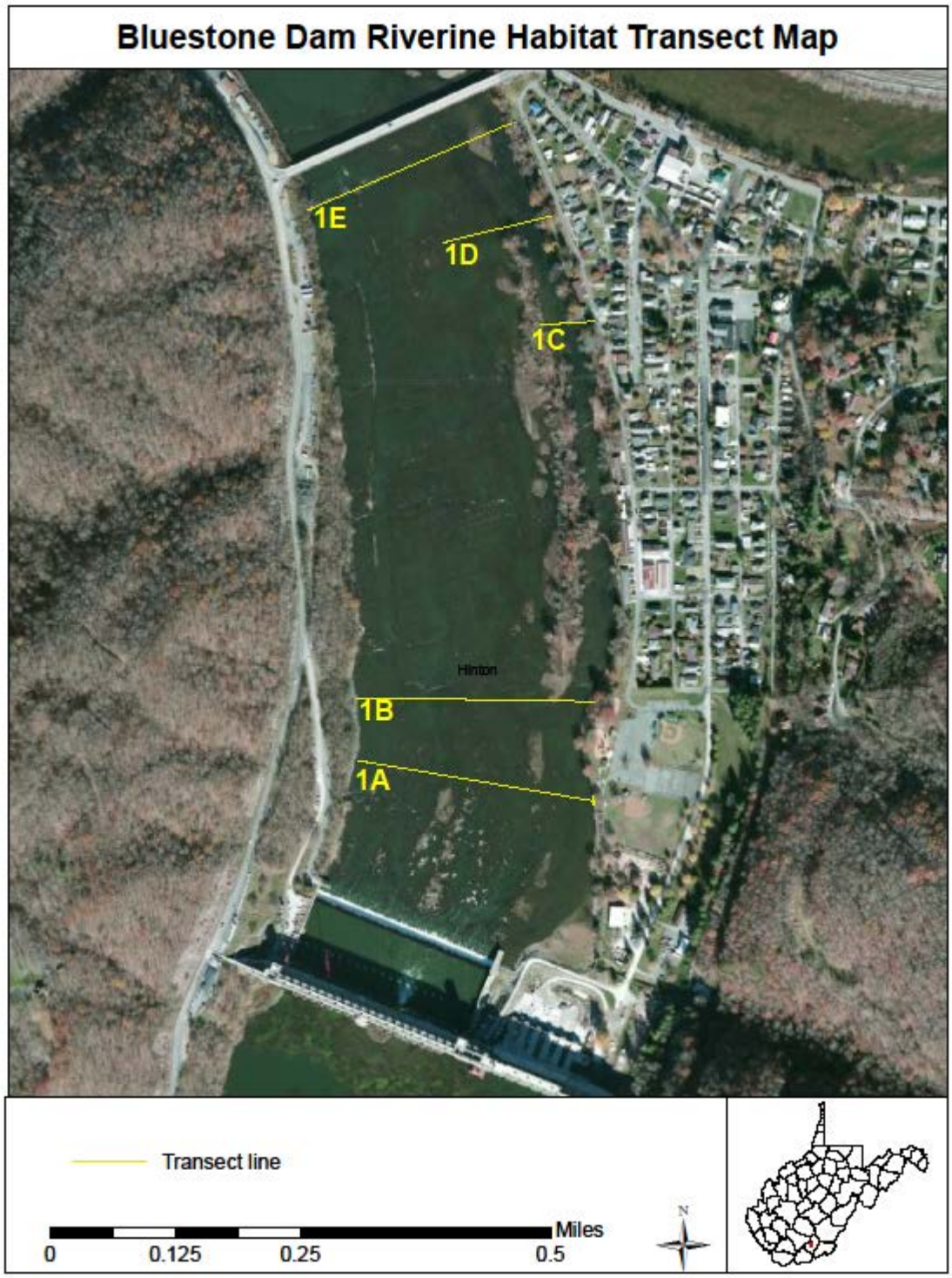


*Figure 2. Riverine Habitat Transect Map.*

*Figure 3. Habitat Map for Riparian Sites 1 & 2.*

*Figure 4. Habitat Map for Riparian Site 3.*

***Table 1. HEP habitat site descriptions and field transect locations.***

| Evaluation Site | Transect No. | Transect Length (m) | Site Size (acres) | HEP Habitat Code | Site Description |
|---|---|---|---|---|---|
| RP-1 | # of transects 8 | N/A | 1.8 ac | Riparian (RP) | Managed riparian habitat - scattered trees and shrubs |
| RP-2 | # of transects 33 | N/A | 1.4 ac | Riparian (RP) | Managed riparian habitat – fair vegetative cover |
| RP-3 | # of transects 29 | N/A | 2.5 ac | Riparian (RP) | Dense riparian cover |
| R-1 | 1A | 387.8 m | 125 ac | Riverine (R) | Riffle area - gravel, cobble, and boulder |
| R-1 | 1B | 375.9 m | 125 ac | Riverine (R) | Riffle area - gravel, cobble, and boulder |
| R-1 | 1C | 62.4 m | 125 ac | Riverine (R) | Pool-like area |
| R-1 | 1D | 170.7 m | 125 ac | Riverine (R) | Pool-like area |
| R-1 | 1E | 353.2 m | 125 ac | Riverine (R) | Riffle area – gravel, cobble, and boulder |

## Site Descriptions

All sites assessed are located in the tailwaters within the vicinity of the proposed dam modification project near the City of Hinton in Summers County, West Virginia. Each site is described in more detail below. The study area for this report extended from the dam downstream 0.82 river miles to the Route 3 Bridge. Sites were divided based on location, habitat type, and homogeneity of habitat. Within each of the 4 sites (3 riparian and 1 riverine), habitats were considered homogenous.

### *Riparian Site No. 1 (RP-1)*

Riparian Site 1 consists of approximately 1.8 acres located along the right descending bank of the river (river right) (Fig.3). Land use at this site is primarily for fishing access, with an active construction zone adjacent to the dam at the time of field data collection. A riparian zone of poor quality habitat, consisting of a few scattered trees and shrubs, is present along this portion of the New River (Fig. 5).

Transects were established (every 10 meters) throughout the entire 80 meter length of Riparian Site 1 for the HEP analysis in order to assure a complete sample of the habitat at the site. Unlike other sites on Figure 3, Site 1 is shown with the yellow transect lines. This site is continually maintained and mowed by

the City of Hinton, so shrubby vegetation at this site was scarce. Site 1 had too few scattered trees to be considered good riparian habitat for the selected evaluation species.

The dominant tree species at this site were River Birch (*Betula nigra*), American Sycamore (*Platanus occidentalis*), Eastern Red Cedar (*Juniperus virginiana*), and Tree of Heaven (*Ailanthus altissima*). A full list of the species observed in the entire study area is shown in Appendix B.

***Figure 5. Riparian Site #1.***

***Riparian Site No.2 (RP-2)***

Site 2 consists of approximately 1.4 riparian acres located river right and primarily alongside Hinton City Park (Fig.3). Land use at this site is dominated by narrow bands of riparian forest and shrubs (Fig.6).

Transects were established every 10m throughout the entire 335.0 m length of Site 2 for the HEP analysis in order to assure a complete sampling of habitats at this site. The quality of natural habitat is better than RP Site 1, since it meets more of the requirements for the selected evaluation species.

The dominant tree species at this site were River Birch, American Sycamore, Tree of Heaven, Black Cherry (*Prunus serotina*), Sugar Maple (*Acer saccharum*), Mulberry (*Morus spp.*), Box elder (*Acer negundo*), Willow (*Salix spp.*), American elm (*Ulmus americana*), and Tulip Tree (*Liriodendron tulipifera*) (Appendix B).

***Figure 6. Riparian Site #2.***

***Riparian Site No. 3 (RP-3)***

This riparian site consists of approximately 2.5 acres located on the left descending bank downstream of the dam (river left) extending from the fishing pier to the end of the Corps property line along the fishing pier access road (Fig. 4). Land use at this site is dominated by a long narrow band of steep, dense riparian cover (Fig. 7).

Transects were established (every 10 m) throughout the 292.6 meter length of Site 3 for the HEP analysis in order to assure a complete sampling of habitat at the site (Fig.4). Site 3 had a mix of dense shrub cover and mature tree stands.

The dominant tree species at this site were River Birch, American Sycamore, Tree of Heaven, Black Cherry, Sugar Maple, Mulberry, Box elder, American elm, Tulip Tree, Red Bud (*Cercis canadensis*), Honey Locust (*Gleditsia Triacanthos*), Slippery Elm (*Ulmus rubra*), and Silk Tree (*Albizia spp.*)(Appendix B).

***Figure 7. Riparian Site #3.***

***Riverine Site No. 1 (R-1)***

Riverine Site 1 is approximately 0.82 river miles (125 ac), stretching from the Bluestone Dam downstream to the Route 3 Bridge (Fig.2). The riffle-run habitat in Site 1 is of high quality; the dominant substrate consists of gravel, cobble, and boulders (Fig.8).

Five lateral transects were run within the 0.82 mile length of R-1 Site. Transects A, B, and E were very similar in substrate type and were classified as riffle-run areas. Transects C and D were setup across the only pool-like habitat within the project area at the time of the survey (Fig.2). Transects measurements can be found in Table. 1.

***Figure 8. Riverine Site # 1.***

## Species Selection and HSI Models

In order to encompass the habitat needs of multiple species in the project area an ecological guilding approach was used. The evaluation species used in this HEP were selected to represent groups of species that exploit the same or similar resource needs; for example, species that share certain habitats or characteristics for breeding, feeding, or sheltering. Representative species were selected based on the following criteria:

1. Species that are anticipated to be sensitive to proposed land and water use changes
2. Species that perform a key role in a community for their part in nutrient cycling or energy flow
3. Species that represent groups of species which share a common environmental resource
4. Species that are familiar to the public
5. Availability of species HEP models approved by the COE

The initial step in selecting appropriate models was to determine which species could potentially occur within or near the project area based on their habitat requirements. A list of potential evaluation species was assessed and discussed amongst the HEP team to determine which species would best represent the project area. The species were selected for their representation of riverine or riparian habitat types. The guilding approach was used to determine final evaluation species. Riverine species were selected based on feeding guild; one predatory game fish and one forage fish. Terrestrial species were selected based on breeding stratum, ranging from the ground layer to the tree layer. The selected evaluation species for the riverine habitat were the smallmouth bass and common shiner; the yellow warbler, mink, and black-capped chickadee were selected for the terrestrial habitat (Table 2).

***Table 2. Pertinent selection criteria for HEP species.***

| Species | Habitat Type | Class | Feeding Guild | Breeding Stratum | References |
|---|---|---|---|---|---|
| Smallmouth Bass | Aquatic | Fish | Vert. /Invert. Carnivore | Pools with Rock/gravel/sand or by debris/structure | Edwards et al. (1983) |
| Common Shiner | Aquatic | Fish | Omnivore | Shallow riffles on gravel/sand | Trial et al. (1983) |
| Mink | Riparian | Mammal | Carnivore | Ground layer | Allen (1986) |
| Yellow Warbler | Riparian | Avian | Insectivore | Shrub layer | Schroeder (1982) |
| Black-capped Chickadee | Riparian | Avian | Insectivore/herbivore | Tree layer | Schroeder (1983) |

**Species and Model Descriptions**

Smallmouth bass commonly occur in large clear lakes and reservoirs with rocky shorelines, as well as in perennial streams with bottoms comprised of gravel beds, large boulders, rubble, or bedrock. These are the preferred substrates for smallmouth bass to build their nests for spawning, and provide shelter to juveniles and adults. Smallmouth bass are sight feeders and choose their prey based on relative abundance and availability. Smallmouth bass typically eat smaller fish, crayfish, insects, and amphibians. Smallmouth bass prefer a water temperature of about 21°C. They also require at least 6 mg/L of dissolved oxygen and a pH range of 5.7-8.6 for optimal growth.

For the smallmouth bass, the HEP team approved the use of the blue book's additional habitat model, which consisted of the variables most essential in providing smallmouth bass with optimum riverine conditions. The HEP team agreed that this model gave the smallmouth bass a more appropriate HSI score when compared to the full blue book model and Pennsylvania modified model (PAM). Model variables for the smallmouth bass include:

Cover/Reproduction/Feeding

- Clear (≤ 25 JTU[1]) water
- Stream gradient between 0.75 and 4.7 meters/kilometer (m/km)
- At least 25% pools
- At least 25% cover and/or > 1m depth in the pools
- Warm summer water temperatures, 21 -29°Celsius (°C)
- Gravel, rubble, or boulder substrate

Common shiners are found in small and medium-sized streams with clear, cool water, and a moderate current. These shiners prefer unvegetated gravel to rubble bottoms; they frequent pools in streams more often than rapids. They excavate depression nests in gravel or sand; most nests are built in riffles 13 to 44 mm deep. Common shiners are omnivorous, feeding on nearly equal amounts of plant and animal matter. The common shiner model was selected to represent the New River shiner (*Notropis scabriceps*), an endemic species in the New River that has similar habitat requirements as the common shiner.

For the common shiner, the HEP team approved the use of the blue book's additional habitat model, which consisted of the variables most essential in providing common shiner with optimum riverine conditions. The HEP team agreed that this model gave the common shiner a

[1] The Jackson turbidity unit (JTU) is roughly the same as a Nephelometric turbidity unit (NTU): a measure of turbidity in a water sample.

more appropriate HSI score when compared to the full blue book model. Model variables for the common shiner include:

Water Quality

- Maximum summer water temperature persisting for longer than 1 week (below 25˚C is optimal)
- Minimum pH between 6.5 and 8.5
- Average turbidity (clear < 30 JTU)

Food/Cover

- Percent pools – interspersed with riffle areas for spawning (1:1 pool-riffle ratio is optimum)
- Predominant pool class- moderate size and depth, commonly found below falls or riffle-run areas; 5-30% of bottom obscured by depth or turbulence

We note that the additional model in the HSI blue book for common shiner has a minor error. The number of variables for the common shiner should be 5 instead of 4; percent pools and predominant pool class should be separate variables. Therefore the HSI value was derived by dividing the number of variables present by 5 (rather than by 4).

The mink is a predatory semi-aquatic mammal that is associated with streams and riverbanks. The species' diet is highly variable, and depends on season, availability of prey, and habitat type. Typical food items include aquatic species such as fish and crayfish, semi-aquatic or aquatic mammals such as muskrat, or terrestrial species such as rabbits and rodents. Mink prefer areas with brushy or woody cover adjacent to aquatic habitats, and generally avoid open or exposed areas. Snags, large rocks, debris and aquatic vegetation also provide foraging cover. Mink select den sites that are close to preferred foraging areas. Dens usually consist of log jams, fallen branches, and other debris. Blue book mink model variables tailored to riverine habitat types include:

Water/Cover

- Percent of year with surface water present
- Percent shoreline cover within 1 meter of water's edge
- Percent canopy cover of trees and shrubs within 100 m of water's edge

The yellow warbler prefers wet habitats with abundant shrubs or small trees. They are commonly found inhabiting marshes, swamp edges, hedgerows, aspen groves, and willow swamps. Yellow warblers primarily eat insects off the foliage of deciduous trees on smaller

limbs. For nesting, warblers prefer hydrophytic shrubs or trees between 3 and 8 feet from the ground, with closed canopy cover. Blue book model variables for the yellow warbler include:

Cover/Reproduction

- Percent deciduous shrub crown cover
- Average height of deciduous shrub canopy
- Percent of deciduous shrub canopy comprised of hydrophytic shrubs

Black-capped chickadees are found in forested wetlands, deciduous, coniferous, and mixed forests. Chickadees are cavity nesters seeking out soft cavities in dead or hollow trees. They will nest anywhere from 1 to 15 feet from the ground. Chickadees are insectivorous, feeding from the ground to the tree tops. They are primary predators of the gypsy moth. Blue book model variables for the black-capped chickadee include:

Breeding

- Number of snags per acre with diameter at breast height (dbh) of 4 to 10 inches

Feeding

- Tree canopy closure
- Average height of overstory trees
- Shrub crown cover

**Methods**

The limits of the terrestrial study area were from the base of the dam, river right, to the end of the public park in Hinton. The river left study area boundaries stretched from the fishing pier to the end of COE property, marked by a sign along the access road. The limits of the riverine study area were from the base of the dam downstream to the Route 3 Bridge. Terrestrial and riverine measurements were only taken immediately within the project area instead of in all four reconnaissance areas leading to the Ohio River. At this early stage of project planning, we assumed direct and indirect impacts would only occur directly below the dam in the tailwaters (Fig. 2, 3, 4). However, additional field work may be necessary in other locations due to the potential for new risk management plans that were not considered when this effort was originally scoped. Those future assessments may include areas that are not appropriate for evaluation with these current riverine and riparian species models.

For measurements in riparian habitats, linear transects were established perpendicular to the bank every 10 meters and variable measurements were recorded and averaged to get an overall representative value for each variable, such as: percent canopy closure, average height

of overstory trees, average height of deciduous shrub canopy, and percent shoreline cover. Percent shrub crown cover and percent shrub canopy comprised of hydrophytic shrubs were measured using the line intercept technique (Mitchell and Hughes 1995). The number of snags per acre with a DBH of 4 to 10 inches was determined by walking the site and measuring the circumference of suitable snags and then calculating DBH. Average height of overstory trees was determined by selecting the tallest tree on each linear transect and estimating its height with a clinometer. Percent shoreline cover and percent canopy closure were estimated visually by the HEP team.

Riverine measurements were taken at four different transects across the width of the river between the dam and the Route 3 Bridge. Dominant substrate was recorded every 10 meters, while average depth and pool class were recorded at two sites that were classified as pool-like areas. Dissolved oxygen, water temperature, pH, and alkalinity scores were determined by using previously collected water quality data from the Department of Environmental Protection water quality monitoring station 1.2 miles downstream of the dam (the closest water quality monitoring station). Ten years of water quality data (2003-2012) was assessed and averaged to determine HSI scores (Appendix C). Turbidity was measured on site using a TB200 Portable Turbidimeter.

Acreage measurements for each evaluation area, distances between adjacent cover types, and stream gradients were measured from USGS topographic maps, or from GIS analysis of the previously constructed habitat maps of the project area.

Terrestrial and aquatic field data were gathered on September 10 – September 13, 2013.

**Results and Discussion**

The results of this HEP reflect the conditions in the project area in a discreet amount of time. A few of the variables will fluctuate throughout the year. For example, at riparian sites 1 and 2 mowing had just occurred and this affected variable scores that were associated with vegetation. Riverine variables associated with pools received low scores because there were no actual pools within the project area. The water levels in the tailwaters were unusually high this year throughout the summer, due to increased regional precipitation, which prevented the HEP team from measuring the study area during normal flows. The altered water levels made it difficult to distinguish between riffle-run areas and pool-like areas.

Within each site, transect and/or point measurements for a given variable (e.g., percent canopy cover) were averaged to get an overall representative value. Each variable was then assigned a score based on the species' habitat requirements and preferences as set forth in the applicable HSI model. These variable value scores were then used to derive a Habitat Suitability Index

score for each species (Appendix A). As noted previously, these HSI scores range from 0 – 1.0 and are used as an index to the suitability of the habitat for that species.

Riparian

Riparian Site # 1 received consistently low scores for all evaluation species due to the poor quality of the habitat (Table 3). Site # 1 had few trees and shrubs and was adjacent to an on-going construction project (which was approved in the 1998 Dam Safety Assurance Evaluation Report and is currently in Phases 3 and 4 of construction). The purpose of Phase 3 is to reduce the risk of scour and threat to the stability of the dam in the event the penstocks are used to increase discharge capacity. Phase 4 of work includes installing over 200 high strength steel anchors in the spillway and non-overflow monoliths (Corps 2013a).

***Table 3. Overall terrestrial HSI scores for RP- 1, 2, and 3.***

| **HSI Model** | **Riparian Site # 1** | **Riparian Site # 2** | **Riparian Site # 3** |
|---|---|---|---|
| Black-capped chickadee | 0.48 | 0.86 | 1.0 |
| Yellow Warbler | 0.0 | 0.33 | 0.32 |
| Mink | 0.0 | 0.55 | 1.0 |

Site # 2 is located alongside of a park and is distinguished from Site #1 due to the presence of more trees and shrubs. The overall large size of trees and high number of snags within site #2 contributed to higher scores for the black-capped chickadee and yellow warbler than at site # 1. The increase in cover sites near the water's edge helped improve the HSI score for the mink from 0 at site #1 to 0.55 at site # 2 (Table 3). The presence of a copse of willow trees contributed to the increased yellow warbler score at site #2 versus site # 1.

Site # 3 is located on river left opposite of sites #1 and #2. The site received overall scores of 1.0 for the black-capped chickadee and mink due to the abundance of canopy cover, snags, shrub cover, and suitable tree heights. Percent shoreline cover within 1 meter of water's edge was estimated to be 100% for the mink. At Site # 3 the yellow warbler received a low score because 0 % of the shrub canopy was comprised of hydrophytes; one common feature of yellow warbler habitat is the presence of various species of willows (Lowther et al. 1999).

Riverine Habitat

Two species were evaluated for the riverine portion of the habitat. The overall HSI for the smallmouth bass in the tailwaters was 0.83 (Table 4). The clear ( ≤ 25 JTU) water, stream gradient of 1.5 m/km, more than 25 % cover, summer temperature of approximately 22.58˚ C, and gravel, rubble, or boulder substrate represents almost ideal conditions for this species, which is consistent with the popularity of the area by bass fisherman. The common shiner scored a 0.80 for overall HSI in the tailwaters (Table 4). The limiting factor for both species was the lack of pools in the study area, although one would expect limited pool habitat in the tailwaters of a dam. The availability of optimal pool habitat increased further downstream, past the Route 3 Bridge. As previously noted, unusually high flows persisted during the field work making it difficult to determine if pool habitat was present in the tailwaters. However, the HEP team agreed that the HSI score for smallmouth bass would remain the same during normal flows because it is not likely that 25% pool habitat is present in the tailwaters (the smallmouth bass model required at least 25% pools). The common shiner model required pools with moderate size and depth, commonly found below falls or riffle-run areas, interspersed with riffle areas for spawning (1:1 pool-riffle ratio). The presence of instream cover, provided by boulders and fractured bedrock cavities, contributed to the high score for smallmouth bass (Appendix A).

***Table 4. Overall aquatic HSI scores for smallmouth bass and common shiner (R-1)***

| **HSI Model** | **HSI Score** |
|---|---|
| Smallmouth Bass | 0.83 |
| Common Shiner | 0.80 |

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# APPENDIX A

Habitat Suitability Index Value

**Riparian Site # 1**

Location: River right, extending along 80 m of shoreline below the dam.

## Black-capped Chickadee

| Variable | Average | HSI Score |
|---|---|---|
| Number of snags per acre with dbh of 4 to 10 inches | 2 | 1.0 |
| Tree canopy closure | 34% | 0.7 |
| Average height of overstory trees | 38.3 ft. | 0.75 |
| Shrub crown cover | 0% | 0.0 |
| **Food HSI** | | **0.48** |
| **Breeding HSI** | | **1.0** |
| | **Overall HSI** | **0.48** |

## Yellow Warbler

| Variable | Average | HSI Score |
|---|---|---|
| Percent deciduous shrub crown cover | 0% | 0.0 |
| Average height of deciduous shrub canopy | 0 m | 0.0 |
| Percent of deciduous shrub canopy comprised of hydrophytic shrubs | 0% | 0.0 |
| | **Overall HSI** | **0.0** |

## Mink

| Variable | Average | HSI Score |
|---|---|---|
| Percent of year with surface water present | 100% | 1.0 |
| Percent canopy cover of trees and shrubs within 100 m of the wetland's edge | 34% | 0.5 |
| Percent shoreline cover | 0% | 0.0 |
| **Water HSI** | | **1.0** |
| **Cover HSI** | | **0.0** |
| | **Overall HSI** | **0.0** |

**Summary: Overall HSI for Site #1**

| | |
|---|---|
| Black-capped Chickadee | **0.48** |
| Yellow Warbler | **0.0** |
| Mink | **0.0** |

**Riparian Site # 2**

Location: River right, entire length of city park along the shore line.

## Black-capped Chickadee

| Variable | Average | HSI Score |
|---|---|---|
| Number of snags per acre with dbh of 4 to 10 inches | > 2 | 1.0 |
| Tree canopy closure | 32% | 0.65 |
| Average height of overstory trees | 54ft. | 1.0 |
| Shrub crown cover | 18.3% | 0.95 |
| **Food HSI** | | **0.86** |
| **Breeding HSI** | | **1.0** |
| | **Overall HSI** | **0.86** |

## Yellow Warbler

| Variable | Average | HSI Score |
|---|---|---|
| Percent deciduous shrub crown cover | 18.3% | 0.25 |
| Average height of deciduous shrub canopy | 2 m | 1.0 |
| Percent of deciduous shrub canopy comprised of hydrophytic shrubs | 36% | 0.43 |
| | **Overall HSI** | **0.33** |

## Mink

| Variable | Average | HSI Score |
|---|---|---|
| Percent of year with surface water present | 100% | 1.0 |
| Percent canopy cover of trees and shrubs within 100 m of the wetland's edge | 32% | 0.45 |
| Percent shoreline cover | 68% | 0.68 |
| **Water HSI** | | **1.0** |
| **Cover HSI** | | **0.55** |
| | **Overall HSI** | **0.55** |

**Summary: Overall HSI for Site #2**

| | |
|---|---|
| Black-capped Chickadee | **0.86** |
| Yellow Warbler | **0.33** |
| Mink | **0.55** |

**Riparian Site #3**

Location: River left, from fishing pier to end of Corps property line.

## Black-capped Chickadee

| Variable | Average | HSI Score |
|---|---|---|
| Number of snags per acre with dbh of 4 to 10 inches | 6 | 1.0 |
| Tree canopy closure | 75.5% | 1.0 |
| Average height of overstory trees | 51.6 ft. | 1.0 |
| Shrub crown cover | 56.9% | 1.0 |
| **Food HSI** | | **1.0** |
| **Breeding HSI** | | **1.0** |
| | **Overall HSI** | **1.0** |

## Yellow Warbler

| Variable | Average | HSI Score |
|---|---|---|
| Percent deciduous shrub crown cover | 56.9% | 1.0 |
| Average height of deciduous shrub canopy | 2 m | 1.0 |
| Percent of deciduous shrub canopy comprised of hydrophytic shrubs | 0% | 0.1 |
| | **Overall HSI** | **0.32** |

## Mink

| Variable | Average | HSI Score |
|---|---|---|
| Percent of year with surface water present | 100% | 1.0 |
| Percent canopy cover of trees and shrubs within 100 m of the wetland's edge | 75.5% | 1.0 |
| Percent shoreline cover | 100% | 1.0 |
| **Water HSI** | | **1.0** |
| **Cover HSI** | | **1.0** |
| | **Overall HSI** | **1.0** |

**Summary: Overall HSI for Site #1**

| | |
|---|---|
| Black-capped Chickadee | **1.0** |
| Yellow Warbler | **0.32** |
| Mink | **1.0** |

## Riverine Habitat Data

Location: From dam 0.82 miles downstream to Route 3 Bridge.

**Smallmouth Bass**

| Variable | Present or Not Present |
|---|---|
| V9: Maximum monthly average turbidity level during the summer (≤ 25 JTU) | Present |
| V15: Stream gradient within representative reach (between 0.75 and 4.7 m/km) | Present |
| V2: Percent pools (at least 25%) | Not Present |
| V5: Percent cover in the form of boulders, stumps, dead trees, and crevices (adults) or vegetation and rocks (fry) (at least 25% cover) | Present |
| V10,V11,V12,V13: Water temperature in selected habitat during the summer (21-29˚C) | Present |
| V1: Dominant substrate type (gravel, rubble, or boulder substrate) | Present |
| **Total HSI** | **0.83** |

HSI = number of above criteria present/6

HSI = 5/6

**Common Shiner**

| Variable | Present or Not Present |
|---|---|
| V3: Average turbidity (<30 JTU) | Present |
| V7: Predominant pool class (B- moderate size and depth, commonly found below falls or riffle-run areas; 5-30% of bottom obscured by depth or turbulence) | Present |
| V1: Maximum summer temperature persisting for longer than 1 week (below 25˚C) | Present |
| V2: Least suitable pH level occurring during the year (between 6.5 and 8.5) | Present |
| V5: Percent pools(1:1 pool-riffle ratio) | Not Present |
| **Total HSI** | **0.80** |

HSI = number of above criteria present/5

HSI = 4/5

# APPENDIX B

Terrestrial and Riverine Species Present in the Tailwater Area

**Riparian**

| | |
|---|---|
| River Birch (*Betula nigra*)[1] | American Sycamore (*Platanus occidentalis*)[1] |
| Eastern Red Cedar (*Juniperus virginiana*)[1] | Black Cherry (*Prunus serotina*) [1] |
| Sugar Maple (*Acer saccharum*)[1] | American elm (*Ulmus americana*)[1] |
| Mulberry (*Morus spp.*)[1] | Box alder (*Acer negundo*) [1] |
| Tree of Heaven (*Ailanthus altissima*)[1] | Autumn Olive (*Elaeagnus umbellata*)[1] |
| Tulip Tree (*Liriodendron tulipifera*)[1] | Willow (*Salix spp.*)[1] |
| Red Bud (*Cercis canadensis*)[1] | Wild Grape (*Vitis spp.*)[1] |
| Wood Duck (*Aix sponsa*)[1] | Osprey (*Pandion haliaetus*)[1] |
| Great Blue Heron (*Ardea Herodias*)[1] | Honey Locust (*Gleditsia Triacanthos*)[1] |
| Slippery Elm (*Ulmus rubra*)[1] | Silk Tree (*Albizia spp.*)[1] |
| Poison Ivy (*Toxicodendron radicans*)[1] | Song Sparrow (*Melospiza melodia*)[1] |
| Eastern chipmunk (*Tamias striatus*)[1] | Canada goose (*Branta canadensis*[1] |
| American Goldfinch (*Carduelis tristis*)[1] | Mallard (*Anas platyrhynchus*)[1] |

**Riverine**

| | |
|---|---|
| Northern Hogsucker (*Hypentelium nigricans*)[1] | Green Sunfish (*Lepomis cyanellus*)[2] |
| Smallmouth Bass (*Micropterus dolomieu*)[1] | Channel Catfish (*Ictalurus punctatus*)[2] |
| Flathead Catfish (Pylodictis olivaris)[2] | Largemouth Bass (Micropterus salmoides)[2] |
| Rock Bass (*Ambloplites rupestris*)[2] | Central Stoneroller (*Campostoma anomalum*)[2] |
| Rainbow Darter (*Etheostoma caeruleum*)[2] | Whitetail Shiner (*Cyprinella galactura*)[2] |
| Spotfin Shiner (*Cyprinella spiloptera*)[2] | Greenside Darter (*Etheostoma blennioides*)[2] |
| Variegate Darter (*Etheostoma variatum*)[2] | Brook Silverside (*Labidesthes sicculus*)[2] |
| Redbreast Sunfish (*Lepomis auritus*)[2] | Bluegill (*Lepomis macrochirus*)[2] |
| White Shiner (*Luxilus albeolus*)[2] | Spotted Bass (*Micropterus punctulatus*)[2] |

[1] Direct observation during the September 10 – 13, 2013 HEP field work
[2] Species was present in the tailwater study area during an electrofishing survey conducted by the Corps in 2004

Bigmouth Chub (*Nocomis platyrhynchus*)[2]

Rosyface Shiner (*Notropis rubellus*)[2]

Margined Madtom (*Noturus insignis*)[2]

Roanoke Darter (*Percina roanoka*)[2]

White Crappie (*Pomoxis annularis*)[2]

Longnose Dace (*Rhinichthys cataractae*)[2]

Spottail Shiner (*Notropis hudsonius*)[2]

Telescope Shiner (*Notropis telescopus*)[2]

Sharpnose Darter (*Percina oxyrhynchus*)[2]

# APPENDIX C

Water Quality Graphs for the New River

1.2 miles downstream of Bluestone Dam