National Park Service
Department of the Interior

Big South Fork National River & Recreation Area

ENVIRONMENTAL ASSESSMENT

Remediation of Selected Contaminated Mine Drainage Sites

Big South Fork National River and Recreation Area, McCreary County, Kentucky.

June 2016

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Summary

During 2007, Lake Cumberland, which is managed by the U.S. Army Corps of Engineers (Corps) was lowered to a target elevation of 680 feet mean sea level to reduce the risk of failure while repairs were being made to Wolf Creek Dam. Lower reservoir elevations allowed approximately 10 river miles (miles 33.5 to 44) of the Big South Fork of the Cumberland River (BSF) to revert to natural free flowing conditions where they had been previously inundated at times over the last sixty years.

Prior to returning to normal reservoir operations, U.S. Fish and Wildlife Service (FWS) required that the Corps conduct surveys for federally listed aquatic species within areas of the BSF that would be inundated under a return to normal operations. The Corps committed to conduct these surveys in a Record of Decision signed for the 2008 Final Environmental Impact Statement titled Wolf Creek Dam/Lake Cumberland, Emergency Measures in Response to Seepage. Surveys were conducted in September and November, 2013 to determine the presence/absence of federally protected aquatic species in the affected reach of the BSF. During these surveys, the federally endangered duskytail darter (*Etheostoma percnurum*) was observed in 8 of 15 exposed riffle sites. Prior to these surveys historic records for the duskytail darter indicated that it was only observed upstream of the affected reach in Tennessee and Kentucky.

The duskytail darter is a small (6.4 cm) member of the Family Percidae known only to six streams in Tennessee, Kentucky and Virginia. The duskytail darter inhabits the edges of gently flowing, shallow pools (up to 120 cm in depth), eddy areas, and slow runs in usually clear water of large creeks and moderately large rivers.

Following the 2013 aquatic survey which identified the presence of the endangered duskytail darter in the reach of the BSF affected by the return to normal pool operations, the Corps prepared a Biological Assessment (BA) and requested the FWS initiate formal consultation under the Endangered Species Act (ESA). An Incidental Take Statement (ITS) and associated Biological Opinion (BO) was issued by the FWS (March 2014). In conducting the ESA consultation, the National Park Service (NPS), Corps and FWS attempted to develop conservation measures (CMs) that would improve habitat conditions within much of the historical reach of the BSF for the duskytail darter. This reach is contained entirely within the Big South Fork National River and Recreation Area (BISO) which is managed by the NPS. The Corps committed to implementing those water quality/habitat improvement CMs in cooperation with the NPS who administers the lands affected. Previous efforts by the NPS had identified a suite of contaminated mine drainage (CMD) remediation projects associated with coal mining that preceded the park's establishment. From the suite of projects, the NPS recommended several that appeared feasible within the timeframe of the BO. The first

term and condition relating to these projects was entering into a Memorandum of Understanding (MOU) with the BISO and the FWS. This was completed on July 29, 2014. In this MOU the Corps agreed to be lead agency for any necessary National Environmental Policy Act (NEPA) requirements. The NPS is acting as a cooperating agency. The Corps is acting as a participating agency for an Environmental Impact Statement that the NPS is conducting for all contaminated mine drainage Remediation Sites in the BISO. Currently the NPS is drafting an Environmental Impact Statement to review the similar remediation activities within the BISO.

The purpose of the proposed action is the remediation of a minimum of two CMD sites for water quality improvements and one sediment abatement site on NPS lands to fulfill the requirements of the ITS and associated BO. The proposed project would help improve the water quality and aquatic habitat in the BSF for the duskytail darter. Completion of the proposed project would allow Wolf Creek Dam and Lake Cumberland to return to normal operations. This Environmental Assessment (EA) serves to define the specific sites associated with this proposed action, explores possible remediation methods at each site, and identifies the affected environment and environmental consequences associated with the proposed action for the final array of at least three sites. This EA also addresses the NPS making lands available for the Corps to construct the CMs selected, including activities associated with design, construction, and monitoring of the selected remediation projects.

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Acronyms

AHPA	Archeological and Historic Data Preservation Act
AIRFA	American Indian Religious Freedom Act
AMSL	Above Mean Sea Level
APE	Area of Potential Effect
ARPA	Archeological Resources Protection Act
BA	Biological Assessment
BHLT	Blue Heron Loop Hiking Trail
BHS	Blue Heron Spoils
BISO	Big South Fork National River and Recreation Area
BO	Biological Opinion
BSF	Big South Fork of the Cumberland River
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMD	Contaminated Mine Drainage
CMs	Conservation Measures
Corps	U.S. Army Corps of Engineers
DBH	Diameter at Breast Height
DGA	Dense Grade Aggregate
DJSP	Devils Jump Settling Pond
DO	Dissolved Oxygen
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPP	Environmentally Preferred Plan
ESA	Endangered Species Act
°F	Fahrenheit
FEMA	Federal Emergency Management Agency

FONSI	Finding of No Significant Impact
FWS	U.S. Fish and Wildlife Service
HTRW	Hazardous, Toxic, and Radioactive Waste
ITS	Incidental Take Statement
K & T	Kentucky and Tennessee
KDAM	Kentucky Division of Abandoned Mines
KDEP	Kentucky Department of Environmental Protection
KDOW	Kentucky Division of Water
KYTC	Kentucky Transportation Cabinet
LBC	Laurel Branch Confluence
LBHT	Laurel Branch horse Trail
LBSS	Laurel Branch Stream Spoils
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standards
NAGPA	Native American Graves and Repatriation Act
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWP	Nationwide Permit
ROW	Right of Way
SEPA	Southeastern Power Administration
SHPO	State Historic Preservation Office
Sp Cond	Specific conductivity
SUP	Special Use Permit
TCLP	Toxicity Characteristic Leaching Procedure
TDEC	Tennessee Department of Environment and Conservation
Temp	Temperature

Tot Alk	Total Alkalinity
TVA	Tennessee Valley Authority
USDA	U.S. Department of Agriculture
UT1SC	Unnamed Tributary 1 Stream Crossing
UT2SC	Unnamed Tributary 2 Stream Crossing
UT3CLS	Unnamed Tributary 3 Concrete Lined Stream

1.0 INTRODUCTION-PURPOSE AND NEED FOR ACTION

This Environmental Assessment (EA) is to provide National Environmental Policy Act (NEPA) of 1969 (42 USC 4321 et seq.) compliance to address construction and operation of approved remediation sites that provide equal or greater conservation and recovery benefits of the duskytail darter and a sediment reduction site within the Big South Fork National River and Recreation Area (BISO) by the Corps of Engineers (Corps) on National Park Service (NPS) lands. The purpose is to improve aquatic habitat conditions in the Big South Fork of the Cumberland River (BSF) for the endangered duskytail darter (*Etheostoma percnurum*) in accordance with the Incidental Take Statement (ITS) issued by the U.S. Fish and Wildlife Service (FWS).

Following a 2013 aquatic survey which identified the presence of the endangered duskytail darter in the reach of the BSF affected by the return to normal pool operations, the Corps prepared a Biological Assessment (BA) and requested the FWS initiate formal consultation under the Endangered Species Act (ESA).

The ITS along with a Biological Opinion (BO) which includes the Conservation Measures (CMs) was issued by the FWS in March 2014 (Appendix A). The ITS addressed the Corps' return to normal pool operations at Wolf Creek Dam (Lake Cumberland). The ITS associated terms and conditions to be implemented by the Corps include a requirement to construct remediation actions on at least two sites affected by contaminated mine drainage (CMD) and one action on sediment producing activities within the Blue Heron vicinity of the Big South Fork National River and Recreation Area (BISO). The purpose of this project is to help improve the water quality and aquatic habitat within the BSF for the duskytail darter. The Corps committed to implementing those water quality/habitat improvement CMs in cooperation with the NPS who administers the lands affected. Previous efforts by the NPS had identified a suite of CMD remediation projects associated with coal mining that preceded the park. From the suite of projects, the NPS recommended several that appeared to be implementable. The NPS is supportive of the Corps' implementation of the CMs on their lands.

For the purposes of this document, CMD refers to groundwater, base flow surface waters, or runoff surface waters that have been affected by remnants of oxidized pyrite and/or other sulfur containing minerals associated with coal mines or related spoils. This water consequently has a low pH, high acidity, and/or high metal concentrations or suspended sediment levels. This EA evaluates several potential remediation sites and methods for implementing the CMs on NPS land. The Corps would fund, design, construct, and monitor the remediation projects, in cooperation with the NPS and FWS. If the proposed project is approved by the NPS, the NPS would grant the Corps

necessary access to do the work using a Special Use Permit (SUP), Right of Way Permit (ROW), and/or Letter of Approval (LOA) to the Corps following the signature of a Finding of No Significant Impacts Statement (FONSI).

The proposed action is the remediation of two CMD sites for water quality improvements and one sediment abatement site on NPS lands to fulfill a requirement of the ITS. This EA serves to define the specific sites associated with this proposed action, explore possible remediation methods at each site, and identify the affected environment and environmental consequences associated with the proposed action for the final array of at least three sites. This EA also addresses the NPS making lands available through a SUP, ROW, and/or LOA for the Corps to construct the CMs selected, including activities associated with design, construction, and monitoring both prior, during, and immediately following construction of the selected remediation projects.

Currently the NPS is drafting an Environmental Impact Statement (EIS) for mine remediation within the BISO. This EIS is a programmatic document that provides a framework for treatment of contaminated mine drainage sites within the park. The EIS also includes a number of specific sites identified as high priority treatment sites that are analyzed in greater detail.

This EA is being prepared pursuant to the NEPA (42 USC 4321 et seq.), Council on Environmental Quality regulations (40 CFR, 1500-1508), NPS Director's Order 12 (Conservation Planning, Environmental Impact Analysis and Decision-making), the National Parks Omnibus Management Act of 1998 (16 USC 5901 et seq.), Corps Regulation ER 200-2-2, titled Policies and Procedures for Implementing NEPA, and the Operation and Maintenance authority for Wolf Creek Dam - Lake Cumberland Kentucky.

1.1 Purpose and Need for the Proposed Action

The purpose of this project is to construct remediation actions on at least three sites affected by historic coal mining (sediment production or CMD) within the Blue Heron vicinity of the BISO to improve water quality and aquatic habitat in the BSF for the duskytail darter to comply with the FWS ITS terms and conditions issued to the Corps in March 2014.

Streams in the BSF watershed generally contain sandstone beds that have poor buffering capacities and are particularly susceptible to CMD (TDEC 1997). As a result of CMD, many tributaries to the BSF are coated with an iron precipitate known as "yellow boy", which often interferes with the life cycle of aquatic organisms. In addition, pH levels and metal concentrations of CMD are often toxic to aquatic organisms. Due

to these physical and chemical alterations resulting in CMD, many streams in the project area lack or have degraded aquatic life.

1.1.1 Project Background

During 2007, Lake Cumberland was lowered to a target elevation of 680 feet mean sea level to reduce the risk of failure while repairs were being made to Wolf Creek Dam. Lower reservoir elevations allowed approximately 10 river miles (miles 33.5 to 44) of the BSF to revert to natural free flowing conditions. Previously, this reach had been inundated by reservoir backwater for part of each year since completion of the dam in the early 1950's. Normal reservoir operations are illustrated in Figure 1. This operation is defined as maintaining the reservoir between elevations allocated for Southeastern Power Administration (SEPA) curves noted in the diagram. The SEPA curve was developed with a perspective of that being the ideal lake elevations to maximize hydropower benefits while also supporting flood control, water quality, navigation, and other downstream uses.

For Lake Cumberland, during high inflow events, pool level may spike above the top of the SEPA curve but are generally returned within the limits of the curve (top/bottom) efficiently, taking into account all project purposes. The Corps historically allowed the Lake Cumberland pool level to rise above the top of the SEPA curve to ensure the summer pool was met by early May. The highest water levels are typically reached between May-June which coincides with the power pool water level being reached. The power pool water level for Lake Cumberland is between elevations 673 feet to 723 feet.

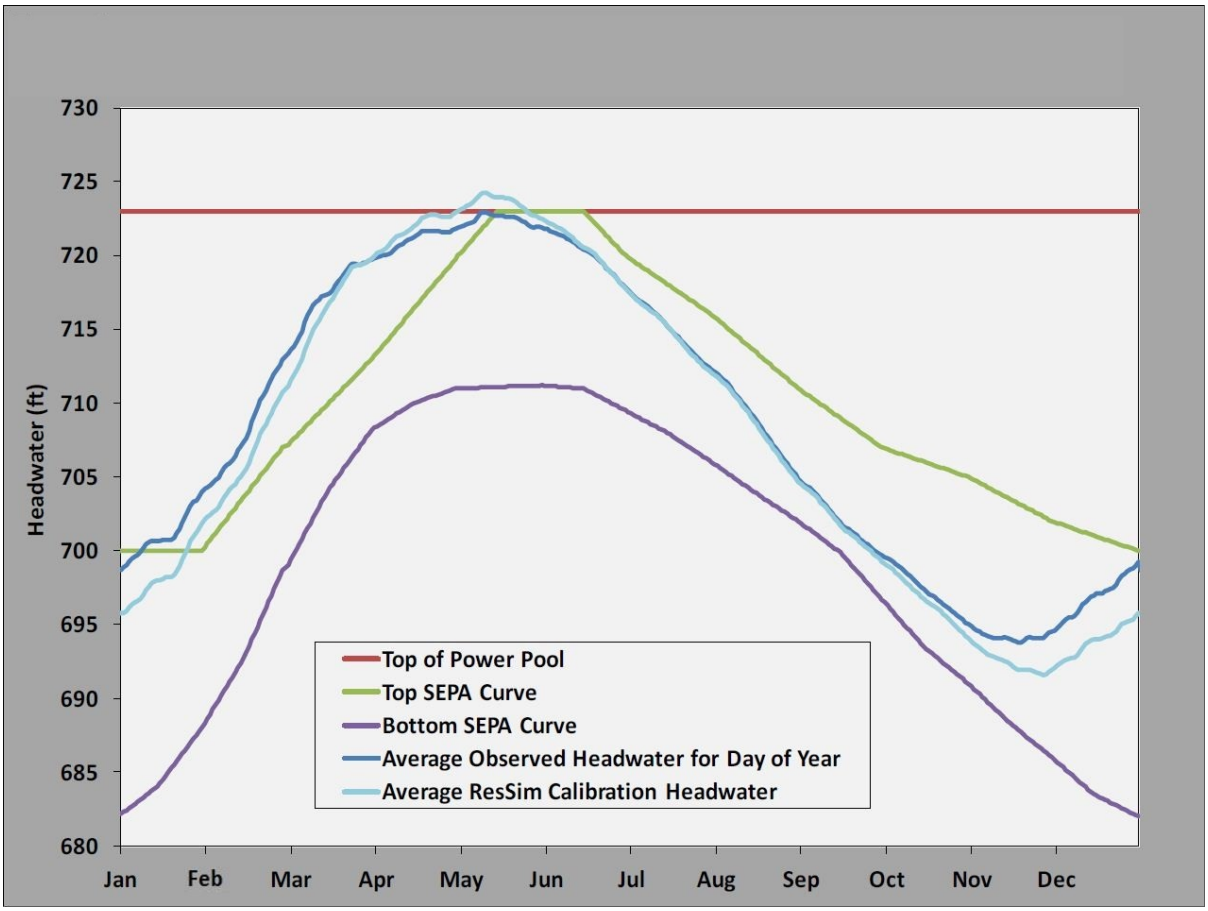


Figure 1. Average observed water elevations for Wolf Creek Dam

Prior to returning to normal reservoir operations, the FWS required that the Corps conduct surveys for federally listed aquatic species within areas of the BSF that would be inundated under a return to normal operations. The Corps committed to conduct these surveys in a Record of Decision signed for the 2008 Final EIS titled Wolf Creek Dam/Lake Cumberland, Emergency Measures in Response to Seepage. Surveys were conducted in September and November, 2013 to determine the presence/absence of federally protected aquatic species in the affected reach of the BSF. During the 2013 surveys conducted by Tennessee Valley Authority (TVA), the federally endangered duskytail darter (*Etheostoma percnurum*) was observed in 8 of 15 exposed riffle sites. Prior to the 2013 survey the duskytail darter had only been document upstream of the affected reach in Tennessee and Kentucky.

The duskytail darter is a small (6.4 cm) member of the Family Percidae known only to six streams in Tennessee, Kentucky and Virginia. The duskytail darter inhabits the edges of gently flowing, shallow pools (up to 120 cm in depth), eddy areas, and slow runs in usually clear water of large creeks and moderately large rivers (FWS 1993).

The project area within BISO is primarily impacted by mine discharges and reactive mine spoils discarded from up-slope abandoned underground coal mine entries, including spoil piles that are being eroded by the BSF during high flow events providing a source of sediment to the river. Proposed project area is located along the right descending bank, stretching over an approximate one mile stretch upstream from Blue Heron.

1.2 Environmental Assessment Framework

This EA was prepared to evaluate potential environmental impacts resulting from remedial actions described in Section 2. The purpose of the proposed project is to improve the aquatic habitat for the duskytail darter. Significant adverse impacts are not anticipated to be caused by implementation of the remedial actions. This EA was prepared under the provisions of, and in accordance with, NEPA, the Council on Environmental Quality Regulations Implementing the Procedural Provisions of NEPA (40 CFR 1500-1508), and the NPS NEPA Compliance Guideline regulation suite (DO-12 and DO-12 Handbook).

This EA consists of the following sections:

- Section 1.0 - Purpose and Need of the Proposed Actions
- Section 2.0 - Alternatives Considered
- Section 3.0 - Affected Environment
- Section 4.0 - Environmental Consequences
- Section 5.0 - Cumulative Impacts
- Section 6.0 - Environmental Commitments, Permits, and Approvals
- Section 7.0 - Environmental Compliance
- Section 8.0 - Public and Agency Coordination
- Section 9.0 - Conclusions
- Section 10.0 - References

1.3 Location

BISO is located on the Cumberland Plateau, approximately 50 miles northwest of Knoxville, Tennessee and encompasses approximately 125,000 acres in portions of Pickett, Morgan, Fentress and Scott Counties, Tennessee and McCreary County Kentucky (Figure 2). The BSF watershed includes the above counties plus smaller areas of Anderson and Campbell counties, Tennessee. Counties surrounding BISO contain scattered, low-density rural development with no major urban areas.

Major access to BISO is provided by Interstates 40, 65, and 75. Major population centers within a 150 mile radius are Knoxville, Nashville, and Chattanooga, Tennessee;

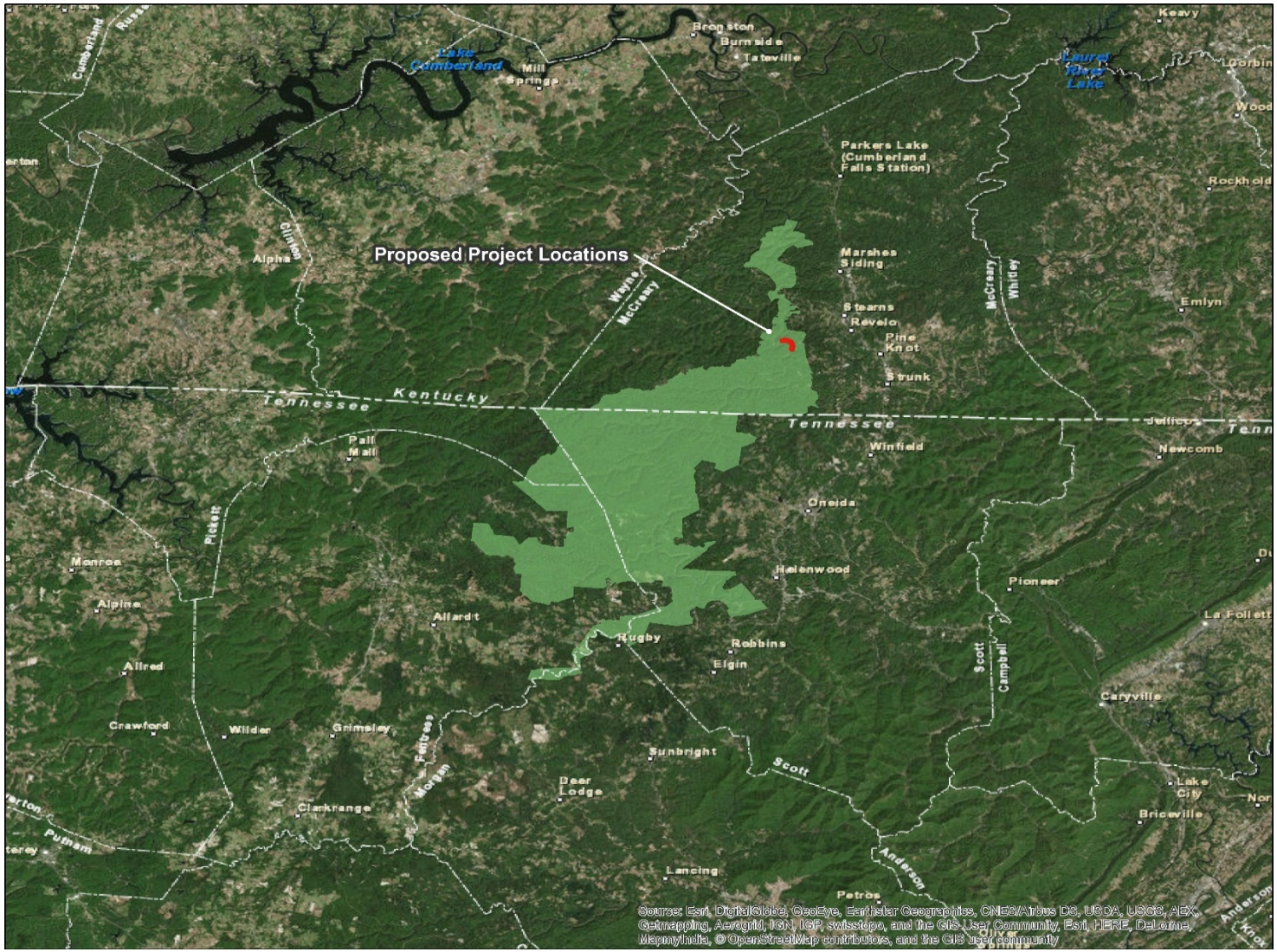


Figure 2. Vicinity Map depicting the Big South Fork National River and Recreation Area location and the proposed remediation sites.

Lexington and Louisville, Kentucky; and Asheville, North Carolina. U.S.27 and 127 are major north-south corridors just outside BISO boundary.

1.4 Historical Land Use

The BISO region has been extensively mined for coal since the turn of the century with some mines still operating in the BSF watershed. Influx of settlers to the BSF area began in the early 1800's, and drilling for salt and mining for potassium nitrate began in 1812. The first commercial oil well in North America was drilled in this area in 1818. Extensive coal mining and timber harvesting occurred from the 1880's to the 1960's and have had significant environmental impacts on the region, including the project area.

The Stearns Coal and Lumber Company was founded by J. S. Stearns in the early 1900's and commercial coal mining began along the Kentucky portion of BISO when this company built a railroad to Barthell on Roaring Paunch Creek. The Stearns Company, which was the largest coal mining company that operated in what is now BISO, established a large-scale underground mining operation, employing approximately 1,300 miners. The Stearns' Worley mines were opened in 1906 and the region continued to grow. Coal mining in the Stearns area peaked around 1929, and in 1937, the Stearns Company opened the Blue Heron Mine, which was subsequently closed in 1962 due to economic reasons (TDEC 1997).

As a result of these and other past mining operations, remnants of mining towns, railroad spurs, mine sites, and haul roads remain throughout the region and specifically throughout the project area. In conjunction with the coal mining operations, waste materials were generally deposited as rock dumps near the mines. Coal spoils and pyrolized gob piles occur throughout the project area and continue to be a source of metal-laden acidic drainage or sediment.

1.5 Current Land Use

The Secretary of the Army established BISO in 1974 by Title I of Public Law (PL) 93-251, H.R.10203.The act was amended by PL 94-587 in 1976 and PL101-561 in 1990.On November 15, 1990, the Secretary of Interior assumed responsibility of Federal lands, water, interests therein, and improvements thereon within BISO.

BISO was established for the following purposes, as defined by Section 108(a) of PL 93-251 as amended by PL 94-587 and PL 101-561:

- To conserve and interpret cultural, historic, geologic, fish and wildlife, archeological, scenic, and recreational values;
- To preserve the free flowing BSF and portions of its tributaries;
- To preserve the natural integrity of the scenic gorges and valleys; and

- To develop the area's potential for healthful outdoor recreation.

Legislation establishing BISO both defines activities allowed within its boundaries and identifies restrictions (16 USC 460ee).When BISO was created, the land had suffered from long-term intensive land use including coal mining, timber harvesting, oil and gas operations, and a large network of unmaintained roads. Since 1974, some efforts have been made to minimize the effect of mine spoils on surface waters. Additional reclamation activities have been completed within the watershed, but outside BISO, by Tennessee Department of Environment and Conservation (TDEC), the U.S. Department of Agriculture (USDA), and the Natural Resources Conservation Service (NRCS). The Kentucky Division of Abandoned Mines (KDAM) has conducted gating at mine openings in the Blue Heron area, primarily to address public safety concerns. More recent work in 2010 was accomplished by NPS using American Recovery and Reinvestment Act of 2009 funds. KDAM has also recently constructed remediation projects within the nearby lower Rock Creek watershed on Daniel Boone National Forest lands as part of a multi-agency remediation effort for the lower Rock Creek basin. This project has provided tremendous benefits to aquatic life in Rock Creek, which enters the BSF at river mile 40.7, within the drawdown reach.

The portions of BISO on which the proposed project is focused are severely impacted by CMD. However, the general area in which the sites are located offers numerous recreational opportunities including fishing, swimming, hiking, biking, horseback riding, canoeing and kayaking, back-county camping, hunting, and nature study. Laurel Branch Horse Trail (LBHT) and the Blue Heron Loop Hiking Trail (BHLT) traverses the general project area and in some cases cross or occur in proximity to the project sites. LBHT and BHLT cross near most of the sites under consideration in this EA.

Additional recreational facilities that are located in the general project area include the Blue Heron historic mining community and the Big South Fork Scenic Railway, both of which are popular tourist attractions.

1.6 Rationale for Preparing an Environmental Assessment

To meet the requirements of the 2014 ITS, the Corps, in cooperation with the FWS and NPS, intends to implement projects to remediate selected sites severely impacted by CMD or past spoil disposal to improve water quality and/or aquatic habitat within the BSF. As a result of preliminary impact analysis, the NPS and Corps have determined that an EA would likely provide sufficient level-of-detail in NEPA analysis, and would comprehensively identify, analyze, and discuss the potential environmental, cultural, and socioeconomic impacts of practical remediation alternatives most likely to improve the water quality of the BSF.

2.0 Alternatives Considered

This EA provides descriptions of seven possible remediation sites in the Blue Heron vicinity (Figure 3) and potential measures as summarized in the following sections. These sites were determined based on an inter-agency site visit and meeting that included KDAM, NPS, Corps and FWS. Many of the potential sites had been evaluated by earlier NPS reports.

All alternatives considered were sites which would potentially benefit water quality and would be feasible within a relatively short time span and have a limited impact on other resources and recreation.

2.1 Remediation Site/Measure Descriptions

From the array of sites described below, at least three are to be implemented to comply with the FWS ITS terms and conditions issued to the Corps in March 2014. The three sites would be selected as those deemed to have benefits to water quality and aquatic habitat in the BSF. The proposed action is the final array of at least three remediation sites and measures as required by the ITS.

2.1.1 Laurel Branch Stream Spoils

A description of the Laurel Branch Stream Spoils (LBSS) from the 1998 conceptual design report was reviewed. The site is located on the right descending bank (east side) of the BSF approximately 1.5 miles upstream from the Blue Heron Boat Ramp (Figure 3). A historic deep mine was located on an adjacent slope. Mine spoil was deposited downslope of the mine opening and included a large section of spoil deliberately placed across the Laurel Branch channel as fill for a bridge. Remnants of this spoil have created an approximate 20’ high waterfall just downstream of the LBHT crossing on Laurel Branch as shown in Figure 4. As a result of past mining activities, lower reaches of Laurel Branch are impacted by mine spoil piles from direct contact. In addition, sections of Laurel Branch are filled with permeable alluvial deposits, which provide a recharge area for stream flow to infiltrate and react with the spoil material.

Water quality samples were collected on December 16, 2014 (Table 1) to aid in the evaluation of LBSS (Figure 5). The stream has eroded away much of the spoil that was present during the earlier NPS report and the immediate substrate and banks are relatively stable now. Additional information pertaining to water quality is discussed in detail in Section 3.2.2 of this document.

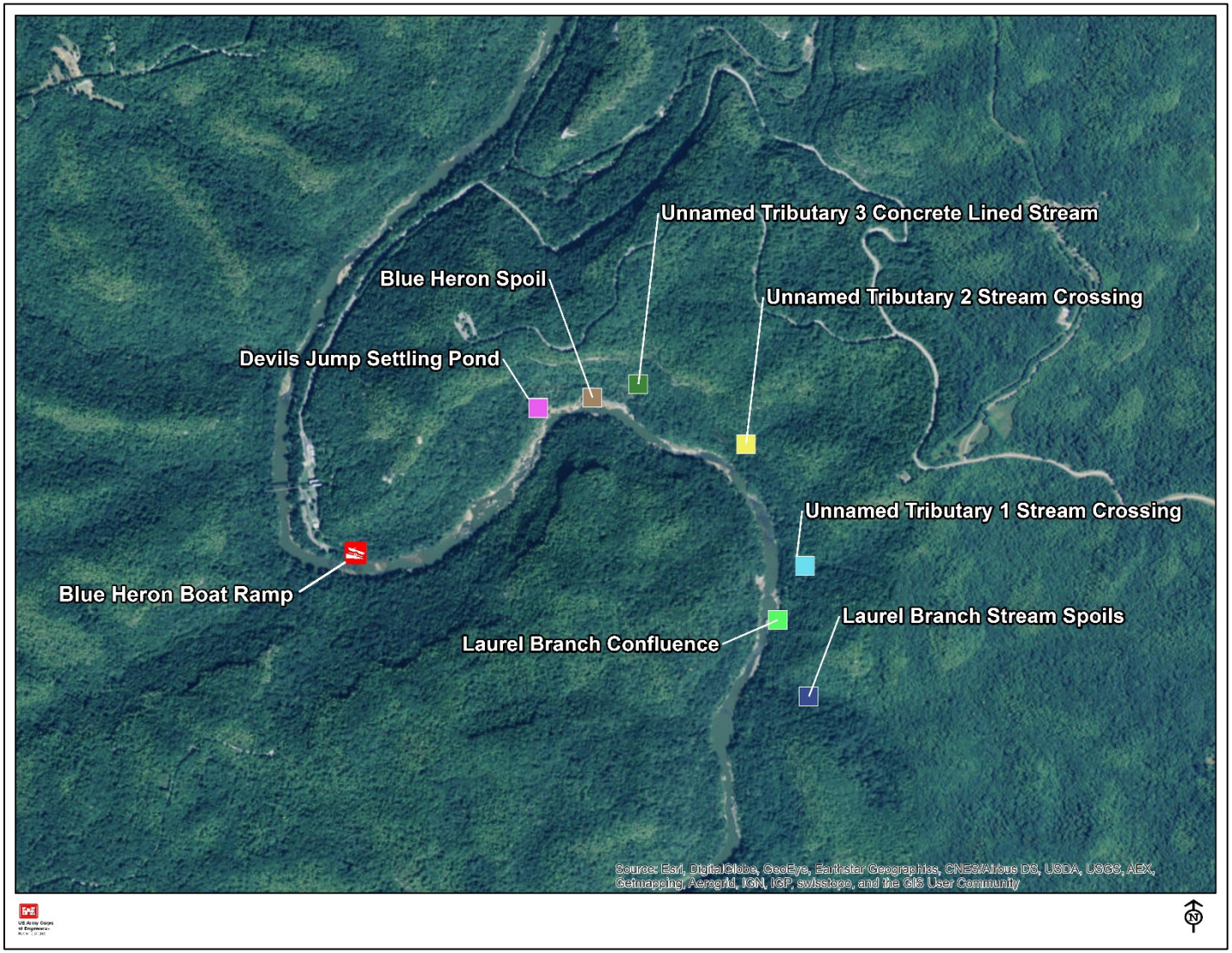


Figure 3. Proposed remediation sites with the Big South Fork National River and Recreation Area – Blue Heron Mine Community Area

Figure 4. Coal mine spoils located below the confluence of the Laurel Branch Horse Trail and Laurel Branch.

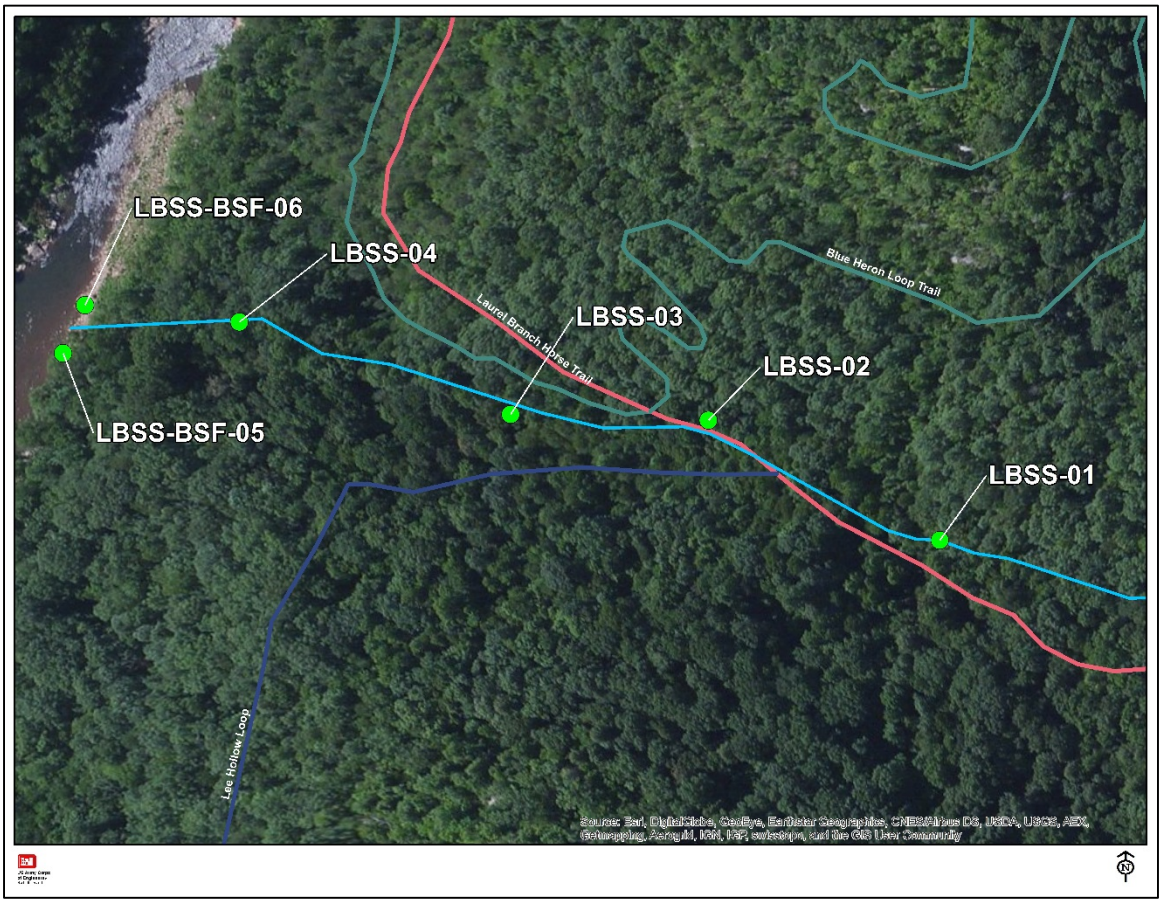


Figure 5. Location of Laurel Branch Stream Spoil water quality sample points collected December 15, 2014.

Table 1.Laurel Branch Stream Spoil water quality field data collected December 15, 2014.

Station ID	Temp. (^{0}F)	DO mg/l	Sp Cond (*u* mho/cm)	pH	Tot Alk. (mg/l)
LBSS-01	42.4	12.0	27	6.8	6
LBSS-02	42.4	11.9	27	6.7	5
LBSS-03	42.6	12.1	37	5.8	5
LBSS-04	42.6	12.1	49	5.8	4
LBSS-BSF-05	41	12.6	75	7.2	16
LBSS-BSF-06	41	12.7	77	7.3	Unknown

2.1.2 Laurel Branch Confluence (Stream Bank Stabilization)

The Laurel Branch Confluence (LBC) site is located on the right descending bank of the BSF approximately 800 feet downstream of the confluence of Laurel Branch. A photograph of the LBC site is shown as Figure 6.

This site consists of approximately one to two acres of partially re-vegetated mine spoils. The mine spoils extend steeply up from the east bank of the BSF at near-vertical slopes. These slopes have been cut away by erosional forces under high river flows. The base of the spoil pile contains partially pyrolized spoil below loose material. The tops of the spoils are slightly higher than the alluvial terraces along the river as shown in Figure 6. From the crest, the spoils extend at a slight grade up the hillside, which is well vegetated by pine (*Pinus spp.*). CMD seeps directly into the BSF from the base of these spoil piles.

Figure 6. Relic coal mine spoils located along the Big South Fork River at the proposed remediation site, Laurel Branch Confluence.

This site was originally considered a water quality improvement conservation measure due to seepage that was present during the earlier NPS report, but based on the minimal amount of seepage currently occurring would now be considered only a sediment reduction conservation measure. Water quality samples were taken of seeps December 15, 2014 to gather baseline conditions of LBC (Table 2). Additional information pertaining to water quality is discussed in detail in Section 3.2.2 of this document.

Table 2. Laurel Branch Confluence water quality field data collected on December 15, 2014.

Station ID	Temp. (^{0}F)	DO mg/l	Sp Cond (*u* mho/cm)	pH	Tot Alk. (mg/l)
LBC-01	51.1	8.3	1388	2.5	0
LBC-02	51.3	9.8	1116	2.6	0

As shown in Table 2 above, pH was low and specific conductivity was elevated. Flows were not measured but estimated to be less than one gallon per minute. In addition to the two water quality samples taken of seeps, four additional readings were measured along the BSF shoreline to evaluate localized impacts of the seeps found within LBC (Table 3) but these did not show any measureable degradation in the river. Figure 7 shows the location of each water quality sample point.

Table 3. Near-shore water quality field data collected from BSF along LBC river bank measured December 15, 2014

Station ID	Temp. (^{0}F)	DO mg/l	Sp Cond (*u* mho/cm)	pH
LBC-BSF-01	41	12.7	77	6.9
LBC-BSF-02	41.2	12.6	80	6.7
LBC-BSF-03	41.2	12.6	80	7.1
LBC-BSF-04	41.2	12.6	78	7.2

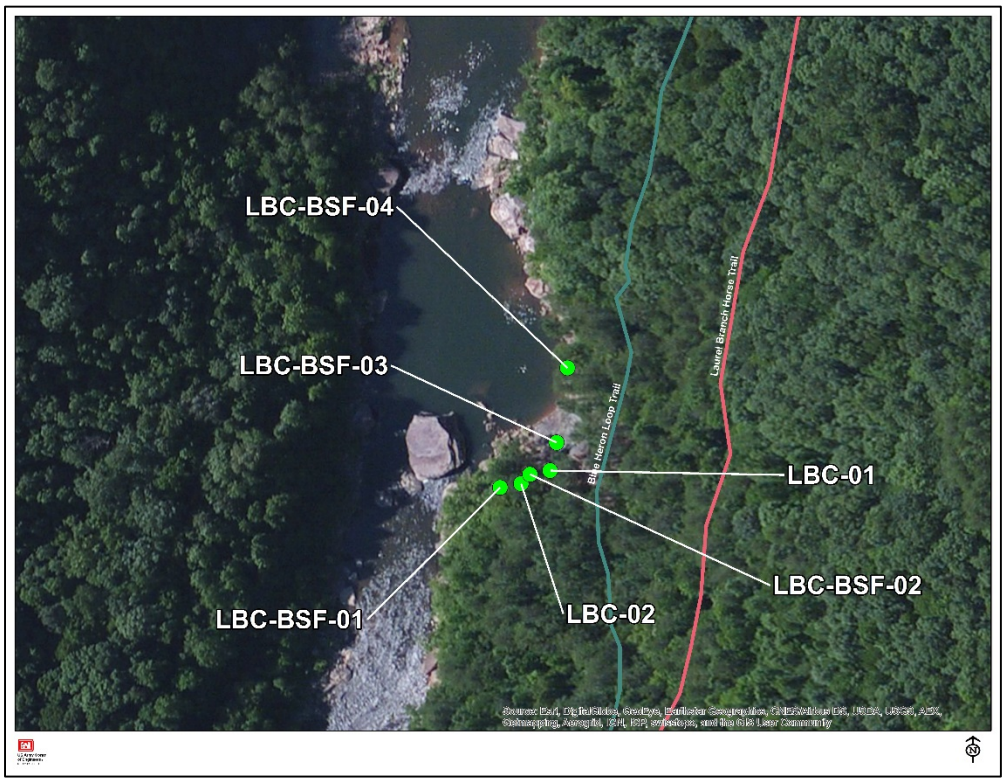


Figure 7. Location of Laurel Branch Confluence water quality sample points collected December 15, 2014.

2.1.3 Blue Heron Spoils (Stream Bank Stabilization)

The Blue Heron Spoils (BHS) site is located on the right descending bank of the BSF approximately 0.70 mile upstream from the Blue Heron Boat Launch Area (Figure 3). This site is approximately 300 feet in length and directly adjacent to the BSF (Figure 8). The site erodes during high flow events, particularly at the toe of the spoil pile. This results in unstable, near vertical slopes, as evidenced by a scarp approximately 75 to 150 feet back from the toe with a vertical displacement of 20-30 feet.

This remediation site would be considered both a water quality improvement site in addition to reducing a sediment source. Water quality field readings and samples were collected from three seeps on December 16, 2014 to gather baseline conditions of BHS (Table 4).

Table 4.Blue Heron Spoils seeps water quality field data observed on December 16, 2014.

Station ID	Temp. (^{0}F)	DO mg/l	Sp Cond (*u* mho/cm)	pH	Tot Alk. (mg/l)
BHS-01	58.1	5.4	6735	2.3	0
BHS-02	48.7	5.6	3954	2.4	0
BHS-03	52.9	10.1	1410	2.6	0

Figure 8. Depiction of relic coal mine spoils which introduces contaminated coal spoils and sedimentation into the Big South Fork River.

As shown in Table 4 above field data varied across the site. Additional water quality measurements were taken along the shoreline (Figure 9) of the BSF to gather baseline conditions on influences of seeps on near shore habitat (Table 5). This data varied dramatically due to mixing of seepage with BSF flows. Additional information pertaining to water quality is discussed in detail in Section 3.2.2 of this document.

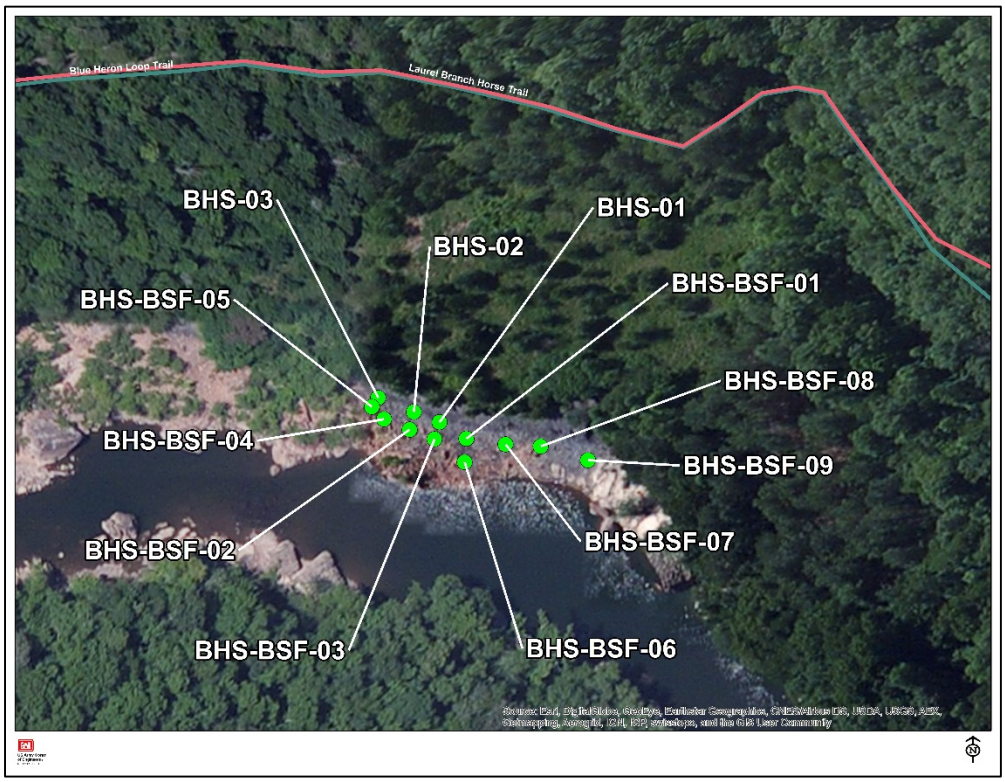


Figure 9. Blue Heron Spoils water quality sample points collected on December 16, 2014.

Table 5.Blue Heron Stream Spoil field measurements along the Big South Fork shoreline measured December 16, 2014.

Station ID	Temp. (^{0}F)	DO mg/l	Sp Cond (*u* mho/cm)	pH
BHS-BSF-01	43.7	12.1	170	3.8
BHS-BSF-02	41.4	12.3	81	6.5
BHS-BSF-03	41.7	12.3	86	6.7
BHS-BSF-04	41.7	12.3	91	5.7
BHS-BSF-05	41.9	12.1	345	4.1
BHS-BSF-06	41.5	12.2	199	4.8
BHS-BSF-07	41.5	12.1	413	3.8
BHS-BSF-08	41.5	12.3	90	6.5
BHS-BSF-09	41.5	12.3	86	6.7

2.1.4 Devils Jump Settling Pond

The Devils Jump Settling Pond (DJSP) site is located on the northern side of the BSF approximately 0.60 miles upstream from the Blue Heron Boat Ramp Area (Figure 3). Two wetland areas (totaling approximately 0.10 acres) have been identified within the project site. To aid in discussion, the wetland area was split into two separate parts –

Upper Pond (approximately 0.060 acres) and Lower Pond (approximately 0.040 acres). Figure 10 is a photograph of the upper pond and berm which separates the upper and lower ponds/wetlands. According to NPS staff, the wetland/ponds were originally built for sediment retention by the Corps during earlier Blue Heron site restoration associated with establishment of the park in the 1970's.

Figure 10. Relic coal mine spoil located between the upper and lower wetland/pond areas at the proposed remediation site, Devils Jump Settling Pond.

The lower pond/wetland has been filled with sediment as a result of up-gradient mine spoil. The outflow channel of the lower pond is crossed by the BHLT. Water quality data and samples, as shown in Figure 11, were taken December 16, 2014 to gather baseline conditions of DJSP (Table 6). Additional information pertaining to water quality is discussed in detail in Section 3.2.2 of this document.

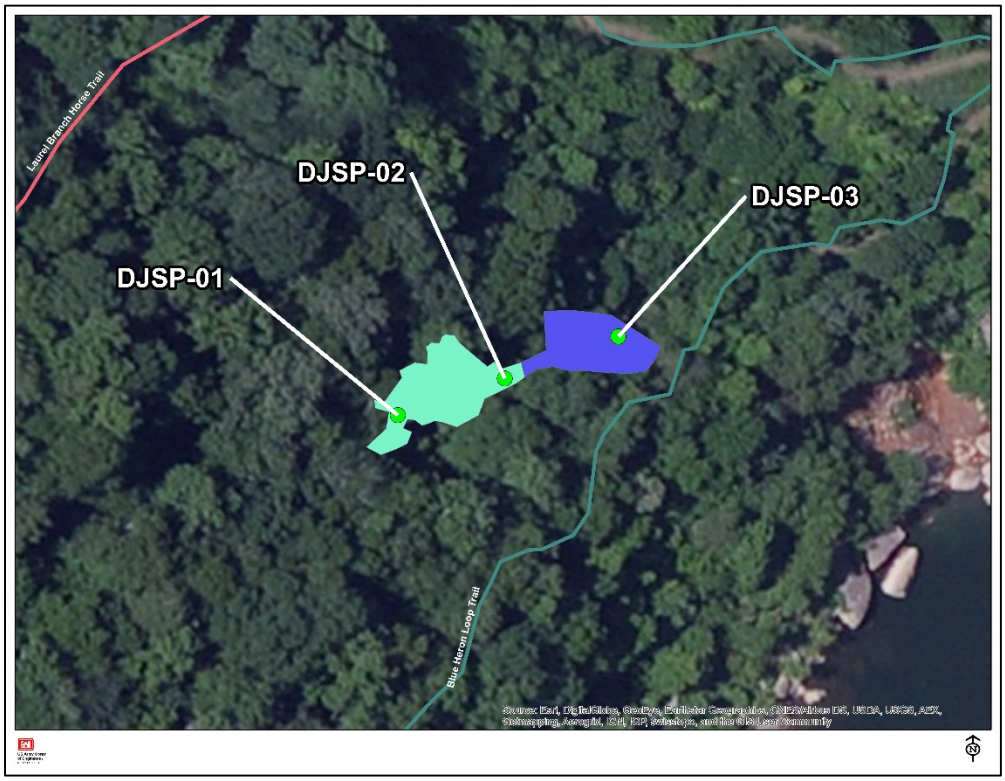


Figure 11. Devils Jump Settling Pond water quality sample points collected on December 15, 2014.

Table 6. Devils Jump Settling Pond water quality field data observed on December 15, 2014.

Station ID	Temp. (^{0}F)	DO mg/l	Sp Cond (*u* mho/cm)	pH	Tot Alk. (mg/l)
DJSP-01	46.6	2.8	170	6.1	12
DJSP-02	45.1	5.0	209	5.5	7
DJSP-03	45.7	11.3	311	3.6	0

2.1.5 Unnamed Tributary 1 Stream Crossing

Unnamed Tributary 1 Stream Crossing (UT1SC) site is located on the right-descending bank of the BSF approximately 1.2 miles upstream from the Blue Heron Boat Ramp Area (Figure 3) and crossed by the BHLT. Figure 12 is a photograph of the stream.UT1SC, approximately 1857 feet in length, is a sandstone channel with coatings of “yellow boy” precipitate throughout the channel.

Figure 12. Presence of “yellow boy” throughout the entirety of Unnamed Tributary 1 Stream Crossing remediation site.

Historic mining operations in this drainage basin have left spoil piles alongside slopes and within the stream channel. The influence of deep mine discharge is unknown but based on discussions during the inter-agency site visit, there is a good likelihood that much of the stream flow and metal loadings originates from a deep mine discharge and not from contacting spoil piles. Water quality measurements taken December 15, 2014 to gather baseline conditions of UT1SC are listed in Table 7. Stations are listed from upstream to downstream and the influence of the suspected deep mine discharge is apparent between stations UT1SC-02 and UT1SC-03 (Figure 13). Additional information pertaining to water quality is discussed in detail in Section 3.2.2 of this document. Note pH decreasing and alkalinity being depleted due to suspected deep mine discharge. Based on the potential influence of the deep mine discharge, channel-lining would result in minimal benefits.

Table 7. Unnamed Tributary 1 Stream Crossing water quality field data observed on December 16, 2014.

Station ID	Temp. (^{0}F)	DO mg/l	Sp Cond (*u* mho/cm)	pH	Tot Alk. (mg/l)
UT1SC-01	47.3	11.3	27	6.4	6
UT1SC-02	47.1	11.4	32	5.9	6
UT1SC-03	47.1	11.2	202	3.7	0

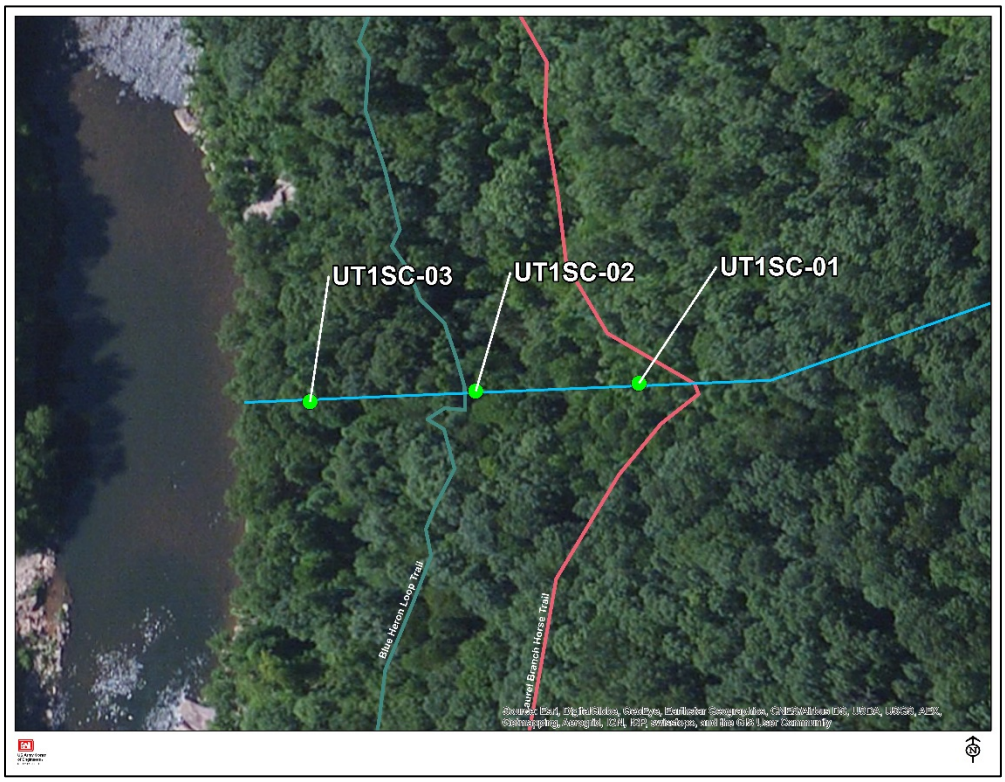


Figure 13. Unnamed Tributary 1 Stream Crossing water quality sample points collected on December 16, 2014.

2.1.6 Unnamed Tributary 2 Stream Crossing

Unnamed Tributary 2 Stream Crossing (UT2SC) site is located on the right descending bank of the BSF approximately 1 mile upstream from the Blue Heron Boat Ramp Area (Figure 3) and crossed by the BHLT. A photograph depicting stream characteristics is shown in Figure 14.

Figure 14. Depiction of the existing conditions of the proposed remediation site, Unnamed Tributary 2 Stream Crossing.

Historic mining operations in this drainage basin have left spoil piles alongside slopes and within the stream channel. As a result, approximately 1200 feet of UT2SC is impacted by mine spoil piles. Water quality observations were taken by NPS personnel in March 2014 to gather baseline conditions of UT2SC (Table 8). Influence of deep mine seepage is unknown. The field measurements show only a relatively minor impact from spoil piles. See section 3.2.2 for information regarding water quality.

Table 8. Unnamed Tributary 2 Stream Crossing water quality field data observed by National Park Service personnel in March 2014.

Station ID	DO mg/l	Sp Cond (*u*mho/cm)	pH
UT2SC-01	10.6	40.6	6.2
UT2SC-02	10.9	40	6.1
UT2SC-03	10.4	40	5.9
UT2SC-04	10.7	57.4	5.6

2.1.7 Unnamed Tributary 3 Concrete Lined Stream

Unnamed Tributary 3 Concrete Lined Stream (UT3CLS) site is located on the right-descending bank of the BSF approximately 0.80 mile upstream from the Blue Heron Boat Ramp Area (Figure 3). Water discharges from a deep mine just below the LBHT, through a culvert, and flows down to a short section of concrete-lined channel (approximately 200 ft) then follows an obvious realigned channel until it reaches the BSF. The concrete-lined and realigned channel section is believed to have been constructed in the 1970s when the Corps was stabilizing the adjacent BHS. The realigned channel would have been intended to reduce water interactions with the BHS site spoil material. The resulting channel is unstable and eroding in several areas as it flows towards the BSF adding to the sediment loads of the BSF. As a result, approximately 672 feet of UT3CLS is impacted by historic mining activities (Figure 15). The stream exhibits initially depressed pHs, increased acidity, and increased metal concentrations during base flow but recovers to acceptable levels in the downstream station (UT3CLS-02). The predominance of eroding banks contributes sediment to the tributary and ultimately the BSF. Water quality measurements, locations shown on were taken December 16, 2014 to gather baseline conditions of UT3CLS (Table 9). Additional information pertaining to water quality is discussed in detail in Section 3.2.2 of this document.

Figure 15. Depiction of the existing conditions at the end of the concrete lined section of the proposed remediation site, Unnamed Tributary 3 Concrete Lined Channel.

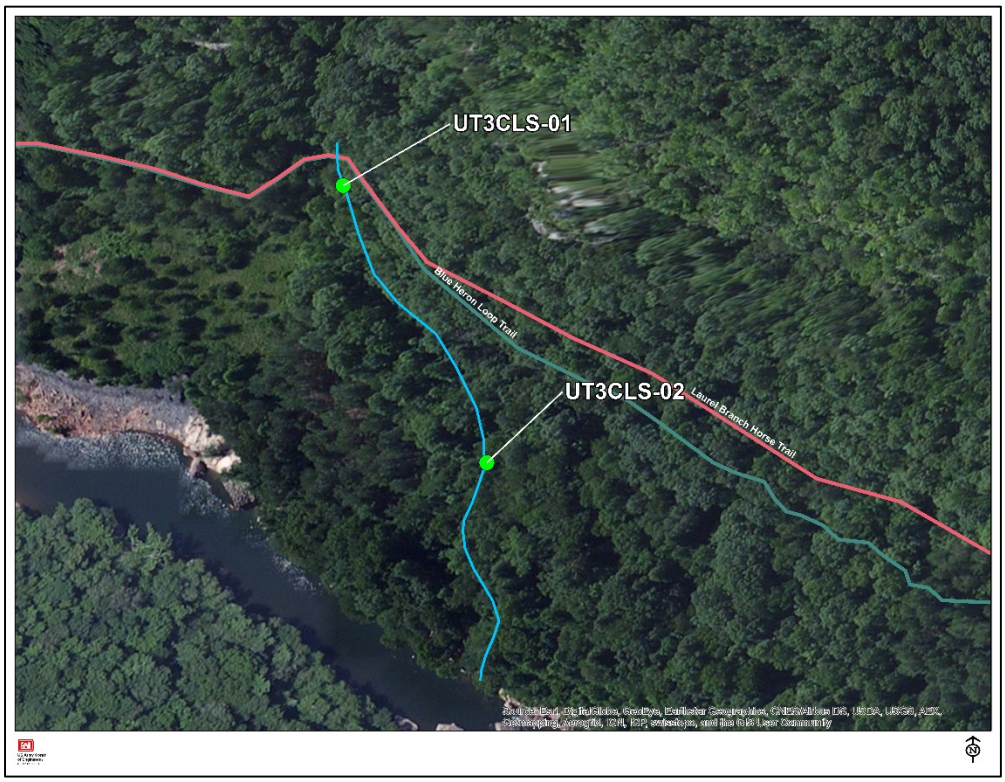


Figure 16. Unnamed Tributary 3 Concrete Lined Channel water quality sample points collected on December 16, 2014.

Table 9. UT3CLS Water Quality Data taken December 2014.

Station ID	Temp. (^{0}F)	DO mg/l	Sp Cond (*u* mho/cm)	pH	Tot Alk. (mg/l)
UT3CLS-01	45.9	11.5	17	5.1	4
UT3CLS-02	45.3	11.4	32	6.7	6

2.2 Remediation Sites Eliminated from Detailed Evaluation

As described previously, seven remediation sites were initially considered by the NPS, FWS, and the Corps. To fulfill the commitments of the ITS, the Corps is obligated to perform two water quality improvement projects and at least one sediment/aquatic habitat improvement project. Based on discussions of the inter-agency site visit that included staff from the KDAM, NPS, FWS, and Corps, four of the seven sites were eliminated from detailed evaluation due to reasons discussed in this section. This included sites: LBSS, LBC, UT1SC, and UT2SC. Although LBSS and LBC are specifically mentioned in the ITS and BO as proposed remediation site further investigations determined that these were not acceptable and were eliminated. All sites that are carried forward in this EA would provide at least equal or greater benefits to the conservation and recovery of the duskytail darter.

Access Route 2

Access route 2 is the logical route for reaching the LBSS, LBC, UT1SC, and UT2SC sites. It involves improving portions of the LBHT and the BHLT (Figure 11). Laurel Branch Horse Trail would be accessed from an unimproved road off the Kentucky 742 via an existing NPS right-of-way. Approximately 1.29 miles of the LBHT and 0.61 miles of the existing BHLT would be impacted during remediation construction activities if Access Route 2 was utilized. Access Route 2 would require a stream crossing of Laurel Branch at the LBHT as well as extensive trail upgrades at numerous wet or boggy areas. Crossing of smaller unnamed tributaries would also be needed. Access Route 2 would require major upgrades to the existing hiking trail as it descends steeply to the river. The cost of improving the access to these sites in conjunction with the environmental impacts of remediation construction plus the costs considerations for hauling materials to/from the sites were key considerations in removing these sites and Access Route 2 from further consideration. Additional site specific factors are included in the narrative below.

Figure 17. Depiction of Access Route 2 considered for Laurel Brach Stream Spoil, Laurel Branch Confluence, Unnamed Tributary 1 Stream Channel, and Unnamed Tributary 2 Stream Channel.

LBSS

LBSS water quality data showed the stream is somewhat stable with acceptable water quality levels (pH, DO, and Sp Cond). LBSS would provide little net ecological improvement or beneficial water quality effects, and would not address a sediment source to the BSF; therefore, this site was dropped from further review. One action discussed during the inter-agency meetings was possibly periodically dosing the stream with limestone fines to improve buffering capacity of Laurel Branch and polish water quality conditions before it enters the BSF.

LBC

As shown in Section 2.1.2, water quality data shows that seeps from LBC have relatively low pH when compared to BSF pH levels. However, based on discussion with the NPS and review of possible access routes, the environmental impacts of constructing suitable access would be extremely high if LBC was selected. Access to/from LBC would require significant road (LBHT) improvements, including a stream crossing of Laurel Branch, tree removal, and to meet Corps safety requirements a significant amount of cut/fill to construct the access road to an acceptable slope. Although LBC is in need of restoration, access-related environmental impacts are too great to pursue at this time. Therefore, LBC site was dropped from further consideration.

UT1SC

Restoration of UT1SC would have minimal temporary ecological improvement, would have no benefit to reducing sedimentation, or improving water quality in the BSF. Since the discharge from the deep mine would require different treatment techniques to prevent yellow-boy from forming in the tributary, it was considered beyond the scope of what could be implemented as part of the BO. Access to/from UT1SC would also require significant access road improvements. Since limestone channel-lining would produce only minimal temporary ecological lift and little beneficial water quality effects to BSF, and access to/from the site would be difficult and result in moderate environmental impacts for access improvements, UT1SC was ruled out from further review. To address this site, capture of the deep mine discharge prior to aeration of the water would be needed to prevent yellow-boy from forming in the tributary.

UT2SC

UT2SC water quality data showed the stream is somewhat stable with acceptable water quality levels (pH, DO, and Sp Cond). Remediation measures through channel lining with limestone at UT2SC would have no ecological improvement or beneficial water quality effects, and would not address a sediment source to the BSF; therefore, this site was dropped from further review. Table 10 provides an overview of site screening analysis.

Table 10. Remediation Site Screening Analysis

SITES	LIFTS		ACCESS AND ENVIRONMENTAL IMPACTS	FURTHER REVIEW WARRANTED
	ECOLOGICAL/WATER QUALITY	SEDIMENTATION REDUCTION		
LBSS	LOW	LOW	ACCESS DIFFICULT ENVIRONMENTAL IMPACT HIGH	NO
LBC	HIGH	HIGH	ACCESS EXTREMELY DIFFICULT ENVIRONMENTAL IMPACT HIGH	NO
BHS	HIGH	HIGH	ACCESS MODERATE ENVIRONMENTAL IMPACT MINOR	YES
DJSP	HIGH	LOW	ACCESS MODERATE ENVIRONMENTAL IMPACTS MINOR	YES
UT1SC	TEMPORARY	NO	ACCESS DIFFICULT ENVIRONMENTAL IMPACT MODERATE	NO
UT2SC	NO	NO	ACCESS DIFFICULT ENVIRONMENTAL IMPACT HIGH	NO
UT3CLS	LOW	MEDIUM	ACCESS MODERATE ENVIRONMENTAL IMPACT MODERATE	YES

2.3 Access Routes for Sites Carried into Detailed Evaluation

The sites proposed for CMD remediation are relatively remote without improved roads available for access. The proposed remediation actions would require improving the access routes leading to project sites. The access routes are primarily sited along existing trails and/or former mining/timber roads. Figure 12 shows the probable access routes to the three remediation sites (BHS, DJSP, and UT3CLS) that have been carried forward for design.

BHS, DJSP, and UT3CLS sites would be accessed from the Blue Heron Boat Ramp parking area via the existing LBHT and for DJSP, a short portion of BHLT. Detailed plans can be found in Appendix B. The parking lot closest to the Blue Heron Boat Ramp would be used for staging of construction equipment (Figure 13). A canoe access detour path would be provided along one side of the proposed staging area. To allow for boater access the canoe access detour path would be a minimum of eight feet

wide to allow boaters to safely transport boats (canoes, rafts, etc.) to and from the BSF. A construction security fence would be installed around the proposed staging area to separate recreational users from construction activities ensuring public safety.

The proposed remediation sites access route (road) would be constructed to meet the Corps and NPS safety regulations and would be no greater than 15 feet in width (unless the route currently exceeds 15 feet in width). Following the completion of the proposed remediation measures, the proposed access route would be restored to the existing width (per NPS trail standards) however, gravel and rock placed for surface improvements may be left within the trail surface and/or removed and hauled to an designated area approved by the NPS. The improved path would be reshaped and graded to no greater than 8 feet in width per the NPS trail standards. Side banks would be replanted using the NPS recommended planting list of native plants. During construction, temporary erosion control measures would be installed on these access roads and trails. A need for continued Operation and Maintenance access to the BHS and DJSP sites is not anticipated.

The proposed access route is divided into three different sections (Section A, B, and C) in order to discuss improvements required in more detail.

Section A is comprised of the existing LBHT which follows the former railroad grade. A few sections of the existing trail would need to be widened to no greater than 15 feet to allow construction equipment access to/from the site. Section A is approximately 0.47 miles long. In order to widen the trail, minor tree removal would be required. Tree species included but are not limited to: tulip popular (*Lirodendron tulipifera*), oak species (*Quercus spp.*), hickory species (*Carya spp.*), and maple species (*Acer spp*.). Section A would also include the removal of one shagbark hickories (*Carya ovata*) and three snags along LBHT. These species exhibit the criteria specified by FWS to be considered summer roost habitat for the Indiana (*Myotis sodalis*) and northern long-eared (*Myotis septentrionlis*) bats. See Section 3.5.4 for future details regarding the Indiana and northern long-eared bat summer roost habitat and coordination with the FWS.

In addition to widening Section A, up to three pull-outs would be constructed along Section A. Pull-outs would allow for two way traffic to and from the proposed project sites and would reduce additional widening of the entire section. Each pull-out would be created the same as the remainder of the trail. Each pull out location was selected in a manner to reduce environmental impact. In addition to aid in reducing impacts to mature trees within and surrounding the pull-out areas a limitation of tree diameter would be applied without additional review and coordination.

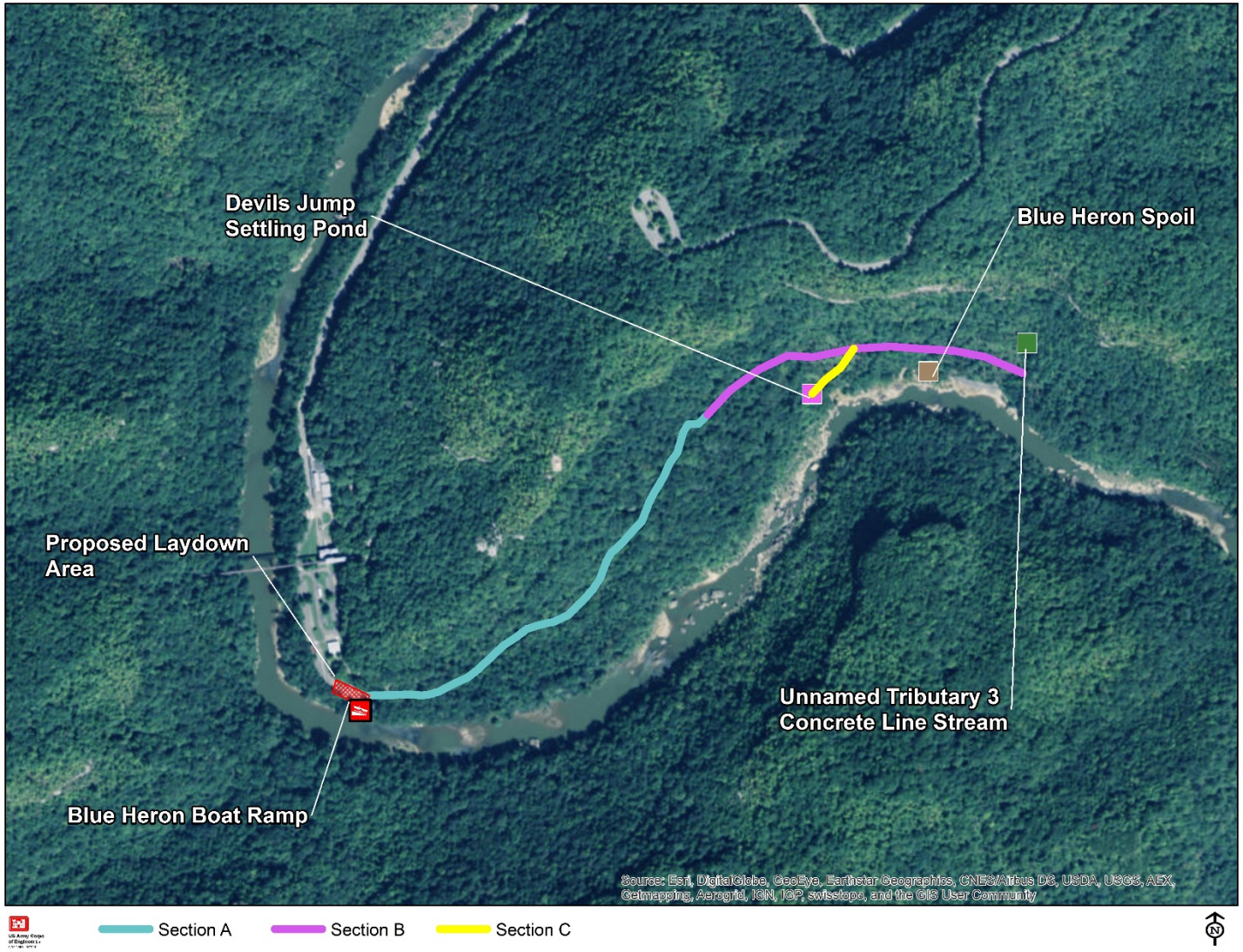


Figure 18. Proposed access routes required to access the proposed remediation projects.

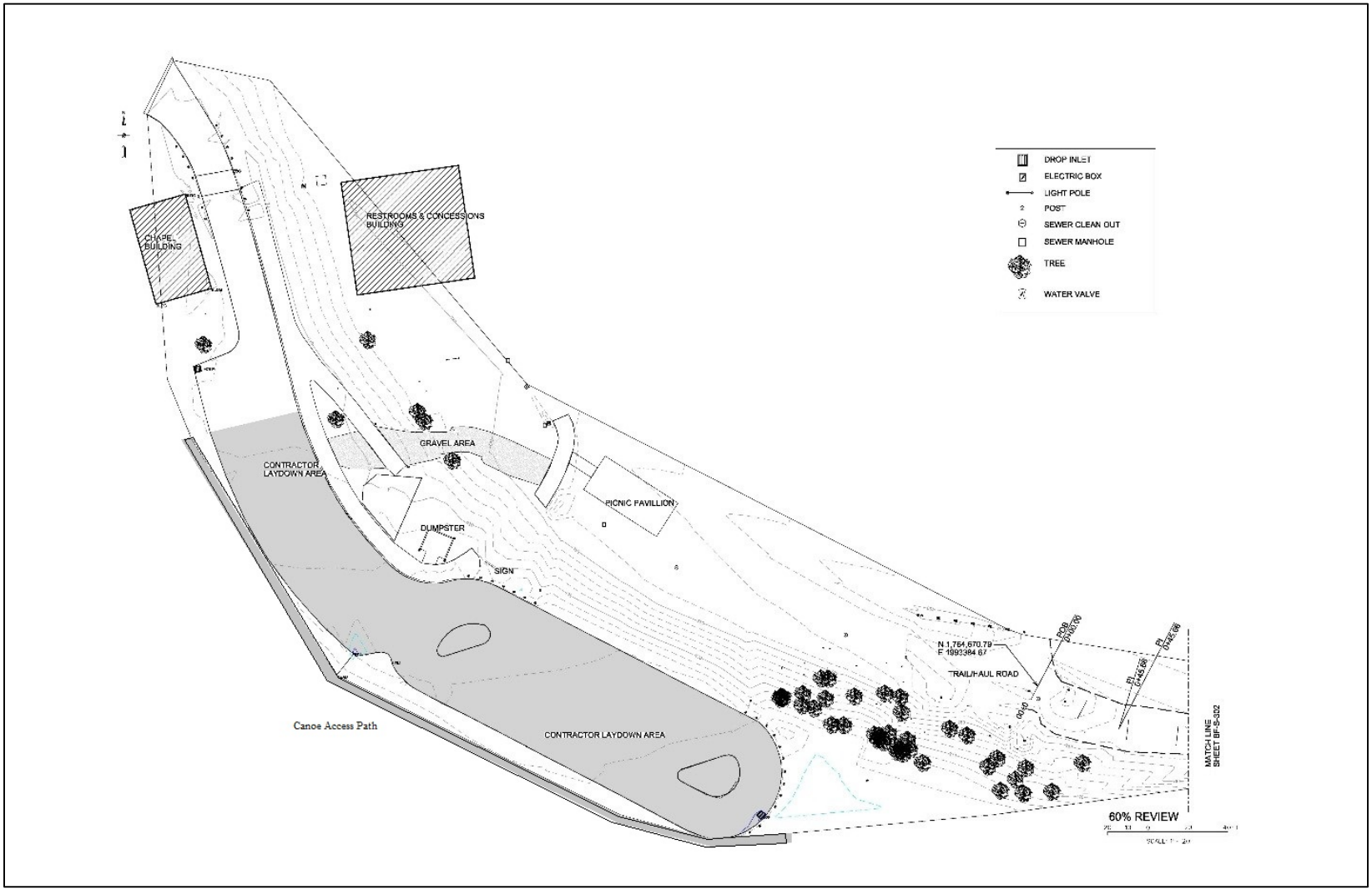


Figure 19. Proposed contractor laydown area within Blue Heron Mine Community.

Section B, approximately 0.34 miles long, would follow an old access route that was used during the stabilization of DJSP and BHS in the 1970's and would end at UT3CLS project location. The majority of this section is comprised of old field growth with small diameter at breast height (DBH) ash species (*Fraxinus spp.*) and maple species (*Acer spp.*). The section would require minor grading and tree removal. However, there is a short (200 linear foot section) that is within an old growth forest. This section is comprised mainly of tulip popular, hemlock (*Tsuga canadensis*), oak species, and hickory species. None of the trees within Section B meet the criteria specified by FWS to be considered summer roost habitat for the Indiana and/or northern long-eared bat. See Section 3.5.4 for further details on summer roost habitat descriptions specified by FWS guidance. No impacts to federally listed bat species would be anticipated by improving Section B. A staging area would be constructed within the former BHS area to facilitate construction activities.

Section C would follow a short portion of the existing BHLT from Section B back to the DJSP site. Similar to Sections A and B, Section C would need to be widened no greater than 15 feet to allow construction equipment to access DJSP. Based on multiple site visits no potential Indiana and/or northern long-eared bat summer roost habitat is present as no trees meeting the criteria for summer roost habitat per FWS are located within Section C. Tree species within the project footprint consist of eastern hemlock, tulip popular, and maple species. No impacts to federally listed bat species would be anticipated by improving Section C. Section C would require minor re-grading of the existing BHLT and reconstruction of the bridge over the pond outlet (per NPS standards). Section C is approximately 0.06 miles long.

All trees that would be removed would be cut as close to the ground as possible, roots would be left in place when possible to reduce soil disturbance, and trees felled and scattered throughout the adjacent forested areas.

2.4 Alternative Descriptions

Five alternatives are discussed in detail below. The alternatives include: Alternative 1 – No Action, Alternative 2 - BHS, Alternative 3 – DJSP, Alternative 4 – UT3CLS, and Alternative 5 – Combination of BHS, DJSP, and UT3CLS. This Section considers BHS, DJSP, and UT3CLS as measures that may be built separately or independent of one another and therefore are evaluated separately under NEPA to allow more flexibility for schedule or funding levels which could impact the order of construction. However, only Alternative 5 meets the Corps ESA commitment under the ITS by providing two water quality and one sediment reduction projects and is the Environmentally Preferred Plan.

All proposed alternatives described below would not require any compensatory mitigation for impacts to streams and/or wetlands. However, to meet the Terms and

Conditions of the ITS and associated BO, the Corps is required to produce a monitoring plan and to monitor the site once construction is completed. In addition to monitoring the project post construction, areas disturbed (i.e. LBHT, BHLP, and areas within the proposed project footprint) would be restored and planted with native species. A copy of the monitoring plan which includes; replanting disturbed areas and specifics on post construction monitoring can be found in Appendix A. In the chance that the proposed project does not meet the criteria set forth by the ITS and associated BO (water quality improvement and/or sediment reduction), the Corps would not be allowed to return Lake Cumberland and Wolf Creek Dam to normal operation and would be required to re-consult with the FWS on the path forward.

2.4.1 Alternative 1 – No Action

Water quality of tributary streams within the project area is considered poor but varies between tributaries. Under the no action alternative, remedial actions would not be implemented to improve water quality or sediment abatement within the project area. If the no action alternative is selected, CMD would continue to erode/contribute to the poor water quality and unstable channels of streams, surface waters, and ultimately the BSF itself. In addition, the Corps would not be in compliance with the requirements of the ITS (and the ESA).

2.4.2 Alternative 2 – BHS

Alternative 2 – BHS would involve bank stabilization by riprapping approximately 300 linear feet of the BSF stream bank. Construction of Alternative 2 – BHS would follow the steps outlined and discussed below.

Access Route Improvement

In order to access BHS site, portions of the existing LBHT would require minor modifications and temporary improvements (See Section 2.3 for further details). Installation of devices according to the State of Kentucky Best Management Practices (BMPs) to minimize and control sedimentation and erosion would be done prior to any construction activities.

Excavation of Spoil Material/Sloping of the Existing Bank

The existing banks (mostly spoil material) would be cut back to a 2:1 (horizontal: vertical) slope. This would require the removal of approximately 3,250 cubic yards of spoil material. This cut material would come from a zone along the top of the existing vertical scarp as illustrated in Figure 20 and detailed plans of the site.

On November 18, 2015, a composite sample of material to be excavated was collected within the cut zone and analyzed per the toxicity characteristic leaching procedure (TCLP) to help determine ultimate disposal options for the material. The TCLP test indicated that the material does not exhibit the characteristics of a hazardous waste, and the excavated material is not required to be disposed of at a Resource Conservation and Recovery Act landfill. Rather the material may be disposed of at a solid waste (commercial) landfill as a special waste (contingent on state and landfill approval of special waste). The nearest landfill is the Volunteer Regional Landfill located in Scott County, Tennessee.

Seep(s) Water Quality Improvement Measures

In order to help address seeps located throughout the length of BHS, approximately 612 tons of dense grade aggregate (DGA) crushed limestone would be placed along the entirety of BHS. Prior to placing the DGA crushed limestone, filter fabric material would be placed on the spoil face to allow water to percolate through the filter fabric and DGA crushed limestone. The DGA crushed limestone would be a onetime application and may eventually lose buffering effectiveness of improving pH as limestone is dissolved or coated with reaction products. However, the rate and timeframe of buffering is unknown.

Placement of Riprap for Stabilizing Bank

Approximately 10,428 tons of Kentucky transportation cabinet (KYTC) Class III Limestone Riprap would be placed at a 2:1 (horizontal: vertical) slope. Alternative 2 – BHS plans can be found in Appendix B. Alternative 2 would be monitored for stability and near shore water quality improvements.

2.4.3 Alternative 3 – DJSP

Alternative 3 would include the conversion of the lower pond to a meandering stream through a limestone-lined outlet channel to the BSF floodplain. As discussed in Section 2.1.4, DJSP consists of two depressional wetlands (Upper and Lower Pond) totaling approximately 0.10 acres. Construction activities would primarily take place within the dividing berm of the Upper Pond and the Lower Pond. This dividing berm appears to consist of compacted spoil material.

Vegetation Clearing and Access Route Improvement

In order to access DJSP, portions of the existing LBHT and BHLT would require temporary improvements (See Section 2.3 for details). Installation of BMPs to reduce sedimentation and erosion would be installed prior to any construction activities. Most

of the access is described previously for accessing the BHS site. Alternative 3 would require additional modifications to approximately 0.06 miles of the BHLT as shown in Figure 18. To aid in construction and improvement of the habitat within the new channel and wetland area, a few trees previously removed would be used. All remaining trees would be either scattered throughout the adjacent forested area or hauled off to an approved disposal site.

Protection of the Upper Pond

In order to maintain the hydrology within the upper pond temporary water retention structures such as sand bags, clay berm, and/or coffer dam would be installed just above the spillway and excavation areas. These structures would be monitored during construction to insure the hydrology of the upper pond is not altered. Following completion of construction activities at DJSP, all temporary retention structures would be removed.

Excavation of Spoil Material

Prior to excavation of the spoil material, the lower pond area would be dewatered. The dewatering of the lower pond would follow applicable Kentucky Division of Water (KDOW) regulations and permit conditions. Approximately 420 cubic yards of spoil material, located between the upper and lower ponds, would be removed to an elevation of 770 feet. In addition to the spoil material removed between the upper and lower ponds, approximately 600 cubic yards of spoil material would be excavated to an elevation of 770 feet at the outlet of the lower pond. A key construction consideration is to maintain the water level in the upper pond/wetland. This would be monitored during construction and reestablished in a timely manner with the use of temporary measures such as sand bags or equivalent techniques. The existing lower pond outlet culvert would be removed as well and following construction would be replaced with a span bridge constructed in accordance with NPS trail specifications since this serves as a portion of the BHLT.

The TCLP sample that was described in the BHS section also included an aliquot of the DJSP material to be excavated. The TCLP test indicated that the material does not exhibit the characteristics of a hazardous waste, and therefore disposal may be at a solid waste (commercial) landfill as a special waste as noted above for the previous site.

Creation of a Limestone Lined Stream Channel from the DJSP Outlet of the Upper Pond to the BSF

Following installation of BMPs, dewatering the lower pond, and removal of spoil material from the identified locations, a new channel and spillway (discussion to follow) would be

constructed from the outlet of the upper pond to the BSF floodplain. This channel would be approximately two feet in depth with a bottom width of three feet. The banks (mostly spoil material within the lower pond) would be cut back to a 2:1 (horizontal: vertical) slope making the top of bank approximately 11 feet in width. Approximately 330 tons of KYTC Class II riprap (minimum of 9 inches) would be placed throughout the stream to line the stream banks and channel bottom. In-stream features such as logs, larger stones, step pools, and different sized gravels would be placed throughout the channel length to provide additional aquatic habitat. The remaining wetland surrounding the newly created channel (former portions of lower pond) would be replanted with native saplings and/or herbaceous species suitable for anaerobic conditions. The lower most portion of the stream naturally braids and percolates into the floodplain. The new limestone-lined channel would be tied into this braided portion and would end above the ordinary high water mark of the BSF. The new channel would be constructed to handle typical high flow events of the BSF.

Installation of a Limestone Spillway between the Upper Pond and the New Riprap Lined (Former Lower Pond) Stream Channel

Once spoil material is excavated approximately 210 tons of DGA crushed limestone would be placed at a 2:1 (horizontal: vertical) slope to create a suitable base for the spillway. To insure the hydrology within the upper pond is not altered a clay wedge would be constructed within the limestone spillway. This would aid in the reduction of water seeping through the limestone spillway. Prior to placing the DGA crushed limestone, filter fabric material would be placed to allow water to percolate through the filter fabric and DGA crushed limestone.

Approximately 248 tons of KYTC Class II Riprap would be placed at a 2:1 (horizontal: vertical) slope. Alternative 3 – DJSP plans can be found in Appendix B. The spillway is intended to control water at an elevation of approximately 772.5 feet to avoid lowering water levels in the upper pond. The spillway would overtop and flow through the newly construction limestone riprap lined channel.

Replanting of Wetland Areas surrounding the Newly Created Limestone Lined Channel

In order to construct the limestone lined channel and spillway, approximately 0.040 acres of wetlands would be impacted in the footprint of the lower pond and immediate fringe. Temporary wetland impacts would occur in the entire lower pond during construction and 0.05 acres would be permanently impacted due to the creation of the limestone lined channel. Temporary wetland impacted areas would be replanted with native saplings and/or herbaceous species suitable for anaerobic conditions and approved by the Corps, NPS, and KDOW.

2.4.4 Alternative 4 - UT3CLS

Alternative 4 – UT3CLS would involve installing limestone step pools to include cross vanes and minor bank and channel stabilization by riprapping in highly degraded areas identified within the stream channel. The channelized section of stream was likely done in the 1970's to route water in the drainage around the adjacent BHS area. Currently, due to the steep stream banks, bank erosion occurs during high flow events. By constructing stone step pools to include cross vanes and placement of riprap along major bank erosional areas water velocities would be lowered and additional erosion and sedimentation loads entering the BSF would be limited. Construction activities would start at the end of the existing concrete-lined channel. Alternative 4 –UT3CLS would follow the steps outlined and discussed below.

Access Route Improvement

In order to access UT3CLS, portions of the existing LBHT and a short section (Section B) of an old access path would require temporary improvements (See Section 2.3 for further details). The old access path is primarily across the BHS site with short segments to access the channel at strategic locations. Installation of BMPs such as but not limited to silt fences, rock check dams, corridor rolls, to reduce sedimentation and erosion would be installed prior to any construction activities. Following construction, areas disturbed would be replanted with NPS approved species.

Placement of Limestone for Stabilizing Bank and Step Pools to include Cross Vanes

Following the installation of BMPs and improvement of channel access points, limestone step pools to include cross vanes would be placed in highly degraded areas identified within UT3CLS. Prior to placing the limestone, a geotextile fabric would be placed. Each limestone step pool would be constructed of approximately 23 cubic yards of KYTC class III riprap.

Banks of UT3CLS are eroding in multiple areas and are introducing sediment into the BSF. During construction, bank erosion areas would be improved by placing limestone riprap along the bank toes. Following the placement of a non-woven geotextile fabric each major bank erosion section would be sloped back to an appropriate slope (typically 2:1 (horizontal: vertical). Additional limestone could be placed in the channel for stabilization, habitat structure, and water quality improvements. Alternative 4 – UT3CLS plans can be found in Appendix B. Stream banks impacted during the construction of Alternative 4 would be seeded with native herbaceous species approved by NPS and KDOW when possible to aid in bank stabilization.

2.4.5 Alternative 5 – Combination of BHS, DJSP, and UT3CLS (Environmentally Preferred Alternative)

Alternative 5 would include a combination of BHS, DJSP, and UT3CLS Remediation Alternatives described in Sections 2.4.2, 2.4.3, and 2.4.4.The Corps would fund, design, and implement a minimum of two water quality (WQ) and one sediment abatement (SA) projects to improve the affected reach of the BSF. Three sites affected by coal mining (sediment production or CMD) within the Blue Heron vicinity of BISO are required to meet the terms and conditions of the ITS. The combination of BHS (both water quality and sediment abatement), DJSP (water quality), and UT3CLS (sediment abatement) remediation measures would reduce CMD and/or sedimentation from entering the BSF and improve water quality conditions (pH, DO, and Sp Cond). Alternative 5 is considered the environmentally preferred plan. The environmentally preferred alternative is the alternative that causes the least damage to the biological and physical environmental and best protects, preserves, and enhances historical, cultural, and natural resources. Detailed project plans for each remediation alternative can be found in Appendix B.

3.0 Affected Environment

3.1 General Overview

This section describes current baseline conditions within the project area, with emphasis on those resources potentially impacted by the proposed project alternatives.

3.2 Air Quality

The ambient air quality in an area can be characterized in terms of whether it complies with primary and secondary National Ambient Air Quality Standards (NAAQS).The Clean Air Act (CAA) required U.S. Environmental Protection Agency (EPA) to set NAAQS for pollutants considered harmful to public health and the environment. NAAQS are provided for seven principal pollutants, called criteria pollutants (as listed under Section 108 of the CAA), including the following:

- Carbon monoxide;
- Lead;
- Nitrogen dioxide;
- Ozone;
- Particulate matter with an aerodynamic size less than or equal to 10 micrometers;
- Particulate matter with an aerodynamic size less than or equal to 2.5 micrometers; and
- Sulfur dioxide.

These pollutants are believed to be harmful to public health and the environment, or are known to cause property damage. National primary and secondary ambient air quality standards have been established for each criteria pollutant.

Areas are designated as "attainment", "nonattainment", "maintenance", or "unclassified" with respect to the NAAQS. General air quality monitoring is conducted in areas of high population density and near major sources of air pollutant emissions. Rural areas are typically not considered in such monitoring. Regions that are in compliance with the standards are designated as attainment areas. Areas for which no monitoring data is available are designated as unclassified, and are by default considered to be in attainment of the NAAQS. In areas where the applicable NAAQS are not being met, a nonattainment status is designated (EPA 1999). McCreary County is currently classified by the EPA as being in attainment for all criteria pollutants.

3.3 Aquatic Resources

Protection and management of water resources within BISO is mandated by numerous laws, regulations, and guidance. Water resources management is governed by one of the following categories: specific federal legislature; other federal legislature; state legislature; and National Park Service guidelines. Water resources within the project area are managed according to these and other applicable environmental laws and NPS regulations (NPS 2005).

3.3.1 Surface Water and Watersheds

The Big South Fork watershed covers approximately 718,720 acres primarily in Fentress and Scott Counties, Tennessee and McCreary County, Kentucky with smaller areas of Anderson, Campbell, Morgan and Pickett Counties, Tennessee.

The project area is located along an approximately 2-mile stretch of the BSF in McCreary County. As shown in Figure 3, the largest tributary of the BSF in the project area is Laurel Branch.

3.3.2 Water Quality

3.3.2.1 Regional Water Quality

The South Fork Cumberland River Watershed (05130104) was categorized by KDOW as Category I - Watersheds in Need of Restoration. Rivers and streams within this watershed were listed as "impaired", "not impaired" or "threatened"; the BSF was listed as "not impaired". The Roaring Paunch Creek, which flows into the BSF just below the project area, was listed as "impaired". Smaller tributary streams, such as those included in the proposed project, were not included in the Unified Watershed Assessment (NPS 2001).

3.3.2.2 Project Area Water Quality

Surface waters in the project area are impacted by CMD. Water quality assessments have been performed by the NPS. A summary of selected parameters are provided in Table 11, Table 12, and Table 13. Table 11 is a range of water quality parameters from May 1996 through April 1997 from locations within the project area. This data was obtained from the preliminary draft EA – Remediation of Selected CMDs.

Table 12 water quality assessment data was obtained from the NPS from the proposed sites on May 19, 2014. The Corps collected additional water quality data (Table 13) to support this EA on December 15-16, 2014. Streams within the project area generally exhibited low pH, low alkalinity, and high conductivity levels. Streams on the Cumberland Plateau are generally low in alkalinity due to the sandstone geology.

pH is defined by EPA as an expression of hydrogen ion concentration in water. pH affects most chemical and biological processes in water, and it is one of the most important environmental factors limiting the distribution of species in aquatic habitats. Different species flourish within different ranges of pH, with the optima for most aquatic organisms falling between pH 6.5-8. Fluctuating pH or sustained pH outside this range reduces biological diversity in streams because it physiologically stresses many species and can result in decreased reproduction, decreased growth, disease, or death. (EPA 2016). Kentucky water quality standards regarding pH, which would be used for the proposed project, is between 6.0-9.0.

Table 11. Range of Water Quality parameter collected by NPS (May 1996 through April 1997) from sites within the project area

Sample Location	Dishcarge (cfs)	pH	Alkalinity	Acidity	Total Iron	Sulfate	Aluminum
LBC	0.005 - 3.02	3.38 - 5.39	<20 - 20	<10 - 78	0.57 - 7.8	<11 - 160	0.08 - 5.6
LBSS	0.03	2.52 - 2.97	-	300 - 1300	11 - 360	67 - 1600	11.0 - 89.0
BHS	0.035 - 0.40	2.40 - 2.99	-	280 - 5000	8.1 - 1,700	580 - 9,600	8.6 - 480

Table 12. Water Quality Assessment for the Proposed Project Locations, NPS data from 2014.

SITE ID	ELEVATION (m)	DATE	pH	CONDUCTIVITY	DO
LBSS	288.39	19-Mar-14	5.8	32.3	10.5
LBSS	282.5	19-Mar-14	5.8	33.1	10.6
LBSS	282.01	19-Mar-14	5.8	28.7	10.7
LBSS	271.91	19-Mar-14	4.9	40.1	10.6
LBSS	267.17	19-Mar-14	5	50	10.3
LBC	251.29	19-Mar-14	2.5	1380	6.4
BHS	242.15	19-Mar-14	2.4	1732	10.5
BHS	238.55	19-Mar-14	2.5	1479	9.6
BHS	232.86	19-Mar-14	2.5	1238	3.5
DJSP	255.02	19-Mar-14	6.1	143	10.9
DJSP	257.23	19-Mar-14	5.2	210	6.3
DJSP	256.51	19-Mar-14	4.7	211	9.3
DJSP	248.16	19-Mar-14	3.3	341	10.2
UT1SC	289.95	19-Mar-14	5.8	32.1	10.7
UT1SC	279.3	19-Mar-14	5.6	33	10.5
UT1SC	274.41	19-Mar-14	3.7	183.2	10.6
UT1SC	266.07	19-Mar-14	3.7	191.2	10.3
UT2SC	287.45	19-Mar-14	6.2	40.6	10.6
UT2SC	285.96	19-Mar-14	5.9	40	10.4
UT2SC	288.94	19-Mar-14	6.1	40	10.9
UT2SC	272.87	19-Mar-14	5.6	57.4	10.7
UT3CLS	303.01	19-Mar-14	4.8	23	10.6
UT3CLS	296.73	19-Mar-14	4.6	10.7	19.7
UT3CLS	268.89	19-Mar-14	4.4	30.4	10.6
UT3CLS	265.61	19-Mar-14	4.5	30.1	10.7

* All Sites are listed from uppermost sample point to lowest sample point.

Table 13. Water quality data collected by Corps December 15-16, 2014.

Station ID	Temp. (^{0}C)	Temp. (^{0}F)	DO mg/l	Sp Cond (*u*mho/cm)	pH	Tot Alk.(mg/l)	Phth.Alk.	Lab Alk.	Al	Fe	Mn	Sulfate	Hardness	Chloride	Acidity in Water	Acidity in Water
																Hot Peroxide
									*u*g/L	*u*g/L	*u*g/L	mg/L	mg/L	mg/L	mg/L	mg/L
BHS-01	14.5	58.1	5.4	6735	2.3	0	0	0	215000	720000	2130	3150	956	1.08	3000	3300
BHS-02	9.3	48.7	5.6	3954	2.4	0	0	0	91300	404000	1700	1850	552	2.37	2000	1500
BHS-03	11.6	52.9	10.1	1410	2.6	0	0	0	7340	36700	912	506	174	1.46	320	180
BHS-SEEP-01	6.5	43.7	12.1	170	3.8											
BHS-SEEP-02	5.2	41.4	12.3	81	6.5											
BHS-SEEP-03	5.4	41.7	12.3	86	6.7											
BHS-SEEP-04	5.4	41.7	12.3	91	5.7											
BHS-SEEP-05	5.5	41.9	12.1	345	4.1											
BHS-SEEP-06	5.3	41.5	12.2	199	4.8											
BHS-SEEP-07	5.3	41.5	12.1	413	3.8											
BHS-SEEP-08	5.3	41.5	12.3	90	6.5											
BHS-SEEP-09	5.3	41.5	12.3	86	6.7											
BSF at Blue Heron	5.2	41.4	12.5	78	7.3	18	0	20	121	202	13.1	18.9	29.7	2.23	<5	-32

Station ID	Temp. (^{0}C)	Temp. (^{0}F)	DO mg/l	Sp Cond (*u*mho/cm)	pH	Tot Alk.(mg/l)	Phth.Alk.	Lab Alk.	Al	Fe	Mn	Sulfate	Hardness	Chloride	Acidity in Water	Acidity in Water
																Hot Peroxide
									*u*g/L	*u*g/L	*u*g/L	mg/L	mg/L	mg/L	mg/L	mg/L
DJSP-01	8.1	46.6	2.8	170	6.1	12	0	13	117	848	284	31.7	35.5	1.1	9	-35
DJSP-02	7.3	45.1	5.0	209	5.5	7	0	<5	1640	4460	222	105	76.4	1.19	16	-22
DJSP-03	7.6	45.7	11.3	311	3.6	0	0	0	1870	2380	252	138	79.8	1.13	73	7
LBC-01	10.6	51.1	8.3	1388	2.5	0	0	0	19300	60400	887	450	59.2	0.967	570	320
LBC-02	10.7	51.3	9.8	1116	2.6	0	0	0	12300	6880	771	281	47.4	1.07	240	170
LBC-SEEP-01	5.0	41	12.7	77	6.9											
LBC-SEEP-02	5.1	41.2	12.6	80	6.7											
LBC-SEEP-03	5.1	41.2	12.6	80	7.1											
LBC-SEEP-04	5.1	41.2	12.6	78	7.2											
LBSS-01	5.8	42.4	12.0	27	6.8	6	0	<5	37.5	43.9	4.9	13.8	8.04	1.63	<5	-31
LBSS-02	5.8	42.4	11.9	27	6.7	5	0	<5	82	65.9	13.3	6.97	8.43	1.73	<5	-29
LBSS-03	5.9	42.6	12.1	37	5.8	5	0	<5	345	472	38.2	13.1	10.2	1.71	<5	-24
LBSS-04	5.9	42.6	12.1	49	5.8	4	0	<5	374	632	77.9	18.9	13.9	1.76	5	-21
LBSS-05	5.0	41	12.6	75	7.2	16	0	20	120	200	18.4	18.3	27.6	2.18	<5	-34

Station ID	Temp. (^{0}C)	Temp. (^{0}F)	DO mg/l	Sp Cond (*u*mho/cm)	pH	Tot Alk.(mg/l)	Phth.Alk.	Lab Alk.	Al	Fe	Mn	Sulfate	Hardness	Chloride	Acidity in Water	Acidity in Water
																Hot Peroxide
									*u*g/L	*u*g/L	*u*g/L	mg/L	mg/L	mg/L	mg/L	mg/L
UT3CLS-01	7.7	45.9	11.5	17	5.1	4	0	<5	104	25.7	34.2	5.94	3.9	0.918	<5	-10
UT3CLS-02	7.4	45.3	11.4	32	6.7	6	0	<5	102	44.4	12.4	9.55	10.4	0.959	<5	-5
UTSC1-01	8.5	47.3	11.3	27	6.4	6	0	<5	33.4	29.8	5.9	7.61	8.11	1.1	<5	-22
UTSC1-02	8.4	47.1	11.4	32	5.9	6	0	<5	69.8	214	14.7	9.02	8.57	1.12	<5	-31
UTSC1-03	8.4	47.1	11.2	202	3.7	0	0	0	952	12700	371	83.2	26	1.05	69	8

The BSF is classified by the KDOW for the following surface water designated uses (River Mile 55.0 to River Mile 45.0): Warm-water Aquatic Habitat, Primary Contact Recreation, Secondary Contact Recreation, and Outstanding State Water Resource (OSRW; 401 KAR 5:026) and Outstanding National Resource Water (ONRW; 401 KAR 5:030).In addition, the BSF is designated as a Kentucky Wild River (KRS 146.241) from the Tennessee/Kentucky border to approximately the Devil's Jump area (River Mile 55.2 to River Mile 45.5).

3.3.3 Floodplains

Floodplains are generally areas of low, level ground present on one or both sides of a stream channel that are subject to either periodic or infrequent inundation by flood waters. The BSF and its tributaries are deeply incised with limited floodplain development in the project area. Minor floodplains generally occur further downstream, including within some of the proposed project areas. Figure 14 below depicts the 100 year floodplain, described by Federal Emergency Management Agency (FEMA), within the proposed project area of the BISO.

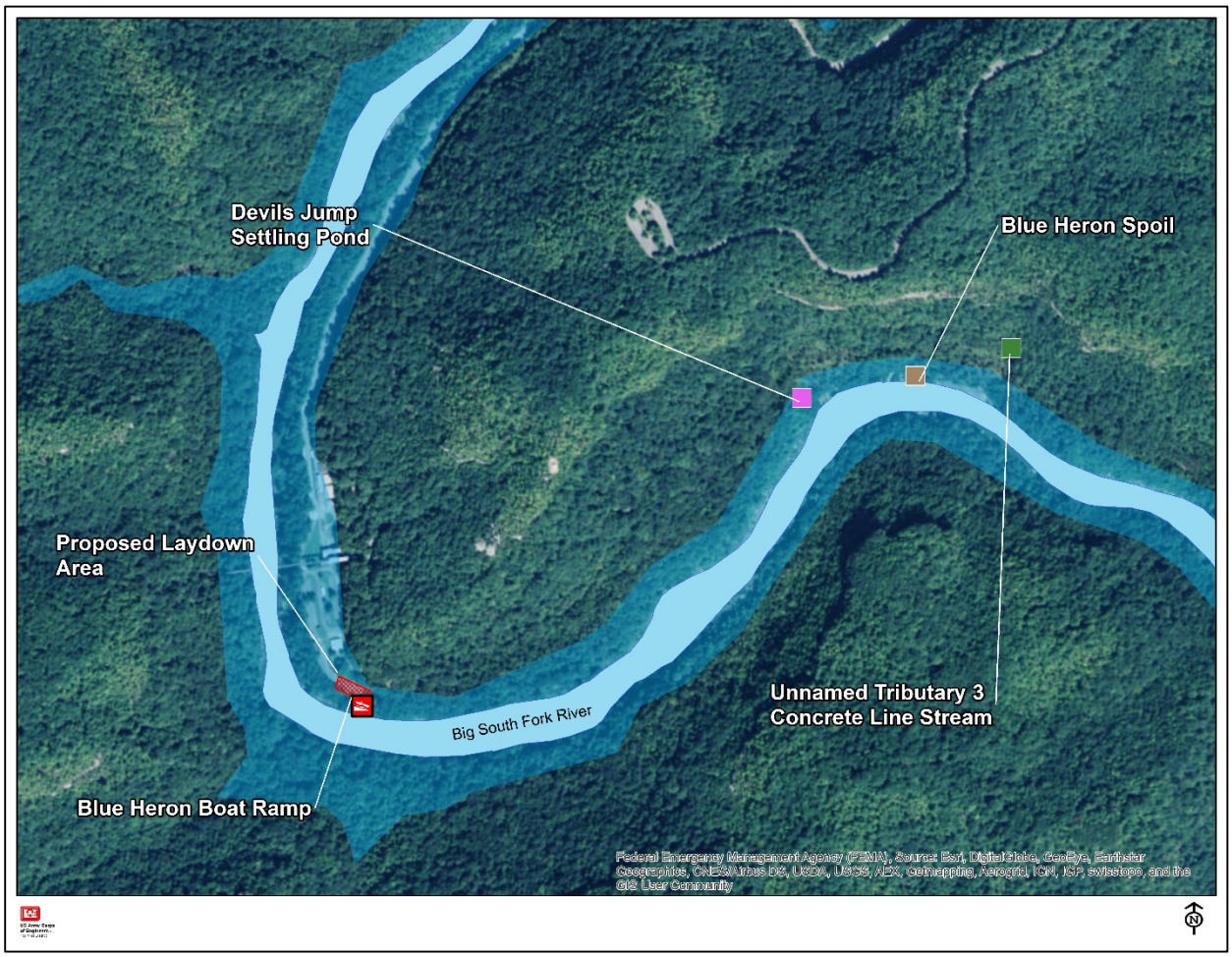


Figure 20. Map of the 100 year floodplains identified by Federal Emergency Management Agency within the Proposed Project Area.

3.3.4 Wetlands

The Corps and the EPA jointly define wetlands as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (USACE 1987).

The NPS uses the Cowardin Classification System to classify aquatic features. The Cowardin Classification System is based on five systems: Riverine, Lacustrine, Palustrine, Marine, and Estuarine. These systems are further divided into subsystems based on the degree or frequency of inundation, and then into classes based on hydrological, substrate, and/or vegetation characteristics. BSF and tributaries would be classified by the Cowardin classification system as Riverine.

Two wetland areas (totaling approximately 0.10 acres) have been identified within the project area within project site DJSP. The wetland areas are classified as a Palustrine Forested, broadleaved deciduous, seasonally flooded/saturated wetlands. Due to the duration of inundation of the wetland and soil material, very little vegetation growth is found. To aid in discussion regarding Alternatives 3 and 5 the wetland area was split into two separate parts – Upper Pond (approximately 0.060 acres) and Lower Pond (approximately 0.040 acres) (Figure 15).

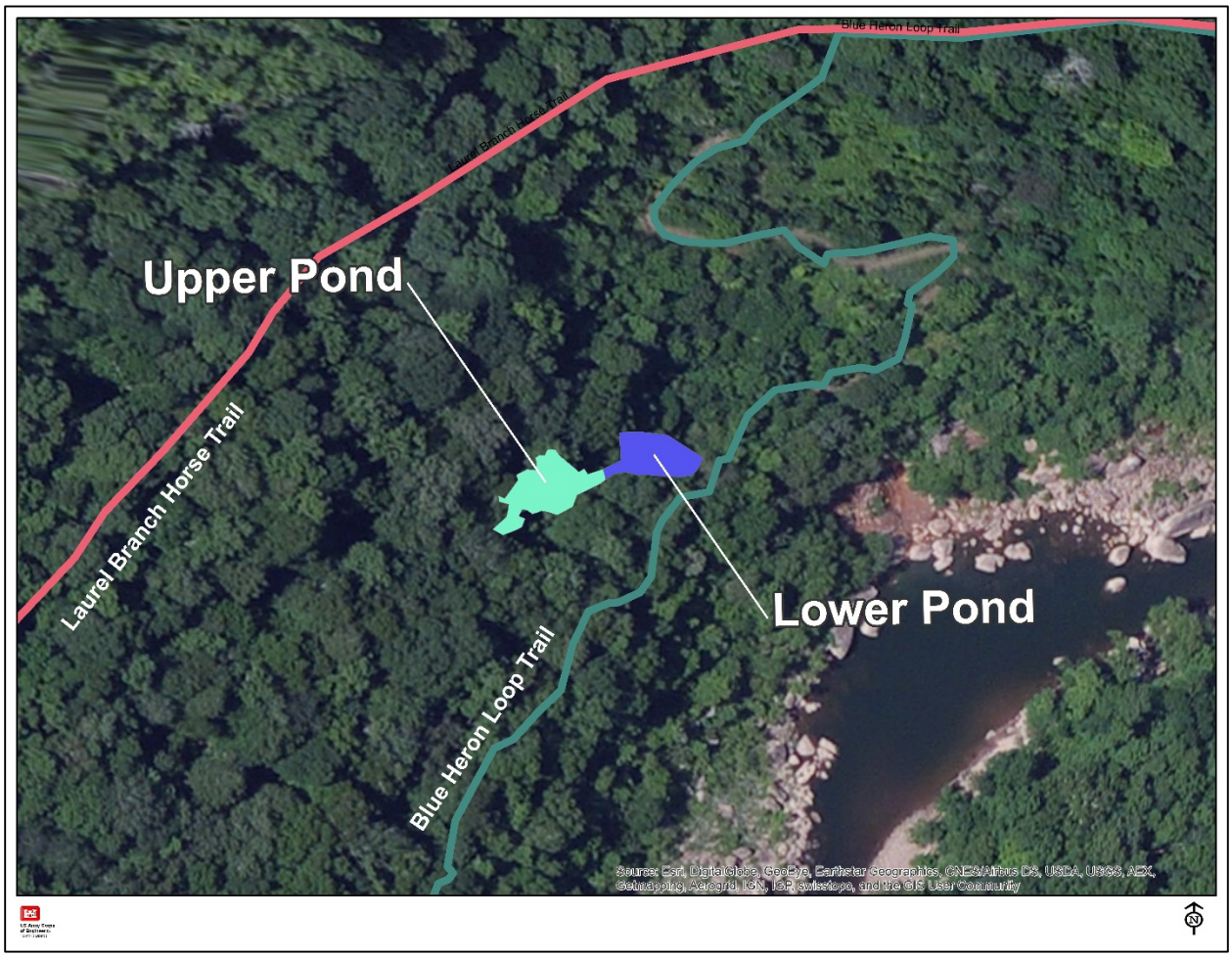


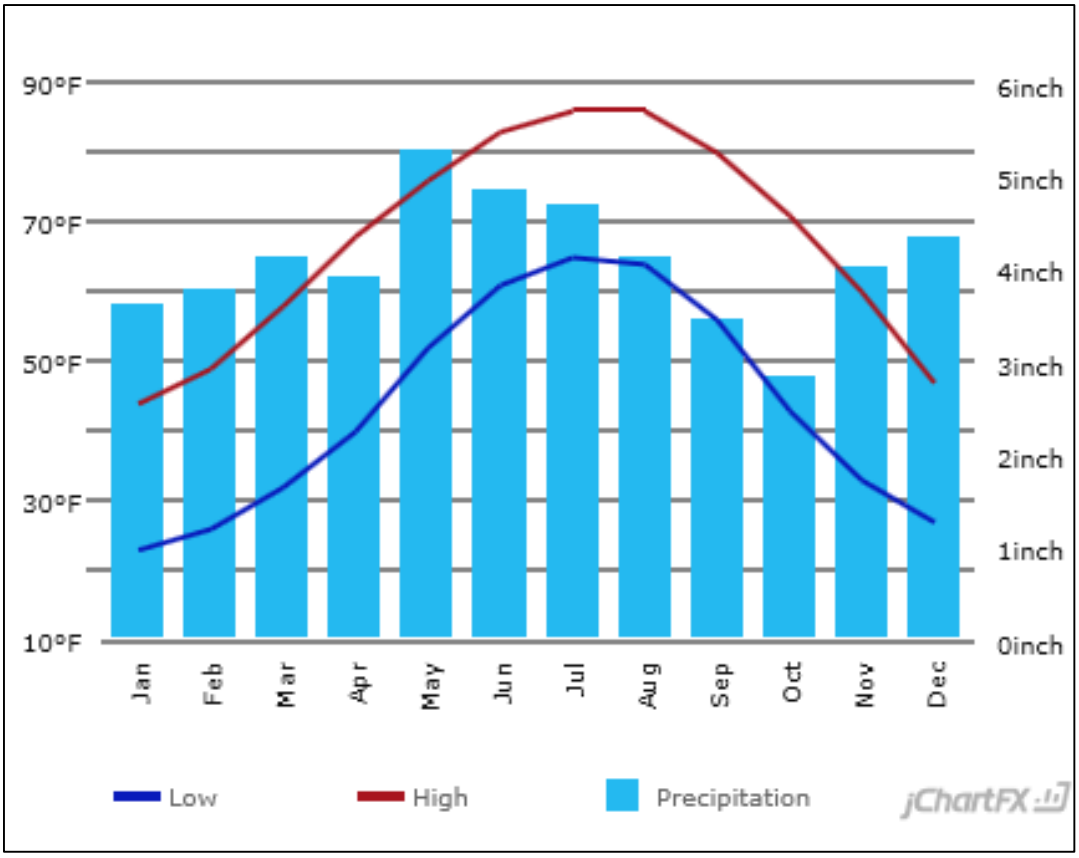
Figure 21. Wetland Area identified within the Devils Jump Settling Pond project area.

3.4 Area Climate and Climate Change

McCreary County has a temperate climate with moderately cold winters and warm and humid summers. Average summer temperatures range from approximately 70 degrees Fahrenheit (°F) to 73 °F, while average winter temperatures range from approximately 32 °F to 37 °F. Temperatures vary with relief; average monthly temperatures are generally higher at lower elevations.

Average annual precipitation for Oneida, Tennessee is 49 inches with average temperatures ranging from 43.5º F to 67.3º F. Table 14 below depicts a climate graph for an average year in Oneida, Tennessee (U.S. Climate Data 2016).

Table 14. Climate Graph for Oneida, Tennessee.



3.5 Biological Resources

Protection and management of biological resources within BISO are mandated by a number of laws, regulations, and guidance. Biological resources within BISO are managed according to these and other applicable environmental laws and NPS regulations.

3.5.1 Terrestrial Ecosystems and Communities

Forest communities within BISO are primarily oak-hickory, mixed oak-hardwoods, pine-oak, white pine-hemlock and hemlock coves. Oak species are common on middle and lower slopes; Eastern hemlocks are often dominant in narrow gorges and along streams; and river birch (*Betula nigra*) and sycamore (*Platanus occidentalis*) are common on the floodplain. Due to extensive logging in the early-to mid-1900s, most forest stands are 2nd or 3rd growth (NPS 2005).

3.5.2 Aquatic Habitat

Aquatic habitats within the project areas include the BSF and several small tributaries. Portions of the BSF host a diverse biotic community. Approximately 79 species of fish, 215 taxa of macroinvertebrates, and 26 species of mussels occur within BISO. However, portions of the watershed have been severely impacted by CMD and do not presently support significant biological resources (NPS 2005).

More recent surveys performed for the Corps by TVA downstream of the proposed project area have documented 55 species of fish (TVA 2014). Table 15 is a current list of species documented by TVA surveys.

3.5.3 Wildlife Resources

Common wildlife species occurring within BISO include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), gray squirrel (*Sciurus carolinensis*), ruffed grouse (*Bonasa umbellus*), eastern wild turkey (*Meleagris gallopavo*), American black bear (*Ursus americanus*), North American beaver (*Castor canadensis*), as well as a variety of amphibians, reptiles, birds, and mammals.

3.5.4 Special Status Species and Special Habitat Areas

U.S. Fish and Wildlife Service and Kentucky Department of Fish and Wildlife Resources were consulted to identify the potential presence of any listed, proposed threatened or endangered species, and/or special habitat areas within the project area. Based on correspondence with the above listed agencies, the proposed project could potentially affect twenty-four federally listed species (Table 16). A detailed description of each species can be found in Appendix C.

Table 15. 2014 TVA survey data for downstream of Blue Heron.

Family/Scientific Name	Common Name	Family/Scientific Name	Common Name
Petromyzontidae		**Ictaluridae**	
Ichthyomyzon bdellium	Ohio lamprey	*Ictalurus punctatus*	Channel catfish
Lepisosteidae		*Noturus flavus*	Stonecat
Lepisosteus osseus	Longnose gar	*Pylodictis olivaris*	Flathead catfish
Hiodontidae		**Fundulidae**	
Hiodon tergisus	Mooneye	*Fundulus catenatus*	Northern studfish
Clupeidae		**Atherinopsidae**	
Dorosoma cepedianum	Gizzard shad	*Labidesthes sicculus*	Brook silverside
Cyprinidae		**Centrarchidae**	
Campostoma oligolepis	Largescale stoneroller	*Ambloplites rupestris*	Rock bass
Cyprinella spiloptera	Spotfin shiner	*Lepomis cyanellus*	Green sunfish
Cyprinella galactura	Whitetail shiner	*Lepomis macrochirus*	Bluegill
Erimystax dissimilis	Streamline chub	*Lepomis megalotis*	Longear sunfish
Hybopsis amblops	Bigeye chub	Hybrid *Lepomis*	Hybrid sunfish
Hybopsis amnis	Pallid shiner	*Micropterus dolomieu*	Smallmouth bass
Luxilus chrysocephalus	Striped shiner	*Micropterus punctulatus*	Spotted bass
Nocomis micropogon	River chub	*Micropterus salmoides*	Largemouth bass
Notropis ariommus	Popeye shiner	**Percidae**	
Notropis atherinoides	Emerald shiner	*Etheostoma baileyi*	Emerald darter
Notropis micropteryx	Highland shiner	*Etheostoma blennioides*	Greenside darter
Notropis photogenis	Silver shiner	*Etheostoma caeruleum*	Rainbow darter
Notropis telescopus	Telescope shiner	*Etheostoma gore*	Cumberland darter
Notropis volucellus	Mimic shiner	*Etheostoma lemniscatum*	Duskytail darter
Notropis sp.	Sawfin shiner	*Etheostoma maydeni*	Redlips darter
Pimephales notatus	Bluntnose minnow	*Etheostoma zonale*	Banded darter
Catostomidae		*Nothonotus camurus*	Bluebreast darter
Hypentelium nigricans	Northern hogsucker	*Nothonotus sanguifluus*	Bloodfin darter
Moxostoma anisurum	Silver redhorse	*Nothonotus tippecanoe*	Tippecanoe darter
Moxostoma breviceps	Smallmouth redhorse	*Percina caprodes*	Logperch
Moxostoma carinatum	River redhorse	*Percina copelandi*	Channel darter
Moxostoma duquesnei	Black redhorse	*Percina maculata*	Blackside darter
Moxostoma erythrurum	Golden redhorse	*Percina sciera*	Dusky darter
Sciaenidae		*Sander vitreus*	Walleye
Aplodinotus grunniens	Freshwater drum		

Table 16. List of federally threatened and endangered species potentially identified to be potentially present within the project area.

SPECIES	SCIENTIFIC NAME	STATUS
Indiana bat	*Myotis sodalis*	Endangered
Northern long-eared	*Myotis septentrionalis*	Threatened
Gray bat	*Myotis grisescens*	Endangered
Blackside dace	*Chrosomus cumberlandensis*	Threatened
Palezone shiner	*Notropis albizonatus*	Endangered
Cumberland darter	*Etheostoma susanae*	Endangered
Duskytail darter (Tuxedo darter)	*Etheostoma percnurum*	Endangered
Cumberland bean	*Villosa trabilis*	Endangered
Cumberlandian combshell	*Epioblasma brevidens*	Endangered
Cumberland elktoe	*Alasmidonta atropurpurea*	Endangered
Fluted kidneyshell	*Ptychobranchus subtentum*	Endangered
Littlew ing pearlymussel	*Pegias fabula*	Endangered
Oyster mussel	*Epioblasma capsaeformis*	Endangered
Pink mucket	*Lampsilis abrupta*	Endangered
Spectaclecase	*Cumberlandia monodonta*	Endangered
Fanshell	*Cyprogenia stegaria*	Endangered
Tan riffleshell	*Epioblasma florentina walkeri*	Endangered
Purple catspaw	*Epioblasma obliquata obliquata*	Endangered
Ring pink	*Obovaria retusa*	Endangered
Rough pigtoe	*Pleurobema plenum*	Endangered
Orangefoot pimpleback	*Plethobasus cooperianus*	Endangered
Virginia spiraea	*Spiraea virginiana*	Threatened
Cumberland sandw ort	*Arenaria cumberlandensis*	Endangered
Cumberland rosemary	*Conradina verticillata*	Threatened

Currently three federally protected fish species are listed as occurring within BISO. Two of the three federally listed species, the blackside dace (*Chrosomus cumberlandensis*) and the duskytail darter, can still be found within the park. The Palezone shiner (*Notropis albizonatus*) was found in adjacent tributaries but currently has not been found within the BSF. Bat surveys of abandoned mine shafts within BISO were completed in 1983. A total of 114 mine openings were inspected, many of these occurring within the project area and/or adjacent to the project sites. One federally listed bat, Indiana bat was observed in the vicinity of the BHS in 1981. A mammal inventory of the BISO was conducted between the fall of 2003 through the fall of 2004 documented the presence of northern long-eared bats within the BISO. Based on the surveys the northern long-eared bat was the most commonly captured bat (44.8%) with the majority captured in a mine within the Blue Heron area (NPS 2007).

Site visits were conducted to review the proposed sites and access route for potential Indiana and/or northern long-eared bat habitat. Suitable summer habitat for Indiana bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥5 inches dbh (12.7 centimeter) that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of other forested/wooded habitat (FWS 2015).

Suitable summer habitat for the northern long-eared bat consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥3 inches dbh that have exfoliating bark, cracks, crevices, and/or cavities), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit characteristics of suitable roost trees and are within 1000 feet of other forested/wooded habitat. Northern long-eared bats have also been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures should also be considered potential summer habitat. Northern long-eared bats typically occupy their summer habitat from mid-May through mid-August each year and the species may arrive or leave some time before or after this period (FWS 2015).

Tree species to be removed primarily consist of tulip popular (*Liriodendron tulipifera*), maple species, oak species, three snags (dead trees), and hickory species to include one shagbark hickory tree. The shagbark hickory and the three snags meet the FWS guidelines for suitable Indiana and northern long-eared bat summer roost habitat (i.e. exfoliating bark, crevices, and/or cavities). The remainder of trees, excluding the shagbark hickory and three snags, required to be removed do not meet the criteria listed above to be consider suitable summer roost habitat. Based on the surrounding landscape and additional adjacent habitat within the proposed project area, the Corps determined that the removal of the identified suitable summer roost habitat trees would not likely adversely impact federally list bats and recommended that trees be removed between November 15 – March 31.

In addition to the Indiana and northern long-eared bat, the proposed BHS project could impact federally listed mussel species and/or duskytail darter. In order to construct the BHS project, a shallow shoreline strip (approximately four feet or less in depth) would be impacted by placement of riprap. The placement of the riprap within the BSF could impact federally listed species if present. Documented within the BO, the FWS concurred with the Corps determination "may affect – not likely to adversely affect" for the species found in Table 16. However, prior to construction, proactive measures such as surveys for mussels would be completed by TVA to ensure no federally listed species are present. If found, mussels would be removed and reestablished outside of the project footprint in suitable habitat to avoid any potential impacts. It is the Corps understanding that this would be covered by the 2014 ITS and associated BO.

Coordination with the FWS for the removal of the four identified suitable summer roost habitat trees and potential impacts to federally listed mussel species was initiated on May 18, 2016. In an email dated June 3, 2016 the FWS concurred with the Corps determination and proactive measures.

3.6 Cultural Resources

Cultural resources are prehistoric and historic sites, structures, districts, or any other physical evidence of human activity considered important to a culture, subculture, or a community for scientific, traditional, or religious reasons. Based on statutory requirements, the term cultural resources is defined to include:

1. Historic properties, as defined in the National Historic Preservation Act (NHPA) of 1966, as amended;

2. Cultural items, as defined in the Native American Graves and Repatriation Act (NAGPRA);

3. Archaeological resources, as defined in the Archeological Resources Protection Act (ARPA);

4. Historic and paleontological resources, as defined by the Antiquities Act of 1906, as amended;

5. Sites that are scientifically significant, as defined by the Archeological and Historic Data Preservation Act (AHPA);

6. Sacred sites, as defined in EO 13007, to which access and use is permitted under the American Indian Religious Freedom Act (AIRFA); and,

7. Collections, as defined in 36 Code of Federal Regulations (CFR) Part 79, Curation of Federally-Owned and Administered Collections.

The NPS defines cultural resources as "an aspect of a cultural system that is valued by or significantly representative of a culture or that contains significant information about a culture. A cultural resource may be a tangible entity or a cultural practice. Tangible cultural resources are categorized as districts, sites, buildings, structures and objects eligible for the National Register of Historic Places (NRHP), and as archeological resources, cultural landscapes, structures, museum objects and ethnographic resources for NPS management purposes" (NPS 2005).

3.6.1 Architectural and Archaeological Resources within BISO

Numerous surveys pertaining to cultural resources have been completed within BISO and document human occupation in the area for at least 12,000 years. Although shallow caves and rock shelters within BISO were most likely used by Native Americans, no evidence of permanent Native American settlements has been discovered in the park. Based on sampling, NPS estimates that over 10,000 archeological (both historic and prehistoric) sites exist within the boundaries of BISO. However, no prehistoric sites are known to occur in proximity to the project sites (NPS 2005). Conversely, historic sites, predominantly remnants of past mining operations, mining towns, homesteads, railroad/tramway spurs, and mine portals, exist near the project area. In 1984, the remediation sites were included in a cultural resources. (Ferguson et al.1984). Given the level of detail of the report and the need to address the proposed action's impacts, NPS reassessed the proposed project area in 2016 (NPS 2016).

The proposed project is located near the Blue Heron Mining Community Area. This site includes the remnants of the Stearns Coal and Lumber Company's coal mining facilities, Mine 18. Fifty-three discrete areas of cultural material are documented, which include coal processing facilities, loading facilities, the coal mines, housing for mine workers and other community facilities are located adjacent to the Area of Potential Effects (APE). Site informant data and historic maps indicate the building include the remains of 20 houses, a church, a school, a company store and numerous industrial support facilities. The southern extent of the Blue Heron Mining Community Area overlap with the western extent of the APE. However, the construction of the recreation area in the 1980s would have destroyed any intact archaeological deposits. In addition, the structures closest to the APE were constructed in the 1980s and are not contributing elements to Blue Heron Mining Community Area. The proposed project would also affect a wood/tar-paper flume, but this feature is not a defining characteristic of the Blue

Heron Mining Community Area. Therefore, the proposed project would not adversely affect the Blue Heron Mining Community Area.

3.7 Geology, Topography, and Soils

3.7.1 Geology

BISO is fully contained within the Cumberland Plateau physiographic province, which is the southern portion of the Appalachian Plateau structural province. This portion of the plateau is characterized primarily by horizontally-bedded sedimentary rocks of the Pennsylvanian and Mississippian Age. These rocks are predominately sandstone and shale but also include conglomerate, siltstone, and coal. A generalized stratigraphic column for the project area would include (in descending order) the Breathett Formation, Lee Formation, and the Pennington Formation.

The Breathett Formation is the youngest of the sedimentary rocks exposed in the project area. This formation is middle Pennsylvanian in age and extends over 170 feet thick in areas. This formation is composed primarily of shale, siltstone, and sandstone beds. This formation forms the bluffs along the top of the BSF gorge.

The Lee Formation underlies the Breathett Formation and outcrops along the slopes of the BSF gorge. This formation is Lower Pennsylvanian in age and ranges from approximately 440 to 640 feet thick. The Lee Formation is composed of several members and beds including the Corbin Sandstone, Rockcastle Conglomerate, Beattyville Shale, and Barren Fork coal bed.

The Pennington formation underlies the Lee Formation and is exposed within the inner gorge adjacent to the BSF. This formation is characterized by grayish-red or olive-green shale and contains thin-to medium bedded sandstone and limestone. The Pennington Formation is upper Mississippian in age and extends over 200 feet thick. The Pennington is covered in some areas along the BSF by recent alluvium of silt, sand, gravel, and boulders.

3.7.2 Topography

The project area is located along an approximately 2-mile stretch of the BSF in McCreary County, Kentucky. BISO includes relatively flat areas of the plateau as well as a deep gorge, created by the BSF and its tributaries. The main gorge is characterized by many sheer bluffs at the gorge rim and steep, talus slopes. There is little floodplain development along the BSF, and valleys within the gorge contain huge boulders broken from cliff faces above. Tributaries are generally characterized by steep, densely-vegetated V-shaped gorges. Elevations range from approximately 740

feet above mean sea level (AMSL) along the BSF to approximately 1,250 feet AMSL on knolls at the edge of the river gorge.

3.7.3 Soils

Soils in the project area are dominated by two major soil classifications: Shelocta-Bouldin Complex and Itmann soils. Both the Shelocta-Bouldin Complex and Itmann soils consist primarily of shallow to moderately deep, well-drained rocky or stony, silty clay to loam soils.

3.8 Hazardous and Toxic Materials/Wastes

Hazardous wastes are defined as any solid, liquid, contained gaseous or semi-solid waste, or any combination of wastes, which pose either a substantial present or potential hazard to human health or the environment, as determined by ignitable, corrosive, reactive, or toxic characteristics.

No hazardous wastes are generated, stored, handled, transported, treated, or disposed within the project area, and with the exception of historical mining activities and limited construction to stabilize the spoil areas as part of park development, no activities have been conducted at the project sites that could potentially result in contamination by a hazardous material, substance, or waste. Mine spoil piles from historic mining operations occur throughout the project area and contribute CMD to local streams and drainages. CMD generally is characterized by relatively low pH, high acidity, and high heavy metal concentrations. Although mine spoil piles and CMD exhibit characteristics that are considered hazardous to human health and the environment, mine spoils and CMD within the project area not considered to be hazardous waste based on samples taken. As previously stated, a composite sample of material to be excavated was collected within the cut zone and analyzed per the TCLP to help determine ultimate disposal options for the material. The TCLP test indicated that the material does not exhibit the characteristics of a hazardous waste.

3.9 Land Use (to include Recreation)

Portions of BISO have been extensively mined for coal since the turn of the century with some mines still operating in the BSF watershed located outside of the park boundary. These mining activities created at least 120 underground entries within BISO that are clustered along the various coal seams outcropping from the steep slopes of BISO gorge.

Remnants of mining facilities, railroad and tramway spurs, mine entries, haul roads and spoil piles are common throughout the project area and occur within project sites.

Today, the project sites are primarily forested by secondary and tertiary-growth forest stands (NPS 2005).

Visual resources are defined as the natural and manufactured features that comprise the aesthetic qualities of an area. These features form the overall impression that an observer receives of an area or its landscape character. Landforms, water surfaces, vegetation, and manufactured features are considered characteristic of an area if they are inherent to the structure and function of the landscape.

The project area is located entirely within BISO and is used for outdoor recreational purposes such as hiking, canoeing/kayaking, horseback riding, hunting and fishing, climbing, recreational boating, and numerous other outdoor activities. The portion of BISO in which the project sites are located includes a mixture of natural features and remnant coal mining features.

As discussed in Section 1, BISO, as managed by the NPS, was established to protect the BSF, preserve historic and natural features, and provide for outdoor recreation for the public. Land use within BISO includes abandoned coal mines, roads and trails, the Oneida and Western Railroad right-of-way, oil and gas extraction sites, mineral ownership, in holdings (privately owned land within the boundaries of BISO), recreation area facilities, agricultural leases, Scott State Forest, the Kentucky and Tennessee (K & T) Railroad right-of-way, gas pipelines, a TVA power line right-of-way, and Corps flowage easements on Lake Cumberland.

Land uses within or in the vicinity of the project areas that could potentially be impacted by the proposed project include: abandoned coal mines and related facilities and features; roads and trails; recreation area facilities; and the K & T Railroad right-of-way; these are discussed below.

- Abandoned coal mines, mine spoils, and related facilities and features occur throughout the project area.

- Roads and trails used by cars, trucks, hikers, mountain bikes, river users and horses occur throughout the project area. The Lee Hollow Loop extends north from the Bear Creek Horse Camp, crosses Blair Creek, where it becomes the Laurel Branch Trail. After crossing the Laurel Branch, it merges with the Lee Hollow Loop Trail and returns south to the Bear Creek Horse Camp. From the Laurel Branch crossing, the LBHT follows a mine tramway route toward the Blue Heron Boat Ramp/Canoe Launch. The BHLT extends from the Laurel Branch crossing towards Blue Heron, at times using the same route as the LBHT. Portions of LBHT are

designated for both hiking and horseback riding. Other trails that could be impacted include Lee Hollow Loop Trail and Long Trail North (Segment A). See Section 2.3 for a more detailed description of impacts associated with the proposed project alternatives.

- Recreation area facilities within the vicinity of project sites or access routes include the Blue Heron interpretive area and the river access point at Blue Heron. The Blue Heron mining community and the original narrow-gauge railroad, which are within the general project area, have been restored by the NPS and the reconstructed Blue Heron mining camp and interpretive center is a popular attraction for BISO visitors. The proposed project would be accessed from the Blue Heron mining community and would utilize the Blue Heron Canoe Ramp parking area as a laydown area during construction.

- The K & T Railroad right-of-way includes 47.6 acres along approximately four miles of track from Barthell on Roaring Paunch Creek north along the BSF towards Yamacraw. The owners of the K & T Railroad operate the Big South Fork Scenic Railway.

3.10 Noise

Under NEPA, the Noise Control Act of 1972 (PL 92-574), and Executive Order (EO) 12088, the NPS is required to assess the environmental impact of noise produced by its activities. Noise environment within the project area is primarily generated from vehicles or natural sources such as river rapids.

3.11 Socioeconomics

The project area lies within McCreary County, Kentucky. Socioeconomic areas of discussion include demographics, local economy, recreational facilities, and associated issues of health and safety to the surrounding communities. McCreary County is located in southeastern Kentucky on the northern Tennessee state line. It is bordered by Wayne County to the west, Pulaski County and Laurel Counties to the north, Whitley County to the east and Scott and Campbell Counties, Tennessee to the south. Fifty-three percent of land area within the county is occupied by the Daniel Boone National Forest and 12 percent of the land area belongs to BISO. BISO, which occupies portions of five counties in Kentucky and Tennessee, is visited annually by approximately 800,000 to 920,000 people (NPS 2005).

According to the U.S. Census Bureau, the population of McCreary County was 15,603 in 1990, 17,080 in 2000 and 17,989 in 2013. Approximately 91.7% of the population of

McCreary County is white; the remaining population is classified as African-American (5.9%), American Indian or Alaska native (0.8%), Asian alone (0.2%), persons of two or more races (1.4%) and other (0.2%).Persons of Hispanic or Latino origin (2.3%) may be of any race and are included in applicable race categories (U.S. Census Bureau 2013).

Approximately 30.8% of the population was estimated to be below poverty level within McCreary County, Kentucky. Median household income was estimated to be $21,758.Total retail sales in 2007 were approximately $82,470 and per capita sales were $4,639 (U.S. Census Bureau 2016).

BISO provides river use, trail use, hunting, and various other activities such as rock climbing, nature study, and camping. These recreational opportunities are allowed throughout BISO, including the project area.

River use within BISO includes swimming, rafting, motorized and non-motorized boating, and fishing. All of these activities are allowed along the BSF in proximity to the project sites. Fishing is allowed in accordance with state regulations.

Trail use, sight-seeing, and camping are popular within BISO. Trail use makes up a large portion of total visitor use within BISO. Trails in the project area include both single-use trails and multi-use trails for hiking, horseback riding, and mountain biking. Both improved and back country camping are available within BISO. Although off-road vehicle use is not permitted within the project area, off road vehicles are permitted on multi-use trails during hunting season in BISO.

Hunting is very popular within BISO and occurs in all areas except designated safety zones around developed sites. Hunting for deer, turkeys, wild hogs, squirrels, raccoons and waterfowl occur along the BSF and is managed consistent with state regulations and NPS safety zones.

The Big South Fork Scenic Railway is a National Park permit holder. The Scenic Railway operates out of Stearns, Kentucky and offers trips along the historic tracks of the K & T Railway. The Big South Fork Scenic Railway operates on the railway from Stearns through BISO to the Blue Heron historic mining community and north along the BSF toward Worley.

4.0 Environmental Consequences

This section evaluates the environmental impacts that could result with implementation of the No Action and/or any of the Action (Site/Measures) Alternatives previously described in Section 2. Where differences exist between sites/measures for each Action alternative, the anticipated impacts are described for each site and measure being considered. Again, the Proposed Action (Alternative 5) is an array of projects on three sites (Alternatives 2-4) as required in the FWS ITS and associated BO. The Environmentally Preferred Plan (EPP) would be implementation of remediation measures at all three sites. Impacts are analyzed based on the resources that would be affected. For each resource, the methodology used to determine impacts and defined thresholds of impacts are identified. Durations, specifically short- and long-term, of possible impacts are also discussed.

4.1 Air Quality

Methodology. Methodology used to evaluate air quality impacts involved an assessment of project's construction and operational activities that might affect local air quality.

Intensity definitions. Thresholds for determining impacts to air quality are defined as follows:

> *Negligible*—No changes would occur, or changes in air quality would be below or at level of detection, and if detected, would have effects that would be considered slight.
>
> *Minor*—Changes in air quality would be detectable, although the changes would be small, and the effects would be localized.
>
> *Moderate*—Changes in air quality would be measurable and would have consequences, although the effect would be relatively local.
>
> *Major*—Changes in air quality would be measurable, would have substantial consequences, and would be noticed regionally.

Duration of impacts is defined as *short-term*—occurs only during the duration of the project, or *long-term*—persists beyond the duration of the project.

Alternative 1 – No Action

The No Action Alternative would have no effect on air quality since no construction activities would occur.

Alternatives 2, 3, and 4 and Alternative 5 (Combination of Alternatives 2-4)

Implementation of Alternatives 2, 3, 4, and 5 would have short-term negligible impacts to air quality. This would be due to the small degree of construction activities and minimal potential for dust generation as well as minimal emissions from construction equipment. Since this work involves a small amount of construction, impacts to air quality from dust or equipment emissions are considered minor and short-term in duration. No change in the current attainment status is anticipated. Construction equipment would be in proper operating condition. Dust control BMPs are not anticipated to be required.

4.2 Aquatic Resources

4.2.1 Surface Water and Watersheds

Methodology. Methodology used to evaluate surface water and the watershed impacts involved an assessment of the project's construction and operational activities that might affect surface water and the watershed.

Intensity definitions. Thresholds for determining impacts to surface water and watersheds are defined as follows:

> *Negligible*—Surface water and the watershed may be affected, but measurable or perceptible changes would not occur.
>
> *Minor*—Effects on surface water and the watershed would be measurable or perceptible, but would be localized within a small area.
>
> *Moderate*—Change would occur to surface water and the watershed over a relatively large area that would be readily measurable.
>
> *Major*—Effects on surface water and the watershed would be readily apparent, and would change substantially over a large area.

Duration of impacts is defined as *short-term*—impacts are primarily due to construction methods and upon completion of the project, recovery would take less than a year, or *long-term*—impacts are associated with alternative design and following completion of the project, recovery would take more than a year.

Alternative 1 – No Action

Implementation of Alternative 1 would allow the existing conditions to continue to affect the watershed. CMD and sedimentation would continue to affect the BSF, impacting

aquatic/terrestrial species, recreation uses, and aesthetics. The No Action Alternative would result in negative long-term impacts to the BSF and the BSF watershed due to continued low pH levels and sedimentation in streams.

Alternative 2 - BHS

Implementation of Alternative 2 would result in both short-term and long-term impacts to surface water resources in the project area as well as the BSF watershed. Negative short-term impacts such as minor sedimentation release, turbidity, minor bank erosion, and impacts to recreation uses, would be anticipated during construction. Material removed from the existing bank which is composed of mine spoil would be taken to a commercial landfill. However, these impacts would be considered minor and would ultimately result in positive long-term benefits to surface water, would aid in the reduction of CMD and sedimentation within the stream reach as well as the BSF, and would aid in reducing impacts to aquatic/terrestrial species.

Alternative 3 - DJSP

Implementation of Alternative 3 would result in both short-term and long-term impacts to surface water resources in the project area. Negative short-term impacts would be anticipated during construction. Negative short-term impacts could include; minor sediment releases, turbidity, and impacts to recreation uses. Material removed from the project area (spoil material) would be taken to an approved disposal site. These impacts would be considered minor and would ultimately result in positive long-term benefit to surface water and would aid in the reduction of CMD within the BSF.

Alternative 4 – UT3CLS

Implementation of Alternative 4 would require temporarily working within the channel. All work in the channel would be conducted during a time of which the stream is dry. Channel work would extend up to the existing concrete-lined segment. Minor short-term adverse impacts could include sediment releases, minor bank erosion, and turbidity as a result of construction. In order to construction the proposed plan for UT3CLS, construction equipment would work adjacent to/within the existing stream, remove unwanted materials, and stabilize the stream and eroding bank areas with limestone. However, these impacts would be considered minor and would ultimately result in positive long-term benefit to surface water and would aid in the reduction of CMD and sedimentation within the BSF.

Alternative 5 - Combination of BHS, DJSP, and UT3CLS

Implementation of Alternative 5 would be a combination of both positive and negative impacts discussed above (Alternatives 2, 3, and 4). Negative short-term impacts such as; minor bank erosion, sedimentation, turbidity, and impacts to recreational use would be anticipated during construction. However, these impacts would be considered minor and would ultimately result in long-term positive benefits to surface water and the watershed by a combination of sediment and CMD reduction within the project area as well as the BSF. Implementation of Alternative 5 would result in more cumulative benefits since multiple sites within the area would be improved.

4.2.2 Water Quality

Methodology. Methodology used to evaluate water and sediment quality impacts involved an assessment of project construction and operational activities that might impact water quality. Background water quality information was also reviewed.

Intensity definitions. Thresholds for determining impacts to water and sediment quality are defined as follows:

> *Negligible*—Water and sediment quality may be affected, but measurable or perceptible changes would not occur.
>
> *Minor*—Effects on water and sediment quality would be measurable or perceptible, but would be localized within a small area and well below water quality standards or criteria.
>
> *Moderate*—Change would occur to water and sediment quality over a relatively large area that would be readily measurable but would be at or below water quality standards or criteria.
>
> *Major*—Effects on water and sediment quality would be readily apparent, and would change substantially over a large area; effects would be at or exceed water quality standards or criteria for a short period of time.

Duration of impacts is defined as *short-term*—impacts are primarily due to construction methods and upon completion of the project, recovery would take less than a year, or *long-term*—impacts are associated with alternative design and following completion of the project, recovery would take more than a year.

Alternative 1 – No Action

CMD, sedimentation, and erosion would continue to affect the BSF and tributaries, resulting in poor water quality, specifically low pHs and elevated metals, and degraded

stream reaches throughout the project area. High flow events would continue to erode material from the BHS. Seeps and spoil material would continue to impact water quality at DJSP, BHS, and the near-shore areas of the BSF. The No Action Alternative would have moderate to major short-term and long-term negative impacts on water quality.

Alternative 2 - BHS

Temporary minor increases in sedimentation could occur during construction as material is disturbed. Work would be segmented (< 100 feet) into shorter bank sections so that rock placement could be done as quickly as possible to reduce the exposure time of disturbed bank faces. Material removed from the existing bank (spoil piles) would be taken to a commercial landfill or other approved disposal site. As portions of the bank are graded to design slopes, crushed limestone and then larger rock would be placed to provide long-term stabilization. However, these impacts would be considered minor and would ultimately result in positive long-term benefits by aiding in the reduction of CMD influences and sedimentation from the BHS site and in the BSF. Near shore pH levels should approach water quality standards and sedimentation on near shore habitat should be reduced.

Alternative 3 - DJSP

Implementation of Alternative 3 would require removal of mine spoil material from the berm dividing the upper and lower pond and from the lower pond outlet berm. Alternative 3 would have moderate short-term adverse impacts to water quality during construction by earth work required to construct the spillway and limestone-lined channel. Negative impacts could include; CMD release, sedimentation, and release of metals into the BSF. However, BMPs and project sequencing would greatly reduce potential impacts. Efforts would be made to avoid dewatering the upper pond by use of temporary water retaining structure such as but not limited to sand bags during construction and installation of an impervious clay plug to maintain water levels in the upper pond/wetland. The lower pond would be dewatered to facilitate construction of the new limestone-lined outlet channel. The area adjacent to the new outlet channel would be planted with native wetland and riparian species to maintain this area as a wetland. These impacts would be considered minor and short-term. Following construction, Alternative 3 would result in moderate long-term benefits to water quality by reducing water contact with spoil material in the small stream and cumulatively for the BSF. By implementing Alternative 3, CMD and sedimentation loads entering the BSF would be reduced improving pH levels and reducing metals in the tributary from DJSP and cumulatively improving the BSF.

Alternative 4 – UT3CLS

Implementation of Alternative 4 would result in short-term negative impacts to water quality due to construction activities (minor sedimentation, bank erosion) in the project area as well as the BSF. Negative short-term impacts during construction could temporarily increase metal levels and sedimentation. BMPs, such as but not limited to silt fence, wattles, and coir rolls would be utilized during construction to reduce temporary increases in CMD and sedimentation from entering the BSF. However, these impacts would be considered minor and would ultimately result in positive long-term aquatic habitat improvements in the tributary and BSF by reducing sediment production erosion of from unstable banks.

Alternative 5 - Combination of BHS, DJSP, and UT3CLS

Implementation of Alternative 5 would be a combination of both positive and negative impacts discussed above in Alternatives 2, 3, and 4. Negative short-term impacts (sedimentation, release of CMD and heavy metals, and bank erosion) would be anticipated during construction but timely stabilization should minimize this effect. However, these impacts would be considered minor and would ultimately result in long-term positive water quality improvements by a combination of sediment and CMD reduction within the project area as well as cumulatively in the BSF. Alternative 5 would result in a greater positive benefit to water quality by implementing two water quality and one sediment abatement projects rather than only one project.

4.2.3 Floodplains

Methodology. Methodology used to evaluate potential impacts involved an assessment of project construction and operational activities that might impact floodplains within the proposed project area.

Intensity definitions. Thresholds for determining impacts to floodplains are defined as follows:

> *Negligible*—Floodplains may be affected, but measurable or perceptible changes in size, function, integrity, or continuity would not occur.
>
> *Minor*—Effects on floodplains would be measurable or perceptible, but would be localized.
>
> *Moderate*—Change would occur to floodplains over a relatively large area that would be readily measurable in terms of abundance, distribution, quantity, or quality.

Major—Effects on floodplains would be readily apparent, and would substantially change size, function, integrity, or continuity.

Duration of impacts is defined as *short-term*—impacts are primarily due to construction methods and upon completion of the project, recovery would take less than a year, or *long-term*—impacts are associated with alternative design and following completion of the project, recovery would take more than a year.

Alternative 1 – No Action

The No Action Alternative would result in long-term minor negative impacts to floodplains. Existing conditions would continue to affect floodplains within the proposed project locations. Sedimentation and CMD would continue to be deposited along the downstream channel and floodplains within the BSF from the three sites within the project area, including the transitional reach entering Lake Cumberland.

Alternatives 2, 3, 4, and 5

The BSF and its tributaries are deeply incised with limited floodplain development in the project area. Minor floodplains occur along some of the proposed project areas. Implementation of Alternatives 2, 3, 4, and 5 would have short-term negligible to minor impacts from sedimentation and CMD being deposited within floodplains downstream of the proposed project during construction. However, implementation of Alternatives 2, 3, 4, and 5 would result in long-term positive benefits by both stabilizing UT3CLS and BHS banks reducing sedimentation and CMD from being deposited on floodplains found within and downstream of the project area. Surveys have been conducted by Corps as part of the design to determine the net cut/fill balance. While there is a net fill, it is anticipated to have a minimal effect on floodplains. Limestone would be used to provide a protected bank surface. Spoil would be removed in some areas to provide a stable (2:1 or steeper) slope for bank stabilization at BHS and UT3CLS. Additional spoil material would be removed at DJSP and replaced with limestone for water quality benefits. Excavated spoil material would be hauled off site to a landfill or other acceptable disposal area outside of floodplains.

4.2.4 Wetlands

Methodology. Wetlands as defined by NPS policy include areas classified as wetlands by the Cowardin classification system, defined earlier in Section 3.3.4. The Cowardin Classification System is based on five systems: Riverine, Lacustrine, Palustrine, Marine, and Estuarine. These systems are further divided into subsystems based on the degree or frequency of inundation, and then into classes based on hydrological, substrate, and/or vegetation characteristics. Within the project footprint, this would include one

Palustrine wetland located at site DJSP. Wetlands were delineated using the Corps Wetland Delineation Manual.

Intensity definitions. Thresholds for determining impacts to wetlands are defined as follows:

> *Negligible*—Individual wetlands may be affected, but measurable or perceptible changes in size, function, integrity, or continuity would not occur.
>
> *Minor*—Effects on wetlands would be measurable or perceptible, but would be localized.
>
> *Moderate*—Change would occur to wetlands over a relatively large area that would be readily measurable in terms of abundance, distribution, quantity, or quality.
>
> *Major*—Effects on wetlands would be readily apparent, and would substantially change size, function, integrity, or continuity.

Duration of impacts is defined as *short-term*—impacts are primarily due to construction methods and upon completion of the project, recovery would take less than a year, or *long-term*—impacts are associated with alternative design and following completion of the project, recovery would take more than a year.

Alternative 1 – No Action

Existing conditions would continue to affect wetlands within the proposed project locations. One wetland, located within the DJSP footprint, would continue to be impacted by acidic effects of CMD. The No Action Alternative would have no construction effects on wetlands but would result in minor adverse long-term effects on vegetation, soils, and hydrology within the wetland identified in Section 3.3.2.

Alternatives 2 and 4

No wetland areas are located within the project footprint of Alternatives 2 or 4.

Alternatives 3 and 5

One wetland is located with the DJSP project area. This wetland area is divided into two areas (upper and lower ponds) and is discussed in detail in Section 3.3.4. The existing lower pond of the wetland is lacking any hydrophytic vegetation and contains large amounts of sediment and metal deposits. Implementation of Alternatives 3 or 5 would result in permanent impacts to the wetland. However the lower pond of the

wetland area is already degraded and contributes in release of CMD and sedimentation to the BSF.

In order to implement Alternatives 3 or 5 approximately 0.05 acres of the wetland would be permanently impacted during construction. All short-term impacted areas would be restored to a natural state and replanted with saplings and/or herbaceous species suitable for anaerobic conditions. By constructing a meandering riprap-lined channel through the lower pond wetland area and removing spoil/water interaction in the berm between the two ponds, CMD effects would be reduced.

Wetland mitigation would not be required since the permanent impacts are less than 0.05 acres, below the threshold of 0.1 acres under KDOW and Corps regulations. While the slight loss of the degraded wetlands would occur, the overall quality of wetland would be improved and downstream water quality improved by reducing spoil/water interactions. Adjacent areas would be planted with hydrophytic vegetation and implementation of Alternatives 3 or 5 would result in long-term positive benefits by both reducing sedimentation and CMD entering the BSF.

4.3 Area Climate and Climate Change

Methodology. Methodology used to evaluate potential impacts involved an assessment of project construction and operational activities that might impact the area climate and climate change within the proposed project area.

Intensity definitions. Thresholds for determining impacts to terrestrial ecosystems and communities are defined as follows:

> *Negligible*— Area climate and climate change would not be affected or the effects would be at or below the level of detection and would not be measurable.
>
> *Minor*—Area climate and climate change would be measurable or perceptible, but localized within a small area.
>
> *Moderate* – Area climate and climate change would have a readily measurable effect.
>
> *Major*— Area climate and climate change effects would be readily apparent, and would substantially change wildlife populations.

Duration of impacts is defined as *short-term*—impacts are primarily due to construction methods and upon completion of the project, recovery would take less than a year, or *long-term*—impacts are associated with alternative design and following completion of the project, recovery would take more than a year.

None of the alternatives would have any significant effect on the local and/or global climate.

4.4 Biological Resources

4.4.1 Terrestrial Ecosystems, Communities and Wildlife Resources

Methodology. The methodology for assessing impacts to terrestrial ecosystems and communities was based on visual evaluation of the proposed project areas that would be affected by the project.

Intensity definitions. Thresholds for determining impacts to terrestrial ecosystems and communities are defined as follows:

> *Negligible*— Terrestrial ecosystems and communities would not be affected or the effects would be at or below the level of detection and would not be measurable or of perceptible consequence to wildlife populations.
>
> *Minor*—Effects on terrestrial ecosystems and communities would be measurable or perceptible, but localized within a small area. Viability of wildlife populations would not be affected and the community, if left alone, would recover.
>
> *Moderate*—A change to terrestrial ecosystems and communities would occur. The change would be readily measurable in terms of abundance, distribution, quantity, or quality of population.
>
> *Major*—Effects on terrestrial ecosystems and communities would be readily apparent, and would substantially change wildlife populations.

Duration of impacts is defined as *short-term*—impacts are primarily due to construction methods and upon completion of the project, recovery would take less than a year, or *long-term*—impacts are associated with alternative design and following completion of the project, recovery would take more than a year.

Alternative 1 – No Action

Minor negative long-term impacts to the existing vegetation would be anticipated at UT3CLS and BHS as banks would continue to erode.

Alternatives 2, 3, 4, and 5

Minor short-term negative impacts during construction would be anticipated with implementation of alternative 2, 3, 4, and/or 5. Construction access, laydown areas, and project footprints would require minor clearing of vegetation in order to construct

any of the proposed alternatives. Temporary negligible impacts to wildlife species is anticipated during construction due to loss of habitat, forage and potential displacement. Following construction these areas would be revegetated with native species associated with riparian/wetland areas resulting in minor long-term positive benefits.

4.4.2 Aquatic Habitat and Resources

Methodology. The methodology for assessing impacts to aquatic resources was based on visual evaluation of the project areas that would be affected by the implementation of the proposed alternatives. Additional background information was used to characterize the resources, including the annual surveys performed by TVA, ITS and BO prepared by FWS, and information of water quality and fish community data from NPS documentation.

Intensity definitions. Thresholds for determining impacts to aquatic resources are defined as follows:

> *Negligible*—Aquatic resources may be affected, but measurable or perceptible changes in resource size, integrity, or function would not occur.
>
> *Minor*—Effects on aquatic resources would be measurable or perceptible, but would be localized within a small area. Viability of the resource would not be affected and, if left alone, would recover.
>
> *Moderate*—Change would occur to aquatic resources that would be readily measurable in terms of function, quantity, or quality.
>
> *Major*—Effects on aquatic resources would be readily apparent, and would substantially alter function, abundance, quantity, and/or quality of the resources.

Duration of impacts is defined as *short-term*—impacts are primarily due to construction methods and upon completion of the project, recovery would take less than a year, or *long-term*—impacts are associated with alternative design and following completion of the project, recovery would take more than a year.

Alternative 1 – No Action

The No Action Alternative would result in the continued degradation of the BSF and tributaries within the project footprints from continued CMD, and thus, increase the potential for additional negative long-term, moderate impacts to aquatic resources.

Alternative 2 – BHS

BHS would have minor/moderate short-term impacts to aquatic species during construction from CMD and sedimentation. Work would be segmented (< 100 feet) into shorter bank sections so that rock placement would be done as quickly as possible to reduce the exposure time of disturbed bank faces. BMPs would be emplaced to reduce these impacts during construction. The use of crushed limestone should provide some short-term increases in pH from seeps within the project area of BHS. Long-term positive benefits would be anticipated following construction by buffering of CMD and sedimentation, stabilization of BHS bank, and improving water quality resulting in improved aquatic habitat within the BSF.

Alternative 3 - DJSP

Implementation of Alternative 3 would have negative impacts to aquatic species (mainly amphibian species since DSJP are pond/wetland areas) from the removal of mine spoil material and the dewatering of the lower wetland area. These impacts would be considered negligible since the water quality within the lower wetland area is degraded (see Section 3.3.2) and unsuitable for most aquatic species. Construction of Alternative 3 to include the removal of spoil material and neutralization of CMD is anticipated to improve the water quality of the wetland (in the lower pond). By improving the water quality within the wetland area, this area would be more suitable for aquatic species and would also aid in the reduction of sediment and CMD from entering the BSF.

Alternative 4 –UT3CLS

In order to construct Alternative 4 the existing channel would have to be temporarily diverted and/or work would be done in the dry or during periods of no or low flow. This would allow construction equipment to place stone and other features in the existing stream, remove unwanted materials, and stabilize eroding banks with limestone. Aquatic species within the channel would be directly impacted during construction due to the placement of fill material (i.e. limestone riprap of assorted size). As discussed in Section 3.5.2, surveys for aquatic species (macroinvertebrates, fish, amphibians, etc.) were conducted to assess the quality of the stream. Based on the multiple site visits, very little aquatic fauna was discovered within the stream and impacts to aquatic species would be considered a minor short-term adverse impacts. The site assessments also showed that the stream is heavily impacted by sedimentation.

Constructing Alternative 4 would greatly aid in the reduction of sedimentation and bank erosion within UT3CLS as well as some cumulative benefit to the BSF. The reduction of sediment and erosion would improve the water quality within UT3CLS and ultimately

improve the aquatic life. Therefore, implementation of Alternative 4 would have minor to moderate long-term positive benefits in regards to aquatic species.

Alternative 5 - Combination of BHS, DJSP, and UT3CLS

Implementation of Alternative 5 would have minor/moderate short-term adverse impacts to aquatic species during construction as noted above in the individual site discussions (CMD, sedimentation, removal of spoil material, dewatering the lower wetland area, and placement of step pools and riprap). However, long-term positive benefits would be anticipated following construction at three separate sites to reduce CMD and sedimentation, thereby increasing the water quality resulting in improved aquatic habitat within the BSF.

4.4.3 Special Status Species and Special Habitat Areas

Methodology. The project area was evaluated for the occurrence of threatened and endangered species. During scoping and design, the Corps coordinated with the FWS to develop a list of potential listed species that could be affected by the project activities. A list of Threatened and Endangered species can be found in Section 3.5.4.

Formal consultation with the FWS took place in 2014. The proposed projects are a result of the conservation measures set forth and agreed upon within the ITS and associated BO. Based on the habitat requirements described in the BO, implementation of Alternatives 2, 3, 4, and/or 5 would not include work conducted in habitat that is suitable for duskytail darters. The FWS believes the Corps' proposal to remediate these sites would offset and minimize some of the water quality-related and sedimentation-related harm and harassment and could, potentially, increase numbers and/or occurrences of the duskytail darter downstream of the sites where these conservation actions are implemented. Nonetheless, the FWS expects that some minor adverse effects may occur as a result of the implementation of conservation measures identified in this EA. In particular, minor adverse effects can result from short-term and temporary discharges of sediment and coal mining spoils associated with the construction of the remediation actions. However, these potential adverse effects can and would be minimized through implementation of stringent erosion and sediment control measures and other efforts to reduce the downstream transport of water contaminated with sediment and CMD related contaminants and chemicals. The proposed alternatives should result in minor improvements of water quality conditions along the shoreline of BHS (alternative 2 and 5) and at the confluence of the two tributaries of UT3CLS (alternative 4 and 5) and DJSP (alternative 3 and 5) as a result of this remediation. No direct negative effects on the duskytail darter would be anticipated as a result of implementing Alternative 2, 3, 4, and/or 5.

Of the listed species presented in Table 16, only the duskytail darter, mussel species, Indiana bat, gray bat, and northern long-eared bat were evaluated for potential presence and for environmental impacts resulting from implementing the proposed project. Upon review of habitat requirements for these species, it has been determined that the gray bat habitat requirements do not occur within the proposed project footprints, therefore no impacts are anticipated. The Corps has made a “no effect" determination regarding the gray bat as a result of Alternatives 2, 3, 4, and/or 5. Potential impacts to the duskytail darter are covered under the BO dated March 2014 and should be beneficial to the duskytail dater as well as other aquatic species such as mussels. Habitat surveys for the Indiana and northern long-eared bat summer roost habitat was completed in April 2016 and revealed four potential summer roost trees. Coordination with the FWS took place on May 18, 2016. Documentation submitted to the FWS can be found in Appendix C.

Intensity definitions. Thresholds for determining impacts to threatened and endangered species are defined as follows:

Negligible - Proposed action would not affect listed species or designated critical habitat at any detectable level.

Minor - Proposed action may affect, not likely to adversely affect. Effects on listed species or designated critical habitat would be discountable (i.e., adverse effects are unlikely to occur or could not be meaningfully measured, detected, or evaluated) or completely beneficial.

Moderate - Action may affect, likely to adversely affect: Adverse effects to a listed species or designated critical habitat might occur and the effect would either not be discountable or completely beneficial. Moderate impacts to species would result in a local population decline due to reduced survivorship, declines in population, and/or a shift in distribution; no casualty or mortality would occur.

Major - Impacts would likely jeopardize the continued existence of a species or adversely modify critical habitat. Major impacts would involve a disruption of habitat or breeding grounds of a listed species such that casualty or mortality would result in removal of individuals of a protected species from a population.

Duration of impacts is defined as *short-term* - effects during project implementation activities plus one year for population, community, or designated critical habitat recovery, or *long-term* - effects extend beyond project implementation activities and last longer than one year in the case of population, community, or designated critical habitat recovery.

Alternative 1 – No Action

The No Action Alternative would have moderate, long-term adverse impacts on threatened and endangered species within the BSF, especially the federally-listed duskytail darter. If no projects were initiated, there could be increased CMD within the BSF and tributaries. Water quality remains the primary concern of biologists for the duskytail darter continued existence. As water quality and habitat degrades, species would become limited to pockets of habitat to sustain their existence.

Alternatives 2, 3, 4, and 5

One shagbark hickory and three snags that meet the FWS criteria for Indiana and/or northern long-eared bat summer roost habitat are located along the proposed access path. Due to the contours and slope of the access route these trees would be removed to aid in the stability and slope of the proposed access path.

Based on adjacent habitat, low number of potential trees to be impacted, and the timing of tree removal (November 15 – March 31) the Corps made the determination of "not likely to adversely affect the Indiana and/or northern long-eared bats."

In order to construct the BHS project, a shallow shoreline strip would be impacted by placement of riprap. The placement of the riprap within the BSF could impact federally listed species if present. Documented within the BO, the FWS concurred with the Corps determination "may affect – not likely to adversely affect" for the federally listed mussel species and the duskytail darter. However, prior to construction, proactive measures to include surveys for mussels would be completed by TVA to ensure no federally listed mussel species are present. If found, mussels would be removed and reestablished outside of the project footprint in suitable habitat to avoid any potential impacts. It is the Corps understanding that this would be covered by the 2014 ITS and associated BO.

Coordination with the FWS for the removal of the four identified suitable summer roost habitat trees and potential impacts to federally listed aquatic species was initiated on May 18, 2016. In an email dated June 3, 2016 the FWS concurred with the Corps determination and proactive measures. No other impacts to federally listed species are anticipated at this time.

4.5 Cultural Resources

As described in Section 3.6, cultural resources are subject to review under Federal and state laws and regulations. Section 106 of the NHPA of 1966 empowers the ACHP to comment on federally initiated, licensed, or permitted projects affecting cultural sites listed to, or eligible for inclusion to, the NRHP. Section 106 requires that all Federal

agencies take into account what effects, if any, their actions would have on significant prehistoric archaeological, historic archaeological, or historic resources.

Historic properties are buildings, structures, archaeological sites, districts, landscapes, or objects that are eligible for listing or are listed in the NRHP. Historic properties have generally passed a threshold age of 50 years, be significant for their association with an event, person, design/construction, or information potential.

Intensity definitions. Thresholds for determining impacts to historic properties species are defined as follows:

Negligible – There are no historic properties within the proposed project area.

Minor - Proposed action would not affect historic properties at any detectable level.

Moderate - Proposed action would not adversely affect a historic property. Impacts might be temporary in nature and relate to the setting, such as changes that occur to the surroundings during construction.

Major – Proposed action would adversely affect the historic property requiring the execution of a Memorandum of Agreement to resolve the adverse effects through mitigation.

Alternative 1 – No Action

No impacts to the cultural resources located in the project APE would be anticipated.

Alternative 2 – BHS

Potential impacts would be minor due to alterations to mining spoil piles associated with the Blue Heron Community Area, but the changes would not introduce adverse effects to the site.

Alternative 3 – DJSP

Potential impacts would minor and associated with modification to the tar-paper flume, and the changes would not introduce adverse effects to the Blue Heron Community Area site.

Alternative 4 – UT3CLS

Potential impacts would be negligible as impacts would be to a concrete lined drainage and is not associated with the Blue Heron Community Area.

Alternative 5 – Combination of BHS, DJSP, and UT3CLS

Potential impacts would be minor due to alterations to mining spoil piles and the tar-paper flume associated with the Blue Heron Community Area, but the changes would not introduce adverse effects to the site.

4.6 Geology, Topography, and Soils

Methodology. The methodology used to determine environmental consequences to geology, topography, and soils is a comparison of existing geology, topography, and soils within the project footprint.

Intensity definitions.

> *Negligible*— Geology, topography, and soils would not be affected or the effects would be at or below the level of detection and would not be measurable.
>
> *Minor*— Effects on geology, topography, and soils would be measureable or perceptible, but localized within a small area.
>
> *Moderate*— A change to the geology, topography, and soils would occur and would be measurable through use.
>
> *Major*— A change to the geology, topography, and soils would occur and would be measurable beyond the localized area.
>
> Duration of impacts is defined as *short-term*—impacts are primarily due to construction methods and upon completion of the project, recovery would take less than a year, or *long-term*—impacts are associated with alternative design and following completion of the project, recovery would take more than a year.

Alternative 1 – No Action

The No action alternative would result in continued degradation of the BSF from sedimentation and CMD. Erosion and sloughing of banks would continue with implementation of the no action alternative.

Alternative 2 - BHS

Short-term minor impacts to existing geology, topography, and soils would be anticipated during construction. Impacts include grading of topography and removal of soil and mine spoil material. However, implementation of Alternative 2 would result in moderate long-term positive benefits by stabilizing BHS banks reducing bank sloughing

while also reducing sedimentation and CMD from entering the BSF. This site consists of some natural sandstone overlaid on mine spoils.

Alternative 3 - DJSP

Short-term minor impacts to existing geology, topography, and soils would be anticipated during construction. Implementation of Alternative 3 would result in permanent impact to the existing pond/wetland area (0.05 acres). These impacts would be considered negligible due to the permanent impacted acreage of 0.05 acres. Implementation of either measure would result in moderate long-term positive benefits by both reducing sedimentation and CMD from entering the BSF.

Alternative 4 – UT3CLS

UT3CLS would require access to the stream through a moderately steep section and some construction within the stream channel. This would allow construction equipment to work adjacent to or within the existing stream, remove unwanted materials to include some mine spoil, regarding of the riparian area to allow construction equipment to access the area, and implement the proposed plan. These construction impacts to the existing geology, topography, and soils would be considered minor short-term adverse impacts. However, implementation of the proposed measure would result in long-term benefits by aiding in the reduction of sedimentation and CMD entering the BSF.

Alternative 5 – Combination of BHS, DJSP, and UT3CLS

Short-term minor impacts to existing geology, topography, and soils would be anticipated during construction. Short-term minor impacts are a combination of impacts describe in above alternative (i.e. removal of soil and mine spoil material, loss of wetland acreage, and regarding of riparian areas). However, implementation of all measures would result in moderate long-term positive benefits by both reducing sedimentation and effects of CMD from entering the BSF.

4.7 Hazardous and Toxic Materials/Wastes

No impacts from Hazardous, Toxic, and Radioactive Waste (HTRW) would be anticipated by implementation of any of the alternatives including the No Action alternative. As discussed in Section 3.8, no hazardous wastes are currently generated, stored, handled, transported, treated, or disposed of in the vicinity of the proposed project sites. The construction activities are not anticipated to result in the generation of HTRW and if any were to be generated, the contractor would be responsible for proper disposal. In limited areas, mining spoil piles would be graded and portions removed from project sites. The spoil material removed from BISO would be taken to a commercial landfill and/or an approved disposal site.

4.8 Land Use (to include Recreation)

Methodology. The methodology used to determine environmental consequences to land use (to include recreation) is a comparison of existing types of land use currently available within BISO to the anticipated land use that would be available following implementation of the proposed measures, taking into account long and short-term effects.

Intensity definitions.

Negligible— Land use would not be affected or the effects would be at or below the level of detection and would not be measurable.

Minor— Effects on land use would be measureable or perceptible, but localized within a small area.

Moderate— A change in land use availability would occur and would be measurable but localized within a small area.

Major— A change of land use availability would occur and would be measurable beyond the localized area.

Duration of impacts is defined as *short-term*—impacts are primarily due to construction methods and upon completion of the project, recovery would take less than a year, or *long-term*—impacts are associated with alternative design and following completion of the project, recovery would take more than a year.

Alternative 1 – No Action

Land use to include recreation (such as trails) would continue to be negatively affected as a result of sedimentation and CMD deposits. These impacts would continue to be visually displeasing to recreational users within the project area. These impacts would be considered moderate and long-term.

Alternatives 2, 3, 4, and 5

Moderate, short-term adverse impacts are anticipated to land use practices surrounding the footprints of Alternatives 2, 3, 4, and/or 5. The project sites and portions of access routes (i.e., LBHT, BHLT, and other trails) are utilized for outdoor recreational activities such as hiking and horseback riding. Outdoor activities such as but not limited to; horseback riding, hiking, canoeing, fishing, and visitation of the Blue Heron Mine Community within the proximity to the project sites and access routes would have restricted use during construction activities. Visitation within the proposed project

footprints would be restricted during construction, particularly while trucks are hauling material to and from the sites via LBHT, BHLT, and Blue Heron Road.

Impacts would involve the removal of mine spoil within the proposed project areas. Land use classification of the proposed alternative sites would remain the same. Materials would be disposed of in an approved commercial landfill or acceptable upland location.

Trails, roads, boat ramps, K&T railroad operations to include a snack bar, and parking areas within the project area would sustain minor, short-term impacts as a result of implementing Alternative 2, 3, 4, and/or 5. The public roads, including Kentucky 742, leading to Blue Heron would see short-term increases in construction-related traffic, including trucks hauling rock to the site. During the construction of the proposed remedial activities, use of trails and/or parking areas would be excluded from public use. However, the Blue Heron Mine Community, K & T Railway, canoe ramp, and snack bar would still be open and available to the public even during construction. Every precaution would be made to insure the public safety during construction. The parking area closest to the Blue Heron canoe access ramp would be utilized for construction staging, although an alternative access route would be installed along the edge of the parking area to allow canoe access. Detailed plans regarding the access routes, to include closures and laydown areas, can be found in Appendix B and are described in Section 2.3. Closures of selected areas within the Blue Heron vicinity could increase the usage of other areas within BISO. Following construction these areas would be restored to their previous or better condition. The duration of active construction is anticipated to be less than four months.

Following construction, regular conditions and use of the trails, roads, boat ramps, and parking areas would be restored. Minor long-term positive impact to land use within the project area would be expected as a result of implementing Alternative 2, 3, 4, and/or 5 due to improved aesthetics.

4.9 Noise

Methodology. Methodology used to evaluate noise level impacts involved an assessment of project construction and operational activities that might impact local noise levels.

Intensity definitions. Thresholds for determining impacts to noise are defined as follows:

> *Negligible*— Noise levels may be affected, but measurable or perceptible changes would not occur.

Minor— Effects on noise levels would be measurable or perceptible, but would be localized to the project area.

Moderate— Change would occur to noise levels over a relatively large area that would be readily measurable.

Major— Effects on noise level would be readily apparent and persistent over a large area.

Duration of impacts is defined as *short-term*—impacts are primarily due to construction methods and upon completion of the project, recovery would take less than a year, or *long-term*—impacts are associated with alternative design and following completion of the project, recovery would take more than a year.

Alternative 1 – No Action

If no projects were initiated, no impacts on existing noise levels would be anticipated.

Alternatives 2, 3, 4, and 5

Implementation of Alternatives 2, 3, 4, and/or 5 could have minor short-term negative impacts to noise levels in the immediate project area, along access to include portions of LBHT and BHLP/staging routes, on the public road leading to Blue Heron, and visitation of the Blue Heron Mine Community. Trucks would be transporting material to and from the staging area and remediation sites. This temporary increase in noise levels would only be a result of construction activities and of short duration. Following construction, natural noise levels would return to normal levels.

4.10 Socioeconomics

No alternative would have any significant effect on socioeconomics with the proposed project areas. Temporary short-term positive effects on the local economy could be realized due to construction, associated jobs, lodging, and other services. Some local use of recreational facilities coming from Blue Heron, to include the K&T railroad operation, canoe ramp, and snack bar, could be negatively affected during construction but this would be short-term in duration.

5.0 Cumulative Impacts

Cumulative impacts are defined as “the impact on the environment which results from the incremental impact of the (proposed) action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions (40 CFR 1508.7).” Council on Environmental Quality (CEQ) guidance identifies an 11 - step process for evaluating cumulative effects. For the

purpose of cumulative effects, the entire Kentucky portion BISO is considered, not just the proposed project's footprint.

Step 1: Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals.

Aquatic habitat and water quality within the proposed project footprints as well as the BSF are being impacted by sedimentation and CMD. By implementing the proposed project, both sedimentation and CMD levels would be reduced, thereby improving the water quality and aquatic life within the project footprint and the BSF. Recreation uses within the proposed area would be temporarily closed due to construction activities.

Step 2: Establish the geographic scope for the analysis.

The geographic scope includes areas impacted by the construction of the proposed project, proposed project footprint, and the Kentucky portion of BISO which has been impacted by high degree of pre-park coal mining and timber harvest.

Step 3: Establish the time frame for the analysis.

Past impacts would be considered back to the establishment of BISO in 1974 by the Secretary of the Army, Title I of Public Law 93-251, H.R.10203 to fifty (50) years future projection.

The present/baseline conditions are described in detail in Section 3 of this EA.

Reasonable foreseeable future actions include an increase in recreation within BISO. Additional water quality/mining remediation projects could be conducted within BISO with the goal of improving the water quality and aquatic life of the BSF. The NPS is currently preparing an EIS for the reclamation of other historic coal mine sites within the BISO.

Step 4: Identify other actions affecting the resources, ecosystems, and human communities of concern.

NPS EIS – is an environmental impact statement that the NPS is currently drafting. This EIS would cover similar projects as described in the EA but also covers other potential reclamation sites that differ in size and complexity.

Mining ceased in BISO - Extensive coal mining and timber harvesting occurred from the 1880's to the 1960's and have had significant environmental impacts on the region, including the project area. Mining still takes place outside of BISO and new mines could be approved.

KDAM Rock Creek – is a remediation/restoration project conducted by the KDAM. Rock Creek has been greatly impacted by past mining activities and was considered highly degraded. Since the remediation/restoration of Rock Creek, water quality and aquatic life has improved. Since Rock Creek flows into the BSF, water quality at this junction has also improved.

The establishment of the BISO has allowed some sites within the recreation area to naturally heal over time. Tree reestablishment and recreational uses have affected areas to a limited degree.

Step 5: Characterize the resources, ecosystems and human communities in terms of the responses to change and capacity to withstand stresses.

Many of the wetlands and streams within the BISO have withstood stressors of mining activities, thus have become degraded. Implementation measures and removal or reduction of stressors would aid in the restoration of streams, wetlands, and ecosystems within the BISO. At this time based on discussions with KDOW no mitigation for the proposed project is anticipated. Due to construction activities recreational use within the project area would be restricted in limited areas. As a result, certain trails and Blue Heron parking areas would temporarily be closed to ensure public safety. This could result in alternate trail heads/locations within BISO being more heavily used. Trails impacted due to construction activities would be restored to existing or improved condition as soon as possible following construction. Implementation of the proposed project would result in a positive gradual increase in recreation use (fishing, hiking, etc.).

Step 6: Characterize stresses affecting these resources, ecosystems and human communities.

Water quality has been historically impacted by sedimentation and CMD within the BSF and tributaries. Water quality has a direct effect on aquatic life within the BSF and tributaries.

Implementation of the proposed project and similar projects would affect recreational activities within the proposed project footprint. Recreational users such as hikers and boaters induce minor stresses on topography, vegetation, water quality, and terrestrial and aquatic species.

Step 7: Define a baseline condition for the resources, ecosystems and communities.

Existing water quality within the proposed project sites is the baseline condition and is generally acceptable in the BSF but considered degraded in many tributary streams.

Historically, water quality has been impacted by sedimentation and CMD within the BSF and tributaries. Water quality has a direct effect on aquatic life within the BSF and tributaries. Within the BSF water quality is gradually improving. However, CMD and sedimentation still affect water quality and ultimately the aquatic life within the BSF and tributaries; implementation of project measures would contribute to the improving, trends in recovery.

Step 8: Identify the important cause and effect relationships between human activities and resources, ecosystems, and human communities.

Prior to the establishment of the BISO in 1974, impacts such as logging and coal mining resulted in the degradation of the water quality. Logging and coal mining activities impacted the water quality by increased CMD levels and sedimentation within the BSF. Following the establishment of BISO, logging and coal mining activities ceased which lead to natural restoration of many areas of inside the park and improvement of water quality. Oil and gas activities have continued as a result of approximately 19,000 acres of privately held minerals located within the authorized boundary. Presently there are over 150 operating wells and numerous gas wells located throughout the park. However due to ongoing oil and gas extraction and past mining activities including the placement of mine spoil material along tributaries and the BSF, water quality within the BSF continues to be impacted.

Step 9: Determine the magnitude and significance of cumulative effects.

Past mining activities and logging activities greatly impacted the water quality within BISO by increasing CMD and sedimentation. Oil and gas extraction is still ongoing in BISO and impacts include loss of hydrocarbons, erosion and sedimentation. Past restoration activities such as mine closures within BISO and restoration of Rock Creek have had minor positive improvements to the water quality of the BSF.

Implementation of the proposed alternative would result in additional minor to moderate positive long-term benefits by aiding in the reduction of CMD and sedimentation within the stream reaches as well as the BSF. Reduction of CMD and sedimentation within the project areas would aid in the improvement of water quality resulting in the improvement of the aquatic habitat within the project area. As part of this EA a monitoring plan was developed and can be found in Appendix A. This purpose of the monitoring plan is to meet the Terms and Conditions of the ITS and associated BO and discusses criteria such as but not limited to: species to be planted, ratio of planting, survivability of planted species, visual inspections, water quality sampling, and monitoring timeframe.

In addition to past and the proposed project, the NPS's EIS would also result in additional positive long-term benefits to the BSF.

The proposed project would have minor short-term negative impacts during construction but these impacts would be considered temporary and would not have a significant negative impact on resources within BISO. However, implementation of the proposed project and future projects would result in significant positive benefits on resources within BISO by aiding in the reduction of CMD and sedimentation within the BSF.

Step 10: Modify and add alternatives to avoid, minimize, or mitigate significant cumulative effects.

Although minor positive cumulative impacts have been identified, steps would be taken to avoid, minimize, and/or mitigate for the loss of aquatic habitat (wetlands and streams) as well as reduce potential impacts to federally listed species such as the bats and duskytail darter. Potential Indiana and northern long-eared bat summer habitat would be avoided where possible. Significant cultural resources would be avoided where possible. Construction BMPs would be implemented to contain potential impacts to immediate site vicinity and reduce potential effects to the greatest extent possible.

Step 11: Monitor the cumulative effects of the selected alternative and adapt management.

Implementation of the proposed alternative(s) would result in positive long-term benefits by aiding in the reduction of CMD and sedimentation within the stream reaches as well as the BSF. Reduction of CMD and sedimentation would aid in the improvement of water quality resulting in the improvement of the aquatic habitat within the project area and contributing to improved water quality further downstream within the BSF watershed, particularly as other aquatic resource projects are implemented. The proposed project would be monitored for a minimum of five years to ensure that the project meets all specified criteria. If monitoring reveals unanticipated impacts, these would be evaluated and corrective actions implemented. A detailed monitoring plan can be found in Appendix A.

6.0 Environmental Commitments, Permits, and Approvals

6.1 Required Permits/Reviews

Implementation of the proposed project may involve the following:

1. A Section 401 Water Quality Certification from the KDOW is required for Corps civil works projects. 401 Water Quality Certification and Local Floodplain permits were submitted to KDOW on March 24, 2016. The Corps received issuance of a

local floodplain permit on April 21, 2016. Both permits would be required prior to issuance of a Notice of Proceed to allow construct to begin.

2. A Kentucky Pollutant Discharge Elimination System permit for Stormwater Discharges is required for stormwater discharges for construction projects disturbing greater than one acre of land. The contractor would be required to obtain this permit.

3. A Floodplain Construction permit is required prior to the construction, reconstruction, relocation, or improvement of any dam, embankment, levee, dike, bridge, fill, or other obstruction across or along any stream or in the floodway of any stream; in designated 100-year floodplains; or in areas known to be flood prone. Some of the proposed bank stabilizations would be located in flood-prone areas. This permit may be obtained through the Kentucky Department for Environmental Protection (KDEP).

4. A Wild Rivers Change of Use permit may be required prior to undertaking any change of existing land use in a Wild River corridor. The BSF is considered a Kentucky Wild River from the Kentucky/Tennessee line to approximately Devil's Jump. Blair Creek, Blue Heron, and Laurel Branch project sites lie along this portion of the BSF corridor. This permit is obtained through the KDEP. However, at this time, no specific change in use is expected, as the proposed remedial activities likely will continue to fall within BISO’s current land use designation(s).

5. In compliance with Section 106 of the NHPA, the NPS would be required to obtain a letter of concurrence with respect to the proposed project activities from the Kentucky Heritage Council and the SHPO prior to project implementation. Phase I cultural reconnaissance surveys are required in order to receive such concurrence.

7.0 Environmental Compliance

7.1 Executive Order 11990-Wetlands

Approximately 0.04 acres of the wetlands identified at DJSP would be permanently impacted as a result of the preferred alternative. No mitigation would be required due to the amount of wetland impacts per Corps and KDOW criteria. However, attempts would be made to mitigate for wetland impacts (0.04 acres) within and adjacent to DJSP.

7.2 Farmland Policy Act

No agricultural lands or Prime and Unique Farmlands are located in the project areas.

7.3 Executive Order 11988-Floodplain Management

Floodplains within the proposed project footprint are small to non-existent due to the topography of the area. Due to the nature of the project no anticipated effects to floodplains management would be expected.

7.4 Clean Water Act Compliance

Waters of the United States are present within the proposed project footprint. Therefore, coordination with State and Federal Agencies regarding Clean Water Act compliance is required. Permits from KDOW (Section 401) would be required for the proposed project. It is anticipated that KDOW would cover the three remediation projects under Individual Water Quality Certification. Confirmation of this coverage was obtained from KDOW on 10 February 2016. Water quality permits for KDOW would be required prior to construction.

Under Section 404 of the Clean Water Act, Project Planning Branch evaluates the impacts associated with the proposed project. A Department of Army permit is not required for Corps Civil Works projects. The work would be done in accordance with Nationwide Permit (NWP) 27 (Stream Restoration) and NWP 13 (Bank Stabilization). Therefore an individual Clean Water Act Section 404(b)(1) Evaluation is not required for this project.

7.5 National Pollutant Discharge Elimination System Permit

Construction projects disturbing over one acre of land require a National Pollutant Discharge Elimination System Permit (NPDES) storm water permit. Since this project would disturb over an acre an NPDES permit is required for the proposed action. Coordination with KDOW is required and the permit would be obtained prior to initiation of construction. A Storm Water Pollution Prevention Plan would be prepared by the contractor for the project and reviewed by the Corps (verify if KDOW approval needed) maintained onsite throughout construction of the proposed action.

7.6 Endangered Species Act

This project is being done in accordance with the BO issued by the FWS to the Corps. All phases are being coordinated with the FWS to ensure compliance with the BO and any other requirements of the ESA.

One shagbark hickory tree and four snags meeting the FWS guidelines for suitable Indiana and northern long-eared bats summer roost habitat would be removed in order to

access the proposed project sites. Based on the surrounding landscape, additional adjacent habitat within the proposed project area, and timing of tree removal (November 15 – March 31) the Corps determined that the removal of the identified suitable summer roost habitat trees would not likely adversely impact federally listed bats.

In order to construct the BHS project a shallow shoreline strip would be impacted by placement of riprap. The placement of the riprap within the BSF could impact federally listed species if present. Documented within the BO, the FWS concurred with the Corps determination "may affect – not likely to adversely affect" for the federally listed mussel species and the duskytail darter. However, prior to construction, proactive measures to include surveys for mussels would be completed by TVA to ensure no federally listed species are present. If found, mussels would be removed and reestablished outside of the project footprint in suitable habitat to avoid any potential impacts. It is the Corps understanding that this would be covered by the 2014 ITS and associated BO.

Coordination with the FWS for the removal of the four identified suitable summer roost habitat trees and potential impacts to federally listed mussel species was initiated on May 18, 2016. In an email dated June 3, 2016 the FWS concurred with the Corps determination and proactive measures.

7.7 Fish and Wildlife Coordination Act

Coordination with FWS is ongoing at this time. FWS has been greatly involved with the selection of preferred alternatives.

7.8 National Historic Preservation Act

The NPS is the lead federal agencies for compliance with the NHPA. NPS is completing the site inventory assessment and documentation to consult with the State Historic Preservation Officer and Tribes to meet our collective responsibility under Section 106 and pursuant to 36 CFR 800. Section 106 consultation is expected to conclude with a no adverse effect to historic properties determination.

7.9 Executive Order 13653 - Preparing the United States for the Impacts of Climate Change

The proposed project would have no effect on climate change. Banks stabilized within the proposed project footprint are more resilient to extreme and likely more intense storm events.

7.10 Executive Order 12898 – Environmental Justice

EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations was issued to focus attention of federal agencies on human health and environmental conditions in minority and low-income communities

and to ensure that potential disproportionately high and adverse human health or environmental effects on these communities are identified and addressed. In order to provide a thorough environmental justice evaluation, this section describes the distribution of race and poverty status in areas surrounding BISO and potentially affected by implementation of proposed actions.

Demographic information indicates no minority residents and low-income populations reside on or adjacent to the immediate proposed project areas since it is part of BISO. None of the alternatives would have a disproportionate impact on minority or low-income populations. BISO is public land open to all members of the public for access and use.

7.11 Clean Air Act

The proposal is in an attainment area with regard to the NAAQS. The proposed project would not result in violations of NAAQS.

7.12 Comprehensive Environmental Response, Compensation, and Liability Act

No Comprehensive Environmental Response, Compensation, and Liability Act sites were identified within the proposed project boundaries.

7.13 Resource Conservation and Recovery Act

All alternatives would be in compliance with the Resource Conservation and Recovery Act.

8.0 Public and Agency Coordination

8.1 Scoping Responses

A Scoping letter regarding the proposed project was issued to interested parties and agencies on November 24, 2014. The Scoping letter and comments received are summarized below and included in entirety in Appendices D. All scoping issues relative to the project have been addressed within the EA. NPS's EIS is currently in draft simultaneous with this EA but addresses larger sites and a longer range program. NPS recently conducted public workshops for the larger CMD remediation program addressed by the EIS which involved more substantial remedial projects.

8.1.1 Scoping Comments

No comments were received during the scoping of the proposed project.

8.2 Public and Agency Involvement

The EA would be provided to resource agencies and made available to the public for a 30-day review and comment period. Any responses would be considered before finalizing the EA and FONSI and included in Appendix E of this document. In addition to the EA and unsigned FONSI review, a public open house to discuss the proposed project was held at the Big South Fork Kentucky Ranger Station in Stearns, Kentucky on March 10, 2016. Comments received during the public and agency review as well as the public meeting are considered and incorporated where applicable and are included in entirety in Appendices D.

9.0 Conclusions

The Corps proposes to construct Alternative 5 - Combination of BHS, DJSP, and UT3CLS which is the environmentally preferred alternative. These sites (BHS, DJSP, and UT3CLS) were determined to provide benefits in water quality and sediment reduction to the BSF in the reach containing the endangered duskytail darter. The FWS has reviewed the EA and proposed plans and concurred that Alternative 5 meets the intent of the Terms and Conditions of the ITS. A monitoring plan would be developed and implemented to document the effects of these remediation projects over time to ensure compliance with the March 2014 BO on returning Lake Cumberland to normal pool levels. Implementation impacts associated with these remediation projects would be minor and short-term in duration and should be positive over the long-term as they address issues with remnants of past coal mining. There would be some short-term disruption of recreational uses during construction (limited trail closures and parking). However, once construction activities are completed access to trails, roads, and parking lots would be restored and reopened for public use.

The No Action alternative would allow existing conditions to continue along the proposed project areas. CMD, sedimentation, and erosion would continue to affect the BSF and tributaries resulting in poor water quality and degraded stream reaches throughout the project area. The No Action alternative would likely result in the continued degradation of the BSF, tributaries, and aquatic life. These negative impacts would continue within the range of the duskytail darter, thus providing no benefits to improving the habitat for this endangered fish.

10.0 References

Blanton, R. E. and Jenkins, R.E. 2008. Three new darter species of the *Etheostoma percnurum* species complex (Percidae, subgenus *Catonotus*) from the Tennessee and Cumberland River drainages. Zootaxa 1963:1-24.

Britzke, Eric. 2007. Mammal Inventory of Big South Fork national River and Recreation Area, Tennessee and Kentucky.

Conservation Fisheries, Inc.2003.Survey for the federally endangered duskytail darter, *Etheostoma percnurum*, in the upper Big South Fork River system. Final Report to Big South Fork National River & Recreation Area, Order Number P5530010114.9 pp.

Davis, Jonathan G. and Cook, Bradford S. 2010. Habitat Use of the Tuxedo Darter (*Etheostoma lemniscatum*) at Macrohabitat and Microhabitat Spatial Scales. Journal of Freshwater Ecology, Vol.25, Number 3. pp 321 – 330.

Davis, J.G. 2010. Development of long-term monitoring protocols for two rare fishes, the tuxedo darter and the spotfin chub, in Tennessee. A dissertation presented to the Faculty of the Tennessee Technological University, Cookeville, Tennessee. 262 pp. As referenced in the SERVICE Document, 2012 Duskytail Darter (*Etheostoma percnurum*) 5-Year Review: Summary and Evaluation.

Ferguson, Terry A., Robert A. Pace, and Jeffrey W. Gardner, 1984. An Archaeological Survey and Testing of Proposed Construction Areas and Road Right-of-Ways in the Blue Heron Development Sites and the Blue Heron, Devils Jump, and Leatherwood Ford 0verlooks of the Big South Fork National River and Recreation Area. Department of Anthropology, University of Tennessee, Knoxville.

Jenkins, R. E. and N. M. Burkhead. 1994. Freshwater Fishes of Virginia. American Fisheries Society, Bethesda, MD.

Kentucky Geologic Survey, 1964. Geology of the Barthe11 Quadrangle and Part of the Oneida North Quadrangle, Kentucky. Prepared by Joel B. Pomerene.

Knoedler, Todd. 2012. National Park Service (U.S.Department of the Interior, NPS). Final Mine Closure Summary Report, Install Safety Closures at Abandoned Mines to Protect Visitors and Preserve Resources, Big South Fork National River and Recreation Area (BISO), Oneida, Tennessee.

Layman, S.R. 1991. Life history of the relict duskytail darter, *Estheostoma* (*Catonotus*) spp., in the Little River in Tennessee. Copeia.Pp.471-485.

National Park Service (U.S. Department of the Interior, NPS), 2000. Big South Fork National River and Recreation Area Draft General Management Plan and Environmental Impact Statement.

National Park Service. 2001. Preliminary Draft Environmental Assessment, Implementation of Remediation Activities for Selected Contaminated Mine Drainage Sites.

National Park Service (U.S. Department of the Interior, NPS). 2005. Big South Fork National River and Recreation Area Final General Management Plan and Environmental Impact Statement.

National Park Service (Big South Fork National River and Recreation Area) 2016. Cultural and Archaeological Resource Evaluation of the Proposed Project-Remediation of Selected Contaminated Mine Sites by Army Corps of Engineers in the Big South Fork National River Recreation Area. *Draft report.*

Rakes, P.L., J. R. Shute, and P. W. Shute. 1992. Quarterly states report for the captive propagation of the duskytail darter, *Etheostoma [Catonotus]* sp.). Unpublished report to Tennessee Wildlife Resources Agency; U.S. Fish and Wildlife Service, Asheville Field Office; Cherokee National Forest; and National Park Service, Great Smoky Mountain National Park.5 pp.

Simmons, Jeffrey W. and Shaffer, Gregory P. Tennessee Valley Authority. 2013. Mussel and Fish Survey of the Lower Big South Fork Cumberland River in Areas Inundated by Normal Operations of Wolf Creek Dam.

Shute, J.R., P. W. Shute, and P. L. Rakes. 1993. Captive propagation and population monitoring of rare southeastern fishes by Conservation Fisheries, Inc. Final Report to Tennessee Wildlife Resources Agencies for Fiscal Year 1992-1993 (Contract #FA-2-09667-2-02) and First Quarter Report for Fiscal Year 1993-1994 (Contract #FA-4-10792-4-00).27 pp.

Tennessee Department of Environment and Conservation. 1997. Big South Fork National River and Recreation Area Water Resources Management Plan, Division of Water Pollution Control, Watershed Management Section, Nashville, Tennessee.

Simmons, Jeffery W. 2014. Tennessee Valley Authority. Results of Tuxedo Darter, Fish Community, Water Quality, and habitat Monitoring in the Big South Fork Cumberland River during 2014.

Simmons, Jeffery W. and Susan B. Malone. 2015. Tennessee Valley Authority. Biological Monitoring in the Big South Fork Cumberland River following return of Lake Cumberland to Normal Pool Level Operation – Year Two, 2015.

U.S. Climate Data. 2016. Version 2.2.www.usclimate data.com

U.S. Fish and Wildlife Service. 1993. Duskytail Darter Recovery Plan. Atlanta. GA. 25 pp.

U.S. Fish and Wildlife Service, 1998. Endangered Species Consultation Handbook, Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act.

U.S. Fish and Wildlife Service. 2012. Duskytail Darter (Etheostoma percnurum) 5-Year Review: Summary and Evaluation.

U.S. Fish and Wildlife Service. 2014. Website: Species Profile, Duskytail darter (*Etheostoma percnurum*). http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E078

U.S. Fish and Wildlife Service. 2015. 2015 Rangewide Indiana Bat Summer Survey Guidelines.

11.0 List of Preparers

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APPENDIX A

Incidental Take Statement, Biological Opinion, and Monitoring Plan

United States Department of the Interior

FISH AND WILDLIFE SERVICE
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March 24, 2014

Lieutenant Colonel John L. Hudson
Commander
Nashville District Corps of Engineers
P.O. Box 1070
Nashville, TN 37202

Subject: FWS #2008-B-0075; Final Biological Opinion on the Wolf Creek Dam/Lake Cumberland Return to Historical Pool Level Operations, Russell County, Kentucky

Dear Lieutenant Colonel Hudson:

This document is the Fish and Wildlife Service's (Service) biological opinion based on our review of the U.S. Army Corps of Engineers (Corps) Wolf Creek Dam/Lake Cumberland Return to Historical Pool Level Operations (historical lake operations) and the proposed action's effects on the duskytail darter (*Etheostoma percnurum*). This biological opinion is provided pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act or ESA) (16 U.S.C. 1531 *et seq.*). Your February 7, 2014 request for formal consultation was received on February 10, 2014 and formal consultation under the Act was initiated on February 13, 2014. The Service previously concurred with the Corps' "not likely to adversely affect" (NLAA) determination for 23 other federally-listed species (Table 1) and a "NLAA" determination for designated critical habitat (Table 2).

This biological opinion is based on information the Corps provided in its February 10, 2014 biological assessment (BA), supplemental information to the BA provided on February 26, 2014, the Corps' 2007 Wolf Creek Dam/Lake Cumberland Emergency Measures in Response to Seepage Final Environmental Impact Statement (EIS), telephone conversations with the Corps, meetings, field investigations, and other sources of information. A complete administrative record of this consultation is on file at the Service's Kentucky Ecological Services Field Office (KFO) in Frankfort, Kentucky.

Introduction

Wolf Creek Dam is located at Cumberland River Mile (CRM) 460.9 near Jamestown, Russell County, Kentucky. The dam impounds the Cumberland River and many of its tributaries upstream of Wolf Creek Dam in portions of Clinton, Russell, Wayne, Pulaski, and McCreary counties. The impoundment creates Lake Cumberland, the largest flood control reservoir east of the Mississippi River. As stated in the EIS, the Corps made the decision to immediately lower

Table 1. Species evaluated where the Service has concurred with a "not likely to be adversely affect" determination for the proposed action.

SPECIES	SCIENTIFIC NAME	STATUS
Mammals		
Indiana bat	*Myotis sodalis*	Endangered
gray bat	*Myotis grisescens*	Endangered
Fishes		
blackside dace	*Chrosomus cumberlandensis*	Threatened
palezone shiner	*Notropis albizonatus*	Endangered
Cumberland darter	*Etheostoma susanae*	Endangered
Mussels		
Cumberland bean	*Villosa trabilis*	Endangered
Cumberlandian combshell	*Epioblasma brevidens*	Endangered
Cumberland elktoe	*Alasmidonta atropurpurea*	Endangered
fluted kidneyshell	*Ptychobranchus subtentum*	Endangered[1]
littlewing pearlymussel	*Pegias fabula*	Endangered
oyster mussel	*Epioblasma capsaeformis*	Endangered
pink mucket	*Lampsilis abrupta*	Endangered
spectaclecase	*Cumberlandia monodonta*	Endangered[2]
fanshell	*Cyprogenia stegaria*	Endangered
tan riffleshell	*Epioblasma florentina walkeri*	Endangered
purple catspaw	*Epioblasma obliquata obliquata*	Endangered
ring pink	*Obovaria retusa*	Endangered
rough pigtoe	*Pleurobema plenum*	Endangered
orangefoot pimpleback	*Plethobasus cooperianus*	Endangered
Plants		
Virginia spiraea	*Spiraea virginiana*	Threatened
Cumberland sandwort	*Arenaria cumberlandensis*	Endangered
Cumberland rosemary	*Conradina verticillata*	Threatened
white fringeless orchid	*Platanthera integrilabia*	Candidate

[1] Table 1 represents the current listing status for the species. At the time informal consultation was initiated, the fluted kidneyshell was a candidate for federal listing under the ESA. The fluted kidneyshell was listed as endangered on October 28, 2013 (78 FR 59269-59287). Because this species was considered during informal consultation and none were identified during aquatic species surveys, the Service believes that the change in federal listing status does not warrant additional consultation and the effects determination of "may affect – is not likely to adversely affect" remains appropriate for this species.

[2] Table 1 represents the current listing status for the species. At the time informal consultation was initiated, the spectaclecase was a candidate for federal listing under the ESA. The spectaclecase was listed as endangered on April 12, 2012 (77 FR 14914-14949). Because this species was considered during informal consultation and none were identified during aquatic species surveys, the Service believes that the change in federal listing status does not warrant additional consultation and the effects determination of "may affect – is not likely to adversely affect" remains appropriate for this species.

Table 2. Critical Habitat evaluated where the Service has concurred with a "not likely adversely affect" determination.

SPECIES	DESIGNATED CRITICAL HABITAT
Cumberland elktoe (69 FR 53136-53180)	Big South Fork, Marsh Creek, and Rock Creek, McCreary County, KY Sinking Creek, Laurel County, KY Laurel Fork, Whitley County
Cumberlandian combshell (69 FR 53136-53180)	Big South Fork, McCreary County, KY Buck Creek, Pulaski County, KY
Oyster mussel (69 FR 53136-53180)	Big South Fork, McCreary County, KY Buck Creek, Pulaski County, KY

Lake Cumberland to an elevation of 680 feet to ease stress on the dam's foundation in January 2007 and hold that elevation for an indefinite period until repairs were completed.

The Corps invoked its authority under 33 CFR 230.8 "Emergency Actions" and declared an emergency, made decisions, and took necessary actions to prevent a possible dam failure at Wolf Creek Dam. The emergency decision to lower the pool behind Wolf Creek Dam on an interim basis was made prior to the completion of any necessary National Environmental Policy Act (NEPA) document (e.g., environmental assessment or environmental impact statement). Therefore, pursuant to 33 CFR 230.8 and 40 CFR 1506.11, the Corps sent a letter dated January 18, 2007 to the President's Council on Environmental Quality (CEQ) seeking initiation of consultation with CEQ regarding alternative arrangements for NEPA compliance. As part of those arrangements, the EIS was written to address the impacts from the decision to lower the pool elevation at Lake Cumberland while the dam safety project was undertaken.

The EIS development process also included conducting informal ESA consultation with the Service to determine if adverse effects to federally-listed species were likely. During the informal consultation process, the Service concurred that lowering the pool elevation at Lake Cumberland and conducting the dam safety project was unlikely to result in adverse effects on federally-listed species; however, the Service also raised concerns in its February 12, 2007 letter to the Corps that the subsequent raising of Lake Cumberland, and a return to historical lake operations, could result in adverse effects on federally-listed aquatic species, Indiana bats, and/or gray bats, if habitat for these species was created or restored as a result of the draw-down. The Service was concerned that the pool reduction would likely expose caves or in-stream habitat (i.e., that would normally be inundated by Lake Cumberland) and federally-listed species would begin to occupy these habitats, especially if the draw-down of the lake lasted for an extended period of time.

Based on the Service's concerns, the Corps' Record of Decision on the EIS included a commitment to conduct species surveys in areas where habitat was created prior to returning to historical lake operations. These surveys would help determine if federally-listed species were present in areas that had previously been inundated by Lake Cumberland. In a February 26, 2013 letter to the Corps, the KFO determined that cave surveys for federally-listed bat species were not necessary. This determination was based on information provided by the Corps

showing that in-flow and water elevation data, during the interim draw-down, indicated that any potential caves exposed during the draw-down continued to be exposed to water fluctuations that resulted in periodic inundation of the caves. Therefore, it was unlikely that federally-listed bats would use any of these caves due to these water fluctuations, the periodic inundation of the caves, and the availability of other suitable summer roosting and/or hibernacula in the vicinity for both Indiana bats and gray bats.

Subsequent to the Service's February 26, 2013 letter, the northern long-eared bat (*Myotis septentrionalis)* (NLEB) was proposed for federal listing under the ESA on October 2, 2013. No critical habitat has been proposed for the NLEB at this time, and the final listing decision on this species is expected in October 2014. Pursuant to Section 7(a)(4) of the ESA, federal action agencies are required to confer with the Service if they determine that the proposed federal action is likely to jeopardize the continued existence of the NLEB (50 CFR 402.10(a)). The Service does not expect the proposed action to result in adverse effects on the NLEB, because no potential summer or winter habitat will be disturbed as a result of the action, and no indirect or other adverse effects on the species have been identified or are reasonably certain to occur. Therefore, the proposed action is not likely to result in jeopardy of the NLEB.

Also, subsequent to the Service's February 26, 2013 letter, critical habitat was designated for the endangered fluted kidneyshell (*Ptychobranchus subtentum*). This designation became effective on October 28, 2013. The majority of the newly designated critical habitat either: a) occurs outside of the project action area, or b) overlaps with the designated critical habitat previously considered in the Big South Fork during informal consultation for the three listed mussel species shown in Table 2 above. However, the designation also includes 40.7 river miles of the Little South Fork Cumberland River (Little South Fork) from its confluence with the Big South Fork Cumberland River, upstream to its confluence with Dobbs Creek in Wayne County, Kentucky. A portion of the designated critical habitat near the confluence of the Little South Fork with Big South Fork occurs within the action area. The lower portion of this reach has been continuously inundated by Lake Cumberland, including during the current draw-down, and, therefore, does not contain the Primary Constituent Elements for this designated critical habitat. The upper portion has historically been affected periodically and temporarily by increased lake levels during flood events and would receive the same types of effects after the return to historical lake operations. Based on this information, the Service believes the proposed action is not likely to adversely affect designated critical habitat for the fluted kidneyshell in the Big South Fork or Little South Fork.

In the February 26, 2013 letter to the Corps, the Service maintained its request that surveys for listed aquatic species should be conducted in the Big South Fork between river miles 44 and 33.5. The aquatic surveys requested by the Service were completed by the Corps in November 2013, once Big South Fork flows were conducive. No federally-listed mussels were identified; however, the endangered duskytail darter was observed at 8 of 15 survey sites (i.e., sites 1-8 that were identified in the Corps' 2013 Survey report). Suitable, but unoccupied, habitat for the species was identified at an additional site (i.e., site 9 in the Corps' 2013 Survey report). These areas are likely to be temporarily-to-permanently re-inundated by a return to historical lake operations. Therefore, the Corps developed a BA for the return to historical lake operations that included a "may affect – is likely to adversely affect" determination and associated effects

analysis for the duskytail darter. For all other federally-listed species previously considered during the informal consultation process associated with the dam safety project (Table 1), the KFO's January 22, 2010 concurrence with the Corps' 2008 "may affect – is not likely to adversely affect" determinations is still valid. As a result, the species and critical habitat identified in Tables 1 and 2 above will not be adversely affected by the Corps' proposed action and, therefore, will not be discussed further in this biological opinion. In addition, the information provided in this biological opinion relating to the Northern long-eared bat and designated critical habitat for the fluted kidneyshell shows they will not be adversely affected by the Corps' proposed action and, therefore, also will not be discussed further in this biological opinion.

Consultation History

February 2, 2007	The Corps requested comments on the rehabilitation of Wolf Creek Dam in the Federal Register (72 FR 5020-50201)
February 12, 2007	The KFO provided the Corps with a list of federally-listed species and designated critical habitats that could be affected by the proposed project.
March 23, 2007	The Corps solicited comments from the public; federal, state, and local agencies and officials; Indian tribes; and other interested parties on the preparation of the Draft Environmental Impact Statement (DEIS)
October 9, 2007	The KFO received a copy of the DEIS for comment and review.
December 7, 2007	The KFO, in coordination with the Tennessee Ecological Services Field Office (TFO), provided the Corps with comments on the DEIS.
December 21, 2007	The KFO received notice that the Final EIS (FEIS) was available for review and comment.
February 28, 2008	The KFO and Corps conducted a conference call regarding the FEIS to address the KFO's December 7, 2007 comment letter on the DEIS.
December 22, 2008	The Corps responded to the KFO's December 7, 2007 comment letter on the DEIS, committed to conducting surveys for federally-listed mussel species, and requested concurrence that the proposed project was "not likely to adversely affect" federally-listed species.
August 3, 2009	The KFO issued a response letter to the Corps' December 22, 2008 response requesting additional information on the indirect and cumulative impacts associated with the project.
August 19, 2009	The Corps issued a response to the KFO that provided the additional information requested.

January 22, 2010	The KFO concurred with the Corps' "not likely to adversely affect" determinations for 24 federally-listed species and designated critical habitat in the vicinity of the action area.
November 5, 2010	The EIS was completed and Record of Decision signed.
February 11, 2013	The Corps sent correspondence to the KFO stating that: (1) the dam repairs were ahead of schedule; (2) the Corps would like to return Lake Cumberland to historical pool during the summer of 2014; (3) cave surveys for endangered bat species were not warranted due to documented water fluctuations within the caves; and (4) aquatic species surveys would begin when conditions were favorable.
February 26, 2013	The KFO responded to the Corps' February 11, 2014 correspondence and agreed that cave surveys were not warranted and that aquatic surveys were warranted and should be conducted when conditions were favorable.
November 2013	The Corps completed aquatic surveys and identified the presence of the duskytail darter at 8 of the 15 survey sites (sites 1-8) and suitable, but unoccupied, habitat at 1 site (Site 9) in the Big South Fork.
December 11, 2013	The Corps submitted the final report for the aquatic surveys in the Big South Fork.
January 8, 2014	Representatives from the Corps, Tennessee Valley Authority (TVA), TFO, KFO, and National Park Service's (NPS) Big South Fork National River and Recreation Area (BSFNRRA) met to discuss the preparation of the BA and need for formal consultation.
January 9, 2014	The KFO and Corps had numerous informal and formal discussions via teleconference and exchanged numerous formal and email correspondence related to the proposed project that began on January 9, 2014 and continued through March 24, 2014. These discussions and correspondence are part of the Service's administrative record held at the KFO.
February 10, 2014	The Corps submitted the final BA for the project.
February 13, 2014	The Corps submitted supplemental information for the BA to the KFO via email correspondence.
February 13, 2014	The KFO initiated formal consultation on the Corps' proposed action to return Wolf Creek Dam to historical lake operations.
February 26, 2014	The Corps submitted supplemental BA information regarding it proposed conservation measures.

February 26, 2014	The Corps submitted additional information regarding potential habitat improvement and water quality improvement projects in the BSFNRRA.
February 26, 2014	The KFO conducted a teleconference BSFNRRA Superintendent to update NPS staff on the consultation process and discuss the Corps' proposed conservation measures for the proposed action, which would include habitat improvement and water quality improvement projects within the BSFNRRA.
March 6, 2014	The Corps submitted additional information regarding its proposed conservation measures.
March 12, 2014	The Corps provided additional information via electronic mail on the Interim Dam Adjustment conservation measure.
March 13, 2014	The KFO provided the Corps with a draft biological opinion for review
March 24, 2014	The KFO issued the final biological opinion on the Corps' proposed action to return Wolf Creek Dam to historical lake operations.

FWS Log No.: 2008-B-0075 **Application No.:** N/A
Date Started: February 13, 2014 **Ecosystem:** Upper Cumberland River
Applicant: U.S. Army Corps of Engineers **Action Agency:** U.S. Army Corps of Engineers
Project Title: Wolf Creek Dam/Lake Cumberland Return to Historical Pool Level Operations
County: Russell County, Kentucky

DESCRIPTION OF THE PROPOSED ACTION

As defined in the Service's section 7 regulations (50 CFR 402.02), "action" means "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas." The "action area" (project area) is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." The direct and indirect effects of the actions and activities must be considered in conjunction with the effects of other past and present federal, state, or private activities, as well as the cumulative effects of reasonably certain future state or private activities within the action area. This biological opinion addresses only those actions for which the Service believes adverse effects may occur.

Determination of the Action Area

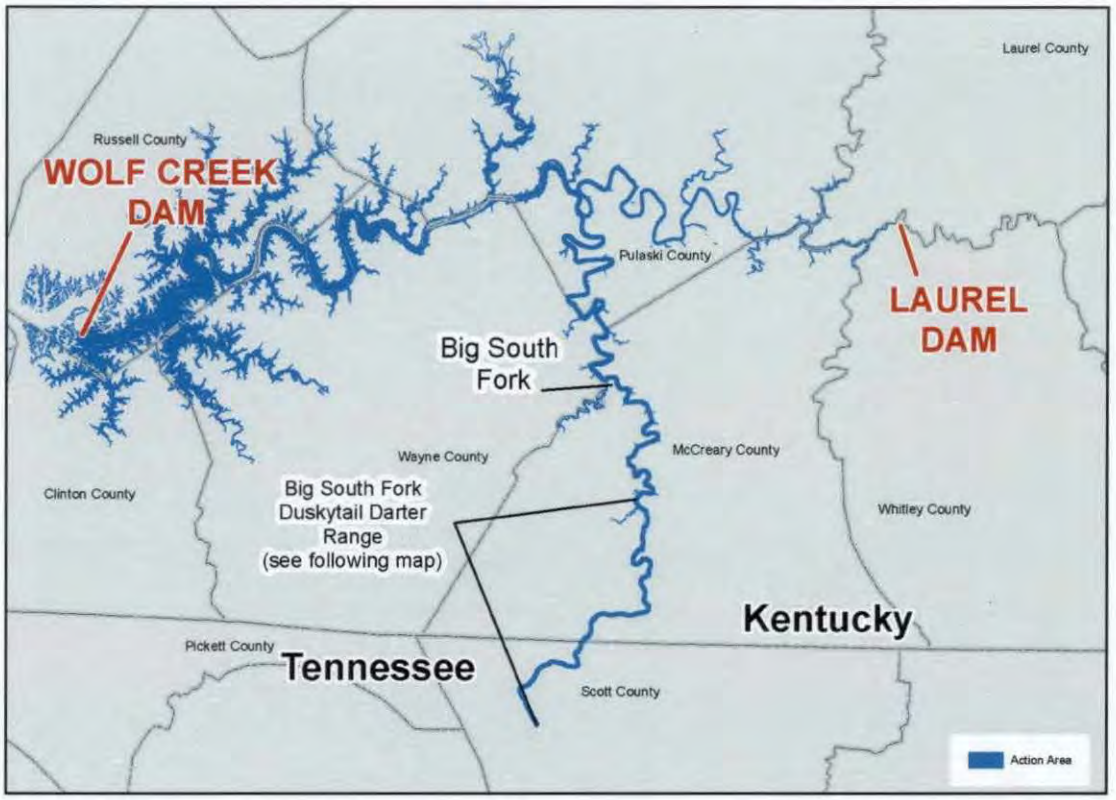
Wolf Creek Dam is located near Jamestown, Kentucky at Cumberland River mile 460.9. Lake Cumberland, created by the dam, impounds 6,089,000 acre-feet at its maximum pool elevation of 760 feet (National Geodectic Vertical Datum of 1929). The action area includes Wolf Creek Dam, Lake Cumberland, and those riverine, riparian, and upland habitats associated with the Cumberland River mainstem and its tributaries upstream of Wolf Creek Dam, that are subject to temporary and/or permanent inundation resulting from the historical operation of Wolf Creek Dam. In addition, the action area includes the portion of the Big South Fork occupied by duskytail darters upstream to BSFRM 66.5. While the upstream portions of the Big South Fork are not usually impacted by the Corps' operation of the Wolf Creek Dam, the Corps has proposed several conservation measures as part of their proposed action, which will occur within this portion of the Big South Fork. While the Service believes the overall outcome of implementing these measures will be positive on duskytail darters, there is the potential for minor, short-term adverse effects on duskytail darters and/or duskytail darter habitat due to implementation of these conservation measures. Therefore, it is appropriate to include the upper portion of the Big South Fork between Blue Heron and the uppermost duskytail darter occurrence at BSFRM 66.5 as part of the action area. A map depicting this action area is contained in Figure 1.

Project action

The construction of Wolf Creek Dam was completed in 1952 and was originally justified on the basis of flood damage reduction and hydropower production. The preferred method of releasing water is through hydropower turbines; however, spillway gates and/or sluice gates are also used when conditions warrant. In 1984, a Memorandum of Understanding (MOU) was signed, by the Corps, Department of Energy, Southeastern Power Administration (SEPA), and the Tennessee Valley Authority (TVA). The MOU directed the Corps to make daily water release decisions for Wolf Creek Dam and other hydropower projects within the Cumberland Basin reservoir system. Under this MOU, TVA continued to set the hourly generation schedule, but instead of TVA receiving all of the hydropower produced, it was now marketed to a group of utilities under the direction of SEPA. For purposes of this consultation, the period from 1984 to 2006 should be considered representative of historical lake operations, as this was the period that best represents how the project was being operated prior to the emergency draw-down initiated in January 2007 for the dam safety project.

The power pool for Wolf Creek Dam extends from the top of the conservation pool, which is at an elevation of 673 feet, up to an elevation of 723 feet. The flood control pool extends from an elevation of 723 feet to an elevation of 760 feet. There is a seasonal operating guide within the power pool called the "Power Marketing Band" (PMB). This operating zone was jointly developed by SEPA, TVA, and the Corps. The PMB starts the year ranging from an elevation of 682-700 feet and then gradually fills from February to mid-May when the elevation ranges from 710-723 feet. The PMB then gradually falls, beginning in mid-June, until it returns to elevations in the 682-700-foot range at the end of the year, prior to initiation of the flood season. The PMB is a non-binding operating guide that maximizes hydropower benefits, while also supporting

Figure 1. Wolf Creek Dam/Lake Cumberland Return to Historical Pool Level Operations Action Area



other operating objectives including flood control, water quality, water supply, and recreation, as well as other downstream uses dependent on the release of stored water through the summer and fall (e.g., navigation). The upper end of the PMB is referred to as the "Top SEPA Curve" throughout the rest of this biological opinion. Raising the pool elevation in Lake Cumberland in the late winter and early spring is a typical operation that balances the need to preserve storage volume during the traditional flood season, while capturing water for release during the summer and fall when natural river flows are not sufficient to meet water management operating objectives (e.g., minimum flows, navigation, etc.). Capturing cool, oxygenated water in the late winter and early spring also benefits water quality, fish, and other aquatic organisms in the lake.

The interim operating restriction implemented at Wolf Creek in 2007 was to operate for a year-round target elevation of 680 feet. In 2013, the operating restrictions at Wolf Creek were revised to allow the pool behind the dam to rise to elevation 705 feet to evaluate the barrier wall, which was a major safety component of the dam safety project that had been completed in March 2013. Following the evaluation period for the barrier wall, the pool was lowered from elevation 705 down to an elevation of 690 feet to support the remaining construction activity on the embankment section of Wolf Creek Dam. This construction is scheduled to be completed by March 2014. Therefore, the Corps proposes to cease the emergency operations that were initiated in 2007 and return Wolf Creek Dam to historical lake operations, with an intended

target elevation of 723 feet. The dam would be operated in accordance with the Corps' existing water control manuals; therefore, project purposes would be restored to pre-construction, pre-drawdown management.

Proposed Conservation Measures

The Corps has proposed the following conservation measures in the BA and supplemental BA information to minimize impacts associated with returning Lake Cumberland to historical lake operations. The conservation measures are, therefore, considered part of the proposed action and include the following:

1. **Capture and Hold:** This measure would involve a tiered implementation approach that focuses on capturing a portion of the affected duskytail darter individuals at 8 sites (i.e., sites 2-9 in the Corps' 2013 survey report) in the Big South Fork and holding them in a secure facility for a length of time that is estimated to last 5 to 10 years. The exact duration that duskytail darters would be held would depend on the duration of the Corps' post-project implementation monitoring of the occupied duskytail darter sites that would be adversely affected by the proposed action. This conservation measure includes specific tasks, described below, that provide flexibility in advance to pursue future conservation and recovery efforts for the duskytail darter if post-project implementation monitoring shows that all duskytail darter occurrences and suitable habitat at sites 2-9 are lost.

    - Tier 1 – Capturing and Holding Duskytail Darters: The elements of Tier 1 would be implemented in-full, as soon as conditions in the Big South Fork are favorable for capturing duskytail darters. Based on historical gauge data, favorable flow conditions for collecting duskytail darters will not typically occur until late August or September. The Corps and the Service believe that collection efforts will still be successful if they occur after Lake Cumberland is returned to historical lake operations, provided that this element of the conservation measure is carried out as soon as conditions become favorable, and after the raising of Lake Cumberland has commenced. Tier 1 would include: (a) capturing duskytail darters from sites 2-9, (b) holding captured duskytail darters at one or more approved facilities for the duration of the Corps' post-project implementation monitoring (c) propagating duskytail darters at levels necessary to maintain the captive population, and (d) maintaining the captive population for the duration of the monitoring period. Tier 1 will also involve conducting genetic analysis of duskytail darters from sites 2-9 and from the other sites within the Big South Fork to ensure that propagation and captive population maintenance efforts are scientifically-based and would promote the species' recovery and conservation. If monitoring indicates that duskytail darters and/or habitat at sites 2-9 are not declining or absent, implementation of Tier 2 will not be necessary, and the Corps and the Service will coordinate on the future disposition of the captured duskytail darters.

    - Tier 2 – Surveys for Potential Reintroduction Sites: Implementation of Tier 2 will be dependent on data obtained during the Corps' post-project implementation monitoring. If monitoring indicates that duskytail darters and/or habitat are

declining or absent at all of the occurrences in the Corps' 2013 Survey report), implementation of Tier 2 will become necessary. If the monitoring effort shows that duskytail darters and their habitat are stable or increasing at one or more of the occurrences at sites 2-9, implementation of Tier 2 will not be necessary, because the effect of the take potentially associated with the proposed action will have been minimized through the retention of the occurrence(s). If implemented, Tier 2 will include: (a) conducting surveys for duskytail darters at sites where the species is not currently known to exist in the Big South Fork and other Cumberland River tributaries that may contain habitat suitable for the species; (b) evaluating potential sites for reintroduction or population augmentation based on these surveys and recommendations resulting from the genetic analysis; (c) developing a reintroduction and population augmentation plan if suitable locations are identified; and (d) conducting reintroduction efforts based on the reintroduction and population augmentation plan.

2. **Water Quality/Habitat Improvement:** The Corps will (a) remediate two acid mine drainages (AMD) on tributaries that drain to the Big South Fork and are within the range of the duskytail darter and (b) implement at least one sediment abatement/soil stabilization project that would reduce sediment levels in the portion of the Big South Fork containing the species. The AMD sites are located in the Laurel Branch area, which is upstream of Blue Heron (i.e., site 1 in the Corps' 2013 Survey report), and are contributing water to the Big South Fork containing a variety of chemical contaminants and metals and sediment into the reach of the Big South Fork occupied by duskytail darters. The Corps has assessed two sites (described below); however, other sites may be chosen if further field investigations indicate their remediation would provide equal, or greater, conservation and recovery benefits to the duskytail darter. The sediment abatement/soil stabilization project would be chosen from several potential trail crossing projects proposed by the NPS, a potential stream bank and coal spoil pile stabilization project located along the mainstem of the Big South Fork, or a similar proposed project that would have demonstrable benefits of reducing sediment sources in the Big South Fork and improving water quality for duskytail darters. Because all of these sites are located within the BSFNRRA, implementation of this conservation measure depends on NPS approval of the Corps' proposed Water Quality/Habitat Improvement projects.

    - AMD Site 1: Laurel Branch Stream Spoil (LBSS) Site – The LBSS site contributes pollutants to the Big South Fork from diffuse discharges associated with historic deep mine spoil on the side-slope of the watershed. The mine spoil from this mining is located down-slope of an abandoned mining opening and includes a large section of spoil deliberately placed across the channel to be used as a bridge during active mining. The bridge foundation has washed away leaving mine residues in the channel and has created a waterfall on Laurel Branch that is approximately 20 feet high. Remediation recommended for this site would involve segregating the stream flow from the mine spoil by construction of a stable, lined stream channel to minimize infiltration of stream flow in the mine spoil. This would eliminate all but direct precipitation falling on the spoil.

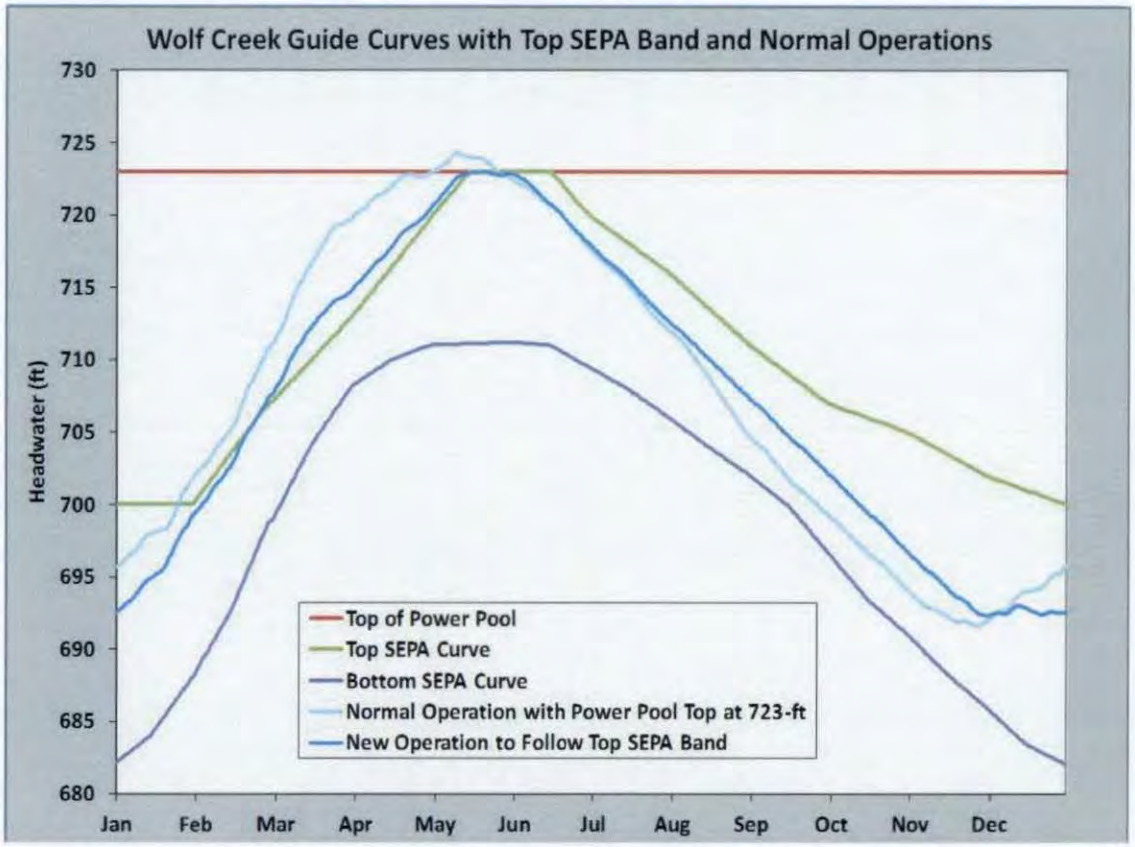
- AMD Site 2: Laurel Branch Confluence (LBC) Site – The LBS site is approximately 800 LF downstream of the confluence of Laurel Branch and the Big South Fork. It consists of 1-2 acres of partially-vegetated spoil. The spoil extends down to the banks of the Big South Fork and are eroded into the river at times of high flow. Remediation at this site would include re-grading the spoil piles to compact and neutralize spoil material with lime, and segregating natural stream flow of a smaller unnamed tributary from the mine spoil with a lined interceptor channel.

- Sediment Abatement: The BSFNRRA has an active recreational component that includes a network of horse, mountain bike, and hiking trails. Points where these trails cross the Big South Fork and its tributaries can result in sources of sediment input. Many of the trails have become entrenched into the floodplain and funnel local runoff into the river, often scouring large sediment loads from the trail or roadbed. As part of its trail management planning, the NPS intends to harden as many of these stream crossings as possible to address both the relic impacts from the trail or road and to reduce the current effects caused by trail users. The NPS and Corps have identified several key stream crossings that would be suitable for sediment abatement based on the proximity of the site(s) to the reach of the Big South Fork that contains duskytail darters. The Corps has also identified several potential erosion control projects along the mainstem of the Big South Fork. These proposed projects would involve stabilizing existing coal mine spoil piles that are currently being eroded by the river. Other erosion protection sites within the duskytail darter's range in the Big South Fork will also be explored as long as the projects would have demonstrable benefits of reducing sediment sources in the Big South Fork and improving water quality for duskytail darters.

3. **Interim Dam Adjustment:** In an effort to offset potential impacts while the water quality/habitat improvement conservation measure is being implemented, operations at the Wolf Creek Dam will follow, as much as conditions allow, the Top SEPA Curve during the filling cycle (Figure 2). The objective of the interim dam operation adjustment will be to follow the Top SEPA Curve during the fill cycle with an overall goal of reaching elevation 723 around the middle of May. During the fill cycle, the Corps will make operational adjustments that include 1) use of sluice releases or 2) full hydropower releases, rather than power peaking releases, when the pool elevation is in the power pool and above the Top SEPA Curve. Based on historical operations, the net long-term result is depicted in Figure 2.

   Strict adherence to the Top SEPA Curve will not be possible due to the range of variability observed in project in-flows. The volume of runoff associated with large rainfall events in the Lake Cumberland watershed far exceeds the discharge abilities of Wolf Creek Dam due to physical discharge constraints. The combination of these factors will result in lake levels that are above the Top SEPA Curve elevations, and may

Figure 2. Wolf Creek Dam Guide Curves with the Top SEPA Curve and Normal Operations



result in lake levels entering the flood control pool. Conversely, during extended dry periods, the pool elevation may drop below the Top SEPA Curve, and the Corps' ability to reach the 723-foot elevation could be compromised. This is due in part to discharges normally made to meet reservoir system minimum flow and hydropower objectives.

As part of the Interim Dam Adjustment conservation measure, the Corps' water managers will maintain the pool elevation as close to the Top SEPA Curve as possible while still considering downstream flooding concerns and forecasted weather events. When the lake level is above the Top SEPA Curve, but within the hydropower pool, all efforts will be made to return the pool to the Top SEPA Curve using hydropower releases. However, in some cases, sluice releases may be necessary and will be undertaken in addition to releases through hydropower generation. As pool levels are drawn down to the Top SEPA Curve and still within the hydropower pool, reductions in releases will be implemented to smooth the transition and minimize navigation and hydropower impacts. Guidance in the Wolf Creek water control manual states that following a flood event, storage is recovered as quickly as possible based on downstream conditions in order to restore the capability to provide protection from future flood events. This guidance will be followed when lake levels enter the flood control pool.

STATUS OF THE SPECIES/CRITICAL HABITAT

Unless cited otherwise[3], the following information was obtained from the Duskytail Darter Recovery Plan (USFWS 1994), the final listing rule for the species (58 FR 25758-25763, April 1993), and the Duskytail Darter 5-year Review: Summary and Evaluation (5-year review) (USFWS 2012).

Species/critical habitat description

The duskytail darter was listed as endangered on April 27, 1993. The species' current distribution is fragmented, but its historical range was likely more widespread within the upper Tennessee River and middle Cumberland River drainages of Kentucky, Tennessee, and Virginia. At the time of listing, the species was known from only four isolated stream reaches: (1) Little River (Blount County, TN), (2) Citico Creek (Monroe County, TN), (3) Big South Fork Cumberland River (Scott County, TN)[4], and (4) Copper Creek/Clinch River (Scott County, VA). Two historical populations – Abrams Creek (Blount County, TN) and South Fork Holston River (Sullivan County, TN) – were considered to be extirpated. Since federal listing, the duskytail darter has been successfully reintroduced into Abrams Creek and the Tellico River. With the addition of these streams, the species now occupies a total of six, geographically-isolated stream reaches within the upper Tennessee and Cumberland River drainages. Critical habitat has not been designated for the species.

Taxonomy

When the recovery plan was completed in 1993, the duskytail darter was recognized as an undescribed member of the *Etheostoma flabellare* species group of the subgenus *Catonotus* (Page 1975, Page 2000). Soon after completion of the recovery plan, the species was described by Jenkins (1994) as *Etheostoma percnurum*. Blanton and Jenkins (2008) examined morphological variation among extant and extirpated populations and concluded that *E. percnurum* represented a species complex, consisting of four geographically isolated and morphologically distinct species. These included *E. percnurum* (duskytail darter) from the Clinch River and Copper Creek (Tennessee River system in Virginia), *E. sitikuense* (Citico darter) from Citico Creek, Abrams Creek, and the Tellico River (Tennessee River system in Tennessee), *E. marmorpinnum* (marbled darter) from the Little River and South Fork Holston River (Tennessee River system in Tennessee), and *E. lemniscatum* (tuxedo darter) from the Big South Fork (Cumberland River system in Kentucky and Tennessee). Blanton & Jenkins (2008) based their conclusions on meristic, morphological, and pigmentation analyses that showed each of the four extant populations were morphologically diagnosable. The Service has not formally recognized these nomenclatural changes; therefore, the duskytail darter description, as published

[3]After 2008, published and unpublished literature typically refers to the Big South Fork population of the duskytail darter as the "tuxedo darter", based on taxonomic work by Blanton & Jenkins (2008) as further described in the "Taxonomy" section of this biological opinion.

[4] Although not referenced in the Recovery Plan or 5-year review, the Big South Fork population also occurs in McCreary County, Kentucky.

in 58 FR 25758 is the current taxon recognized under the ESA and the taxon covered for the purposes of this formal consultation.

Life history

The duskytail darter is a small (6.4 cm) member of the Family Percidae, with a straw to olivaceous colored body, a medium to dark gray top of head, and a dingy-white to pale-gray belly. It has 10 to 15 long dark vertical bars on the sides of its body, 38 to 48 (usually 40 to 45) lateral scales, and 17 to 20 (usually 18 to 19) dorsal spines and rays. It is difficult to determine the sex of non-breeding individuals in the field; however, during the breeding season, males are very distinctive. The head becomes dark and swollen and the humeral spot and lateral vertical bars are intensified. The first dorsal saddle and vertical bar form a dark yolk, and brilliant gold, fleshy knobs develop on the tips of the dorsal fin spines (Layman 1991).

The duskytail darter inhabits the edges of gently flowing, shallow pools (up to 120 cm in depth), eddy areas, and slow runs in usually clear water of large creeks and moderately large rivers. Snorkel observations in Citico Creek by Rakes *et al.* (1992) and in the Little River, Copper Creek and Big South Fork of the Cumberland River by Shute *et al.* (1993), indicate that the species is discriminatory about preferred microhabitat type, being found over heterogeneous mixtures of rock sizes from pea gravel, rubble/cobble, slab-rock, and boulder substrates. This preference for a mixture of various substrate sizes often results in patchy distributions. There may be locally dense clumps of individuals within a relatively short distance, and then long stretches where few specimens were observed.

The duskytail darter is insectivorous (Layman 1991). The youngest individuals consume microcrustaceans, midge larvae (Family Chironomidae), and sometimes large quantities of mayfly nymphs (Family Heptageniidae). Larger individuals are also mainly benthic insectivores but generally feed on larger prey items such as midge larvae, mayfly nymphs, microcrustaceans, and caddisfly larvae. The largest individuals sometimes feed on fish eggs (Layman 1991).
Spawning generally begins in late April or early May and ends in June. Both males and females become mature at age one and rarely survive to age three. Prior to spawning, males choose and clean a spawning site under a rock. Eggs (23 to 150) are deposited by the female on the undersides of rocks and the male remains to guard the eggs. Males stay at the nest site, guard the eggs, and may spawn with multiple females.

Population dynamics

The following is a summary of the most-recent information on the population dynamics of the duskytail darter for each of the six geographic locations where it currently occurs:

Little River (TN): The duskytail darter was known from two sites in the lower Little River until Conservation Fisheries, Inc. (CFI) discovered a third site in 1999 (CFI 2004). Due to perceived population declines, CFI began captive propagation and augmentation of duskytail darters in the Little River in 2003, and over 100 duskytail darters were released above U.S. Highway 411 at that time (CFI 2004). The following summer, five individuals were found at the release site, including one individual resulting from natural reproduction. Since 2003, 719 propagated

duskytail darters have been stocked at three sites in the Little River. While efforts have been made to augment the population and expand the species' range upstream, it is too early to determine the success of these efforts (J.R. Shute 2014, pers. comm.). There are no specific data on population stability for this location, but observations by CFI indicate that the population is declining. There is no specific information on population size or variability for this location.

Citico Creek (TN): The duskytail darter continues to be considered stable or increasing in Citico Creek (Petty *et al.* 2011) and remains the source population for reintroductions into the Tellico River (Petty *et al.* 2011). Eggs taken from nests in Citico Creek are used to propagate young for the reintroduction efforts into Abrams Creek, and the Tellico River. In 2010, CFI stocked a total of 321 individuals into Citico Creek (Petty *et al.* 2011). In 2009 and 2010, 114 individuals and 35 nests were observed by CFI (Petty *et al.* 2011). In 2006, a total of 220 individuals and 24 nests were observed (Rakes and Shute 2007). From 1993-2002, annual abundance indices ranged from 2.0 to 7.85 fish per person-hour, and averaged 4.6 fish per person-hour (CFI 2003); although these indices provide a basis for a range of variation or abundance in this population, there is no specific estimate of population size for this location.

Abrams Creek (TN): In 1992, CFI began captive propagation and reintroduction of the duskytail darter into Abrams Creek, which is in the Great Smoky Mountains National Park, Blount County, Tennessee. Duskytail darter nests removed from nearby Citico Creek, which is isolated from Abrams Creek by Chilhowee and Tellico reservoirs, were reared in order to produce young duskytail darters for the reintroduction efforts. Between 1987 and 2003, a total of 3,430 duskytail darters were stocked into Abrams Creek (Shute *et al.* 2005). Monitoring conducted during the same time period revealed 433 observations of duskytail darters (Shute *et al.* 2005). From 1993 to 2002, annual abundance indices ranged from 0.5 to 1.74 fish per person-hour, with an average of 1.0 fish per person-hour (CFI 2003).

In 2007, the average annual duskytail darter abundance index was 12.1 fish per person-hour, the highest ever recorded (Rakes and Shute 2008). CFI has consistently observed evidence of natural reproduction in Abrams Creek since 1995 (Shute et al. 2005). Duskytail darters appear to be doing well above and below the Abrams campground area (J.R. Shute 2008, pers. comm.). Given steady increases in annual abundance indices and an expanding distribution in Abrams Creek, this population appears to be viable (Rakes and Shute 2008); however, there is no specific information on population size, stability, or variability for this location.

Tellico River (TN): In 2002, CFI began captive propagation efforts for duskytail darter introductions within the Tellico River designated as a non-essential population (NEP) (67 FR 52420-52428). Nests removed from nearby Citico Creek were reared to produce young for the reintroduction efforts. From 2002 to 2010, a total of 3,547 duskytail darters were reintroduced into the Tellico River (Petty *et al.* 2011). Natural reproduction was observed at two reintroduction sites in 2007 (Rakes and Shute 2008), and there is now evidence of natural reproduction and successful recruitment of new year-classes (Petty *et al.* 2011); however, there is no specific information on population size, stability, or variability for this location.

Big South Fork of the Cumberland River (KY and TN): Duskytail darters have consistently been observed in the Big South Fork since at least 1998. From 1993 to 2002, annual abundance indices ranged from 0.66 to 2.0 fish per person-hour, and averaged 1.3 fish per person-hour (CFI 2003). In 2005 surveys, CFI observed 28 individuals at three sites (CFI, unpublished field notes). Recent surveys have expanded the known range of the Big South Fork population to a 22.5-kilometer (km) (14 mile (mi)) reach of the river (Davis 2010), with the core population being located between Station Camp Creek and Blue Heron on the mainstem of the river (CFI 2003). Davis (2010) estimated the total population size as approximately 200 in 2008 and approximately 100 in 2009. Ninety percent of the Big South Fork population was found within a 7-km (4.3-mi) reach (Davis 2010). There is no specific information on population stability or variability for this location.

Copper Creek and Clinch River (VA): From 1993 to 2002, the duskytail darter was indirectly monitored while surveying for the yellowfin madtom in Copper Creek. During that time period, annual abundance indices in Copper Creek ranged from 0.33 to 2.22 fish per person-hour, with an average of 1.2 fish per person-hour (CFI 2003). In 2007, CFI observed 62 duskytail darters in Copper Creek above the VA Highway 627 Bridge (CFI, field notes). In a 2008 survey focused on duskytail darters, CFI observed 98 duskytail darters from approximately 19 km (12 mi) of lower Copper Creek (rkm 2.9 to 22.2 or rmi 1.8 to 13.8) (Rakes *et al.* 2009). In 2008, the duskytail darter numbers ranged from 0 to 8 fish per person-hour, and the range of the fish appeared to have contracted in both an upstream and downstream direction when compared with earlier studies (Rakes *et al.* 2009). In 2009, CFI observed one duskytail darter at Copper Creek rkm 22.4 (mi 13.9) (CFI 2009). There is no specific information on population size, stability, or variability for this location.

Status and distribution

Reasons for listing

In order to determine if listing was warranted for the duskytail darter, the Service assessed the best scientific and commercial information available regarding the past, present, and future threats faced by the species. The final listing rule specifically identified water quality deterioration resulting from siltation and other pollutants from poor land used practices, coal mining, and waste discharge as threats to the species. The final listing rule further states that the species' limited distribution also makes it vulnerable to chemical spills and other stochastic events. Because of the restricted distribution of the duskytail darter and its perceived vulnerability to a variety of threats, the species was listed as endangered.

While the final listing rule included a broad discussion of threats to the duskytail darter, a more comprehensive review was included in the Recovery Plan and 5-year review. These documents identified impoundments, water withdrawal, urbanization, coal mining, toxic chemical spills, siltation, improper pesticide use, and streambank erosion as threats to the duskytail darter. Of these, siltation, caused by excessive releases of sediment from activities such as agriculture, resource extraction (e.g., coal mining, silviculture), road construction, and urban development is considered the most significant (Waters 1995).

Rangewide trends

According to the 5-year review (USFWS 2012), the duskytail darter population was considered stable, as of 2011; however, based on observations by CFI, the Little River population appeared to be declining. No new information is available to indicate that the threats have increased for any of the duskytail darter populations.

New Threats

Physical habitat destruction resulting from a variety of human-induced impacts such as siltation, disturbance of riparian corridors, and changes in channel morphology continues to threaten the duskytail darter; however, no new threats have been identified.

Recovery criteria

The goal of the Duskytail Darter Recovery Plan (USFWS 1994) is to restore viable populations of the duskytail darter to a significant portion of its historic range and remove the species from the Federal List of Endangered and Threatened Species. The duskytail darter will be considered for reclassification to threatened status when the likelihood of the species becoming extinct in the foreseeable future has been eliminated by achieving the following criteria:

1. Three distinct viable populations exist, through protection and enhancement of the existing populations in the Little River, Blount County, Tennessee; Citico Creek, Monroe County, Tennessee; Big South Fork of the Cumberland River, Scott County, Tennessee; and Copper Creek and Clinch River, Scott County, Virginia, and successful establishment of a reintroduced population in Abrams Creek or other historic habitat or the discovery of an additional population.

2. Studies of the fish's biological and ecological requirements have been completed and the implementation of management strategies developed from these studies has been or is likely to be successful.

3. No foreseeable threats exist that would likely threaten the survival of any of the three aforementioned populations.

Although some progress has been made at addressing criterion 2 above, the 5-year review (USFWS 2012) states that none of the reclassification (i.e., downlisting) criteria have been met.

In addition, the criteria necessary to delist the duskytail darter have not been met yet (USFWS 2012), but are presented below for reference.

1. Through protection and enhancement of the existing population and successful establishment of reintroduced populations or the discovery of additional populations, five distinct viable populations exist.

2. Studies of the fish's biological and ecological requirements have been completed and the implementation of management strategies developed from these studies has been successful.

3. No foreseeable threats exist that would likely threaten the survival of any of the populations.

Previous Biological Opinions

Two previous biological opinions have been completed for the duskytail darter (Table 3):

- The first biological opinion was issued by the Tennessee Field Office (TFO) in 1996 for the emergency repair of Citico Creek Road and the associated stabilization of areas along Citico Creek on the Cherokee National Forest in Monroe, Tennessee. The TFO did not identify the number of individuals anticipated to be lost or the amount of habitat that would be disturbed, but instead indicated that the proposed action could have resulted in incidental take of the population in Citico Creek, but this did not occur.

- The second biological opinion was issued by the Virginia Ecological Services Field Office (VFO) in 2013 for a stream restoration and riparian buffer establishment project along Copper Creek in Scott County, Virginia. The VFO indicated that 12 duskytail darters could be incidentally taken as a result of elevated turbidity and sedimentation associated with that project.

Table 3. Previously-issued Biological Opinions for the Duskytail Darter.

Biological Opinion	Species	Take Amount	HABITAT	
			Critical Habitat Impacted	Amount of Habitat Adversely Affected
1996 – TFO	duskytail darter	Not specified	NA	Not specified
2013 – VFO	duskytail darter	12 individuals	NA	0
TOTAL		12 individuals	NA	0

Analysis of the species/critical habitat likely to be affected

This biological opinion considers the effects of the proposed action on the duskytail darter. Critical habitat has not been designated for the species; therefore, no critical habitat will be affected. The KFO has previously concurred with the Corps' "may affect – not likely to adversely affect" determinations for the 23 species shown in Table 1 and the NLEB, and the designated critical habitat for three federally-listed mussel species shown in Table 2 and for the fluted kidneyshell in the Little South Fork. Therefore, those species and critical habitat areas will not be considered further in this biological opinion.

ENVIRONMENTAL BASELINE

Under section 7(a)(2) of the Act, when considering the "effects of the action" on federally-listed species, the USFWS is required to take into consideration the environmental baseline. The environmental baseline includes past and ongoing natural factors and the past and present impacts of all Federal, State, or private actions and other activities in the action area (50 CFR 402.02), including Federal actions in the area that have already undergone section 7 consultation, and the impacts of State or private actions that are contemporaneous with the consultation in process.

Status of the species within the action area

The Big South Fork is the largest tributary to Lake Cumberland where it originates in north-central Tennessee at the confluence of the New River and Clear Fork and flows northeast for 77 miles to join the Cumberland River near Burnside, Pulaski County, Kentucky. The entire free-flowing mainstem portion of the Big South Fork is located within the boundaries of the BSFNRRA, which is operated by the NPS. The duskytail darter is only known to occur within the Big South Fork portion of the action area. Within this reach, duskytail darter only inhabits those areas that provide suitable habitat, which consists of gently flowing stream edges with a heterogeneous mixture of rock sizes (shoals). These shoals are often separated by hundreds of meters of long, deep, pools that are not expected to be utilized by duskytail darters and are not considered suitable habitat for the species.

Prior to implementation of emergency operations at Wolf Creek Dam in 2007, the species had been confirmed in at least 14 shoals, extending from Big South Fork River Mile (BSFRM) 66.5 downstream to BSFRM 45.1 at Blue Heron. Duskytail darters were present at Blue Heron (BSFRM 45.1) in 2005, which was prior to the draw-down of Lake Cumberland and represented the most downstream extent of their known distribution prior to the draw-down (Scott 2010).

The Corps' 2013 survey evaluated all shoal complexes located between BSFRM 45.1 (i.e., the Blue Heron occurrence and site 1 of the survey) and BSFRM 34.4 (site 15) as potential areas for federally-listed and rare aquatic species. Site 1 (Blue Heron) was the most upstream shoal complex, whereas site 15 was the most downstream shoal complex surveyed. Survey sites were selected based on their potential to be affected by inundation under the return to historical lake operation levels and based on whether they were free-flowing during the period of reservoir draw-down (i.e., 2007 – present). New occurrences of duskytail darters were documented at seven new shoals (sites 2-8) and one previously documented site (Blue Heron, site 1). The occurrences observed at sites 2-8 expanded the number of known occurrences within the Big South Fork to 21 (Figure 3). The survey also identified site 9 as containing suitable duskytail darter habitat (Table 4), but no darters were observed at the time of the survey. Therefore, the Service estimates that duskytail darters occur, or are likely to occur, at 22 shoals within the Big South Fork.

Observed abundances were similar to those reported from previous surveys conducted by Eisenhour and Burr (2000) and CFI (2003) in upstream reaches, ranging from approximately 1 to 15 individuals at each shoal. The species may have also been present at site 9, because it was

Figure 3. Duskytail Darter Sites Discussed in the Corps' 2013 Survey Report.

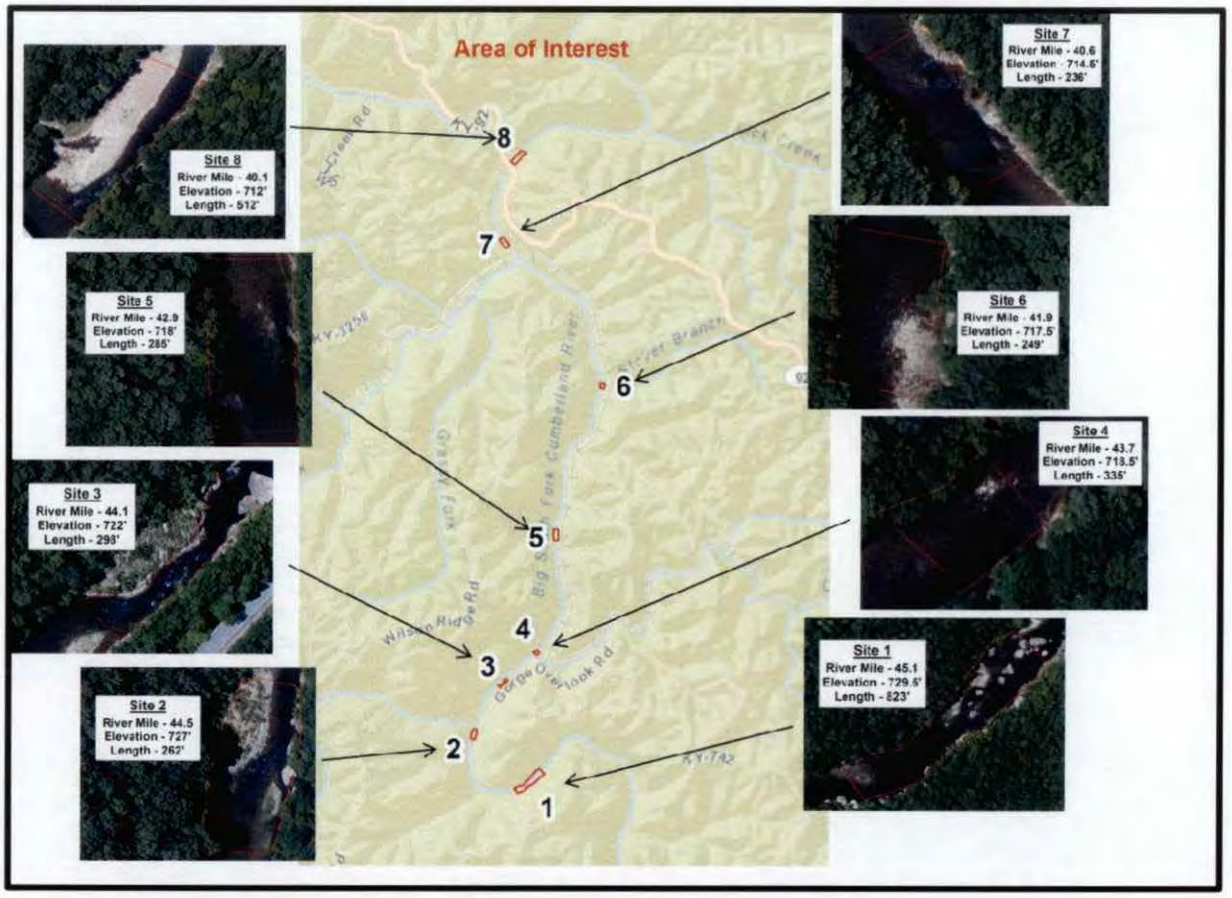


Table 4. Duskytail Darter Site Location Information for Sites 1-9.

Site	BSFRM	Elevation[5]	Length (ft)
1	45.1	729.5	823
2	44.5	727.0	262
3	44.1	722.0	722
4	43.7	718.5	335
5	42.9	718.0	285
6	41.9	717.5	249
7	40.6	714.5	236
8	40.1	712.0	512
9[6]	39.1	707.0	765

[5] The elevations used in this table are based on a 1930s streambed survey (USACE 1975).
[6] Site 9 was considered suitable but unoccupied habitat in the Corps' 2013 survey report.

judged during the Corps' 2013 survey to be suitable habitat. However, the species was not detected at that site during the survey.

Factors affecting the species environment within the action area

The Big South Fork watershed has been impacted by coal mining, agriculture, domestic and industrial wastes, channelization, logging, and oil exploration (O'Bara 1982). According to the 5-year review (USFWS 2012), the Big South Fork and its tributaries continue to be impacted by forestry practices, municipal and domestic waste, agricultural runoff, oil and gas operations, and water withdrawal, all of which can adversely affect the species. However, the Service is not aware of any other Federal actions within the action area that would affect the species.

EFFECTS OF THE ACTION

Factors to be considered

This section includes an analysis of the direct and indirect effects of the proposed action on the species and its interrelated and interdependent effects. While analyzing direct and indirect effects of the proposed action, the Service considered the following factors:

- Proximity and distribution of the action – We describe the known species locations in relation to the action area and proposed action, where the proposed action will occur, and the likely impacts of the activities;
- Timing – We describe the likely effects in relation to sensitive periods of the species' lifecycle;
- Nature of the effects – We describe how the effects of the action may be manifested in elements of a species' lifecycle, population size or variability, or distribution, and how individual animals may be affected;
- Duration – We describe whether the effects are short-term, long-term, or permanent;
- Disturbance frequency – We describe how the proposed action will be implemented in terms of the number of events per unit of time;
- Disturbance intensity – We describe the effect of the disturbance on a population or species; and
- Disturbance severity – We describe how long we expect the adverse effects to persist and how long it would it take a population to recover.

Proximity and distribution of the action

As stated in the environmental baseline, duskytail darters occupy habitat within the action area. The Service anticipates that seven occupied sites (sites 2-8) and one suitable, but potentially

unoccupied, site (Site 9) will be impacted by the proposed action. Site 1 (Blue Heron) was documented to have duskytail darters prior to the drawdown and is, therefore, not expected to be impacted by the proposed action. Site 1 has apparently not been adversely affected by historical lake operations based on the fact that the species has persisted at the site during both historical lake operations and during the period that emergency operations and its associated draw-down were in-effect.

The remaining 13 occurrences within the Big South Fork that are upstream of Blue Heron (site 1) are only expected to experience minor impacts as a result of implementation of the Capture and Hold conservation measure. Similarly, these areas may also experience short-term impacts that result from implementing the Water Quality/Habitat Improvement conservation measure due to short-term changes in water quality and increased sedimentation while projects associated with this conservation measure are being implemented.

Timing of the action

The Service believes the duskytail darter would be most vulnerable during the spring spawning period (late April through June). The Corps has indicated that, once the lake is returned to historical lake operations, lake levels will typically begin to return to an elevation of 723 feet in early spring, in order to capture spring precipitation. Therefore, water depths are expected to be higher, and inundated longer (altering current velocity), during the time that duskytail darters would be beginning to spawn. Because these changes in depth and inundation are likely to increase sediment deposition that would cover nest sites, smother eggs, etc., the Service expects alterations to spawning behavior that could lead to decreased spawning success as a result of the timing of the action.

Nature of the effect

Returning Lake Cumberland to historical lake operations is expected to impact duskytail darter individuals of all age classes by directly and indirectly harming and harassing individuals, indirectly causing the mortality of individuals, and by directly and indirectly altering occupied habitat. These effects are further described in the sections below on Direct and Indirect Effects.

Duration

Returning Lake Cumberland to the historical lake operation level is expected to result in long-term, cyclic, permanent effects to the duskytail darter and its habitat. Once the action is complete, the Corps will return to operating the Wolf Creek Dam and maintaining Lake Cumberland water levels to follow the PMB operating zone. This will mean that the greatest-impacting and most permanent effects will occur at the downstream occurrences at sites 7-9 and the least-impacting and less permanent effects will occur at the upstream sites 2-4.

Disturbance frequency, intensity and severity

The disturbance frequency, intensity, and severity are difficult to determine because these factors will vary throughout the life of the project and are dependent on the synergistic effects of the amount of water entering Lake Cumberland through its various tributaries (e.g., in-flows), climatic conditions (e.g., precipitation amounts and timing), and lake elevations over time and after the return to historical lake operations. However, the Service expects the following effects related to these factors:

Disturbance Frequency: Based on the hydrograph data provided by Corps (USACE 2014) that graphically represents the average effects of historical lake operations, the sites that contain or may contain the duskytail darter that are further downstream (e.g., sites 7-9) are expected to be exposed to the disturbance at a greater frequency than the frequency observed at upstream sites (e.g., sites 2-4). This is because (1) the downstream sites are at a lower elevation that is closer (numerically) to the normal pool elevation of 723-feet and will inundate before upper sites; (2) stream velocities at these locations will be significantly reduced or eliminated for much of the year; and (3) sediment should accumulate for a large proportion of the year at these sites due to reduced flows and increased water depths.

Disturbance Intensity: Hydrograph data provided by Corps (USACE 2014) also indicates that the sites that contain or may contain the duskytail darter that are further downstream (e.g., sites 7-9) are also expected to be exposed to the disturbance at a greater intensity than the upstream sites because (1) the water depth resulting from inundation will be greater at those sites; (2) stream velocities will be significantly reduced or eliminated for much of the year at those sites; and (3) historic sedimentation levels at these sites have been high (i.e., see the photographs in the Corps' BA showing sediment conditions on the river bank at these sites compared to upper sites). For example, site 8 would have an increased backwater depth (up to 7.8 feet) above the normal BSF River Stage for approximately 116 days (late March to mid-July) at the historical pool elevation of 723 feet (Figure 4). This is expected to have a significant impact on habitat and individuals at this location. In comparison, depth hydrographs provided in the BA indicate site 4 (Figure 5) would only have an increased backwater depth (up to 1.3 feet) above the normal BSF River Stage for approximately 24 days in late March to mid-July at the historical pool elevation of 723 feet, indicating that the disturbance at this site would be less intense than the disturbance at site 8.

Disturbance Severity: Hydrograph data provided by Corps (USACE 2014) also indicates that the sites that contain or may contain the duskytail darter that are further downstream (e.g., sites 7-9) are also expected to be exposed to the disturbance at a greater severity than the upstream sites, due to the increased level of inundation, the reduction or elimination of stream velocities, and an increased potential for sedimentation. According to the Corps' data, site 8 would have an increased backwater depth above the normal BSF River Stage for approximately 116 days, while site 4 would only have an increased backwater depth above the normal BSF River Stage for approximately 24 days at the historical pool elevation of 723 feet, indicating that the disturbance severity at site 4 would be less than the disturbance severity at site 8 (Figures 4 and 5).

A summary of the hydrograph data used to compare the disturbance frequency, intensity and severity at all sites is provided in Table 5. Table 5 shows that both the depth and duration of inundation increase in the downstream direction.

Table 5. Summary of Hydrograph Data (USACE 2014)

Site	Duration of Increased Inundation	Backwater Depth Above Normal
1	0	0
2	0	0
3	0	0
4	24 days	up to 1.3 feet
5	30 days	up to 1.8 feet
6	33 days	up to 2.3 feet
7	82 days	up to 5.3 feet
8	116 days	up to 7.8 feet
9	158 days	up to 12.8 feet

Figure 4. Site 8 Depth Hydrograph.

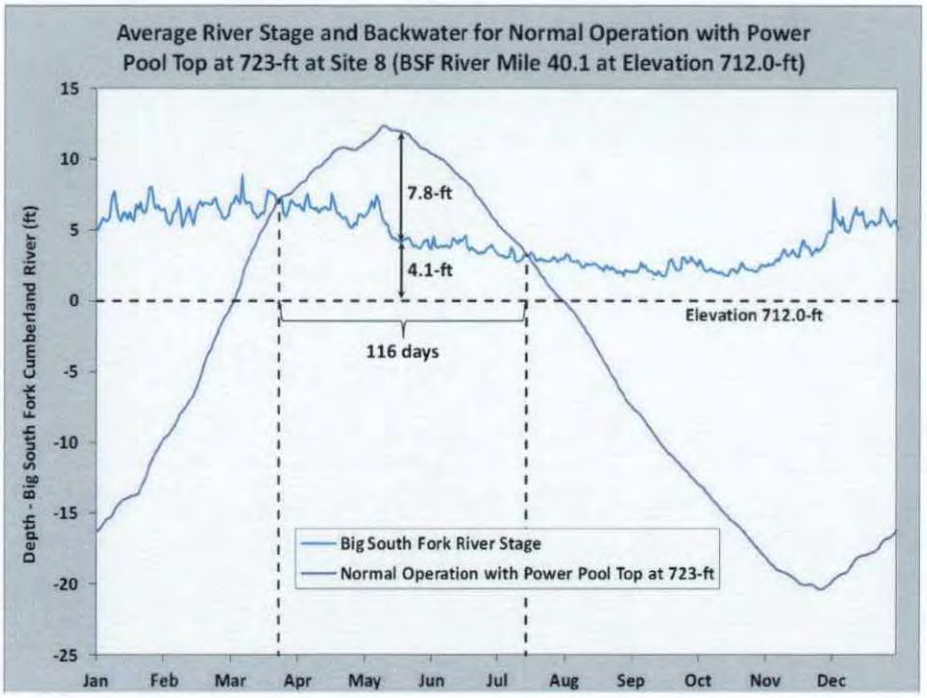
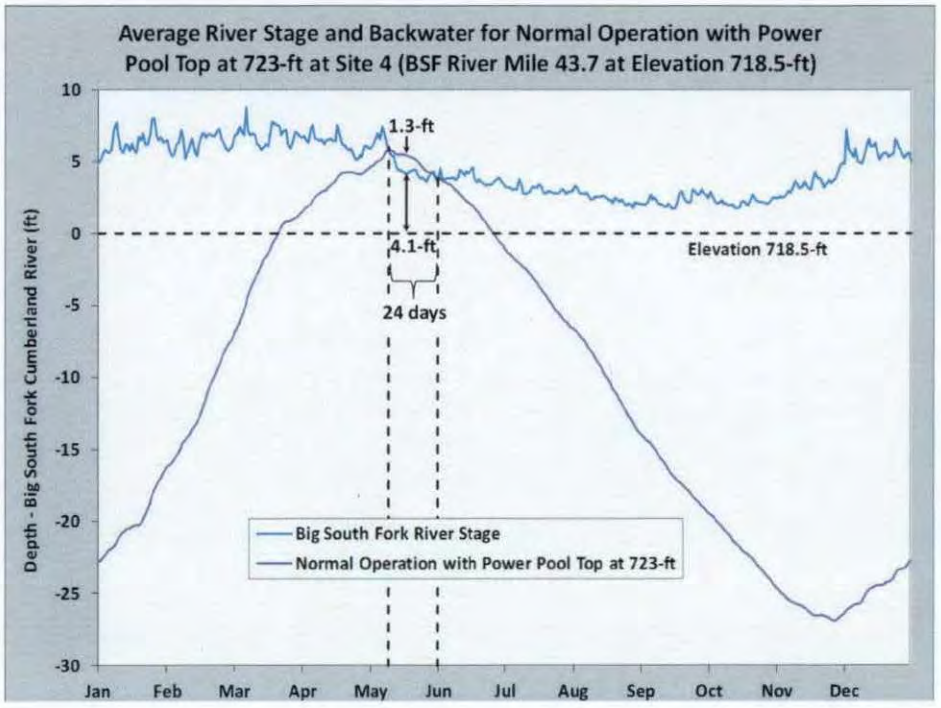


Figure 5. Site 4 Depth Hydrograph.



Direct Effects

Direct effects are considered the direct or immediate effects of the project on the species or its habitat. Direct effects from the proposed action are summarized in the paragraphs below:

Return to Historical Lake Operations

The Service does not expect any direct adverse effects on duskytail darters at site 1 or any of the occurrences upstream of site 1 in the Big South Fork. Conversely, the Service expects direct effects to occur at sites 2-9 and that those effects will follow an increasing downstream gradient, becoming more severe and permanent moving downstream from site 2 to site 9. This would mean that the effects would be most significant at sites 7-9, moderate to significant at sites 4-7, and minor to moderate at sites 2 and 3. While the information provided by the Corps' in Table 6 shows that there would be no increase in the duration of inundation and no increase in water level elevations at sites 2 and 3, this information is based on average historical data and, therefore, cannot accurately predict all potential water level scenarios under a return to historical lake operations. The Service anticipates that there will be periods that result in sites 2 and 3 being subject to increased duration of inundation and water level elevations, which are likely to result in direct adverse effects under a return to historical lake operations. These direct adverse effects would include harm and harassment of duskytail darters at sites 2-9 due to (a) temporary or near-permanent reductions in flow velocities and (b) sediment deposition onto suitable habitat areas.

Capture and Hold Conservation Measure

Direct effects to duskytail darters are likely to occur during implementation of the Capture and Hold conservation measure. During collection efforts at sites 2-9, duskytail darters could be trampled or crushed, resulting in injury or mortality, and some duskytail darters will be captured and retained. Duskytail darters at other sites within the Big South Fork (i.e., from site 1 upstream to BSFRM 44.1) are also likely to be directly affected while obtaining fin clips for genetic analysis. Duskytail darters at those sites could also be trampled or crushed, resulting in injury or mortality while being captured in order to obtain the fin clip. However, the act of fin clipping is only expected to cause minor harm and harassment of individuals and should not result in mortality (Dr. M. Floyd pers. comm. 2014). In addition, all work associated with fin clipping will be conducted by one or more qualified biologists that holds the appropriate State and federal permits and any take associated with this conservation measure would be attributable to the Scientific Collection Permit(s) of the collector(s).

Water Quality/Habitat Improvement Conservation Measure

Implementation of this conservation measure will not include work conducted in habitat that is suitable for duskytail darters. Therefore, no direct effects on the species are anticipated to result from implementation of this conservation measure. The conservation measure may have minor, indirect adverse effects on the species as described in the Indirect Effects section below.

Interim Dam Adjustment Conservation Measure

Following the Top SEPA Curve is expected to minimize the depth and duration of inundation, while also maintaining some velocity within the channel (Table 6). In order to follow the Top SEPA Curve, the Corps will adjust the timing and magnitude of releases from Wolf Creek Dam as necessary to keep water levels as close to the Top SEPA Curve as possible. The Corps has

historically kept Lake Cumberland well above the Top SEPA Curve during the late winter and early spring fill cycle and when weather conditions allowed, ensuring that power generation needs were met to the maximum extent practicable.

Based on the Corps' modeling predictions, following the Top SEPA Curve will be most advantageous at sites 7 and 8. Table 6 below shows the comparison between the proposed action and the proposed action with the implementation of the Interim Dam Adjustment conservation measure. These data show a 2-3 day reduction in flood duration at sites 4-6, a 10-day reduction at site 9, and a 3-4 week reduction at sites 7-8. The Service believes that the implementation of this conservation measure will reduce the depth and duration of extra water on some of the affected sites, thus minimizing potential harm and harassment of the species while the Water Quality/Habitat Improvement conservation measure is being completed. Therefore, implementation of the Interim Dam Adjustment conservation measure would need to be considered a temporary minimization measure, whereas the Water Quality/Habitat Improvement conservation measure would be considered a permanent minimization measure because it permanently fixes specific water quality problems in the Big South Fork.

Indirect Effects

Indirect effects are those effects that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. The Service believes that several aspects of the proposed action will result in adverse effects that may not be evident immediately after the lake is returned in historical lake operation levels, but are reasonably certain to occur. These adverse indirect effects are summarized in the following sections:

Return to Historical Lake Operations

The Service expects that adverse indirect effects will occur as the result of: (1) habitat-related effects resulting from historical lake operations that will, over time, change the habitat from a primarily free-flowing (e.g., lotic) aquatic system to a primarily-to-occasionally impounded (e.g., lentic) aquatic system, and (2) species-related effects on duskytail darters and their behavior that will occur as a result of the change from lotic to lentic habitat.

Habitat-related indirect effects are expected to result in changes to duskytail darter habitat caused by the following:

- Increased water depths;
- Increased duration of inundation;
- Decreased stream flow velocity; and
- Increased sediment deposition.

The Corps' hydrograph data has shown that the return to historical lake operation levels will result in increased water depth, longer periods of inundation, and decreased stream velocities at the affected sites. These impacts are all likely to increase the amount of sedimentation within the affected area, as indicated by the habitat descriptions provided in the Corps' 2013 survey report. Habitat descriptions indicated that sites 10-15 were demonstrative of the lasting effects of impoundment. Water stains were evident on boulders along the shoreline and sediment and detritus piles were common along the stream banks. Site 11, which has been affected by

Table 6. Comparison of Historical Lake Operations and the Interim Dam Adjustment Conservation Measure.

	Normal Operation/Proposed Action					
Site #	# Days Average Lake Backwater is above River Stage	Average Depth from Lake during Backwater Period (ft)	Average Natural BSF Depth during Backwater Period (ft)	Increase in average depth during Lake backwater period (ft)	Percent Increase in average depth during Lake backwater period	Percent decrease in average channel velocity during Lake backwater period (see Note 1)
4	24	5	4.3	0.7	16%	15.1%
5	30	5.2	4.2	1	24%	20.7%
6	33	5.6	4.3	1.3	30%	25.0%
7	82	7.7	4.9	2.8	57%	39.5%
8	116	9	4.9	4.1	84%	49.3%
9	158	12.1	4.7	7.4	157%	65.8%

	Top of SEPA Band Operation						
Site #	# Days Average Lake Backwater is above River Stage	Percent decrease in Lake backwater period as compared to normal operation	Average Depth from Lake during Backwater Period (ft)	Average Natural BSF Depth during Backwater Period (ft)	Increase in average depth during Lake backwater period (ft)	Percent Increase in average depth during Lake backwater period	Percent decrease in average channel velocity during Lake backwater period (See note 1)
4	22	8%	4.3	4.1	0.2	5%	5.0%
5	28	7%	4.7	4	0.7	18%	16.0%
6	30	9%	5.2	4	1.2	30%	24.7%
7	60	27%	7.1	4.4	2.7	61%	41.0%
8	90	22%	8.4	4.4	4	91%	51.2%
9	148	6%	10.8	4.4	5.4	145%	63.5%

Note 1 - Percent decrease in average channel velocity is based on average depths and assumes a 150 foot bottom width trapezoidal channel with 3H to 1V stream bank slopes.

periodic inundation during the draw-down period, silt covered the rocky substrate in the glide and pool habitats. The Service believes that sites 2-9, which are currently indicative of a free-flowing stream (USACE 2013), are likely to experience similar effects, but at varying degrees, once Lake Cumberland is returned to historical lake operations.

As previously stated, duskytail darters have specific habitat preferences, usually in clear, gently flowing water with shallow pools and a mixture of rock sizes (from pea gravel to boulder substrates). Therefore, these physical changes are expected to degrade the habitat quality at sites

2-9 with varying intensity. For example, the Service expects the return to historical lake operations to alter habitat at sites 7-9 to an extent that duskytail darters will no longer occupy these sites because of the significant amount of time these sites will be inundated (82 to 158 days) and the predicted increase in water depths (2.8 to 7.4 feet) at these sites, above baseline conditions. Sites 4-6 are expected to experience moderate changes in habitat, resulting from increased inundation for approximately one month; however, the predicted depth at these sites once the lake is returned to historical lake operation levels, is only slightly higher than the current conditions. However, we expect indirect effects at site 2 and 3 to be less severe, potentially resulting in only minor habitat changes, for shorter periods of time; therefore, potentially remaining suitable for the species throughout the year.

Species-related effects on the duskytail darter are expected to be caused by the following:

- Increased predation; and
- Increased sediment deposition.

The changes to duskytail darter habitat relating to increased water depths and duration of inundation are likely to create suitable conditions for predatory species such as sunfishes and basses (*Lepomis* spp. and *Micropterus* spp.) within the sites where duskytail darters occur. These species, especially larger individuals of sufficient size to prey on adult duskytail darters, are typically not abundant in areas inhabited by duskytail darters because these areas are typically shallow (M. Floyd pers. comm. 2014). Therefore, these species will become more likely to prey on duskytail darters under the return to historical lake operations because of the increased water depths that will occur seasonally and/or permanently at sites 2-9. While some level of predation is normal and can occur from sunfishes and other species, duskytail darters do not normally occur in deeper, pooled waters where such predators are more prevalent. Therefore, some predator-related mortality that is greater than duskytail darters would normally be subjected to is likely to occur as a result of the proposed action.

Activities that contribute sediment discharges into a stream system change the erosion or sediment deposition patterns, which can lead to the destruction of riparian vegetation, bank collapse, excessive in-stream sediment deposition, and increased water turbidity and temperatures. Sediment has been shown to abrade and or suffocate bottom-dwelling organisms by clogging gills; reducing aquatic insect diversity and abundance; impairing fish feeding behavior by altering prey base and reducing visibility of prey; impairing reproduction due to burial of nests; and, ultimately, negatively impacting fish growth, survival, and reproduction (Waters 1995). Wood and Armitage (1997) identified at least five impacts of sedimentation on fish, including (1) reduction of growth rate, disease tolerance, and gill function; (2) reduction of spawning habitat and egg, larvae, and juvenile development; (3) modification of migration patterns; (4) reduction of food availability through the blockage of primary production; and (5) reduction of foraging efficiency.

The Service believes that all of these indirect effects may occur as a result of the proposed action, and the indirect effects could result in mortality, harm, and harassment to individual duskytail darters and habitat degradation at sites 2-9.

Capture and Hold Conservation Measure
Indirect adverse effects are unlikely to result from implementation of this conservation measure, but it is possible that some duskytail darters that are collected and/or their offspring may be harmed or die while being held as part of this conservation measure. However, any take of these individuals would be covered by the Scientific Collection Permit(s) of the collector(s) and facilities that hold these fish.

Water Quality/Habitat Improvement Conservation Measure
The Service believes the Corps' proposal to remediate these sites would offset and minimize some of the water quality-related and sedimentation-related harm and harassment resulting from the proposed action and could, potentially, increase numbers and/or occurrences of the duskytail darter downstream of the sites where these conservation actions are implemented. Nonetheless, the Service expects that some minor adverse effects may occur as a result of the implementation of this conservation measure. In particular, minor adverse effects can result from short-term and temporary discharges of sediment and coal mining spoils associated with the remediation actions associated with this conservation measure. However, these potential adverse effects can and will be minimized through implementation of stringent erosion and sediment control measures and other efforts to reduce the downstream transport of water contaminated with sediment and AMD-related contaminants and chemicals.

Interim Dam Adjustment Conservation Measure
The Interim Dam Adjustment conservation measure is expected to have all of the indirect adverse effects identified in the *Return to Historical Lake Operations* section above; however, those effects will be reduced because the Corps' efforts to follow the Top SEPA Curve will reduce the elevation and duration of inundation at sites 2-9 to various degrees as summarized in Table 6. These reduced effects may be sufficient to maintain duskytail darters at the upper sites (e.g., sites 2-4) for the period that the Interim Dam Adjustment is being implemented, but they are not expected to preclude loss of the species at the lower sites, especially sites 7-9.

Beneficial effects
There are no wholly beneficial effects associated with the proposed project. However, several of the Corps' proposed conservation measures are intended to promote conservation and recovery of the species and are likely to result in long-term benefits to the species and its habitat. In particular, the Capture and Hold conservation measure would ensure that the effects of a stochastic event (e.g., significant contaminants spill) would not eliminate the Big South Fork population and would provide important genetic data that will assist with future management of the species in the Big South Fork. The Water Quality/Habitat Improvement conservation measure would help reduce sediment and the introduction of contaminants into the Big South, thus improving water quality and physical habitat conditions for the species. The Interim Dam Adjustment conservation measure will minimize the duration of inundation and reduce water elevations at some of the upstream sites (e.g., sites 2-4) and, in doing so, will encourage (but not ensure) maintenance of duskytail darters at those sites for a short period of time.

Interrelated and interdependent actions
An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no

independent utility apart from the action under consultation. Based on the Service's review of the Corps' BA and associated documentation, there are no foreseeable interrelated or interdependent actions associated with this project.

Species' response to the proposed action

Numbers of individuals/populations in the action area affected

Eisenhour and Burr (2000) estimated that the Big South Fork duskytail darter population ranged between 300 and 600 individuals. In contrast, adaptive cluster sampling designs by Davis (2010) estimated the population within the Big South Fork at 200 individuals in 2008 and 100 individuals in 2009. Davis (2010) suggested that the Big South Fork population appeared to have declined during the two sampling years of his study but did not offer an explanation for the decline. Davis (2010) also suggested that the Big South Fork population may be larger due to low detectability and sampling inefficiencies (sampling methods using underwater observation are needed for this species to accurately estimate population size). Davis (2010) further clarified the issue, suggesting his results would be more accurately described as a census or estimated count rather than a population estimate. These population estimates (Eisenhour and Burr 2000, Davis 2010) did not include individuals from the 7 additional sites discovered during the Corps' 2013 surveys.

The 2013 surveys revealed abundances at each shoal ranging from 1 to 15 individuals, which is consistent with abundance data reported from previous surveys and recent BSF population information provided by Davis (2010). There are 21 shoals known to be occupied by duskytail darters, and 1 site presumed to be occupied (site 9) within the action area. Assuming there are 15 individuals at each shoal, the Service estimates the average number of individuals present within the action area to be 330 duskytail darters.

Species' sensitivity to change

The duskytail darter has specific habitat needs that consist of shallow pools and runs under substrates of various sizes (Davis and Cook 2010). More specifically, Davis and Cook (2010a) found that micro-habitat preferences are for slow-flowing, relatively shallow areas with an abundance of cobble- or small boulder-sized cover rocks. Duskytail darters have not been found further upstream of the known occurrences, possibly due to high-gradient rapids, or further downstream due to poor water quality and habitat conditions (Davis and Cook 2010). Further, models by Davis and Cook (2010) demonstrate a link between high quality habitat and population size. Therefore, it is reasonable to assume that the duskytail darter is highly sensitive to habitat change, particularly when it involves the anticipated changes to its preferred habitat type that are likely to result from the proposed action.

Species' resilience

There is no specific information to determine how resilient the duskytail darter will be to the proposed action. However, we do not expect the species to be resilient to the expected habitat alterations that will be caused by the return to historical lake operations, because the species has been shown to prefer shallow water habitats with constant flow and little or no sediment.

Species' recovery rate

Given what is known about the species' life history and habitat preferences, the Service believes it is likely that the species may recover at the sites that occur upstream (sites 2 and 3), because these sites may only experience temporary, short-term effects of inundation. This would allow the species to persist because the effects are expected to be minor and of shorter duration at the upper sites. Recovery is unlikely at the lower sites (sites 7-9) due to permanent habitat changes (e.g., increased water depths, sedimentation, low or zero flow) resulting from the effects of increased frequency and duration of inundation. It is unlikely that the species would be able to swim upstream to find suitable habitat under these conditions (P. Shute pers. comm. 2014) or that the habitat would return to suitable conditions at an interval that would support the species.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation under section 7 of the Act. While the Service's 5-year review for the species (USFWS 2012) indicates that the Big South Fork and its tributaries continue to be impacted by forestry practices, municipal and domestic waste, agricultural runoff, oil and gas operations, and water withdrawal, the entire Big South Fork population occurs within the BSRNRAA. Thus, any future State, local, or private actions that could potentially occur within the action area would require a permit or other authorization from the Corps and/or NPS and would require compliance with the consultation provisions of the ESA. The Service expects that the type of activities listed above will likely occur outside of the BSFNRAA, and could result in adverse effects to the duskytail darter by increasing sediment and degrading water quality; however, we cannot precisely predict the total extent and/or specific types of adverse effects that will occur. As a result, we are not aware of any other State, tribal or local actions to include under Cumulative effects.

CONCLUSION

After reviewing the current status of the duskytail darter, the environmental baseline for the action area, the effects of the proposed return to historical lake operations and the cumulative effects, it is the Service's biological opinion that the return to historical lake operations, as proposed, is not likely to jeopardize the continued existence of the duskytail darter. It is further determined that the proposed return to historical lake operations will not destroy or adversely modify designated critical habitat, because no critical habitat has been designated for this species; therefore, none will be affected.

The duskytail darter is considered stable within the Big South Fork, and throughout its range, with the exception of the Little River population, which appears to be declining. Prior to implementation of emergency operations at Wolf Creek Dam in 2007, duskytail darters were confirmed in at least 14 shoals within the Big South Fork. The Corps' 2013 aquatic species survey increased the number of occupied, or presumed occupied, shoals to 22. Although

individual duskytail darters and habitat are likely to be directly and indirectly adversely affected by the proposed action, a complete loss of the Big South Fork population is not anticipated. The Service expects 8 (sites 2-9) of the 22 occupied (or presumed occupied in the case of site 9) sites in the Big South Fork to experience indirect, adverse effects that could potentially result in a complete loss of duskytail darters and habitat at these locations. However, if all 8 sites are lost, no less than 14 occupied occurrences would persist within the Big South Fork. Further, the Service does not anticipate that any additional loss of habitat or duskytail darters is reasonably certain to occur as a result of cumulative effects.

The Corps has also proposed a number of conservation measures that, once implemented, would promote the survival and recovery of the species:

a) The Capture and Hold conservation measure promotes the survival and recovery of the species, because collection and maintenance of some of the affected individuals will ensure that the entire Big South Fork population will not be lost during implementation of the proposed action. This conservation measure ensures that some of the affected duskytail darters will be conserved and, if necessary, used to re-populate the Big South Fork in the event of a stochastic event, such as a major contaminants spill or disease outbreak in the wild population. In addition, it also has the potential to increase the distribution of the species within the Big South Fork and/or other suitable streams by providing individuals that could be used in reintroduction and population augmentation efforts to further the species' recovery.

b) The Water Quality/Habitat Improvement conservation measure will improve water quality and reduce sediment input in areas that are occupied by duskytail darters within the Big South Fork. The sites identified for remediation are contributing pollutants (i.e. metals, such as aluminum and zinc) and sediment to the Big South Fork, which would be reduced once remediation is complete. Stabilizing and providing erosion protection at the identified trail crossing or sediment reduction (i.e., spoil pile) projects will further reduce the sediments and other potential contaminants that are currently entering the Big South Fork in areas that are occupied by duskytail darters.

   These improvements have the potential, over time, to allow the Big South Fork population of the duskytail darters to expand into areas that were not occupied or previously suitable for the species due to poor water quality and habitat conditions. If that were to occur, the duskytail darter's population size and distribution within the Big South Fork would increase, thus contributing to the recovery of the species.

c) The Interim Dam Operation conservation measure will reduce potential adverse effects while the Water Quality/Habitat Improvement conservation measure is being implemented. This measure is expected to minimize the depth and duration of inundation at several of the sites, primarily sites 7 and 8, while also maintaining some velocity within the channel at the affected sites. Although this is an interim measure, the Service believes it contributes to the survival and recovery of the species in the short-term by potentially allowing duskytail darters to persist at the affected sites until other measures are implemented.

After considering the status of the duskytail darter within the Big South Fork and throughout its' range, the environmental baseline within the action area, and all of the effects of the proposed action (both adverse and positive), the Service believes that the species' reproduction, numbers, and distribution will not be appreciably reduced as a result of the proposed action. Therefore, the species can be expected to survive and potentially be recovered within the Big South Fork and the rest of its range.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation under section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Corps so that they become binding conditions of any grant, contract, or permit issued to an applicant, contractor, or permittee, as proper, for the exemption in section 7(o)(2) to apply. The Corps has the continuing duty to regulate the activity covered by this Incidental Take Statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require an applicant, contractor, or permittee to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the grant, contract, or permit document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement. [50 CFR §402.14(I)(3)]

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service expects that much of the incidental take of individual duskytail darters will be difficult to detect because (a) the individuals are small and hard to locate; (b) finding dead or injured specimens during or following project implementation is unlikely; (c) the number of individuals within the action area at the time of project implementation will be unknown; (d) losses of duskytail darters may be masked by seasonal fluctuations in numbers or other natural

causes; and (e) most incidental take that could occur is expected to be non-lethal and undetectable.

The Big South Fork population has been estimated by the Service to support 330 individuals and by Eisenhour and Burr (2000) to be between 300 and 600 individuals, but there is no way of determining how many duskytail darters actually exist in the Big South Fork or will be present in the action area during project implementation. Based on this uncertainty, the Service believes that the amount of incidental take is best estimated by the total amount of duskytail darter habitat that will be impacted at sites 2-9, which is estimated at 9.38 acres of habitat. However, as part of this take, we expect all duskytail darters within the 9.38 acres of habitat to be harmed, harassed, and/or killed as a result of the proposed action, but the exact number of individuals that will be taken is not quantifiable for the reasons previously noted. Incidental take is summarized in Table 7 below.

The Service believes that (1) any incidental take that results from implementing the Water Quality/Habitat Improvement conservation measure will not be quantifiable; and (2) any incidental take associated with fin clipping at sites other than sites 2-9 will be covered by the Scientific Collection Permit(s) of the collector(s) that would be conducting the work associated with the Capture and Hold conservation measure. Therefore, an estimation of incidental take for these activities is not included in Table 7. There is no critical habitat designated for this species; therefore, none will be affected.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of expected take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measure (RPM) is necessary and appropriate to minimize the impacts of the incidental take of the duskytail darter:

Reasonable and Prudent Measure 1: Implementation of Conservation Measures

The Corps will coordinate with the Service to ensure the proposed conservation measures are implemented to provide the maximum benefit to the species and ensure that the anticipated level of take is not exceeded.

Table 7. Summary of Estimated Incidental Take of Duskytail Darters.

Site	Number of individuals	Type of Incidental Take as Previously Summarized in this Biological Opinion	Estimated Habitat Present (acres)
1	0	None	0
2	cannot be quantified	Mortality; harm and harassment; changes to or loss of habitat	0.77
3	cannot be quantified	Mortality; harm and harassment; changes to or loss of habitat	1.25
4	cannot be quantified	Mortality; harm and harassment; changes to or loss of habitat	0.96
5	cannot be quantified	Mortality; harm and harassment; changes to or loss of habitat	1.18
6	cannot be quantified	Mortality; harm and harassment; changes to or loss of habitat	1.05
7	cannot be quantified	Mortality; harm, and/or harassment; habitat loss	0.85
8	cannot be quantified	Mortality; harm, and/or harassment; habitat loss	0.96
9	cannot be quantified	Mortality; harm, and/or harassment; habitat loss	2.36
TOTAL	cannot be quantified		9.38

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which carry out the reasonable and prudent measures, described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

Terms and Conditions Related to RPM 1 – Implementation of Conservation Measures

1. The Corps shall implement the return to historical lake operations as planned and shall provide the Service with either of the following which documents the Corps' decision to return to historical lake operations: (a) written notification of the Corps' intent to return to historical lake operations specifying the date such decision was made and the date that the return to historical lake operations will commence, or (b) a copy of the Corps' decision documentation on the return to historical lake operations if such documentation contains the information identified in (a) of this Term and Condition.

2. The Corps shall develop a monitoring plan and associated monitoring protocols in coordination with the Service by June 23, 2014. The monitoring plan will evaluate the

effects of the return to historical lake operations on duskytail darters and duskytail darter habitat.

3. The Corps shall provide the Service with an annual summary report of monitoring that was conducted under the monitoring plan. The report shall be provided to the Service by February 15th of each year for the previous calendar year. The report shall contain the following minimum information:

    a) A summary plot of daily lake levels (midnight), daily average releases (separated by hydropower, sluice, and spillway), and inflows for the previous calendar year,

    b) A summary of the Corps' efforts related to the implementation of the RPM in this biological opinion,

    c) A summary and photo-documentation of habitat conditions, as described and specified in the monitoring plan, that were observed during the Corps' monitoring efforts at sites 2-9 in the Big South Fork, and

    d) A summary and photo-documentation of duskytail darter presence/absence and population levels that were observed during the Corps' monitoring efforts at sites 2-9 in the Big South Fork.

4. Monitoring will be conducted annually according to one of the following schedules:

    a) a maximum of 7 years of monitoring or less if, during those 7 years, water level conditions meet or exceed the average hydrograph levels in the Big South Fork at sites 2-4 for at least 4 of the 7 years, or as may subsequently be identified in the monitoring plan; or

    b) a minimum of 5 years of monitoring if, during those 5 years, water level conditions meet or exceed the average hydrograph levels in the Big South Fork at sites 2-4 for at least 3 consecutive years, or as may subsequently be identified in the monitoring plan.

5. A qualified biologist, which holds the appropriate State and federal permits, will collect duskytail darters from sites 2-9 and fin clips from other sites within the BSFNRRA as may be sufficient to ensure that captive population of duskytail darters can be established at one or more Service-approved facilities and that a thorough genetic analysis is completed that will serve as the basis for holding and maintaining collected duskytail darters.

6. A genetic analysis will be conducted on collected duskytail darters so that a plan for maintaining the individuals can be developed and executed.

7. Duskytail darters will be held and maintained at one or more Service-approved facilities for the duration of the Corps' monitoring period.

8. If monitoring indicates that duskytail darters and/or habitat at sites 2-9 are not declining or absent, implementation of Tier 2 will not be necessary, and the Corps and the Service will coordinate on the future disposition of the captured duskytail darters. At that point, the Corps' responsibilities for implementing the RPM under this biological opinion can cease unless Term and Condition 18 has not been met.

9. If the duskytail darter monitoring at sites 2-9 shows that duskytail darters are not stable or increasing, as described and specified in the monitoring plan, at one or more of those sites at the end of the Corps' monitoring efforts, the Corps shall implement and/or fund the components in Tier 2 of the Capture and Hold conservation measure, which includes:

    a) Surveys shall be conducted in the Big South Fork and other streams determined by the Service to be potentially suitable for the duskytail darter to (1) determine if duskytail darters are present, (2) evaluate the potential for introduction of the species into unoccupied habitat, and (3) evaluate the potential for population augmentation at sites found to already contain the species.

    b) Based on the results of these surveys and evaluation efforts, a reintroduction and/or population augmentation plan will be developed to support the species' recovery that (1) creates new duskytail darter occurrences where no duskytail darters existed previously and/or (2) improves the viability existing populations through population augmentation.

    c) The reintroduction and/or population augmentation plan will be implemented upon its completion in coordination with the Service and other necessary partners.

10. The Corps shall enter into a Memorandum of Understanding (MOU) with the Service and NPS regarding the remediation of the LBSS and LBC AMD sites on the BSFNRRA. This MOU shall guide the parties' understanding of how and when the AMD remediation work will take place and outline the expectations of the parties.

11. The Corps shall implement and/or fund the remediation of the LBSS and LBC AMD sites, or other approved sites that provide equal or greater conservation and recovery benefits to the duskytail darter, on the BSFNRRA upon receiving approval from the NPS and obtaining any other necessary authorizations and permits.

12. The Corps shall ensure that stringent erosion and sediment control measures are implemented, an erosion and sediment control plan is developed, and other necessary efforts to reduce the downstream transport of water contaminated with sediment and AMD chemicals are implemented, if any exist, to minimize the potential for indirect adverse effects on duskytail darters downstream of these project sites.

13. The Corps shall, in conjunction NPS and the Service, develop and implement a monitoring plan to assess the overall success of the AMD remediation projects on water

quality. The results of this monitoring will be forwarded to the Service as specified in the monitoring plan.

14. The Corps shall enter into a Memorandum of Understanding (MOU) with the Service and NPS regarding the remediation of two trail hardening sites or at least one sediment reduction project site on the BSFNRRA that are in close proximity to and upstream of known duskytail darter occurrences. This MOU shall guide the parties' understanding of how and when the remediation work at these two sites will take place and outline the expectations of the parties.

15. The Corps shall implement and/or fund the remediation of the two trail hardening or one sediment reduction sites on the BSFNRRA upon receiving approval from the NPS and obtaining any other necessary authorizations and permits.

16. The Corps shall ensure that stringent erosion and sediment control measures are implemented, an erosion and sediment control plan is developed, and other necessary efforts to reduce the downstream transport of water contaminated with sediment and other pollutants are implemented, if any exist, to minimize the potential for indirect adverse effects on duskytail darters downstream of the trail hardening or sediment reduction project sites.

17. The Corps shall, in conjunction NPS and the Service, develop and implement a monitoring plan to assess the overall success of the trail hardening remediation or sediment reduction projects on water quality. The results of this monitoring will be forwarded to the Service as specified in the monitoring plan.

18. If the duskytail darter monitoring at sites 2-9 shows that duskytail darters are stable or increasing at one or more of those sites at the end of the Corps' monitoring efforts, but remediation work associated with the Water Quality/Habitat Improvement conservation measure has been initiated but not been completed, the Corps shall complete the remediation work contemplated by Terms and Conditions 11 and 15 that has been initiated.

19. The Corps shall implement the Interim Dam Adjustment as part of its operations at Wolf Creek Dam so that the timing and magnitude of releases from the dam follow, as much as conditions allow, the Top SEPA Curve during the filling cycle as identified in the Corps' BA and supplemental BA information.

20. The Corps shall implement the Interim Dam Adjustment for a minimum of three years or will continue to implement the Interim Dam Adjustment until such time as the Water Quality/Habitat Improvement conservation measure is completed, whichever is longer.

21. The Corps shall notify the Service within 10 business days when the Corps makes an operational decision not to follow the Top SEPA Curve, such as during an emergency response or when water releases from Wolf Creek Dam would result in an unacceptable flood risk as determined by the Corps. This notification will be made via email to the

Service and will give the Service background information on why this course of action was taken. The Corps shall add the Service to their distribution lists for a summary of daily operations (Corps flowsheet) and event-based reservoir system updates which are prepared during high flow events.

22. The Corps shall provide the Service with a written analysis in the annual monitoring report of the likely effects to duskytail darters and duskytail darter habitat at sites 2-9 for each instance where operational decisions made it not possible to follow the Top SEPA Curve in any given year.

23. Upon locating a dead, injured, or sick individual of a duskytail darter or any other federally listed species, initial notification must be made to the USFWS Law Enforcement Office in Louisville, Kentucky (502-582-5989). Additional notification must be made to the KFO in Frankfort Kentucky (502-695-0468). Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury.

The Service believes that no more than 9.38 acres of occupied habitat will be incidentally taken as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Corps must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary (i.e., optional to the Corps with no obligation to carry them out) activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help carry out recovery plans, or to develop information. The following conservation recommendations are recommended in association with the Corps' proposal to return to historical lake operations at Wolf Creek Dam and Lake Cumberland:

1. The Corps should provide sufficient funding to Wolf Creek National Fish Hatchery to maintain duskytail darters for 10 years past the end of the Corps' monitoring period. This conservation recommendation would help ensure that individual duskytail darters are readily available for recovery actions and recovery-related research for a longer period of time than the actions associated with the RPM in this biological opinion.

2. The Corps should fund a study to determine if suitable habitat for duskytail darters can be created and maintained in the Big South Fork through in-stream manipulation of habitat

features (i.e., placement of boulders and flat rocks, and manipulating localized flow patterns).

3. The Corps should continue to work with the National Park Service to identify and fix sources of sediment and contaminants that negatively affect water quality in the Big South Fork and Lake Cumberland.

In order for the USFWS to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the conservation recommendations carried out.

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the request. As written in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Corps involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the Corps' action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the Corps' action is later modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease until reinitiation of consultation is completed.

For this biological opinion, the incidental take would be exceeded when the take exceeds 9.38 acres of occupied habitat, which is what has been exempted from the prohibitions of section 9 of the ESA. The KFO appreciates the cooperation of the Corps during this consultation.

For further coordination on this project, please reference our project identification number FWS #2008-B-0075 and contact Ms. Carrie Allison of this office at 502-695-0468.

Sincerely,

Virgil Lee Andrews, Jr.
Field Supervisor

References

Blanton, R.E., and R.E. Jenkins. 2008. Three new darter species of *Etheostoma percnurum* species complex (Percidae, subgenus *Catonotus*) from the Tennessee and Cumberland river drainages. Zootaxa 1963: 1-24.

Conservation Fisheries, Inc. 2003. Survey for the federally endangered duskytail darter, *Etheostoma percnurum*, in the upper Big South Fork River system. Final Report to Big South Fork National River & Recreation Area, Order Number P5530010114. 9 pp.

Conservation Fisheries, Inc. 2004. Captive propagation for augmentation and expansion of an imperiled population of the endangered duskytail darter, *Etheostoma percnurum*, in the Little River, Blount County, Tennessee. Progress report to World Wildlife Fund (Grant No. LW81). 9pp.

Conservation Fisheries, Inc. 2009. Proposal to survey for duskytail darters, *Etheostoma percnurum*, in Copper Creek in Virginia. Proposal to the Virginia Department of Game and Inland Fisheries. 4 pp.

Davis, J.G. 2010. Development of long-term monitoring protocols for two rare fishes, the tuxedo darter and the spotfin chub, in Tennessee. A dissertation presented to the Faculty of the Tennessee Technological University, Cookeville, Tennessee. 262 pp.

Davis, J.G., and B. Cook. 2010. Habitat use of the tuxedo darter, *Etheostoma lemniscatum* at macrohabitat and microhabitat spatial scales. Journal of Freshwater Ecology 25:3, 321-330.

Eisenhour, D.J., and B.M. Burr. 2000. Conservation status and nesting biology of the endangered duskytail darter, *Etheostoma percnurum*, in the Big South Fork of the Cumberland River, Kentucky. Journal of the Kentucky Academy of Science 61(2): 67-76.

Jenkins, R.E., and Burkhead, N.M. 1994. Freshwater Fishes of Virginia. American Fisheries Society, Bethesda, Maryland. 1080 pp.
Layman, S.R. 1991. Life history of the relict, duskytail darter, *Etheostoma* (*Catonotus*) sp., in Little River, Tennessee. Copeia 1991(2): 471-485.

O'Bara, C.J., W.L. Pennington, W.P. Bonner.1982. A survey of water quality, benthic macroinvertebrates and fish for sixteen streams within the Big South Fork National River and Recreational Area. Tennessee Cooperative Fishery Research Unit, Final Report to the U.S. Army Corps of Engineers, Tennessee Technological University, Nashville.

Page, L. M. 1975. Relations among the species of the subgenus *Catanotus* of *Etheostoma* (Percidae). Copeia 1975:782-784.

Page, L. M. 2000. Etheostomatinae, pp. 225-253 *In* Craig, J. F. (Ed). Percid fishes, systematics, ecology, and exploitation. Blackwell Science, Oxford.

Petty, M.A., P.L. Rakes, J.R. Shute, and C.L. Ruble. 2011. Captive propagation and population monitoring of rare southeastern fishes in Tennessee: 2010. Final Report for 2010 field season and second quarter report for fiscal year 2010 to the Tennessee Wildlife Resources Agency, U.S. Fish and Wildlife Service, Cookeville and Asheville Field Offices, and Cherokee National Forest. 39 pp.

Rakes, P.L., J.R. Shute, and P.W. Shute. 1992. Quarterly states report for the captive propagation of the duskytail darter, *Etheostoma [Catonotus]* sp.). Unpublished report to Tennessee Wildlife Resources Agency; U.S. Fish and Wildlife Service, Asheville Field Office; Cherokee National Forest; and National Park Service, Great Smoky Mountain National Park. 5 pp.

Rakes, P.L., and J.R. Shute. 2007. Restoration efforts in the Powell River of Virginia in 2005 & 2006: the yellowfin madtom, *Noturus flavipinnis*, and the slender chub, *Erimystax cahni*. Final Report to the U.S. Fish and Wildlife Service, Gloucester, Virginia. 4 pp.

Rakes, P.L., and J.R. Shute. 2008. Captive propagation and population monitoring of rare southeastern fishes in Tennessee: 2007. Final Report for 2007 field season and second quarter report for fiscal year 2008 to the Tennessee Wildlife Resources Agency, U.S. Fish and Wildlife Service, Cookeville and Asheville Field Offices, Cherokee National Forest, and International Paper. 28 pp.

Rakes, P.L., C.L. Ruble, M.A. Petty, and J.R. Shute. 2009. Results of surveys for duskytail darters, *Etheostoma percnurum*, in Copper Creek, Scott County, Virginia 2008: Addendum. Final Report to Virginia Department of Game and Inland Fisheries. 15 pp.

Scott, E. M. 2010. Fish Survey of the Big South Fork National River and Recreational Area. Tennessee Valley Authority. National Park Service. Cooperative Agreement FS5000 02 0795.

Shute, J.R., P.W. Shute, and P.L. Rakes. 1993. Captive propagation and population monitoring of rare southeastern fishes by Conservation Fisheries, Inc. Final Report to Tennessee Wildlife Resources Agencies for Fiscal Year 1992-1993 (Contract #FA-2-09667-2-02) and First Quarter Report for Fiscal Year 1993-1994 (Contract #FA-4-10792-4-00). 27 pp.

Shute, J.R., P.L. Rakes, and P.W. Shute. 2005. Reintroduction of four imperiled fishes in Abrams Creek, Tennessee. Southeastern Naturalist 4(1): 93-110.

U.S Army Corps of Engineers, Nashville District. 1975. Big South Fork National River and Recreation Area, General Design Memorandum No. 1.

U.S. Army Corps of Engineers. 2007. Wolf Creek Dam/Lake Cumberland Emergency Measures in Response to Seepage Final Environmental Impact Statement.

U.S. Army Corps of Engineers. 2013. Mussel and Fish Survey of the Big South Fork Cumberland River in Areas Inundated by Normal Operations of Wolf Creek Dam.

U. S. Army Corps of Engineers. 2014. Wolf Creek Dam/Lake Cumberland Return to Historical Pool Level Operations Biological Assessment for the Federally Endangered Duskytail Darter *Etheostoma percnurum* located in Big South Fork of the Cumberland River miles 45.1 to 34.4, McCreary County, Kentucky.

U.S. Fish and Wildlife Service. 1994. Duskytail Darter Recovery Plan. U.S. Fish and Wildlife Service, Atlanta, Georgia. 25 pp.

U.S. Fish and Wildlife Service. 2012. Duskytail Darter *Etheostoma percnurum* 5-Year Review: Summary and Evaluation.

Waters, T. F. 1995. Sediment in streams: sources, biological effects, and control. American Fisheries Soc. Monograph 7, Bethesda, Maryland. 251 pp.

Wood, P. J., and P. D. Armitage. 1997. Biological effects of fine sediment in the lotic environment. Environmental Management. 21:203-217.

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IN REPLY REFER TO

Project Planning Branch

Mr. Lee Andrews
U.S. Fish & Wildlife Service
Kentucky Ecological Field Office
330 West Broadway, Suite 265
Frankfort, Kentucky 40601

Dear Mr. Andrews:

The U.S. Army Corps of Engineers, Nashville District (Corps) is proposing the remediation of three contaminated mine drainage and sediment reduction projects within the Big South Fork National River and Recreation Area (Enclosure 1). The purpose of the proposed action is the remediation of a minimum of two contaminated mine drainage sites for water quality improvements and one sediment abatement site on National Park Service lands to fulfill the requirements of the Incidental Take Statement and associated Biological Opinion issued to the Corps in 2014 for Wolf Creek Dam and Lake Cumberland's return to normal operations. The proposed project purpose is to improve the water quality and aquatic habitat in the Big South Fork River for the duskytail darter (*Etheostoma percnurum*). Completion of the proposed project would allow Wolf Creek Dam and Lake Cumberland to return to normal operations.

A habitat assessment of the proposed project areas and access routes was conducted multiple times throughout 2015 and again with National Park Service on April 25, 2016 to record any potential suitable summer roost habitat and/or caves. Suitable summer habitat for the Indiana bat (*Myotis sodalis*) and northern long-eared bat (*Myotis septentrionalis*) consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags $\geq$3 inches diameter at breast height that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet of other forested/wooded habitat.

Based on the habitat assessment four trees considered potential Indiana bat and/or northern long-eared bat summer roost habitat were recorded that could be impacted by the proposed project (Enclosure 2). Two additional trees were recorded within the vicinity of the proposed project but after further review were determined to be well outside of the project boundary. No caves were located within the project boundary. Therefore, the Corps determined that the project would have **"No Effect"** on the Gray bat (*Myotis grisescens*). In addition to the four potential summer roost trees identified that would be impacted as a result of the project, the National Park Service completed a mammal survey in 2004-2005. Based on the findings of the surveys, Northern long-eared bats were the most common bat species recorded within the Big South Fork National River and Recreation Area, with 46 percent being captured at Mine No. 3. Mine No. 3 is located directly adjacent to the Blue Heron Mine Community between the

primary train depot and concession stand. The contractor's access and staging area is past this point in the lower Blue Heron canoe ramp parking lot and would not impact Mine No. 3.

Based on new guidance, size of the four potential summer roost trees to be impacted, and the time at which trees would be removed (November 15 – March 31), the Corps believes that the proposed project would not directly affect the Indiana and/or Northern long-eared bat and made the determination that the proposed project is **not likely to adversely affect the Indiana and/or northern long-eared bat.** In the chance that the tree removal is ahead of schedule, emergence counts would be conducted by National Park Service and/or Corps staff. Per the "Range-wide Indiana bat Summer Survey Guidelines" if no bats are observed then the four potential trees could be removed the following day. However, if bats are observed then additional coordination with the U.S. Fish and Wildlife Service (Service) would be required.

In addition to the Indiana and northern long-eared bat, the proposed project (especially Blue Heron Spoil Bank Stabilization Remediation Site) could impact federally listed aquatic species. In order to construct the Blue Heron Spoil Remediation project, a shallow shoreline strip (approximately four feet or less in depth) would be impacted by placement of riprap. The placement of the riprap within the Big South Fork could impact federally listed species if present. Documented within the Biological Opinion, the Service concurred with the Corps determination "may affect – not likely to adversely affect" for the species found in Enclosure 3. Based on previous coordination with the Service and the determination of may affect – not likely to adversely affect, the Corps does not anticipate any additional aquatic surveys in order to construct the proposed project. However, prior to construction, surveys for mussels would be completed by Tennessee Valley Authority to ensure no federally listed species are present. If found, mussels would be removed and reestablished outside of the project footprint in suitable habitat to avoid any potential impacts. It is our understanding that this would be covered by the 2014 Incidental Take Statement and associated Biological Opinion and future coordination would not be required.

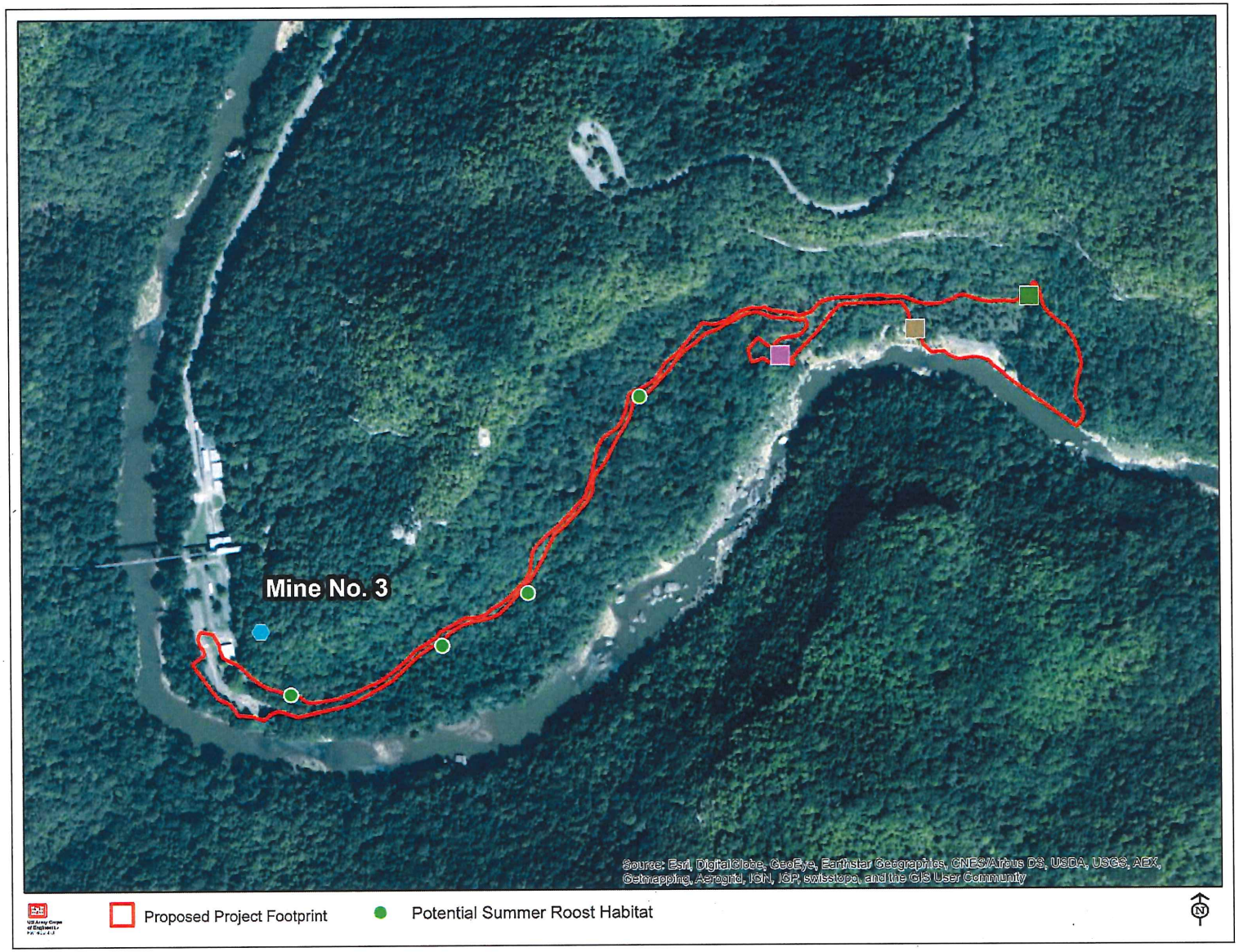
All unavoidable trees are anticipated to be removed during the winter (November 2016 – March 2017). The Corps does not anticipate any other impacts to federally listed species as a result of the proposed project. At this time the Corps is requesting concurrence from the Service for this project. Should you have any questions regarding the enclosed documents please contact Mr. Matthew Granstaff at 615-736-7857 or by email at Matthew.L.Granstaff@usace.army.mil.

Sincerely,

Encls

Russ L. Rote, P.E., PMP, CFM
Chief, Project Planning Branch

Enclosure 1. Proposed Project Footprint and Remediation Sites.



Enclosure 2. Potential summer roost habitat that could be impacted by the proposed project.

Enclosure 3. List of federally threatened and endangered species.

Species	Scientific Name	Status
Blackside dace	*Chrosomus cumberlandensis*	Threatened
Palezone shiner	Notropis albizonatus	Endangered
Cumberland darter	Etheostoma susanae	Endangered
Cumberland bean	Villosa trabilis	Endangered
Cumberlandian combshell	Epioblasma brevidens	Endangered
Cumberland elktoe	Alasmidonta atropurpurea	Endangered
Fluted kidneyshell	Ptychobrachus subtentum	Endangered
Littlewing pearlymussel	Pegias fabula	Endangered
Oyster mussel	Epioblasma capsaeformis	Endangered
Pink mucket	Lampsilis abrupta	Endangered
Spectaclecase	Cumberlandia monodonta	Endangered
Fanshell	Cyprogenia stegaria	Endangered
Tan riffleshell	Epioblasma florentina walker	Endangered
Purple catspaw	Epioblasma obliquata obliquata	Endangered
Ring pink	Obovaria retusa	Endangered
Rough pigtoe	Pleurobema plenum	Endangered
Orangefoot pimpleback	Plethobasus cooperianus	Endangered
Virginia spiraea	Spiraea virginiana	Threatened
Cumberland sandwort	Arenaria cumberlandensis	Endangered
Cumberland rosemary	Conradina verticillata	Threatened
White fringeless orchid	Platanthera integrilabia	Candidate

Project Big South Fork Remediation Project

Scientific Name *Liriodendron tulipifera*

Common Name Tulip Popular

Latitude 36.668

Longitude -84.546

DBH 18+

Cavities Present ☑ yes

Number of Cavities 2

Project Big South Fork Remediation Project

Scientific Name *Quercus alba*

Common Name White Oak

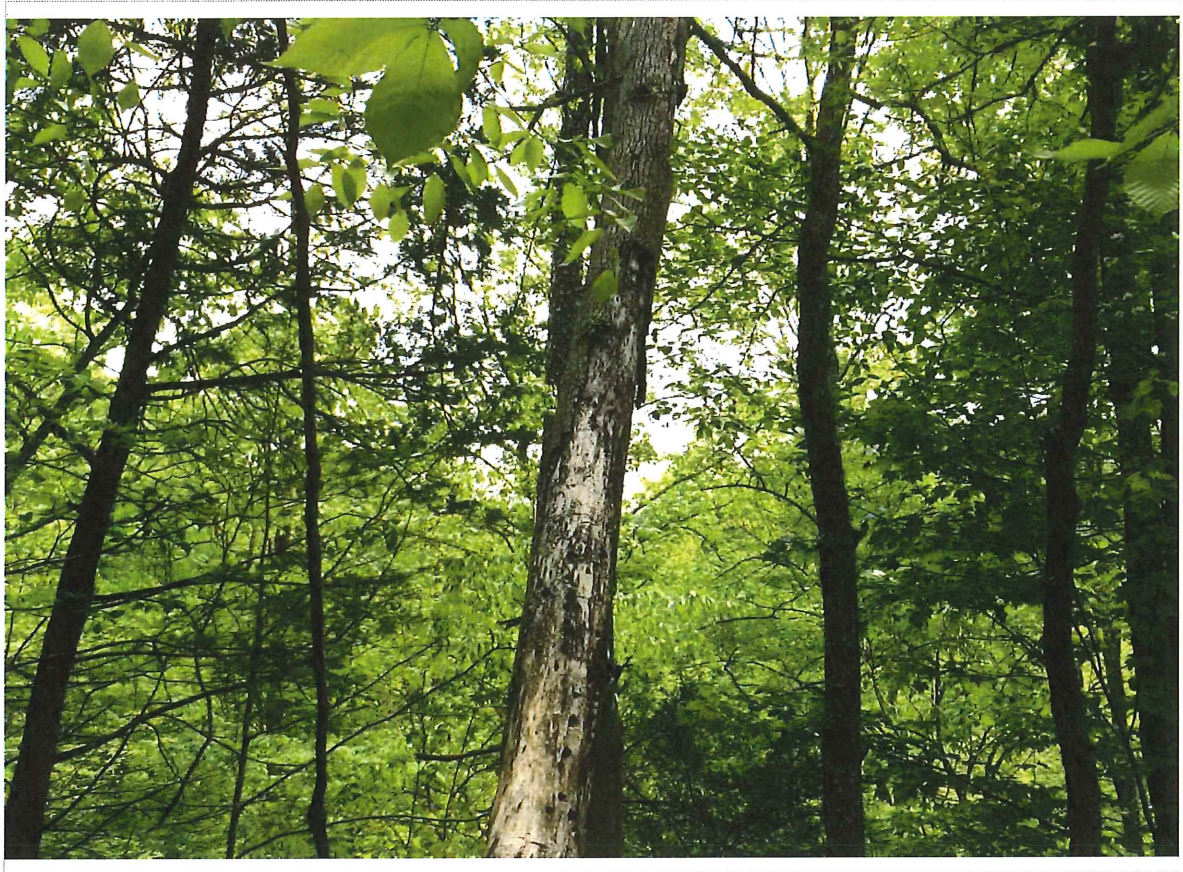
Latitude 36.669

Longitude -84.544

DBH 12

Cavities Present ☐ yes

Number of Cavities 0



Project Big South Fork Remediation Project

Scientific Name *Snag*

Common Name

Latitude 36.669

Longitude -84.542

DBH 7

Cavities Present ☑ yes

Number of Cavities 1

Project Big South Fork Remediation Project

Scientific Name *Carya ovata*

Common Name Shagbark Hickory

Latitude 36.672

Longitude -84.541

DBH 15

Cavities Present ☐ yes

Number of Cavities 0

From: Allison, Carrie
To: Granstaff, Matthew LRN
Subject: [EXTERNAL] Re: Letter to U.S. Fish and Wildlife Service regarding the Big South Fork Remediation Project
Date: Friday, June 03, 2016 1:49:59 PM

Hey, Matt-

Sorry for the delay. This looks good and I talked to Leroy about the mussels and he also thinks it looks good. I'm getting ready to go out of town--is it OK if I get you our official response the week of the 13th?

Thanks

Carrie L. Allison
U.S. Fish and Wildlife Service
330 W. Broadway, Rm. 265
Frankfort, KY 40601
502-695-0468 ext. 103

"You cannot get through a single day without having an impact on the world around you. What you do makes a difference, and you have to decide what kind of difference you want to make."

~Jane Goodall

On Wed, May 18, 2016 at 2:12 PM, Granstaff, Matthew LRN <Matthew.L.Granstaff@usace.army.mil <mailto:Matthew.L.Granstaff@usace.army.mil> > wrote:

> Good Afternoon Carrie,
>
> Per our conversation earlier this week, attached is a copy of the letter to U.S Fish and Wildlife Service regarding tree removal and potential mussel impacts along the Big South Fork. I am also sending a hard copy but wanted to go ahead and get you an electronic form. If you have any questions please feel free to contact me or Tim Higgs.
>
> Thanks
>
> Matthew Granstaff
> Biologist, TN -QHP
> Planning Branch
> U.S. Army Corps of Engineers
> Nashville District
>
> Phone:(615)736-7857
> Matthew.L.Granstaff@usace.army.mil <mailto:Matthew.L.Granstaff@usace.army.mil>

Remediation of Selected Contaminated Mine Drainage Sites Big South Fork National River & Recreation Area, McCreary County, Kentucky

Mitigation and Monitoring Plan

Prepared by:
U.S. Army Corps of Engineers, Nashville District
Project Planning Branch
Environmental Section

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1 INTRODUCTION

1.1 Project Background

During 2007, Lake Cumberland, which is managed by the U.S. Army Corps of Engineers (Corps) was lowered to a target elevation of 680 feet mean sea level to reduce the risk of failure while repairs were being made to Wolf Creek Dam. Lower reservoir elevations allowed approximately 10 river miles (miles 33.5 to 44) of the Big South Fork of the Cumberland River (BSF) to revert to natural free flowing conditions where they had been previously inundated at times over the last sixty years.

Prior to returning to normal reservoir operations, U.S. Fish and Wildlife Service (FWS) required that the Corps conduct surveys for federally listed aquatic species within areas of the BSF that would be inundated under a return to normal operations. The Corps committed to conduct these surveys in a Record of Decision signed for the 2008 Final Environmental Impact Statement titled Wolf Creek Dam/Lake Cumberland, Emergency Measures in Response to Seepage. Surveys were conducted in September and November, 2013 to determine the presence/absence of federally protected aquatic species in the affected reach of the BSF. During these surveys, the federally endangered duskytail darter (*Etheostoma percnurum*) was observed in 8 of 15 exposed riffle sites. Prior to these surveys, historic records for the duskytail darter indicated that it was only observed upstream of the affected reach in Tennessee and Kentucky.

The duskytail darter is a small (6.4 cm) member of the Family Percidae known only to six streams in Tennessee, Kentucky and Virginia. The duskytail darter inhabits the edges of gently flowing, shallow pools (up to 120 cm in depth), eddy areas, and slow runs in usually clear water of large creeks and moderately large rivers.

Following the 2013 survey, the Corps prepared a Biological Assessment (BA) and requested the FWS initiate formal consultation under the Endangered Species Act.

The Incidental Take Statement (ITS) along with the Biological Opinion (BO) which includes Conservation Measures (CMs) was issued by the U.S. Fish and Wildlife Service (FWS) in March 2014 (Appendix A). The ITS addressed the Corps' return to normal pool operations at Wolf Creek Dam (Lake Cumberland). The ITS associated terms and conditions to be implemented by the Corps include a requirement to construct remediation actions on at least two sites affected by contaminated mine drainage (CMD) and one action on sediment producing activities within the Blue Heron vicinity of the Big South Fork National River and Recreation Area (BISO). The purpose of this project is to help improve the water quality and aquatic habitat within the BSF for the duskytail darter. The Corps committed to implementing those water quality/habitat improvement CMs in cooperation with the NPS who administers the lands affected. Previous efforts by the NPS had identified a suite of CMD remediation projects associated with coal mining that preceded the park. From the suite of projects, the NPS recommended several that appeared to be implementable. The NPS is supportive of the Corps' implementation of the CMs on their lands.

For the purposes of this document, CMD refers to groundwater, base flow surface waters, or runoff surface waters that have been affected by remnants of oxidized pyrite and/or other sulfur containing minerals associated with coal mines or related spoils. This water consequently has a low pH, high acidity, and/or high metal concentrations or suspended sediment levels. The Corps would fund, design, construct, and monitor the remediation projects, in cooperation with the NPS and FWS.

1.2 Purpose for Federal Action

The proposed action is the remediation of two CMD sites for water quality improvements and one sediment abatement site on NPS lands to fulfill a requirement of the ITS. The objective of this project are to construct remediation actions on at least three sites affected by historic coal mining (sediment production or CMD) within the Blue Heron vicinity of BISO to improve water quality and aquatic habitat in the BSF for the duskytail darter.

Streams in the BSF watershed generally contain sandstone beds that have poor buffering capacities and are particularly susceptible to CMD (TDEC 1997). As a result of CMD, many tributaries to the BSF are coated with an iron precipitate known as 'yellow boy'', which often interferes with the life cycle of aquatic organisms. In addition, pH levels and metal concentrations of CMD are often toxic to aquatic organisms. Due to these physical and chemical alterations resulting in CMD, many streams in the project area lack or have degraded aquatic life.

1.3 Location

BISO is located on the Cumberland Plateau, approximately 50 miles northwest of Knoxville, Tennessee and encompasses approximately 125,000 acres in portions of Pickett, Morgan, Fentress and Scott Counties, Tennessee and McCreary County Kentucky (Figure 2). The BSF watershed includes the above counties plus smaller areas of Anderson and Campbell counties, Tennessee. Counties surrounding BISO contain scattered, low-density rural development with no major urban areas.

Major access to BISO is provided by Interstates 40, 65, and 75. Major population centers within a 150 mile radius are Knoxville, Nashville, and Chattanooga, Tennessee; Lexington and Louisville, Kentucky; and Asheville, North Carolina. U.S.27 and 127 are major north-south corridors just outside BISO boundary.

1.4 Need for a Mitigation and Monitoring Plan

The need for this plan is to show that the project would have negligible adverse impacts to fish and other aquatic species, wildlife, and wetland losses. This plan demonstrates that damages to all significant ecological resources, both terrestrial and aquatic, have been avoided and minimized to the extent practicable, and that any remaining unavoidable damages have been compensated for or mitigated to in-kind conditions.

2 PROJECT DESCRIPTION

The proposed project would include a combination of Blue Heron Spoils (BHS), Devils Jump

Settling Pond (DJSP), and Unnamed Tributary 3 Concrete Lined Stream (UT3CLS) Remediation Alternatives. The Corps would fund, design, and implement a minimum of two water quality (WQ) and one sediment abatement (SA) projects to improve the affected reach of the BSF. Three sites affected by coal mining (sediment production or CMD) within the Blue Heron vicinity of BISO are required to meet the terms and conditions of the ITS. The combination of BHS (both WQ/SA), DJSP (WQ), and UT3CLS (SA) remediation measures would reduce CMD and/or sedimentation from entering the BSF and improve water quality conditions (pH, DO, and conductivity). The proposed project is considered the environmentally preferred alternative. The environmentally preferred alternative (PA) is the alternative that causes the least damage to the biological and physical environmental and best protects, preserves, and enhances historical, cultural, and natural resources. Detailed project plans for each remediation alternative can be found below.

The sites proposed for CMD remediation are relatively remote without improved roads available for access. The proposed remediation actions would require improving the access routes leading to project sites. The access routes are primarily sited along existing trails and/or former mining/timber roads. BHS, DJSP, and UT3CLS sites would be accessed from the Blue Heron Boat Launch parking area via the existing LBHT and for DJSP, a short portion of BHLT. The parking lot closest to the Blue Heron Boat Ramp would be used for staging of construction equipment. A construction security fence would be installed around the proposed staging area to separate recreational users from construction activities ensuring public safety.

The proposed remediation sites access route (road) would be constructed to meet the Corps and NPS safety regulations and would be no greater than 15 feet in width (unless the route currently exceeds 15 feet in width). The proposed access route is divided into three different sections (Section A, B, and C) in order to discuss improvements required in more detail.

Section A is comprised of the existing LBHT which follows the former railroad grade. A few sections of the existing trail would need to be widened to no greater than 15 feet to allow construction equipment access to/from the site. Section A is approximately 0.47 miles long. In order to widen the trail, minor tree removal would be required. Tree species included but are not limited to: tulip popular (*Lirodendron tulipifera*), oak species (*Quercus spp.*), hickory species (*Carya spp.*), and maple species (*Acer spp*.). Section A would also include the removal of one shagbark hickory (*Carya ovata*) and four snags along LBHT. These species exhibit the criteria specified by FWS to be considered summer roost habitat for the Indiana (*Myotis sodalis*) and northern long-eared (*Myotis septentrionlis*) bats. In addition to widening Section A, up to three pull outs would be constructed along Section A. Pull outs would allow for two way traffic to and from the proposed project sites and would reduce additional widening of the entire section. Each pull out would be created the same as the remainder of the trail. Each pull out location was selected in a manner to reduce environmental impact. In addition to aid in reducing impacts to mature trees within and surrounding the pullout areas a limitation of tree diameter would be applied without additional review and coordination.

Section B, approximately 0.34 miles long, would follow an old access route that was used during the stabilization of DJSP and BHS in the 1970's and would end at UT3CLS project location.

The majority of this section is comprised of old field growth with small diameter (4-6 DBH) ash species (*Fraxinus spp.*) and maple species (*Acer spp.*). The section would require minor grading and tree removal. However, there is a short (200 linear foot) section that is within an old growth forest. This section is comprised mainly of tulip popular, hemlock (*Tsuga canadensis*), oak species, and hickory species. None of the trees within Section B meet the criteria specified by FWS to be considered summer roost habitat for the Indiana and/or northern long-eared bat. A staging area would be constructed within the former BHS area to facilitate construction activities.

Section C would follow a short portion of the existing BHLT from Section B back to the DJSP site. Similar to Sections A and B, Section C would need to be widened no greater than 15 feet to allow construction equipment to access DJSP. Tree species within the project footprint consist of eastern hemlock, tulip popular, and maple species. Section C would require minor re-grading of the existing BHLT and reconstruction of the bridge over the pond outlet (per NPS standards). Section C is approximately 0.06 miles long.

All trees that would be removed would be cut as close to the ground as possible, roots would be left in place when possible to reduce soil disturbance, and trees fallen and scattered throughout the adjacent forested areas.

2.1 BHS

BHS would involve bank stabilization by riprapping approximately 300 linear feet of the BSF stream bank. Construction of BHS would follow the steps outlined and discussed below.

Access Route Improvement

In order to access BHS site, portions of the existing LBHT would require minor modifications and temporary improvements. Installation of devices according to the best management practices (BMPs) to minimize and control sedimentation and erosion would be done prior to any construction activities.

Excavation of Spoil Material/Sloping of the Existing Bank

The existing banks (mostly spoil material) would be cut back to a 2:1 (horizontal: vertical) slope. This would require the removal of approximately 3,250 cubic yards of spoil material. On November 18, 2015, a composite sample of material to be excavated was collected within the cut zone and analyzed per the toxicity characteristic leaching procedure (TCLP) to help determine ultimate disposal options for the material. The TCLP test indicated that the material does not exhibit the characteristics of a hazardous waste, and the excavated material is not required to be disposed of at a Resource Conservation and Recovery Act (RCRA) landfill. Rather the material may be disposed of at a solid waste (commercial) landfill as a special waste (contingent on state and landfill approval of special waste). The nearest landfill is the Volunteer Regional Landfill located in Scott County, Tennessee.

Seep(s) Water Quality Improvement Measures

In order to help address seeps located throughout the length of BHS, approximately 612 tons of

dense grade aggregate (DGA) crushed limestone would be placed along the entirety of BHS. Prior to placing the DGA crushed limestone, filter fabric material would be placed on the spoil face to allow water to percolate through the filter fabric and DGA crushed limestone. The DGA crushed limestone would be a onetime application and may eventually lose buffering effectiveness of improving pH as limestone is dissolved or coated with reaction products. However, the rate and timeframe of buffering is unknown.

Placement of Riprap for Stabilizing Bank

Approximately 10,428 tons of Kentucky transportation cabinet (KYTC) Class III Limestone Riprap would be placed at a 2:1 (horizontal: vertical) slope. BHS plans can be found in Appendix B. Figure 20 below shows a typical cross section for BHS. BHS would be monitored for stability and near shore water quality improvements.

2.2 DJSP

DJSP would include the conversion of the lower pond to a meandering stream through a limestone-lined outlet channel to the BSF floodplain. DJSP consists of two depressional wetlands (Upper and Lower Pond) totaling approximately 0.10 acres. Construction activities would primarily take place within the dividing berm of the Upper Pond and the Lower Pond. This dividing berm appears to consist of compacted spoil material.

Vegetation Clearing and Access Route Improvement

In order to access DJSP, portions of the existing LBHT and BHLT would require temporary improvements. Installation of BMPs to reduce sedimentation and erosion would be installed prior to any construction activities. To aid in construction and improvement of the habitat within the new channel and wetland area, a few trees previously removed would be used. All remaining trees would be either scattered throughout the adjacent forested area or hauled off to an approved disposal site.

Protection of the Upper Pond

In order to maintain the hydrology within the upper pond temporary water retention structures such as sand bags, clay berm, and/or coffer dam, would be installed just above the spillway and excavation areas. These structures would be monitor during construction to insure the hydrology of the upper pond is not altered. Following completion of construction activities at DJSP, all temporary retention structures would be removed.

Excavation of Spoil Material

Prior to excavation of the spoil material, the lower pond area would be dewatered. The dewatering of the lower pond would follow applicable Kentucky Division of Water (KDOW) regulations and permit conditions. Approximately 420 cubic yards of spoil material, located between the upper and lower ponds, would be removed to an elevation of 770 feet. In addition to the spoil material removed between the upper and lower ponds, approximately 600 cubic yards of spoil material would be excavated to an elevation of 770 feet at the outlet of the lower pond. A key construction consideration is to maintain the water level in the upper pond/wetland.

This would be monitored during construction and reestablished in a timely manner with the use of temporary measures such as sand bags or equivalent techniques. The existing lower pond outlet culvert would be removed as well and following construction would be replaced with a span bridge constructed in accordance with NPS trail specifications since this serves as a portion of the BHLT.

The TCLP sample that was described in the BHS section also included an aliquot of the DJSP material to be excavated. The TCLP test indicated that the material does not exhibit the characteristics of a hazardous waste, and therefore disposal may be at a solid waste (commercial) landfill as a special waste as noted above for the previous site.

Creation of a Limestone Lined Stream Channel from the DJSP Outlet of the Upper Pond to the BSF

Following installation of BMPs, dewatering the lower pond, and removal of spoil material from the identified locations, a new channel and spillway (discussion to follow) would be constructed from the outlet of the upper pond to the BSF floodplain. This channel would be approximately two feet in depth with a bottom width of three feet. The banks (mostly spoil material within the lower pond) would be cut back to a 2:1 (horizontal: vertical) slope making the top of bank approximately 11 feet in width. Approximately 330 tons of KYTC Class II riprap (minimum of 9 inches) would be placed throughout the stream to line the stream banks and channel bottom. In-stream features such as logs, larger stones, step pools, and different sized gravels would be placed throughout the channel length to provide additional aquatic habitat. The remaining wetland surrounding the newly created channel (former portions of lower pond) would be replanted with native saplings and/or herbaceous species suitable for anaerobic conditions. The lower most portion of the stream naturally braids and percolates into the floodplain. The new limestone-lined channel would be tied into this braided portion and would end above the ordinary high water mark of the BSF. The new channel would be constructed to handle typical high flow events of the BSF.

Installation of a Limestone Spillway between the Upper Pond and the New Riprap Lined (Former Lower Pond) Stream Channel

Once spoil material is excavated approximately 210 tons of DGA crushed limestone would be placed at a 2:1 (horizontal: vertical) slope to create a suitable base for the spillway. To insure the hydrology within the upper pond is not altered a clay wedge would be constructed within the limestone spillway. This would aid in the reduction of water seeping through the limestone spillway. Prior to placing the DGA crushed limestone, filter fabric material would be placed to allow water to percolate through the filter fabric and DGA crushed limestone.

Approximately 248 tons of KYTC Class II Riprap would be placed at a 2:1 (horizontal: vertical) slope. DJSP plans can be found in Appendix B. The spillway is intended to control water at an elevation of approximately 772.5 feet to avoid lowering water levels in the upper pond. The spillway would overtop and flow through the newly construction limestone riprap lined channel.

Replanting of Wetland Areas surrounding the Newly Created Limestone Lined Channel

In order to construct the limestone lined channel and spillway, approximately 0.05 acres of wetlands would be impacted in the footprint of the lower pond and immediate fringe. Temporary wetland impacts would occur in the entire lower pond during construction and 0.05 acres would be permanently impacted due to the creation of the limestone lined channel. Temporary wetland impacted areas (approximately 0.02 acres) would be replanted with native saplings and/or herbaceous species suitable for anaerobic conditions and approved by the Corps, NPS, and KDOW.

2.3 UT3CLS

UT3CLS would involve installing limestone step pools to include cross vanes and minor bank and channel stabilization by riprapping in highly degraded areas identified within the stream channel. The channelized section of stream was likely done in the 1970's to route water in the drainage around the adjacent BHS area. Currently, due to the steep stream banks, bank erosion occurs during high flow events. By constructing stone step pools to include cross vanes and placement of riprap along major bank erosional areas water velocities would be lowered and additional erosion and sedimentation loads entering the BSF would be limited. Construction activities would start at the end of the existing concrete-lined channel. UT3CLS would follow the steps outlined and discussed below.

Access Route Improvement

In order to access UT3CLS, portions of the existing LBHT and a short section (Section B) of an old access path would require temporary improvements. The old access path is primarily across the BHS site with short segments to access the channel at strategic locations. Installation of BMPs such as but not limited to silt fences, rock check dams, corridor rolls, to reduce sedimentation and erosion would be installed prior to any construction activities. Following construction, areas disturbed would be replanted with NPS approved species.

Placement of Limestone for Stabilizing Bank and Step Pools to include Cross Vanes

Following the installation of BMPs and improvement of channel access points, limestone step pools to include cross vanes would be placed in highly degraded areas identified within UT3CLS. Prior to placing the limestone, a geotextile fabric would be placed. Each limestone step pool would be constructed of approximately 23 cubic yards of KYTC class III riprap.

Banks of UT3CLS are eroding in multiple areas and are introducing sediment into the BSF. During construction, bank erosion areas would be improved by placing limestone riprap along the bank toes. Following the placement of a non-woven geotextile fabric each major bank erosion section would be sloped back to an appropriate slope (typically 2:1 (horizontal: vertical)). Additional limestone could be placed in the channel for stabilization, habitat structure, and water quality improvements. UT3CLS plans can be found in Appendix B. Stream banks impacted during the construction of UT3CLS would be replanted with species approved by NPS and KDOW to aid in bank stabilization.

2.4 Impacted Area and Trail System Restoration

Following the completion of the proposed remediation measures, the proposed access route

would be restored to the existing width (per NPS trail standards) however, gravel and rock placed for surface improvements may be left within the trail surface. The improved path would be reshaped and graded to no greater than 8 feet in width per the NPS trail standards. Side banks would be replanted using the NPS recommended planting list. During construction, temporary erosion control measures would be installed on these access roads and trails. A need for continued Operation and Maintenance access to the BHS and DJSP sites is not anticipated.

3 MITIGATION PLAN

3.1 Summary of Mitigation Objectives

The goal of mitigation is to provide compensatory mitigation for wetlands, and replacement of lost forest habitat for wildlife. The objectives of mitigation are to compensate for temporary loss of approximately 0.02 acre of wetlands and replacement for the loss of approximately 10 acres of upland/riparian forest habitat as a result of the proposed project. The Project is not expected to result in any substantial adverse impacts to the overall quality, function, and value of surface waters (streams and wetlands) and forest. The Project is not expected to result in a lowering of the existing use for any of the affected resources.

4 MITIGATION REQUIREMENTS

All mitigation efforts are per the Kentucky Division of Water (KDOW) Permit and NPS standards. All plants would be native species and approved by FWS, KDOW, and NPS.

4.1 Mitigation Requirements

All disturbed areas would be restored with native species and would be approved by FWS, KDOW, and NPS prior to planting. Please see Appendix D for a detailed planting list.

5 MONITORING REQUIRMENTS

The state water quality certification (KDOW), NPS and FWS ITS requires annual monitoring of the restoration success of the restored wetland (DJSP), stream segment (UT3CLS), bank stabilization (BHS), restored riparian areas, and disturbed areas (i.e. LBHT, BHLT, lay down areas). Annual monitoring would be completed between September and October of each year. The Corps would be responsible for conducting the monitoring on an annual basis for a minimum of 5 years or until the restored areas (wetland, stream, bank stabilization, and associated trails and uplands) meet the success criteria. An annual report of monitoring results would be submitted to the FWS, KDOW, and NPS. Success would be evaluated by the following:

5.1 BHS

Water Quality

Four sampling sites would be established to insure data collections represent the natural state of the stream. Annual water quality samples would be collected for analysis annually in late summer to early fall (i.e. September – October). The following parameters would be collected to better assess the sustainability of the project over time: pH, conductivity, dissolved oxygen, and

temperature.

Visual Observations

In addition to water quality samples, visual inspections would be conducted to determine the success of the proposed project. Any deficiency would be recorded and if needed appropriate measures would be taken to correct.

5.2 DJSP

Monitoring of the site would take place annually for a five-year period. Procedures used to determine if wetland conditions have been established would follow guidance in the eastern mountains and piedmont regional supplement (U.S. Army Corps of Engineers 2012). Details of the monitoring program are described in the sections below. The wetland area would be evaluated for hydrology, vegetation, and soils.

Water Quality

Two sampling sites would be established to insure data collections represent the natural state of the stream. Annual water quality samples would be collected for analysis annually in late summer to early fall (i.e. September – October). The following parameters would be collected to better assess the sustainability of the project over time: pH, conductivity, dissolved oxygen, and temperature.

Hydrology

Hydrology would be monitored using one water level sensor with pressure transducers and data loggers installed in two-inch diameter monitoring wells that would be approximately two feet deep. The well would be constructed and installed according to guidance found in Sprecher, S. W. (2000). "Installing monitoring wells/piezometers in wetlands," *WRAP Technical Notes Collection* (ERDC TN-WRAP-00-02), U.S. Army Engineer Research and Development Center, Vicksburg, MS. *www.wes.army.mil/el/wrap*. The well would be placed in a central location of the wetland area (Figure 4). This location also would serve as the establish plot used to monitor vegetation and soils. The water level sensor would record a measurement once every 24 hours and stored in the data logger. Once ground water levels drop significantly below two feet (e.g., by June or July), the data loggers data would be analyzed. A hydrograph representing subsurface water levels would be produced for the well location.

All indicators of wetland hydrology identified within the monitoring plot would be documented (e.g., inundation/saturation of the soil, crayfish chimneys, water marks, water-stained vegetation, oxidized rhizospheres, etc.). Growing season dates and rainfall data would be compared to rainfall data from the closest available weather station to determine if "normal conditions" were present.

Vegetation

Monitoring of vegetation would be conducted in late summer to early fall (i.e. September – October). Data describing the composition of the plant community would be collected from the permanently established plot containing the water level sensor.

Vegetation Plots

The vegetation plot would be approximately one meter squared. Due to the overall size of the wetland area only one herbaceous vegetation plot would be established. Vegetation data collected would include total percent cover, percent cover by species, and species richness. A prevalence index value for vegetation within the plot would be calculated to determine if the plant community is "hydrophytic." Due to the surrounding forest composition and shading no tree and/or shrubs are to be planted.

Inspection of the wetland to identify and locate invasive species would be conducted annually. Any invasive plant species discovered to be occupying an area would be controlled. In the event it is determined that it is no longer practical to attempt to control such species, other appropriate measures would be considered.

Soils

A soil pit, approximately 1 square foot, would be excavated within the permanently established plot to determine if hydric soil indicators are present. Data would be collected from the upper 18 inches of the soil profile and would include Munsell color, and types and abundance of redoximorphic features present.

Utilization of the site by wildlife would be documented during site visits conducted to monitor hydrology and sample vegetation. Monitoring of wildlife would include direct observations and aural verification, as well as evidence of presence such as tracks, hair, nests, and eggs. A list of wildlife species would then be produced for each monitoring period.

Visual Observations

In addition to water quality samples, visual inspections would be conducted to determine the success of the proposed project. Any deficiency would be recorded and if needed appropriate measures would be taken to correct.

5.3 UT3CLS

Vegetation

Monitoring of vegetation would be conducted in late summer to early fall (i.e. September – October) within the riparian area (30 ft from stream bank). Data describing the composition of the plant community would be collected from two permanently established plot within the riparian area. Herbaceous vegetation plot would be approximately one square meter in size. Vegetation data collected would include total percent cover, percent cover by species, and species richness. The estimated survival of planted tree species within the site would be determined by tallying planted trees as either living or dead. Location and number of transects will be determined prior to the first monitoring event and would take place within the reestablished riparian areas.

Inspection of the riparian area to identify and locate invasive species would be conducted annually. Any invasive plant species discovered to be occupying an area would be controlled. In the event it is determined that it is no longer practical to attempt to control such species, other

appropriate measures would be considered.

Water Quality

Two established monitoring sampling site would be established to insure data collections represent to natural state of the stream. Annual water quality samples would be collected for analysis annually in late summer to early fall (i.e. September – October). The following parameters would be collected to better assess the sustainability of the project over time: pH, conductivity, etc.

Visual Observations

In addition to water quality samples, visual inspections would be conducted to determine the success of the proposed project. Any deficiency would be recorded and if needed appropriate measures would be taken to correct.

5.4 Impacted Area and Trail System Restoration

Vegetation

Monitoring of vegetation would be conducted in late summer to early fall (i.e. September – October). Data describing the composition of the plant community would be collected from multiple permanently established plot within the proposed area. Herbaceous vegetation plot would be approximately one meter is size. Vegetation data collected would include total percent cover, percent cover by species, and species richness. The estimated survival of planted tree species within the site would be determined by tallying planted trees as either living or dead. Location and number of transects would be determined prior to the first monitoring event and would take place within the reestablished riparian areas.

Inspection of the riparian area to identify and locate invasive species would be conducted annually. Any invasive plant species discovered to be occupying an area would be controlled. In the event it is determined that it is no longer practical to attempt to control such species, other appropriate measures would be considered.

Visual Observations

Visual inspections would be conducted to determine the success of the proposed project. Any deficiency would be recorded and if needed appropriate measures would be taken to correct.

6 ADAPTIVE MANAGEMENT PLAN

Unforeseen changes in site conditions could result in changing, or adapting, a revised mitigation plan to the changed condition. If the mitigation plan is not meeting success criteria based on monitoring results, corrective actions would need to be identified and implemented. A revised plan would be prepared that would include proposed actions, a time schedule for activities, and any changes to the monitoring plan. A report of these changes would be submitted to the FWS, KDOW, and NPS.

7 FINANCIAL ASSURANCES

Funding for this mitigation plan would come from Lake Cumberland Major Rehab funds.

8 LITERATURE CITED

Cowardin, L. M., V. Carter, F.C. Golet, and E. T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Fish and Wildlife Service. Biological Services Program Rept. FWS/OBS-79/31. 103 p.

Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Ohio Department of Transportation, Office of environmental Services. 2010. *Final Stream and Mitigation Plan, FRA-270-19-84 (PID 77319) North Central Outerbelt Improvements.*

U. S. Fish and Wildlife Service. 1980. *Habitat Evaluation Procedures (HEP) ESM 102.*

U. S. Fish and Wildlife Service. 1987 Revised. *Habitat Suitability Index Models: Gray Squirrel*

APPENDIX B

Project Plans

US Army Corps
of Engineers
Nashville District

Plans For
WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT

BLUE HERON, MCCREARY COUNTY, KENTUCKY

BCOES REVIEW

W912P5-XX-X-XXXX

Note:

(1.) This project was designed by the Nashville District of the U.S. Army Corps of Engineers. The initials or signatures and registration designations of individuals appear on these project documents within the scope of their employment as required by ER 1110-1-8152.

(2.) The approval signatures appearing in the title block on this sheet constitute approval of all drawings listed in the index.

Submitted:	Approval Recommended:
Chief, Civil Design Branch	Chief, Engineering Construction Division
Approved:	
Lt. Colonel, C.E. District Engineer	DATE

SHEET INDEX

BF-S-002	BIG SOUTH FORK SURVEY MAY 2015 PROJECT SITE AREA
BF-S-003	AREA 1, 2, 3, & CONTRACTOR LAYDOWN AREA
BF-S-004	CONTRACTOR'S LAYDOWN AREA
BF-S-005	TRAIL AND HAUL ROAD PLAN
BF-S-006	HAUL ROAD PLAN STA 4+75 - 11+50
BF-S-007	HAUL ROAD PLAN STA 11+50 - 17+50
BF-S-008	HAUL ROAD PLAN STA 17+50 - 23+25
BF-S-009	HAUL ROAD PLAN STA 23+25 - 29+25
BF-S-010	HAUL ROAD PLAN STA 29+25 - 35+75
BF-S-011	HAUL ROAD PLAN STA 35+75 - 40+63
BF-S-012	HAUL ROAD PROFILE STA 0+00 - 21+00
BF-S-013	HAUL ROAD PROFILE STA 20+00 - 40+63
BF-S-101	SITE PLAN - EXISTING CONDITIONS - AREA 1
BF-S-102	FINAL GRADING PLAN - AREA 1
BF-S-107	AREA 1 CROSS SECTIONS 1+00 TO 1+25
BF-S-108	AREA 1 CROSS SECTIONS 1+50 TO 1+75
BF-S-109	AREA 1 CROSS SECTIONS 2+00 TO 2+25
BF-S-110	AREA 1 CROSS SECTIONS 2+50 TO 2+75
BF-S-111	AREA 1 CROSS SECTIONS 3+00 TO 3+25
BF-S-112	AREA 1 CROSS SECTIONS 3+50 TO 3+75
BF-S-113	AREA 1 CROSS SECTIONS 4+00 & A-A'
BF-S-114	AREA 1 TYPICAL CROSS SECTIONS & DETAILS
BF-S-201	SITE PLAN - EXISTING CONDITIONS - AREA 2
BF-S-202	FINAL GRADING PLAN - AREA 2
BF-S-230	AREA 2 CROSS SECTIONS A-A; B-B; C-C; D-D
BF-S-231	TIMBER BRIDGE DETAILS
BF-S-301	SITE PLAN AREA 3
BF-S-306	AREA 3 PLAN AND PROFILE STA 0+00 - 2+50
BF-S-307	AREA 3 PLAN AND PROFILE STA 2+50 - 5+00
BF-S-308	AREA 3 PLAN AND PROFILE STA 5+00 - 7+60
BF-S-330	AREA 3 STEP POOL CROSS SECTIONS AND DETAILS

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MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
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NASHVILLE, TENNESSEE

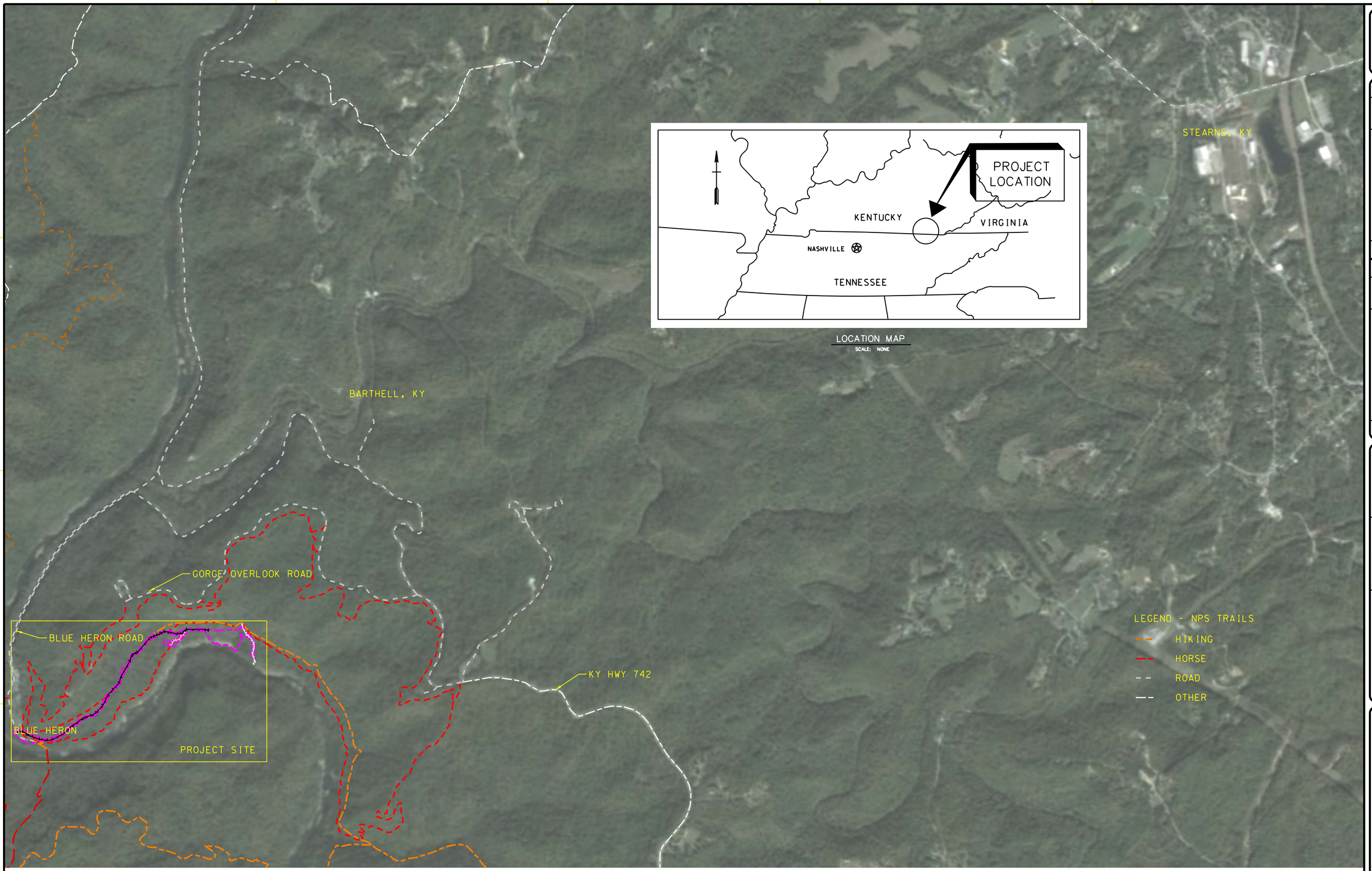
DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE P.E.
PLOT SCALE: 1" = 40'
PLOT DATE: 6/8/2016
SOURCE:
SIZE: ANSI D
FILE NAME: $FILE$$

DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCREARY COUNT, KENTUCKY

SHEET INDEX

SHEET IDENTIFICATION
BF-S-001



LOCATION MAP
SCALE: NONE

BCOES REVIEW

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SCALE: 1"= 750'

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DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE P.E.
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SIZE: ANSI D
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DATE: SEPT 2015
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

BIG SOUTH FORK SURVEY
MAY 2015
PROJECT SITE AREA

SHEET IDENTIFICATION
BF-S-002

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BCOES REVIEW

200 100 0 200 400FT
SCALE: 1"= 200'

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MARK	DESCRIPTION	DATE	APPR

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NASHVILLE, TENNESSEE

DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: EGC
SUBMITTED BY: JAMES K. WADDLE P.E.
PLOT SCALE: 1 = 200.00'
PLOT DATE: 6/8/2016
SIZE: ANSI D
FILE NAME: $FILE$
DATE: SEPTEMBER 2015
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

BIG SOUTH FORK SURVEY
MAY 2015
AREAS 1-3 & CONTRACTOR LAYDOWN AREA

SHEET IDENTIFICATION
BF-S-003

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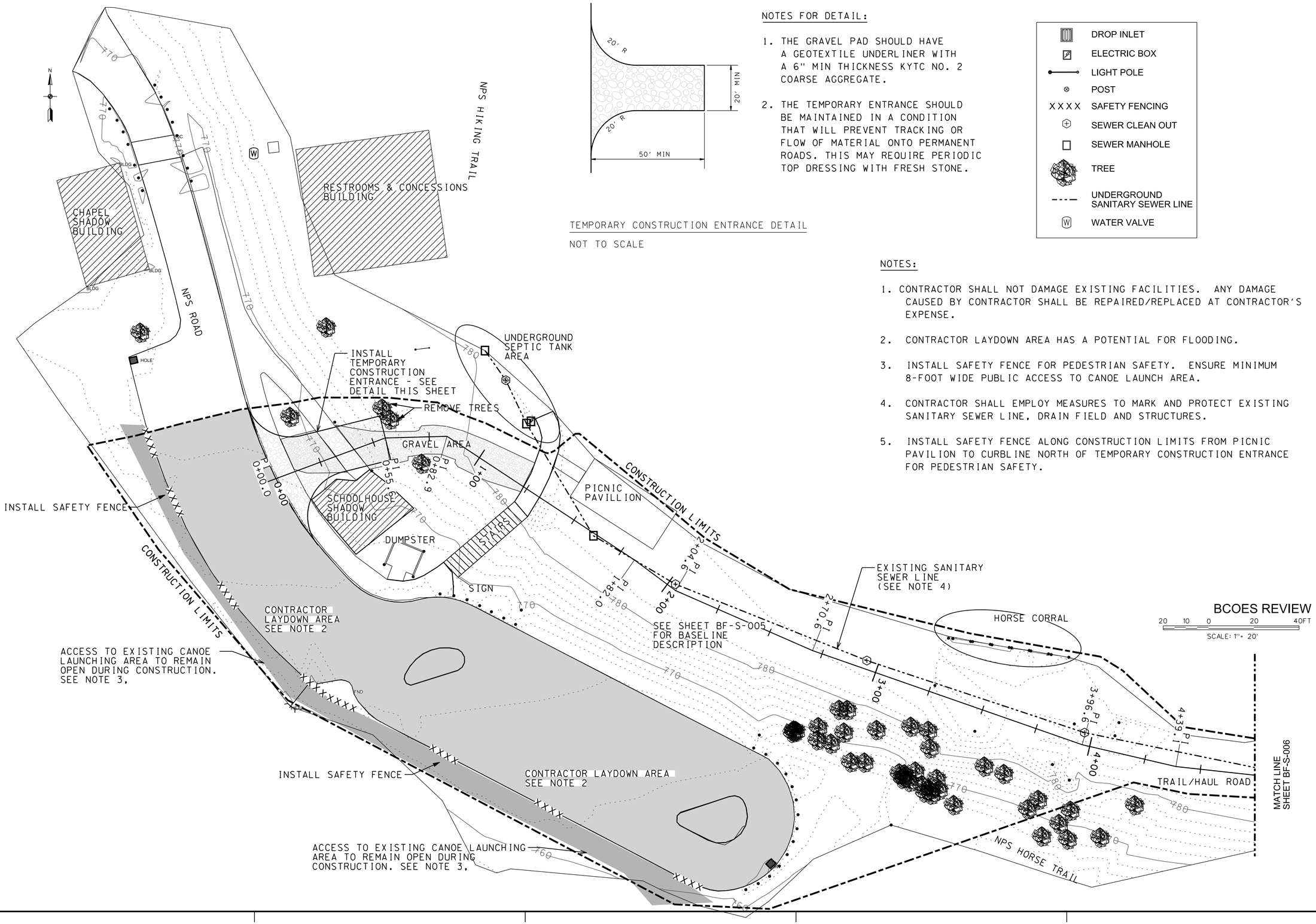

TEMPORARY CONSTRUCTION ENTRANCE DETAIL

NOT TO SCALE

NOTES FOR DETAIL:

1. THE GRAVEL PAD SHOULD HAVE A GEOTEXTILE UNDERLINER WITH A 6" MIN THICKNESS KYTC NO. 2 COARSE AGGREGATE.
2. THE TEMPORARY ENTRANCE SHOULD BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOW OF MATERIAL ONTO PERMANENT ROADS. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH FRESH STONE.

- DROP INLET
- ELECTRIC BOX
- LIGHT POLE
- POST
- XXXX SAFETY FENCING
- SEWER CLEAN OUT
- SEWER MANHOLE
- TREE
- UNDERGROUND SANITARY SEWER LINE
- WATER VALVE

NOTES:

1. CONTRACTOR SHALL NOT DAMAGE EXISTING FACILITIES. ANY DAMAGE CAUSED BY CONTRACTOR SHALL BE REPAIRED/REPLACED AT CONTRACTOR'S EXPENSE.
2. CONTRACTOR LAYDOWN AREA HAS A POTENTIAL FOR FLOODING.
3. INSTALL SAFETY FENCE FOR PEDESTRIAN SAFETY. ENSURE MINIMUM 8-FOOT WIDE PUBLIC ACCESS TO CANOE LAUNCH AREA.
4. CONTRACTOR SHALL EMPLOY MEASURES TO MARK AND PROTECT EXISTING SANITARY SEWER LINE, DRAIN FIELD AND STRUCTURES.
5. INSTALL SAFETY FENCE ALONG CONSTRUCTION LIMITS FROM PICNIC PAVILION TO CURBLINE NORTH OF TEMPORARY CONSTRUCTION ENTRANCE FOR PEDESTRIAN SAFETY.

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MARK	DESCRIPTION	DATE	APPR.
1	ACCORDANCE W/MODIFICATION NO. 1	7/1/2005	TSR

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: MICHAEL A. BROWN
DRWN BY: JH
CKD BY: EGC
SUBMITTED BY: JAMES R. WADDLE, PE
PLOT SCALE: 1:1
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DATE: 2015/09/10
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TENNESSEE

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY KENTUCKY

SITE PLAN
CONTRACTOR'S LAYDOWN AREA

SHEET IDENTIFICATION
BF-S-004
SHEET X OF Y

FILE: $File$
DATE: 6/8/2016

DESCRIPTION OF BASELINE FOR HAUL ROAD 1

STATION	NORTHING	EASTING	Tangent Direction	Tangent Length
00+00.0	1764775.2	1993024.1		
00+55.6	1764794.5	1993076.2	N 69°36'37" E	55.62
00+82.9	1764795.3	1993103.4	N 88°27'06" E	27.26
01+82.0	1764740.7	1993186.2	S 56°35'52" E	99.08
02+04.6	1764727.2	1993204.4	S 53°21'23" E	22.68
02+70.6	1764700.7	1993264.8	S 66°21'10" E	65.96
03+96.6	1764659.3	1993383.7	S 70°46'27" E	125.99
04+39.1	1764649.6	1993425.1	S 76°52'35" E	42.49
05+35.1	1764639.2	1993520.6	S 83°44'47" E	96.02
06+24.1	1764656.6	1993607.8	N 78°41'29" E	88.97
08+28.2	1764753.0	1993787.8	N 61°49'48" E	204.12
10+24.4	1764885.4	1993932.6	N 47°33'27" E	196.24
11+14.1	1764933.6	1994008.2	N 57°30'10" E	89.65
12+26.8	1765003.7	1994096.4	N 51°31'15" E	112.72
12+69.7	1765022.4	1994135.1	N 64°11'37" E	42.92
13+76.3	1765046.4	1994238.9	N 76°58'14" E	106.62
14+74.5	1765097.1	1994323.0	N 58°54'00" E	98.18
16+43.0	1765222.0	1994436.2	N 42°10'28" E	168.53
18+30.4	1765391.8	1994515.3	N 24°58'32" E	187.33
19+57.8	1765481.6	1994605.7	N 45°13'37" E	127.40
21+04.4	1765591.5	1994702.8	N 41°26'07" E	146.68
21+97.2	1765681.5	1994725.5	N 14°12'16" E	92.76
25+08.0	1765951.9	1994878.8	N 29°32'39" E	310.82
25+95.1	1766035.9	1994901.9	N 15°22'42" E	87.11
26+33.8	1766067.0	1994924.9	N 36°26'22" E	38.71
26+78.2	1766066.8	1994969.3	S 89°44'26" E	44.38
27+23.7	1766094.9	1995005.0	N 51°47'54" E	45.48
30+59.8	1766349.6	1995224.2	N 40°43'02" E	336.06
31+16.7	1766356.8	1995280.8	N 82°48'25" E	56.99
31+65.3	1766373.1	1995326.5	N 70°18'53" E	48.57
32+33.7	1766406.3	1995386.2	N 60°55'06" E	68.35
32+49.1	1766416.5	1995397.9	N 48°47'02" E	15.47
32+99.9	1766432.1	1995446.1	N 72°05'23" E	50.73
33+66.2	1766428.0	1995512.3	S 86°24'34" E	66.31
35+21.9	1766392.9	1995664.0	S 76°57'54" E	155.68
35+76.2	1766397.8	1995718.1	N 84°49'07" E	54.38
36+35.5	1766423.4	1995771.6	N 64°21'41" E	59.29
36+65.5	1766453.0	1995776.5	N 9°21'58" E	29.99
37+03.9	1766468.1	1995811.8	N 66°56'00" E	38.37
40+20.5	1766469.7	1996128.4	N 89°42'21" E	316.61
40+63.0	1766453.3	1996167.6	S 67°21'05" E	42.45

DESCRIPTION OF BASELINE FOR HAUL ROAD 2

STATION	NORTHING	EASTING	Tangent Direction	Tangent Length
00+00.0	1766423.5	1995771.7		
00+44.0	1766383.0	1995754.5	S 22°59'15" W	44.01
00+79.5	1766363.0	1995725.2	S 55°42'41" W	35.48
01+43.7	1766307.5	1995693.0	S 30°11'22" W	64.16
02+07.8	1766291.3	1995630.9	S 75°20'49" W	64.11
02+33.7	1766281.4	1995607.0	S 67°28'34" W	25.93
02+64.3	1766259.2	1995585.9	S 43°35'16" W	30.58
03+24.4	1766207.7	1995554.9	S 31°00'51" W	60.12

NOTES:
1. BASED ON EXISTING GRADES, HAUL VEHICLES SHALL BE EQUIPPED WITH ENGINE RETARDERS TO ASSIST IN CONTROLLING DOWNGRADE DESCENTS.

LEGEND - NPS TRAILS
- HIKING
- HORSE

BCOES REVIEW

100 50 0 100 200FT
SCALE: 1"= 100'

US Army Corps of Engineers® Nashville District

U.S. ARMY CORPS OF ENGINEERS NASHVILLE DISTRICT NASHVILLE, TENNESSEE

DESIGNED BY: MICHAEL A. BROWN | DWN BY: JH | CKD BY: EGC | SUBMITTED BY: JAMES R. WADDLE P.E. | PLOT SCALE: 1"=100' | PLOT DATE: 6/8/2016 | SIZE: ANSI D | FILE NAME: $FILESS | DATE: SEPTEMBER 2015 | SOLICITATION NO.: | CONTRACT NO.: | FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY KENTUCKY

BIG SOUTH FORK AREA 1
TRAIL & HAUL ROAD PLAN

SHEET IDENTIFICATION
BF-S-005

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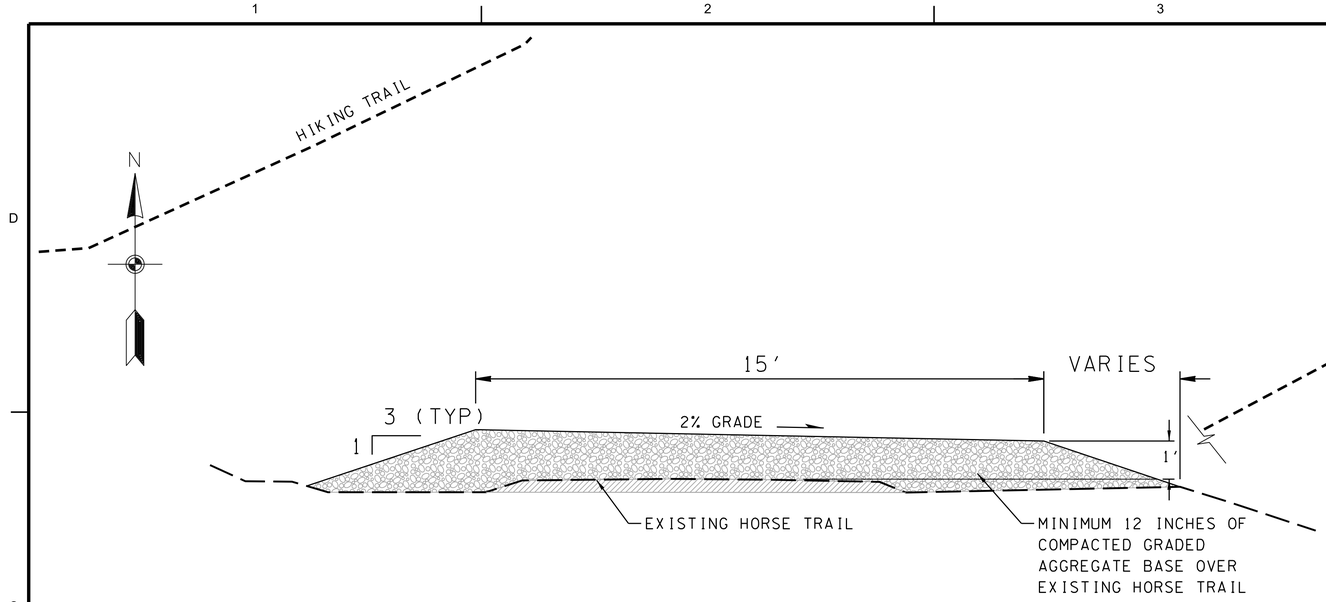

CROSS SECTION A-A
TYPICAL HAUL ROAD SECTION

SCALE: 1" = 2'

HIKING TRAIL

MATCH LINE SHEET BF-S-004

EXISTING SANITARY SEWER LINE (SEE NOTE 5)

EXISTING SANITARY SEWER DRAIN FIELD AREA (SEE NOTE 5)

5+00

5+35 PI

6+00

6+24.5 PI

7+00

CONSTRUCTION LIMITS

8+00

8+28.2 PI

9+00

EXISTING HORSE TRAIL

10+00

10+24.4 PI

11+00

11+14.1 PI

MATCH LINE SHEET BF-S-007

HIKING TRAIL

CONSTRUCTION LIMITS

LEGEND - NPS TRAILS

- HIKING
- HORSE

NOTES:

1. REGRADE AND COMPACT EXISTING HORSE TRAIL TO RECEIVE NEW HAUL ROAD STONE.
2. SEE PLAN AND PROFILE SHEETS FOR GRADELINE.
3. AFTER CONSTRUCTION, HAUL ROAD TO BE REDUCED TO SURFACE NOT GREATER THAN 10 FEET IN WIDTH WITH SIDE EDGES MULCHED OR TOPSOIL AND SEEDED.
4. PRIOR TO HAUL ROAD CONSTRUCTION, CONTRACTOR TO SUBMIT TREE REMOVAL PLAN FOR GOVERNMENT APPROVAL.
5. CONTRACTOR SHALL EMPLOY MEASURES TO MARK AND PROTECT EXISTING SANITARY SEWER LINE, DRAIN FIELD AND STRUCTURES.
6. SCARIFY EXISTING HORSE TRAIL SURFACE IN ORDER TO BOND GRADED AGGREGATE BASE TO EXISTING GRADE.

BCOES REVIEW

20 10 0 20 40FT

SCALE: 1"= 20'

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Nashville District

MARK	DESCRIPTION	DATE	APPR.
X			
X			
MARK	DESCRIPTION	DATE	APPR.
X		XX/XX	X

DESIGNED BY: MICHAEL A. BROWN		DATE: JANUARY 2016	
DWN BY: JH	CKD BY: WBL	SOLICITATION NO.:	
SUBMITTED BY: JAMES R. WADDLE P.E.		CONTRACT NO.:	
PLOT SCALE: 1 = 20'0"	PLOT DATE: 6/8/2016	FILE NUMBER:	
SIZE: ANSI D	FILE NAME: $FILESS		

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TENNESSEE

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

BIG SOUTH FORK SURVEY
HAUL ROAD
STA 4+75 - 11+50

SHEET IDENTIFICATION
BF-S-006

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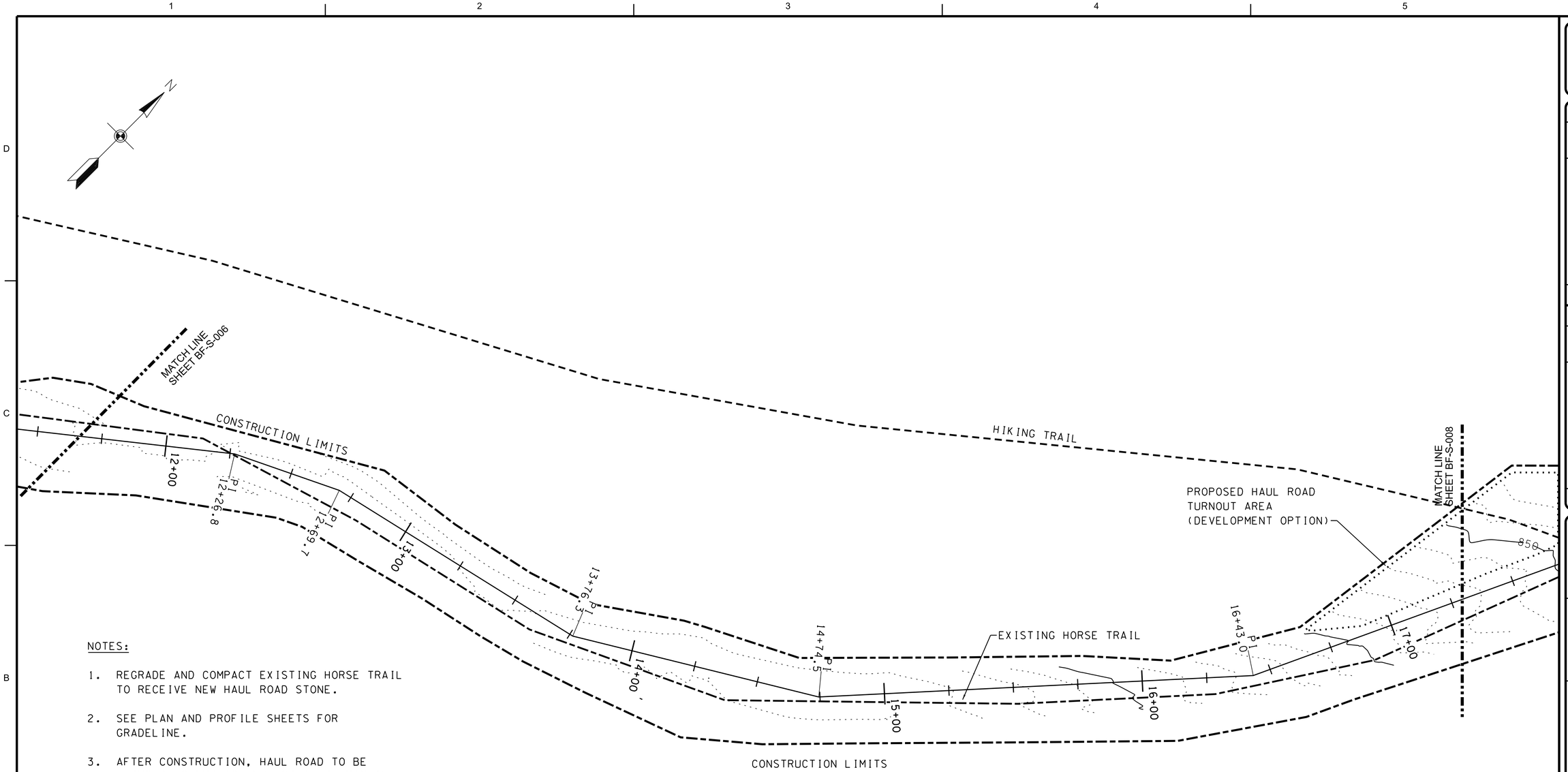

NOTES:

1. REGRADE AND COMPACT EXISTING HORSE TRAIL TO RECEIVE NEW HAUL ROAD STONE.

2. SEE PLAN AND PROFILE SHEETS FOR GRADELINE.

3. AFTER CONSTRUCTION, HAUL ROAD TO BE REDUCED TO SURFACE NOT GREATER THAN 10 FEET IN WIDTH WITH SIDE EDGES MULCHED OR TOPSOIL AND SEEDED.

4. PRIOR TO HAUL ROAD CONSTRUCTION, CONTRACTOR TO SUBMIT TREE REMOVAL PLAN FOR GOVERNMENT APPROVAL.

BCOES REVIEW

20 10 0 20 40FT
SCALE: 1"= 20'

US Army Corps of Engineers®
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MARK	DESCRIPTION	APPR.	DATE
X			
X	DESCRIPTION	APPR.	DATE
		X	XX/XX

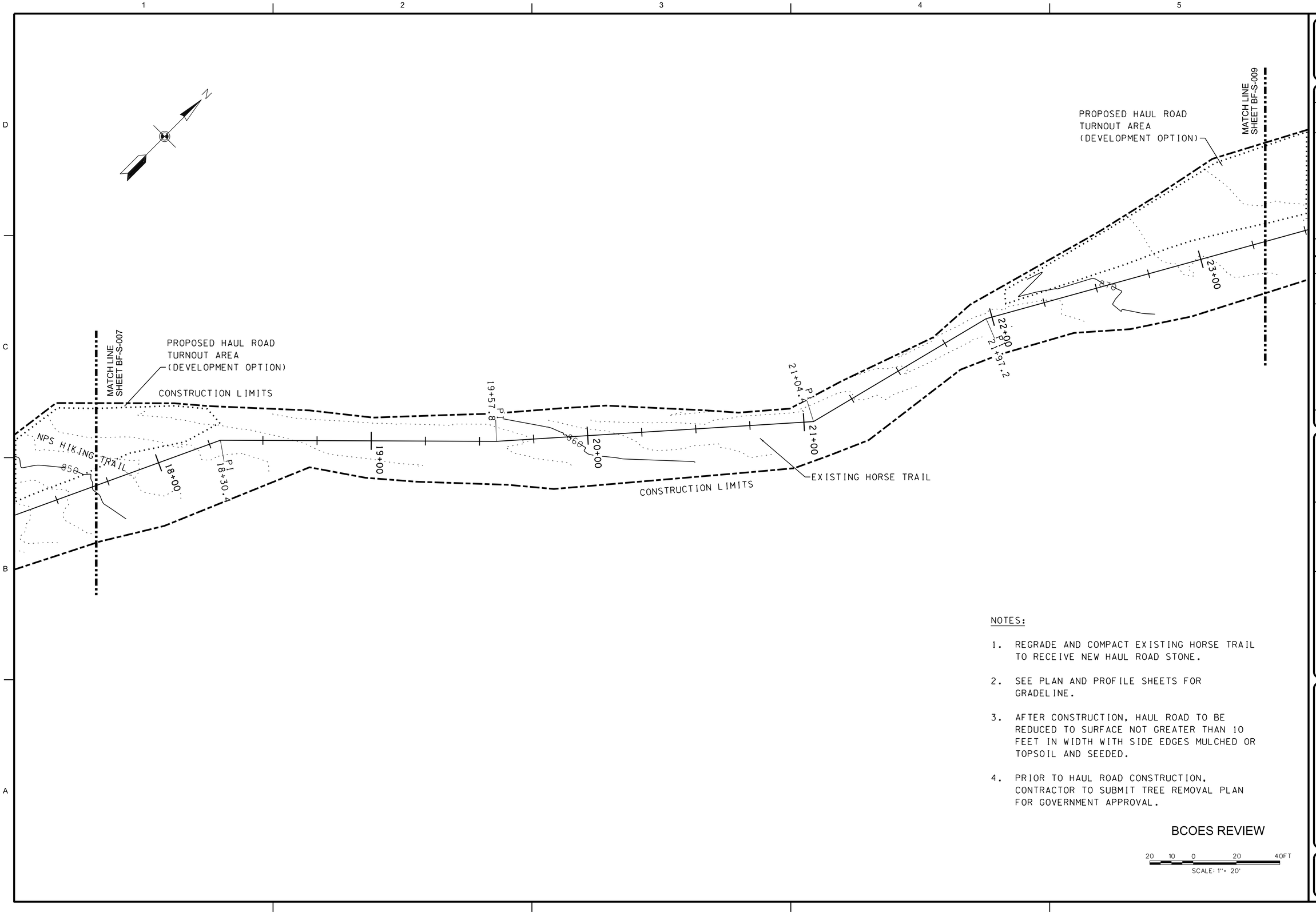
U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TENNESSEE

DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES K. WADDLE P.E.
PLOT SCALE: 1 = 20.0000 '/ IN.
PLOT DATE: 6/8/2016
SIZE: ANSI D
FILE NAME: SFILESS
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

BIG SOUTH FORK SURVEY
HAUL ROAD
STA 11+50 - 17+50

SHEET IDENTIFICATION
BF-S-007



NOTES:

1. REGRADE AND COMPACT EXISTING HORSE TRAIL TO RECEIVE NEW HAUL ROAD STONE.
2. SEE PLAN AND PROFILE SHEETS FOR GRADELINE.
3. AFTER CONSTRUCTION, HAUL ROAD TO BE REDUCED TO SURFACE NOT GREATER THAN 10 FEET IN WIDTH WITH SIDE EDGES MULCHED OR TOPSOIL AND SEEDED.
4. PRIOR TO HAUL ROAD CONSTRUCTION, CONTRACTOR TO SUBMIT TREE REMOVAL PLAN FOR GOVERNMENT APPROVAL.

BCOES REVIEW

20 10 0 20 40FT
SCALE: 1"= 20'

US Army Corps of Engineers®
Nashville District

MARK	DESCRIPTION	DATE	APPR.
X			

MARK	DESCRIPTION	DATE	APPR.
X		XX/XX	X

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TENNESSEE

DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE P.E.
PLOT SCALE: 1" = 20'-0"
PLOT DATE: 7/6/2016
SIZE: ANSI D
FILE NAME: SFILESS
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

BIG SOUTH FORK SURVEY
HAUL ROAD
STA 17+50 - 23+25

SHEET IDENTIFICATION
BF-S-008

File Name - X:\Personal\Harris_JI\Working Proj Files_JH\Harris\Big_South_Fork\BSF_BCOES_Review\BSF_BCOES_dgn\BF-S-008.dgn
Plot Date - 6/8/2016
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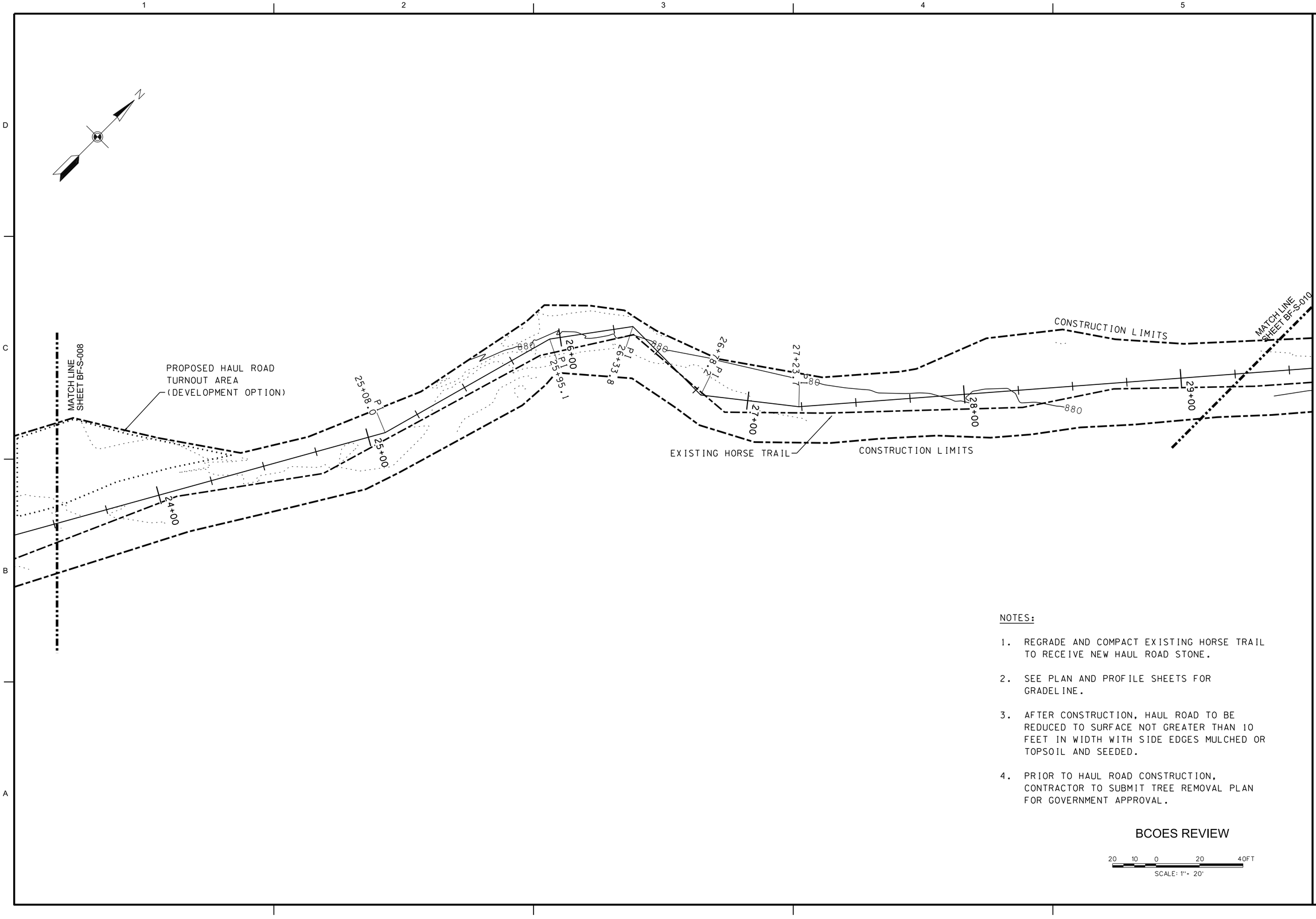


NOTES:

1. REGRADE AND COMPACT EXISTING HORSE TRAIL TO RECEIVE NEW HAUL ROAD STONE.
2. SEE PLAN AND PROFILE SHEETS FOR GRADELINE.
3. AFTER CONSTRUCTION, HAUL ROAD TO BE REDUCED TO SURFACE NOT GREATER THAN 10 FEET IN WIDTH WITH SIDE EDGES MULCHED OR TOPSOIL AND SEEDED.
4. PRIOR TO HAUL ROAD CONSTRUCTION, CONTRACTOR TO SUBMIT TREE REMOVAL PLAN FOR GOVERNMENT APPROVAL.

BCOES REVIEW

20 10 0 20 40FT
SCALE: 1"= 20'

US Army Corps of Engineers®
Nashville District

MARK	DESCRIPTION	DATE	APPR.
X			
X		XX/XX	X

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TENNESSEE

DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE P.E.
PLOT SCALE: 1"=20'
PLOT DATE: XX/XX/XX
SIZE: ANSI D
FILE NAME: $FILESS
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

BIG SOUTH FORK SURVEY
HAUL ROAD
STA 23+25 - 29+25

SHEET IDENTIFICATION
BF-S-009

File Name - X:\Personal\Harris_J\Working Proj Files_JH\Harris\Big_South_Fork\BSF_BCOES_Review\BSF_BCOES_dgn\BF-S-009.dgn
Plot Date - 6/8/2016
Plot Time - 11:29:29 AM

1 2 3 4 5

D C B A

N

NPS HIKING TRAIL

CONSTRUCTION LIMITS

CONSTRUCTION LIMITS

BASELINE
HAUL ROAD 1

BASELINE
HAUL ROAD 2

EXISTING HORSE TRAIL

LOCATION OF AREA 2

NPS HIKING TRAIL

MATCH LINE
SHEET BF-S-009

MATCH LINE
SHEET BF-S-011

BCOES REVIEW

20 10 0 20 40FT
SCALE: 1" = 20'

US Army Corps of Engineers®
Nashville District

MARK	DESCRIPTION	DATE	APPR.
X			
X			

MARK	DESCRIPTION	DATE	APPR.
X		XX/XX	X

DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE P.E.
PLOT SCALE: 1" = 20'-0"
SHEET SIZE: ANSI D
PLOT DATE: 6/8/2016
FILE NAME: $FILE$
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TENNESSEE

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

BIG SOUTH FORK SURVEY
HAUL ROAD
STA 29+25 - 35+75

SHEET IDENTIFICATION
BF-S-010

File Name - X:\Personal\Harris_J\Working Proj Files_JH\Harris\Big_South_Fork\BSF_BCOES_Review\BSF_BCOES_dgn\BF-S-010.dgn
Plot Date - 6/8/2016
Plot Time - 11:30:31 AM

EXISTING HORSE TRAIL

NPS HIKING TRAIL

CONSTRUCTION LIMITS

37+03.9 PI

37+00

38+00

39+00

40+00

PI 40+20.5

PI 40+63.0

PI 36+65.5

36+35.5 PI

0+00 PI

0+00.0

36+00

PI 0+44.0

NPS HIKING TRAIL

MATCH LINE
SHEET BF-S-010

CONSTRUCTION LIMITS

LOCATION OF AREA I

BCOES REVIEW

20 10 0 20 40FT
SCALE: 1" = 20'

N

1 2 3 4 5

D C B A

US Army Corps of Engineers®
Nashville District

MARK	DESCRIPTION	DATE	APPR.
X			
X			

MARK	APPR.	DATE
X		XX/XX

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TENNESSEE

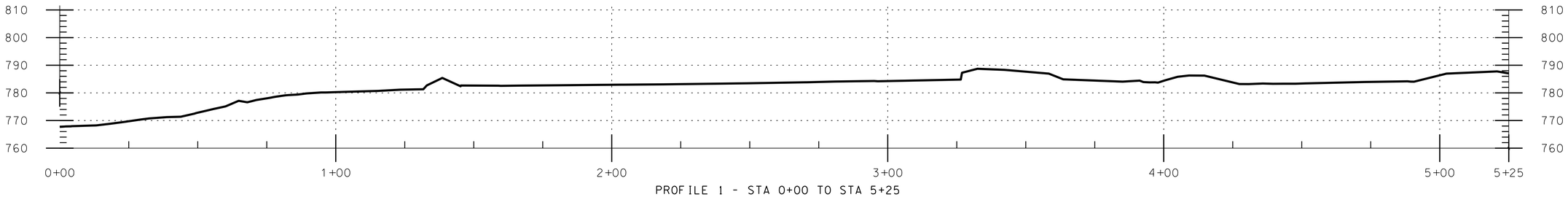
DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE P.E.
PLOT SCALE: 1" = 20'-0"
PLOT DATE: XX/XX/XX
SIZE: ANSI D
FILE NAME: $FILE$$
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

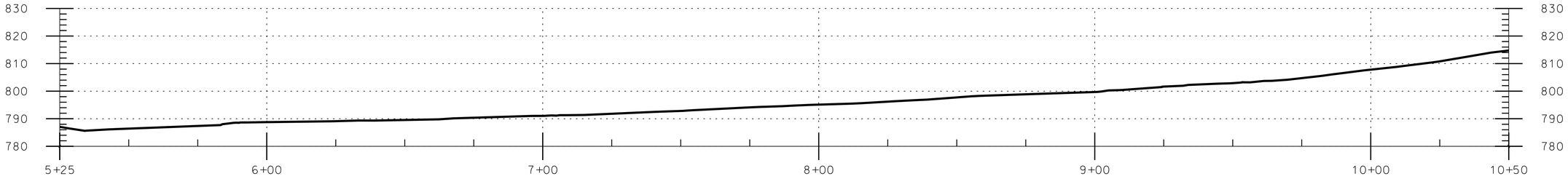
BIG SOUTH FORK SURVEY
HAUL ROAD
STA 35+75 - 40+63

SHEET IDENTIFICATION
BF-S-011

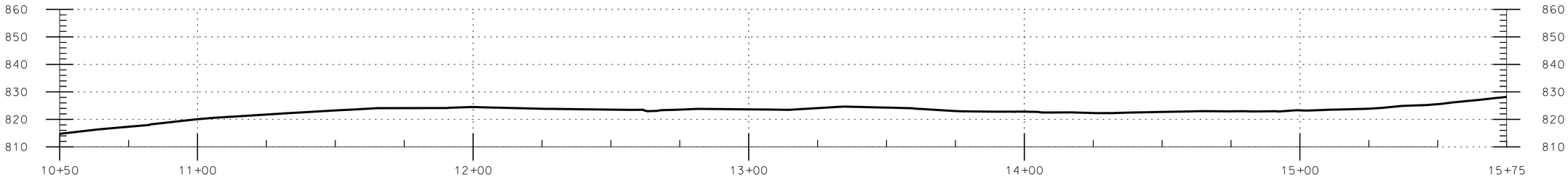
File Name - X:\Personal\Harris_JI\Working Proj Files_JH\Harris\Big_South_Fork\BSF_BCOES_Review\BSF_BCOES_dgn\BF-S-011.dgn
Plot Date - 6/8/2016
Plot Time - 11:31:25 AM



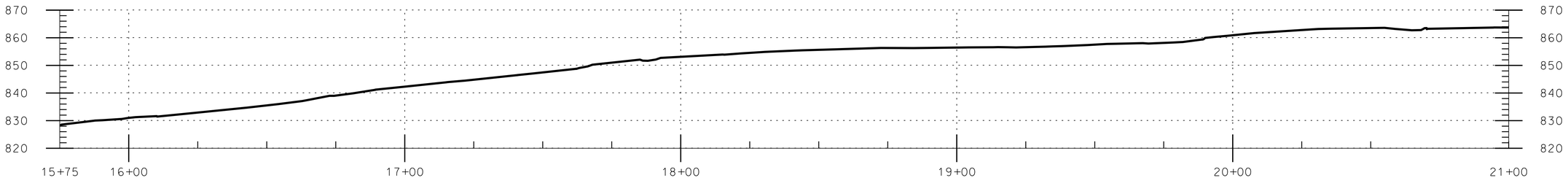
PROFILE 1 - STA 0+00 TO STA 5+25



PROFILE 2 - STA 5+25 TO STA 10+50



PROFILE 3 - STA 10+50 TO STA 15+75



PROFILE 4 - STA 15+75 TO STA 21+00

BCOES REVIEW

20 10 0 20 40FT
SCALE: 1"= 20'

US Army Corps of Engineers®
Nashville District

MARK	DESCRIPTION	DATE	APPR.
X			
X		XX/XX	APPR.

DESIGNED BY:
DWN BY:
CKD BY:
SUBMITTED BY: JAMES R. WADDLE P.E.
PLOT SCALE: 1"=1'
PLOT DATE: 6/8/2016
SIZE: ANSI D
DATE:
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:
FILE NAME: $FILESS

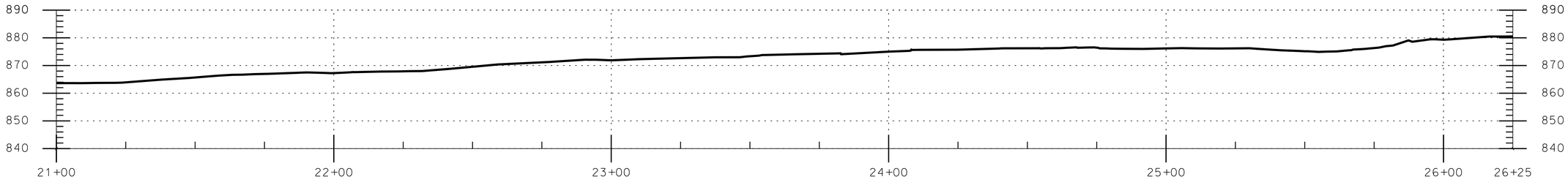
U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TENNESSEE

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

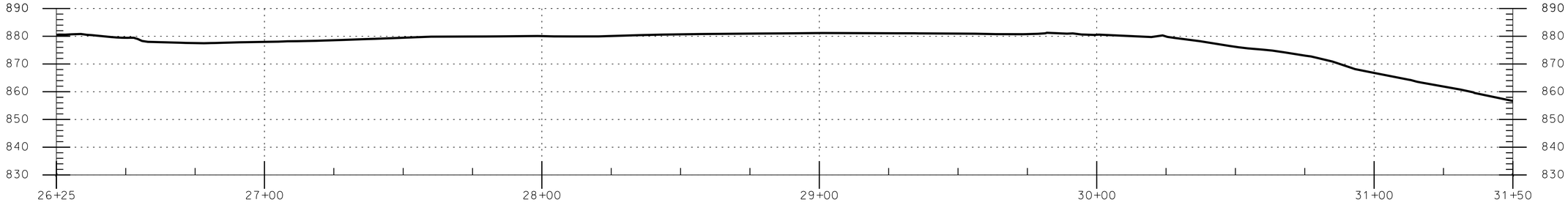
BIG SOUTH FORK SURVEY
HAUL ROAD PROFILE
STA 0+00 - 21+00

SHEET IDENTIFICATION
BF-S-012

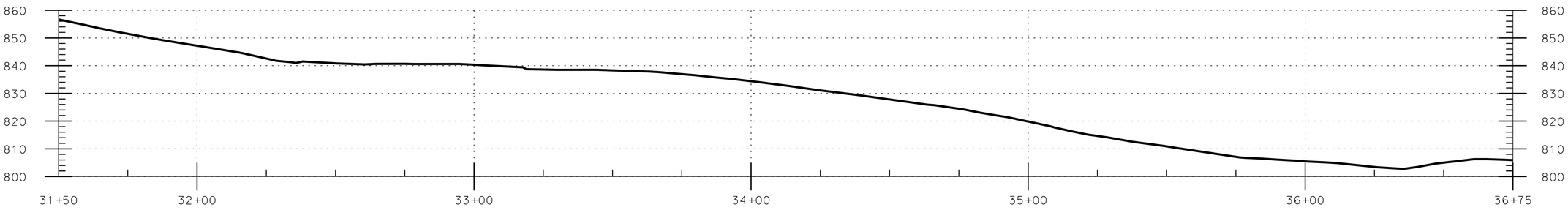
File Name - X:\Personal\Harris_J\Working Proj Files_JH\Harris\Big_South_Fork\BSF_BCOES_Review\BSF_BCOES_dgn\BF-S-012.dgn
Plot Date - 6/8/2016
Plot Time - 11:32:18 AM



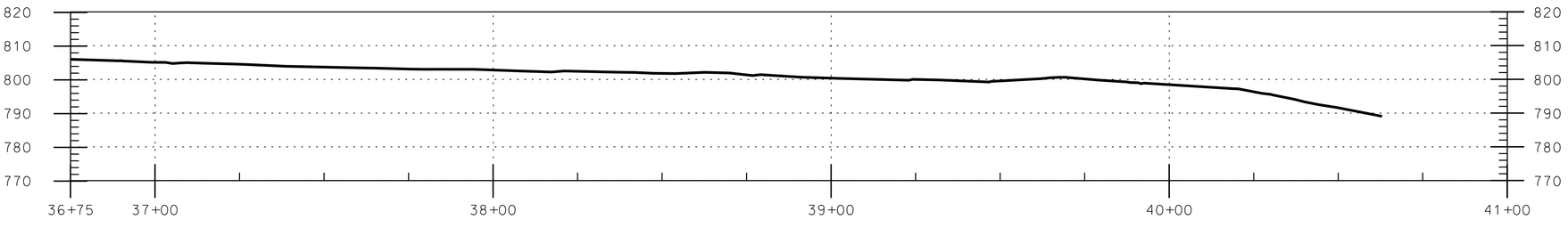
PROFILE 5 - STA 21+00 TO STA 26+25



PROFILE 6 - STA 26+25 TO STA 31+50



PROFILE 7 - STA 31+50 TO STA 36+75



PROFILE 8 - STA 36+75 TO STA 40+63

BCOES REVIEW

20 10 0 20 40FT
SCALE: 1"= 20'

US Army Corps of Engineers®
Nashville District

MARK	DESCRIPTION	DATE	APPR.
X		XX/XX	X
X			

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TENNESSEE

DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE P.E.
PLOT SCALE: 1"=20' NAVD88
SIZE: ANSI D
PLOT DATE: 6/8/2016
FILE NAME: $FILESS
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

BIG SOUTH FORK SURVEY
HAUL ROAD PROFILE
STA 21+00 - 40+63

SHEET IDENTIFICATION
BF-S-013

File Name - X:\Personal\Harris_J\Working Proj Files_JH\Harris\Big_South_Fork\BSF_BCOES_Review\BSF_BCOES_dgn\BF-S-013.dgn
Plot Date - 6/8/2016
Plot Time - 11:33:10 AM

1 2 3 4 5

D C B A

HAUL ROAD

P.I. 40+20.5

P.I. 40+63.0964

40+63

CONSTRUCTION LIMITS

N

BASELINE FOR CROSS SECTIONS

5+00 4+00 3+00 2+00 1+00 0+00

N 1766344.92
E 1996292.27

A

A'

N 1766344.92
E 1996692.27

KEY TRENCH

END PROTECTION

CONSTRUCTION LIMITS

END PROTECTION

EDGE OF WATER
27 OCT 2015

EDGE OF WATER
4 FEB 2015

TOE TRENCH

BCOES REVIEW

20 10 0 20 40FT

SCALE: 1"= 20'

NOTES:

1. WATER LEVELS INDICATED FOR 4 FEB 2015 AND 27 OCT 2015 WERE TAKEN AT RANDOM AND ARE NOT INTENDED TO REPRESENT THE FULL RANGE OF POTENTIAL RIVER FLUCTUATION. LOWER AND HIGHER RIVER LEVELS MAY, AND LIKELY WILL, OCCUR DURING CONSTRUCTION.

2. SEE SHEETS S-107-S-113 FOR CROSS SECTIONS 1+00 - 4+00 AND SECTION A-A'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.
APPR. MARK	DESCRIPTION	DATE	APPR.

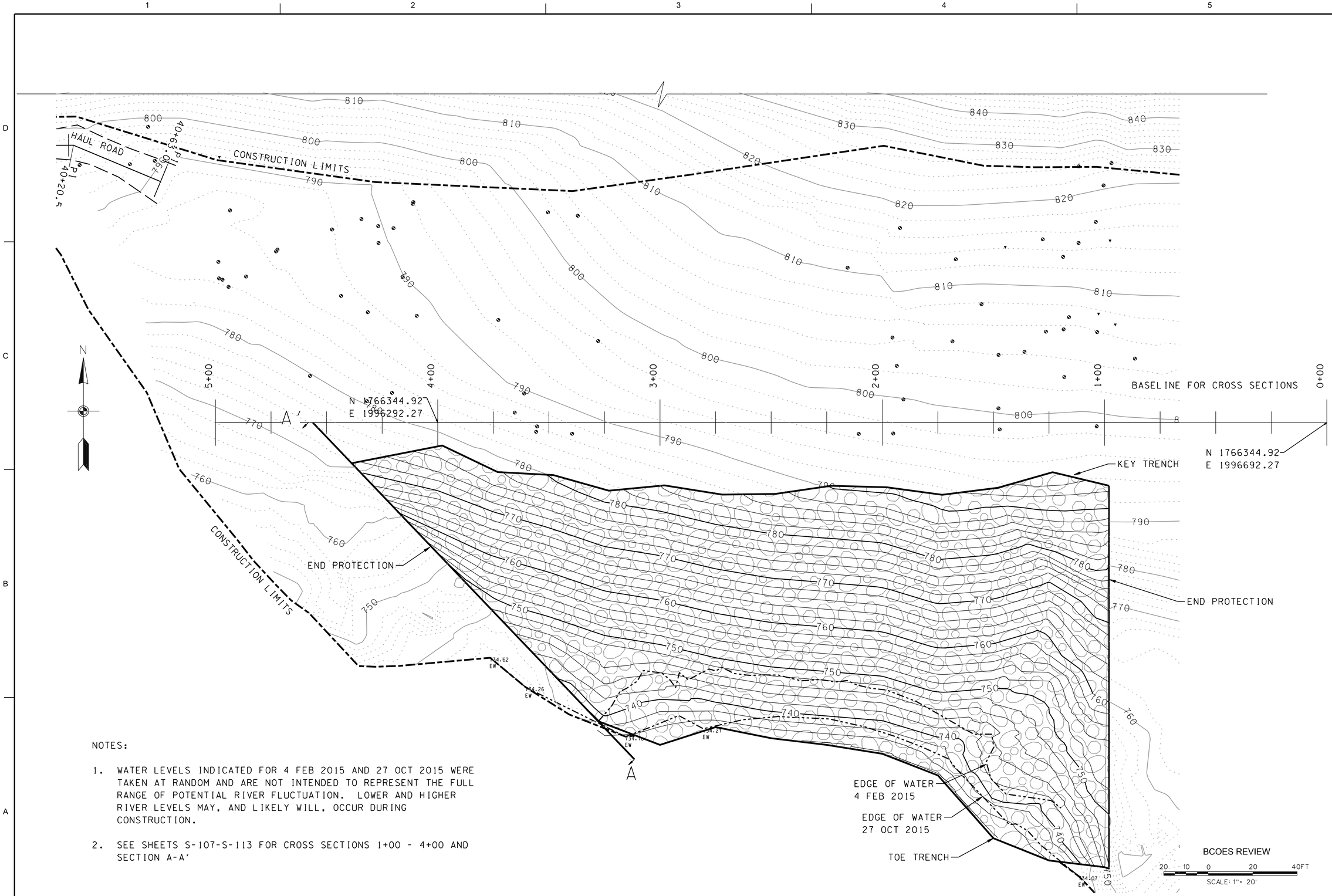
U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TN

DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: VBL
SUBMITTED BY: JAMES R. WADDLE, P.E.
PLOT SCALE: 1.00 PLOT DATE: 1/4/2016
SIZE: ANSI D
FILE NAME: $FILESS
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

MINE SPOIL SURVEY
SITE PLAN - EXISTING CONDITIONS
AREA 1

SHEET IDENTIFICATION
BF-S-101
SHEET X OF Y



NOTES:

1. WATER LEVELS INDICATED FOR 4 FEB 2015 AND 27 OCT 2015 WERE TAKEN AT RANDOM AND ARE NOT INTENDED TO REPRESENT THE FULL RANGE OF POTENTIAL RIVER FLUCTUATION. LOWER AND HIGHER RIVER LEVELS MAY, AND LIKELY WILL, OCCUR DURING CONSTRUCTION.

2. SEE SHEETS S-107-S-113 FOR CROSS SECTIONS 1+00 - 4+00 AND SECTION A-A'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.
MARK	DESCRIPTION	DATE	APPR.

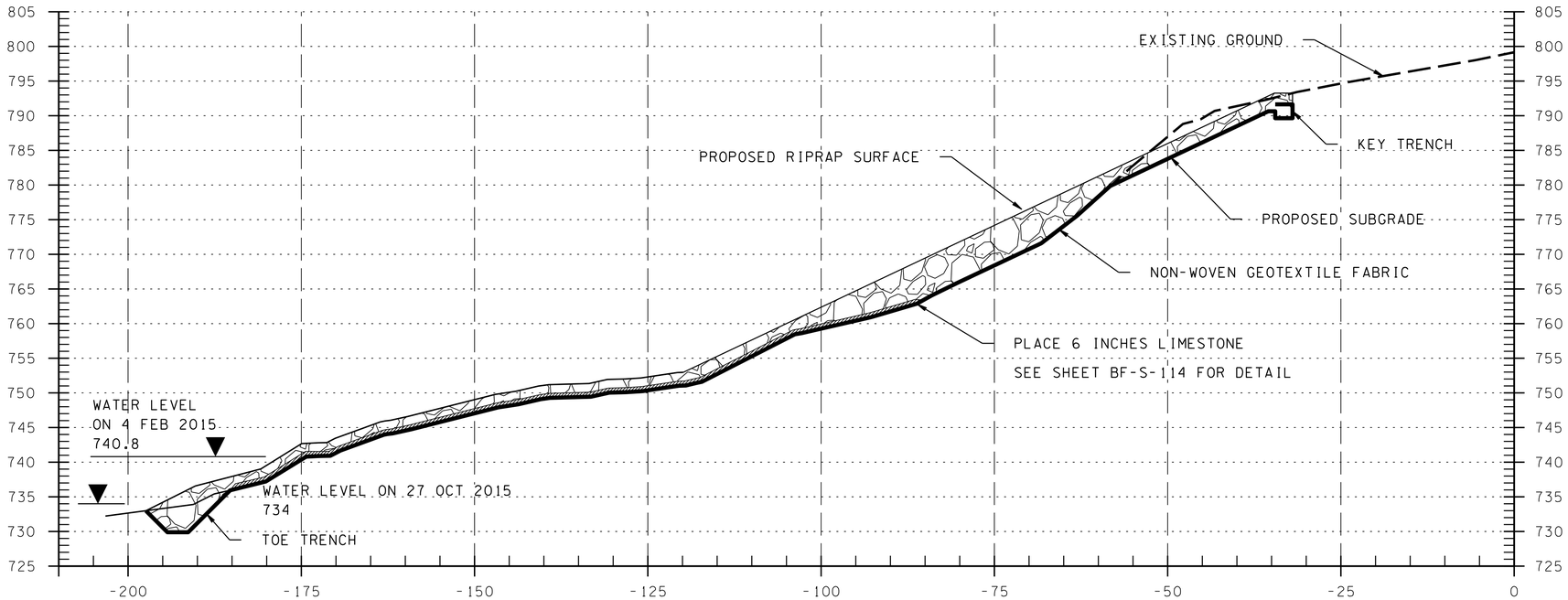
U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TN

DESIGNED BY: MICHAEL A BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE, P.E.
PLOT SCALE: 1:1
PLOT DATE: 1/4/2016
SIZE: ANSI D
FILE NAME: $FILE$$
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

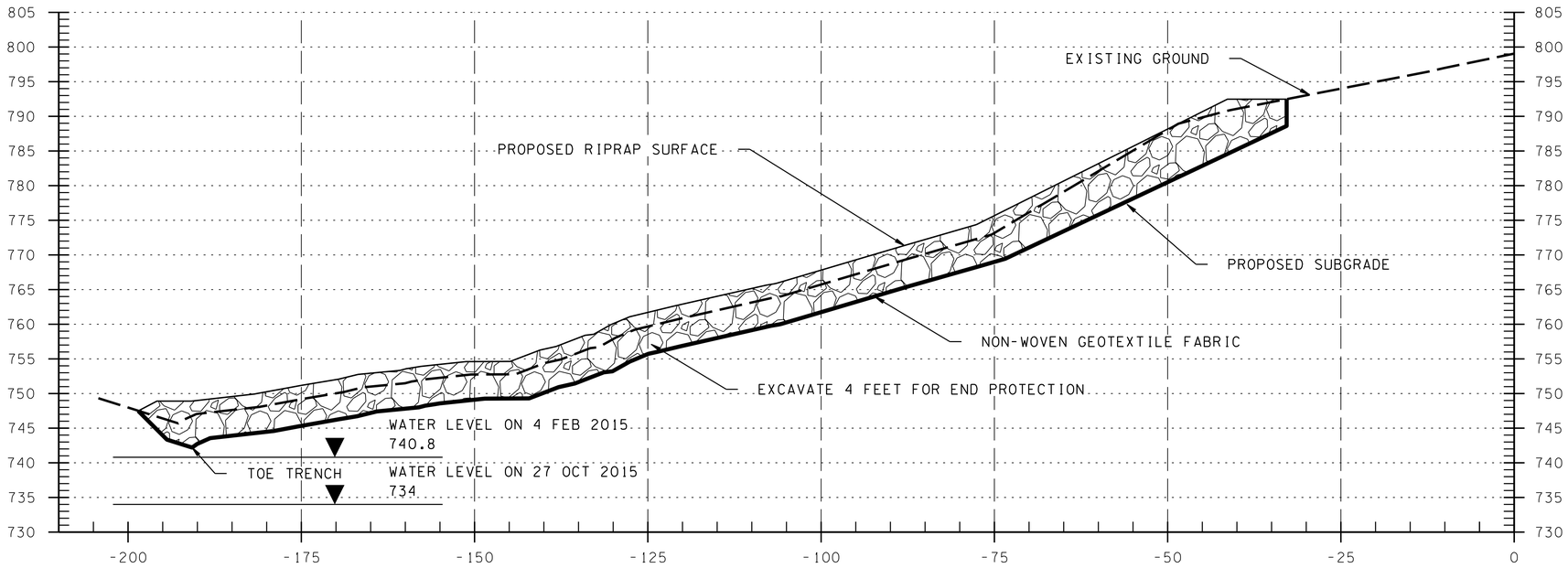
WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

MINE SPOIL SURVEY
FINAL GRADING PLAN
AREA 1

SHEET IDENTIFICATION
BF-S-102
SHEET X OF Y



STATION 1+25
CROSS SECTION



STATION 1+00
CROSS SECTION

NOTES:

1. WATER LEVELS INDICATED FOR 4 FEB 2015 AND 27 OCT 2015 WERE TAKEN AT RANDOM AND ARE NOT INTENDED TO REPRESENT THE FULL RANGE OF POTENTIAL RIVER FLUCTUATION. LOWER AND HIGHER RIVER LEVELS MAY AND LIKELY WILL OCCUR DURING CONSTRUCTION.
2. FOR TYPICAL DETAILS, SEE DWG. BF-S-114.
3. DISTURBED SOIL OUTSIDE OF RIPRAP TO BE SEEDED WITH NATIVE GRASS.
4. END PROTECTION TO BE CONSTRUCTED AT UPSTREAM AND DOWNSTREAM LIMITS.
5. SURFACE OF RIPRAP SLOPE SHALL BE 1V:2H OR FLATTER.
6. RIPRAP THICKNESS SHALL BE A MINIMUM OF 30 INCHES.
7. SEE SPECIFICATION 35 31 19 PARAGRAPH 2.3.1 FOR RIPRAP GRADATION TABLE.
8. FOR DISPOSAL AREA INFORMATION, SEE SPECIFICATION 31 11 00 PARAGRAPH 3.6, FOR GOVERNMENT PRE-APPROVED LANDFILL LOCATION.

BCOES REVIEW

10 5 0 10 20FT
SCALE: 1"= 10'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.
MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TN

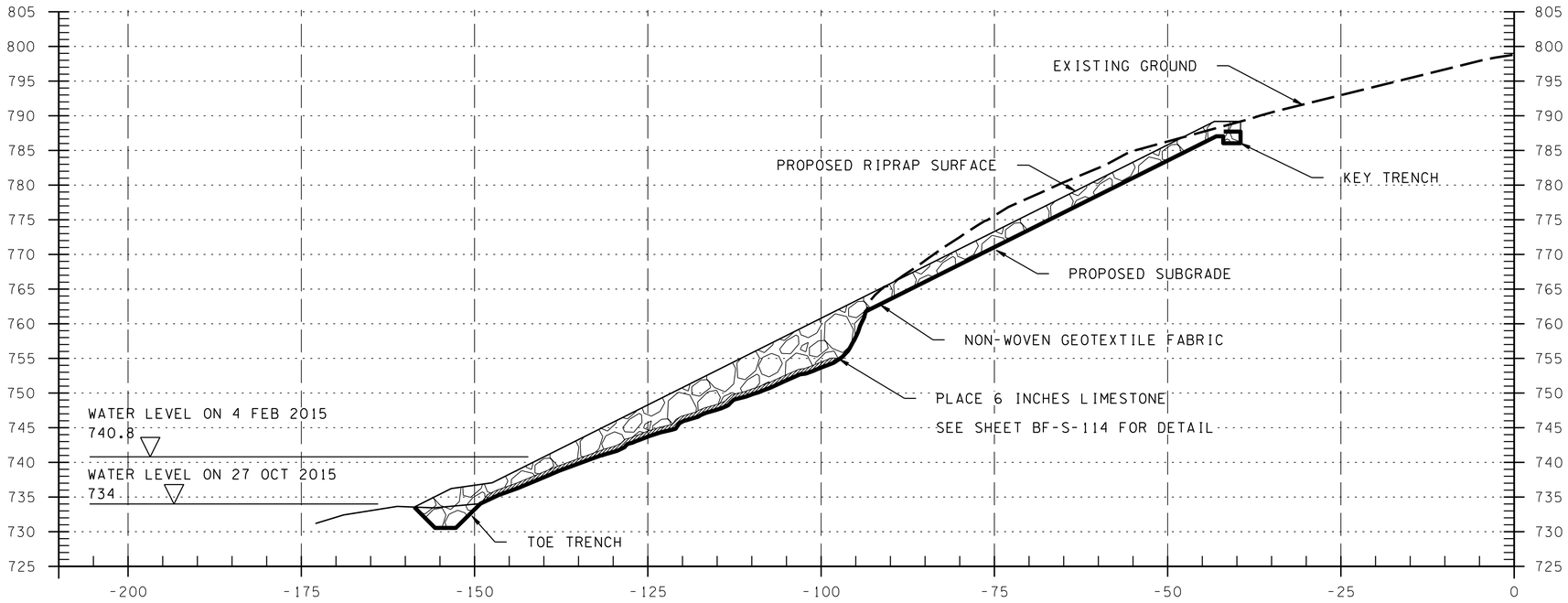
DESIGNED BY: MICHAEL A. BROWN
DRAWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE P.E.
PLOT SCALE: 1:1
PLOT DATE: 6/8/2016
SIZE: ANSI D
FILE NAME: $FILES$
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

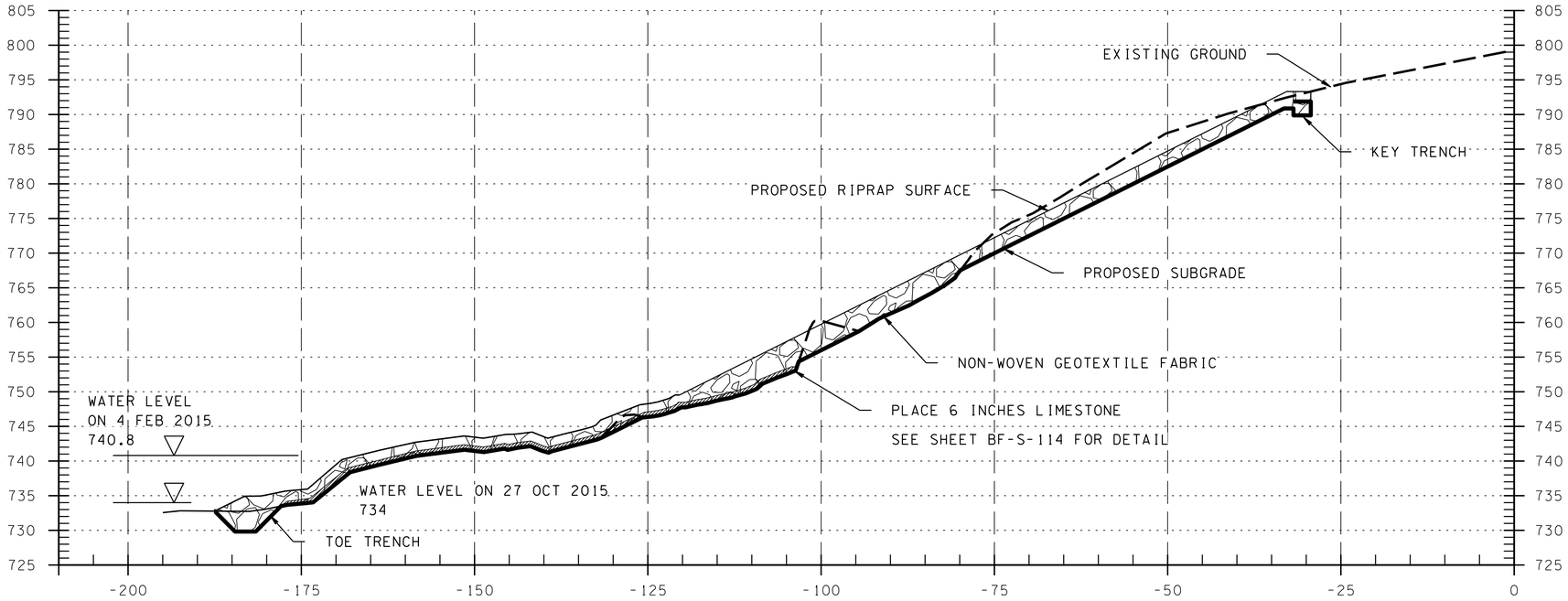
SITE PLAN
MINE SPOIL SURVEY - AREA 1
CROSS SECTIONS 1+00 TO 1+25

SHEET IDENTIFICATION
BF-S-107
SHEET X OF Y

FILE: $File$
DATE: 6/8/2016



STATION 1+75
CROSS SECTION



STATION 1+50
CROSS SECTION

NOTES:

1. WATER LEVELS INDICATED FOR 4 FEB 2015 AND 27 OCT 2015 WERE TAKEN AT RANDOM AND ARE NOT INTENDED TO REPRESENT THE FULL RANGE OF POTENTIAL RIVER FLUCTUATION. LOWER AND HIGHER RIVER LEVELS MAY AND LIKELY WILL OCCUR DURING CONSTRUCTION.
2. FOR TYPICAL DETAILS, SEE DWG. BF-S-114.
3. DISTURBED SOIL OUTSIDE OF RIPRAP TO BE SEEDED WITH NATIVE GRASS.
4. END PROTECTION TO BE CONSTRUCTED AT UPSTREAM AND DOWNSTREAM LIMITS.
5. SURFACE OF RIPRAP SLOPE SHALL BE 1V:2H OR FLATTER.
6. RIPRAP THICKNESS SHALL BE A MINIMUM OF 30 INCHES.
7. SEE SPECIFICATION 35 31 19 PARAGRAPH 2.3.1 FOR RIPRAP GRADATION TABLE.
8. FOR DISPOSAL AREA INFORMATION, SEE SPECIFICATION 31 11 00 PARAGRAPH 3.6, FOR GOVERNMENT PRE-APPROVED LANDFILL LOCATION.

BCOES REVIEW

10 5 0 10 20FT
SCALE: 1"= 10'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: MICHAEL A. BROWN		DATE: JANUARY 2016	
DWN BY: JH	CKD BY: WBL	SOLICITATION NO.:	
SUBMITTED BY: JAMES R. WADDLE, P.E.		CONTRACT NO.:	FILE NUMBER:
PLOT SCALE: FULL SIZE	PLOT DATE: SAME AS		
SIZE: ANSI D	FILE NAME: $FILES		

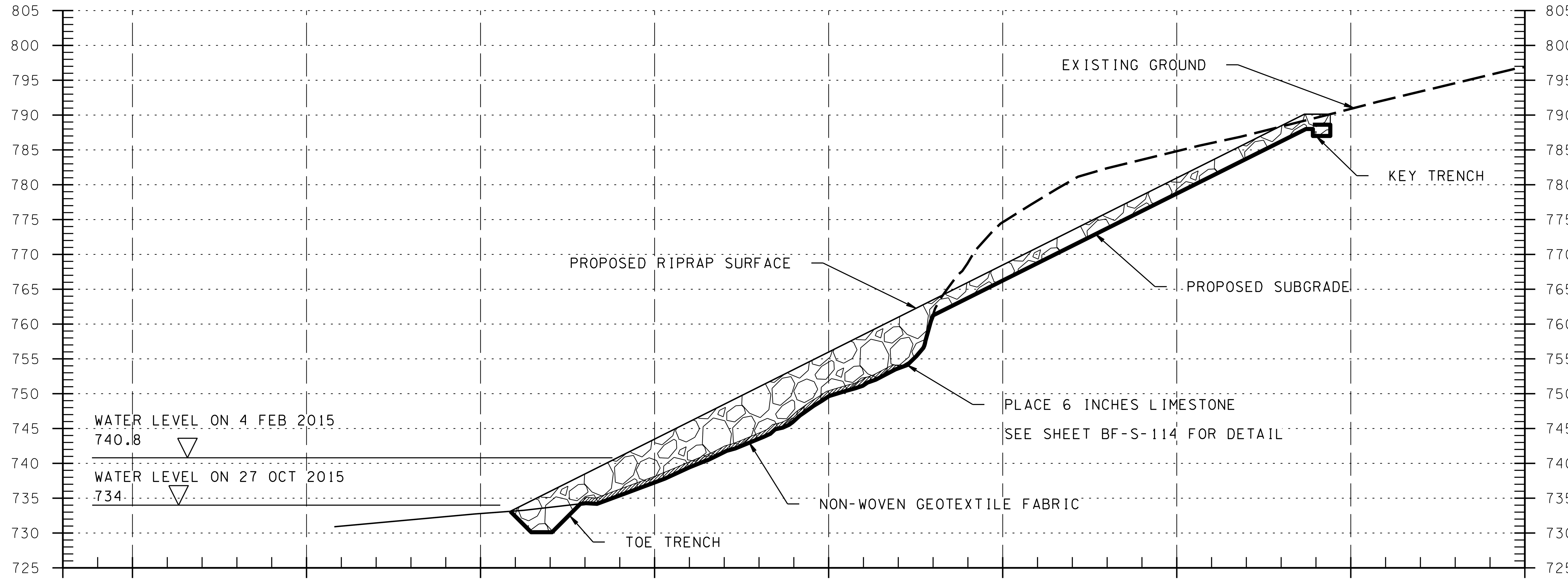
U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TN

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

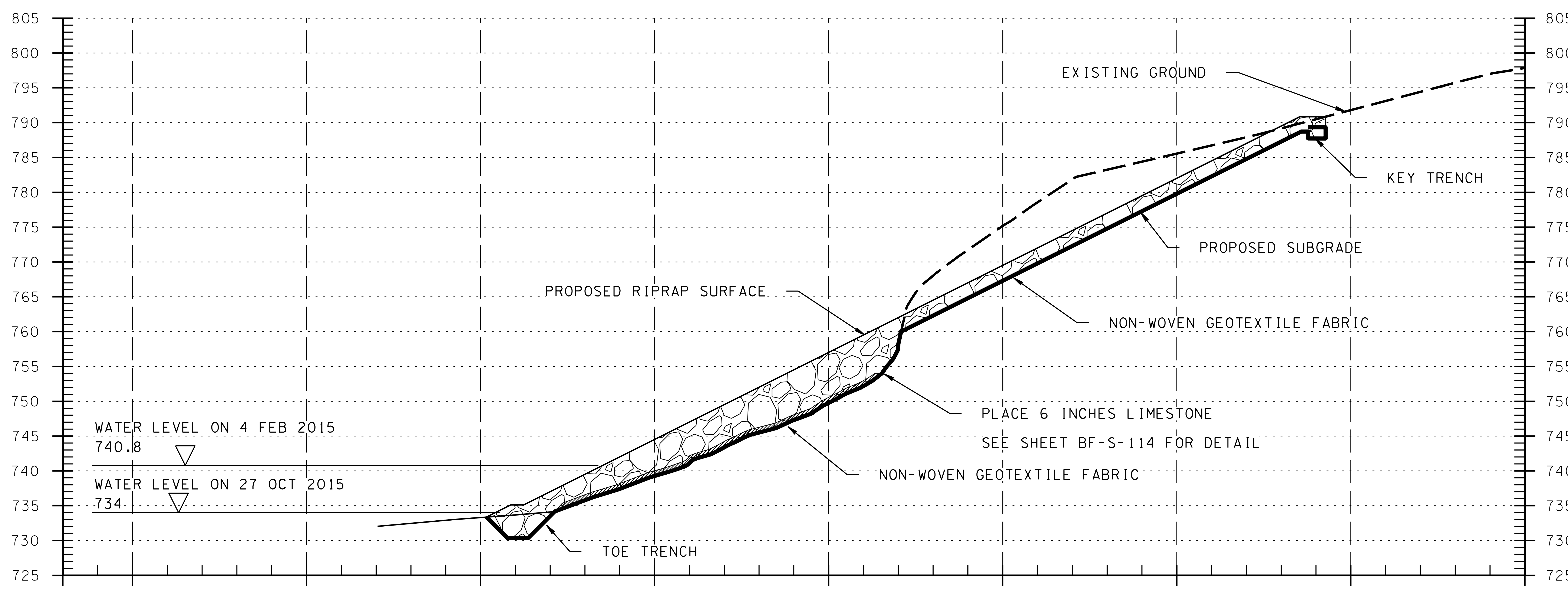
SITE PLAN
MINE SPOIL SURVEY - AREA 1
CROSS SECTIONS 1+50 TO 1+75

SHEET IDENTIFICATION
BF-S-108
SHEET X OF Y

FILE: $File$
DATE: 6/6/2016



STATION 2+25
CROSS SECTION



STATION 2+00
CROSS SECTION

NOTES:

1. WATER LEVELS INDICATED FOR 4 FEB 2015 AND 27 OCT 2015 WERE TAKEN AT RANDOM AND ARE NOT INTENDED TO REPRESENT THE FULL RANGE OF POTENTIAL RIVER FLUCTUATION. LOWER AND HIGHER RIVER LEVELS MAY AND LIKELY WILL OCCUR DURING CONSTRUCTION.
2. FOR TYPICAL DETAILS, SEE DWG. BF-S-114.
3. DISTURBED SOIL OUTSIDE OF RIPRAP TO BE SEEDED WITH NATIVE GRASS.
4. END PROTECTION TO BE CONSTRUCTED AT UPSTREAM AND DOWNSTREAM LIMITS.
5. SURFACE OF RIPRAP SLOPE SHALL BE 1V:2H OR FLATTER.
6. RIPRAP THICKNESS SHALL BE A MINIMUM OF 30 INCHES.
7. SEE SPECIFICATION 35 31 19 PARAGRAPH 2.3.1 FOR RIPRAP GRADATION TABLE.
8. FOR DISPOSAL AREA INFORMATION, SEE SPECIFICATION 31 11 00 PARAGRAPH 3.6, FOR GOVERNMENT PRE-APPROVED LANDFILL LOCATION.

BCOES REVIEW

10 5 0 10 20FT
SCALE: 1"= 10'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TN

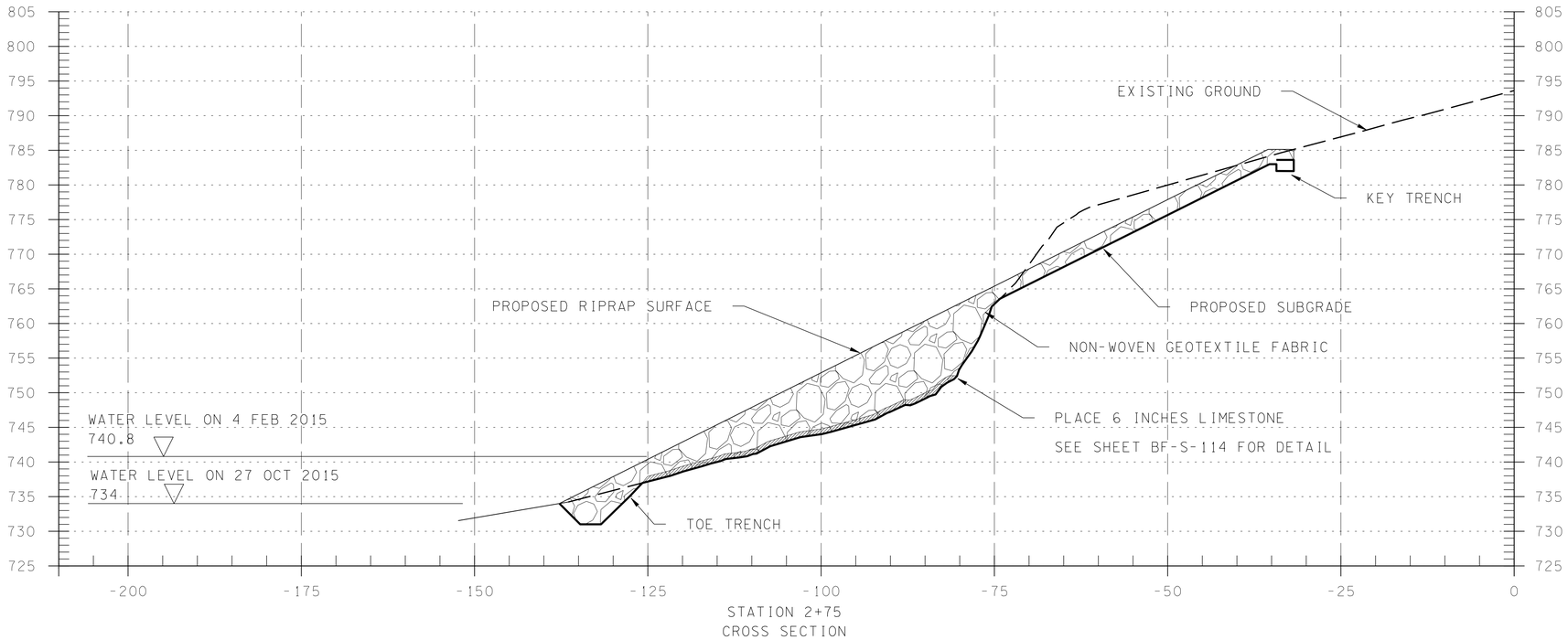
DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE, P.E.
PLOT SCALE: 1"= 10'
PLOT DATE: $DATE$
SIZE: ANSI D
FILE NAME: $FILE$$
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

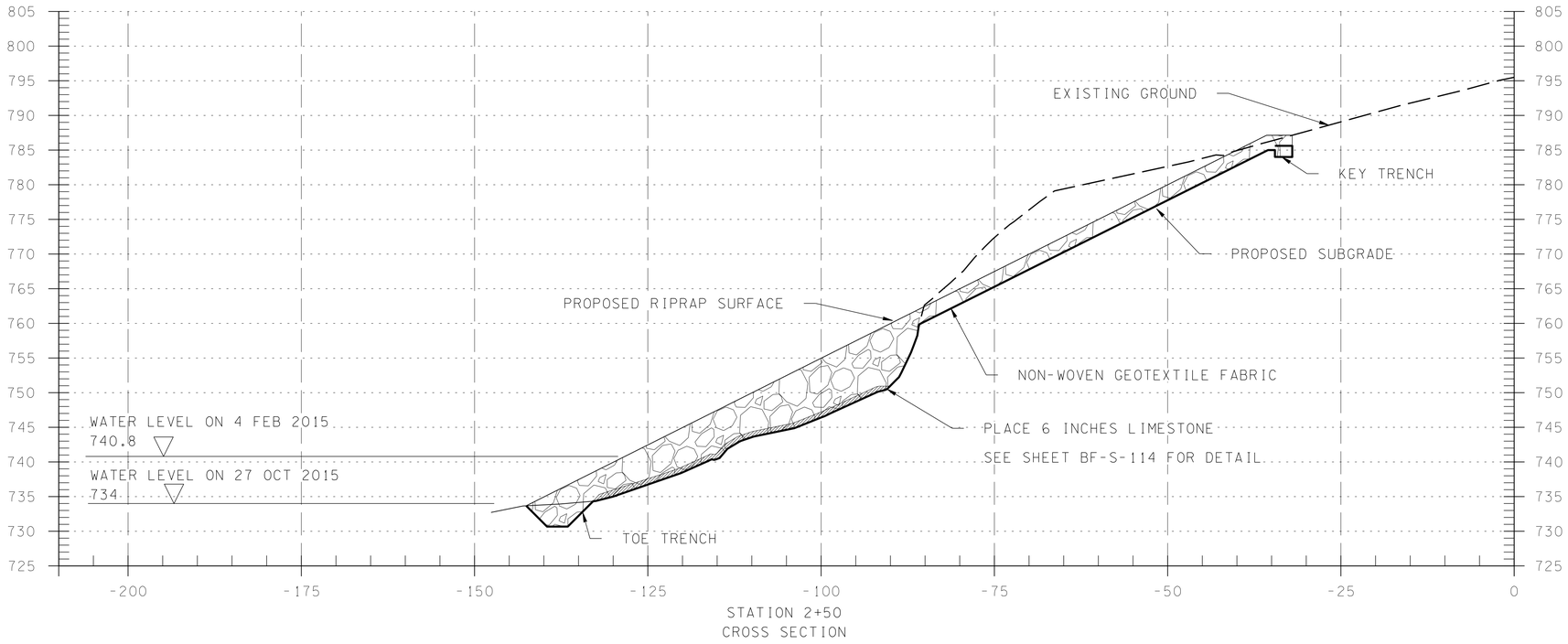
SITE PLAN
MINE SPOIL SURVEY - AREA 1
CROSS SECTIONS 2+00 TO 2+25

SHEET IDENTIFICATION
BF-S-109
SHEET X OF Y

FILE: $File$
DATE: 6/8/2016



STATION 2+75
CROSS SECTION



STATION 2+50
CROSS SECTION

NOTES:

1. WATER LEVELS INDICATED FOR 4 FEB 2015 AND 27 OCT 2015 WERE TAKEN AT RANDOM AND ARE NOT INTENDED TO REPRESENT THE FULL RANGE OF POTENTIAL RIVER FLUCTUATION. LOWER AND HIGHER RIVER LEVELS MAY AND LIKELY WILL OCCUR DURING CONSTRUCTION.
2. FOR TYPICAL DETAILS, SEE DWG. BF-S-114.
3. DISTURBED SOIL OUTSIDE OF RIPRAP TO BE SEEDED WITH NATIVE GRASS.
4. END PROTECTION TO BE CONSTRUCTED AT UPSTREAM AND DOWNSTREAM LIMITS.
5. SURFACE OF RIPRAP SLOPE SHALL BE 1V:2H OR FLATTER.
6. RIPRAP THICKNESS SHALL BE A MINIMUM OF 30 INCHES.
7. SEE SPECIFICATION 35 31 19 PARAGRAPH 2.3.1 FOR RIPRAP GRADATION TABLE.
8. FOR DISPOSAL AREA INFORMATION, SEE SPECIFICATION 31 11 00 PARAGRAPH 3.6, FOR GOVERNMENT PRE-APPROVED LANDFILL LOCATION.

BCOES REVIEW

10 5 0 10 20FT
SCALE: 1"= 10'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TN

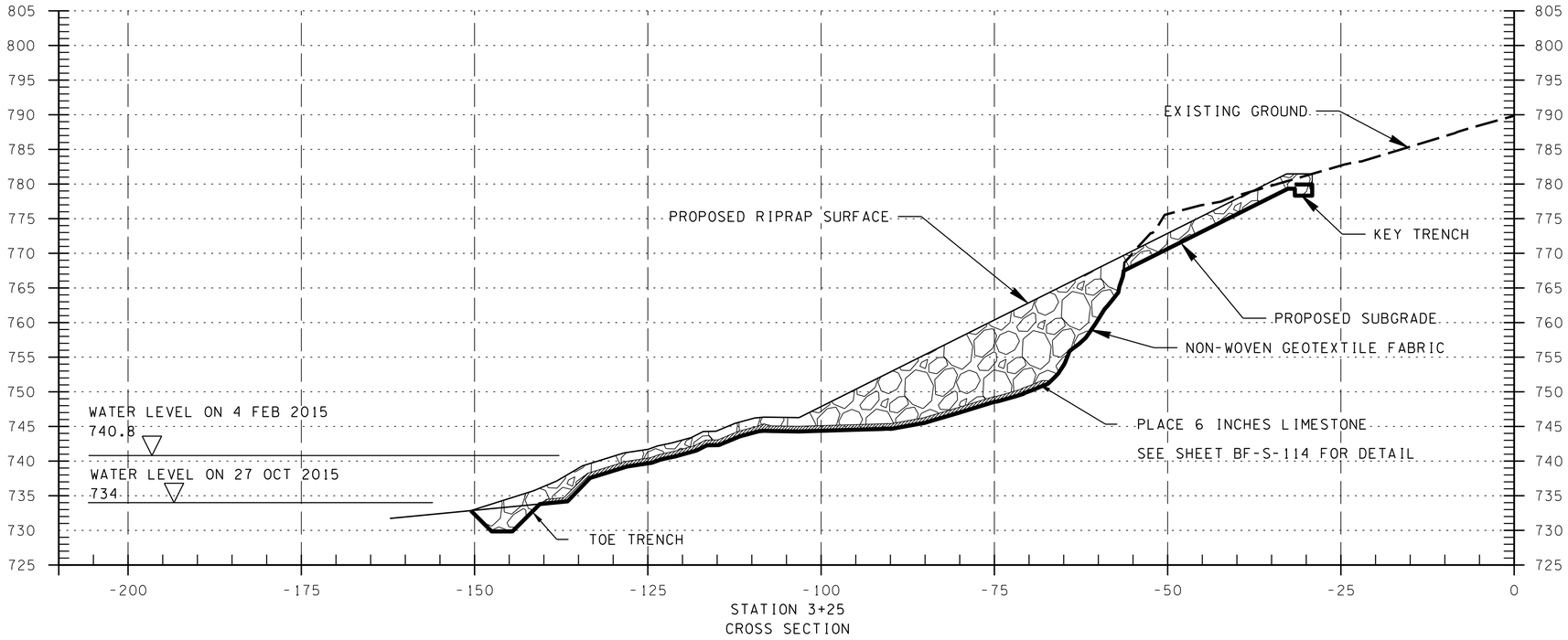
DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE P.E.
PLOT SCALE: 1.00'= 1.00'
PLOT DATE: 6/8/2016
SIZE: ANSI D
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:
FILE NAME: BF-S-110.dgn

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

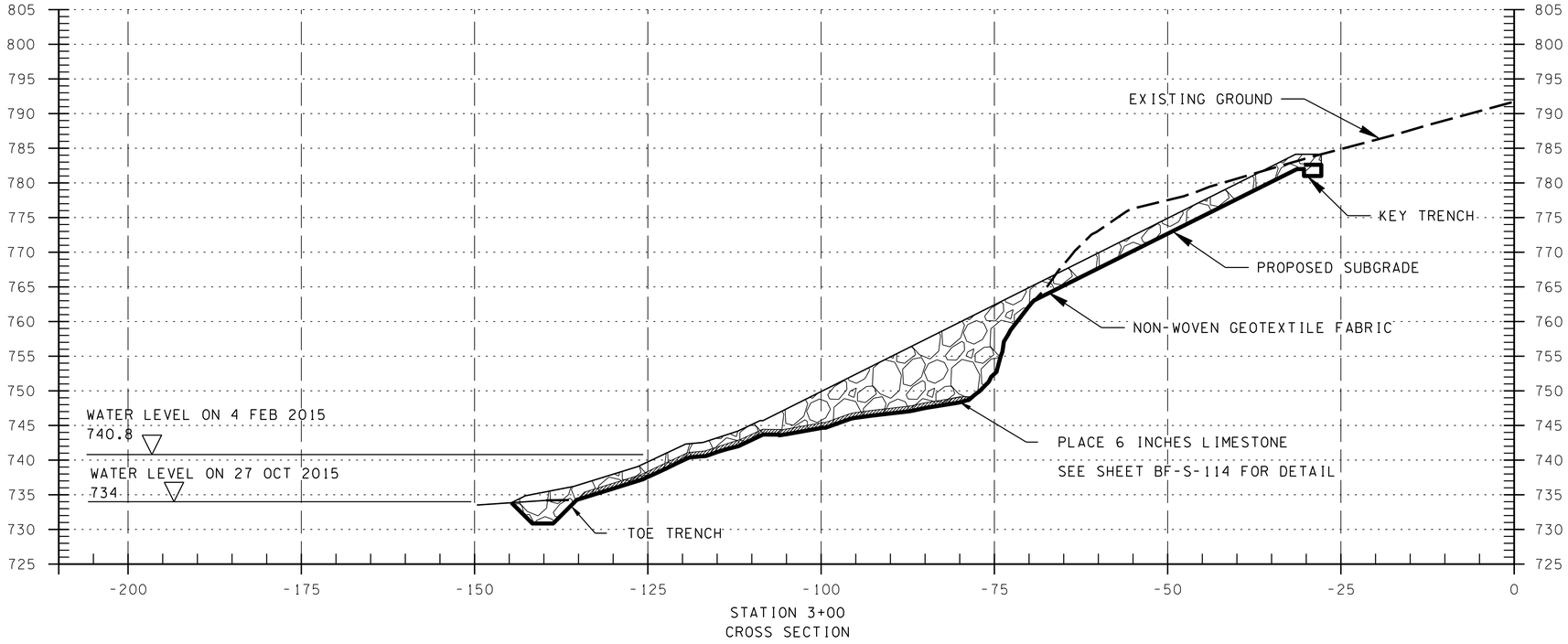
SITE PLAN
MINE SPOIL SURVEY - AREA 1
CROSS SECTIONS 2+50 TO 2+75

SHEET IDENTIFICATION
BF-S-110
SHEET X OF Y

FILE: X:\Personal\Hamlk_JW\Working Proj Files_JH\Hamlk\Big_South_Fork\BSF_BCOES_Review\BSF_BCOES_dgn\BF-S-110.dgn
DATE: 6/8/2016



STATION 3+25
CROSS SECTION



STATION 3+00
CROSS SECTION

NOTES:

1. WATER LEVELS INDICATED FOR 4 FEB 2015 AND 27 OCT 2015 WERE TAKEN AT RANDOM AND ARE NOT INTENDED TO REPRESENT THE FULL RANGE OF POTENTIAL RIVER FLUCTUATION. LOWER AND HIGHER RIVER LEVELS MAY AND LIKELY WILL OCCUR DURING CONSTRUCTION.
2. FOR TYPICAL DETAILS, SEE DWG. BF-S-114.
3. DISTURBED SOIL OUTSIDE OF RIPRAP TO BE SEEDED WITH NATIVE GRASS.
4. END PROTECTION TO BE CONSTRUCTED AT UPSTREAM AND DOWNSTREAM LIMITS.
5. SURFACE OF RIPRAP SLOPE SHALL BE 1V:2H OR FLATTER.
6. RIPRAP THICKNESS SHALL BE A MINIMUM OF 30 INCHES.
7. SEE SPECIFICATION 35 31 19 PARAGRAPH 2.3.1 FOR RIPRAP GRADATION TABLE.
8. FOR DISPOSAL AREA INFORMATION, SEE SPECIFICATION 31 11 00 PARAGRAPH 3.6, FOR GOVERNMENT PRE-APPROVED LANDFILL LOCATION.

BCOES REVIEW

10 5 0 10 20FT
SCALE: 1"= 10'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.
MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TN

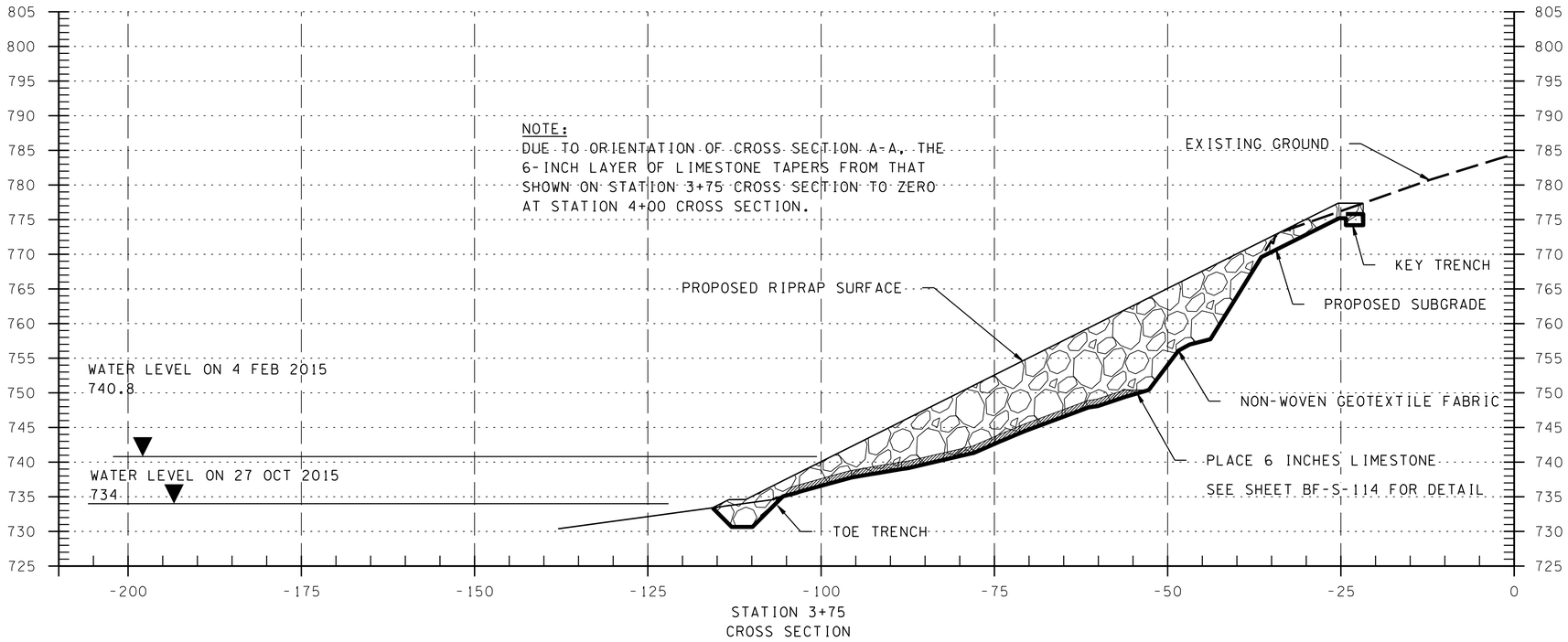
DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE P.E.
PLOT SCALE: 1.00 '= 1"
PLOT DATE: 6/8/2016
SIZE: ANSI D
FILE NAME: $FILES$
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

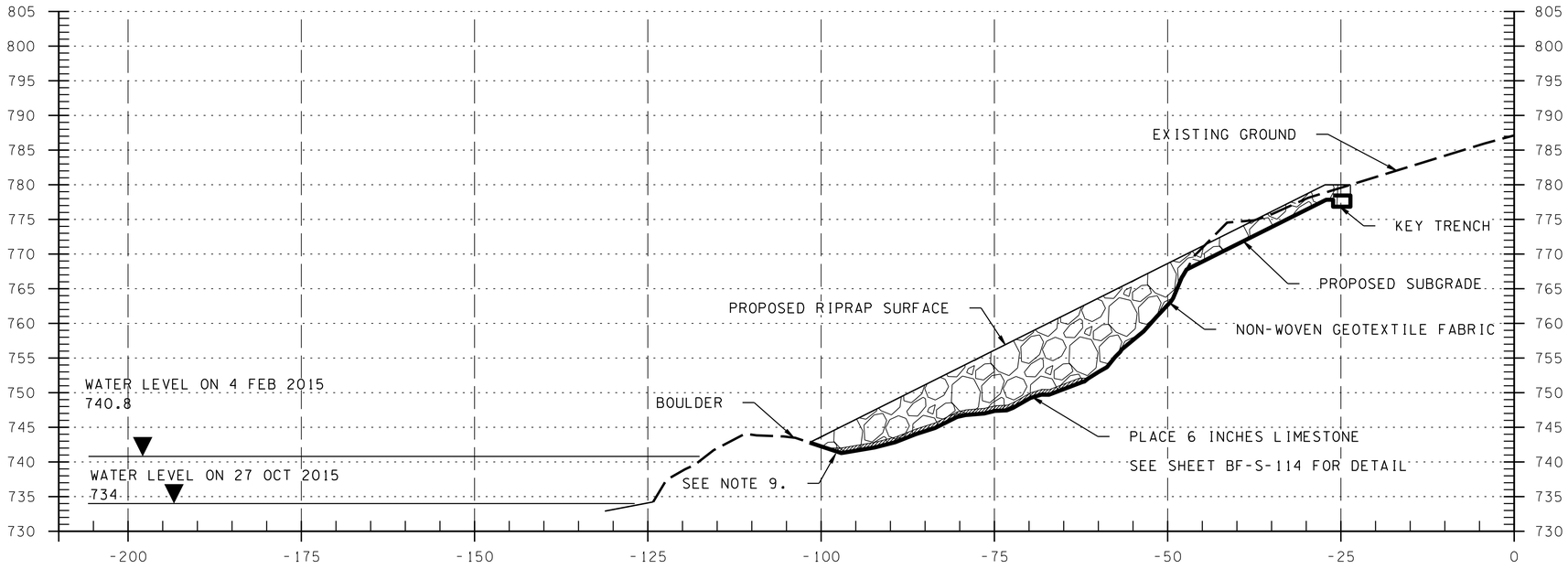
SITE PLAN
MINE SPOIL SURVEY - AREA 1
CROSS SECTIONS 3+00 TO 3+25

SHEET IDENTIFICATION
BF-S-111
SHEET X OF Y

FILE: $File$
DATE: 6/8/2016



STATION 3+75
CROSS SECTION



STATION 3+50
CROSS SECTION

NOTES:

1. WATER LEVELS INDICATED FOR 4 FEB 2015 AND 27 OCT 2015 WERE TAKEN AT RANDOM AND ARE NOT INTENDED TO REPRESENT THE FULL RANGE OF POTENTIAL RIVER FLUCTUATION. LOWER AND HIGHER RIVER LEVELS MAY AND LIKELY WILL OCCUR DURING CONSTRUCTION.
2. FOR TYPICAL DETAILS, SEE DWG. BF-S-114.
3. DISTURBED SOIL OUTSIDE OF RIPRAP TO BE SEEDED WITH NATIVE GRASS.
4. END PROTECTION TO BE CONSTRUCTED AT UPSTREAM AND DOWNSTREAM LIMITS.
5. SURFACE OF RIPRAP SLOPE SHALL BE 1V:2H OR FLATTER.
6. RIPRAP THICKNESS SHALL BE A MINIMUM OF 30 INCHES.
7. SEE SPECIFICATION 35 31 19 PARAGRAPH 2.3.1 FOR RIPRAP AND CHOKE STONE GRADATION TABLE.
8. FOR DISPOSAL AREA INFORMATION, SEE SPECIFICATION 31 11 00 PARAGRAPH 3.6, FOR GOVERNMENT PRE-APPROVED LANDFILL LOCATION.
9. TOE TRENCH IS NOT REQUIRED IN AREAS OF EXPOSED BEDROCK.

BCOES REVIEW

10 5 0 10 20FT
SCALE: 1"= 10'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.
MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TN

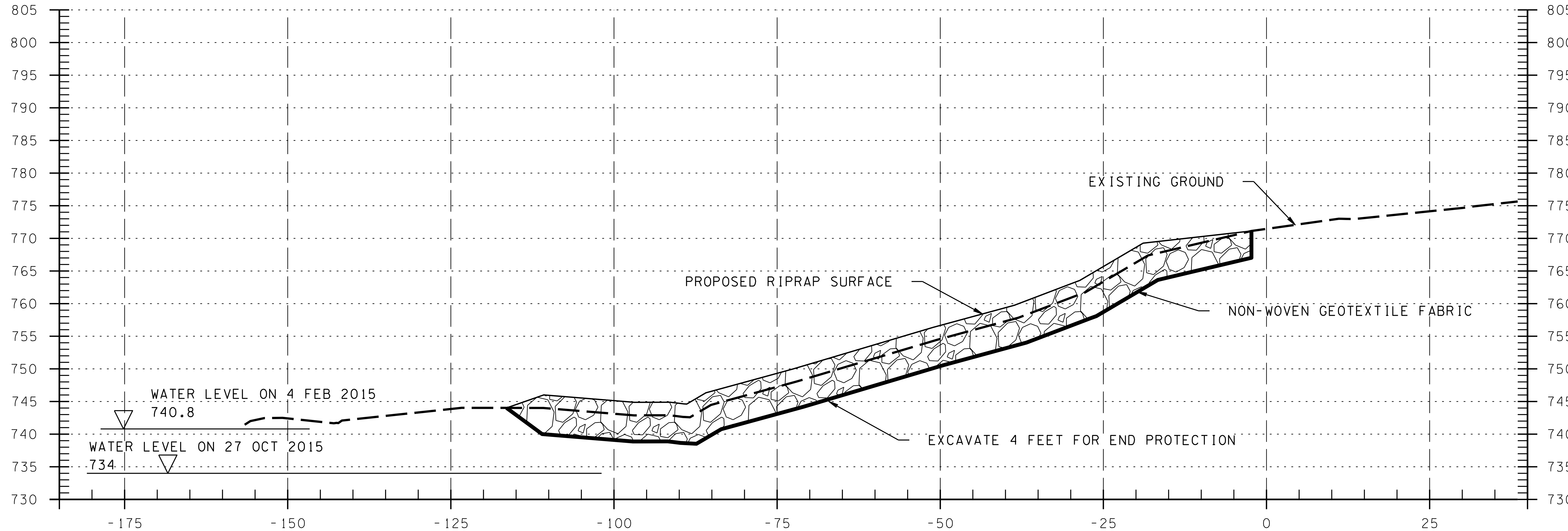
DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE P.E.
PLOT SCALE: 1:1
PLOT DATE: 6/8/2016
SIZE: ANSI D
FILE NAME: $FILE$
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

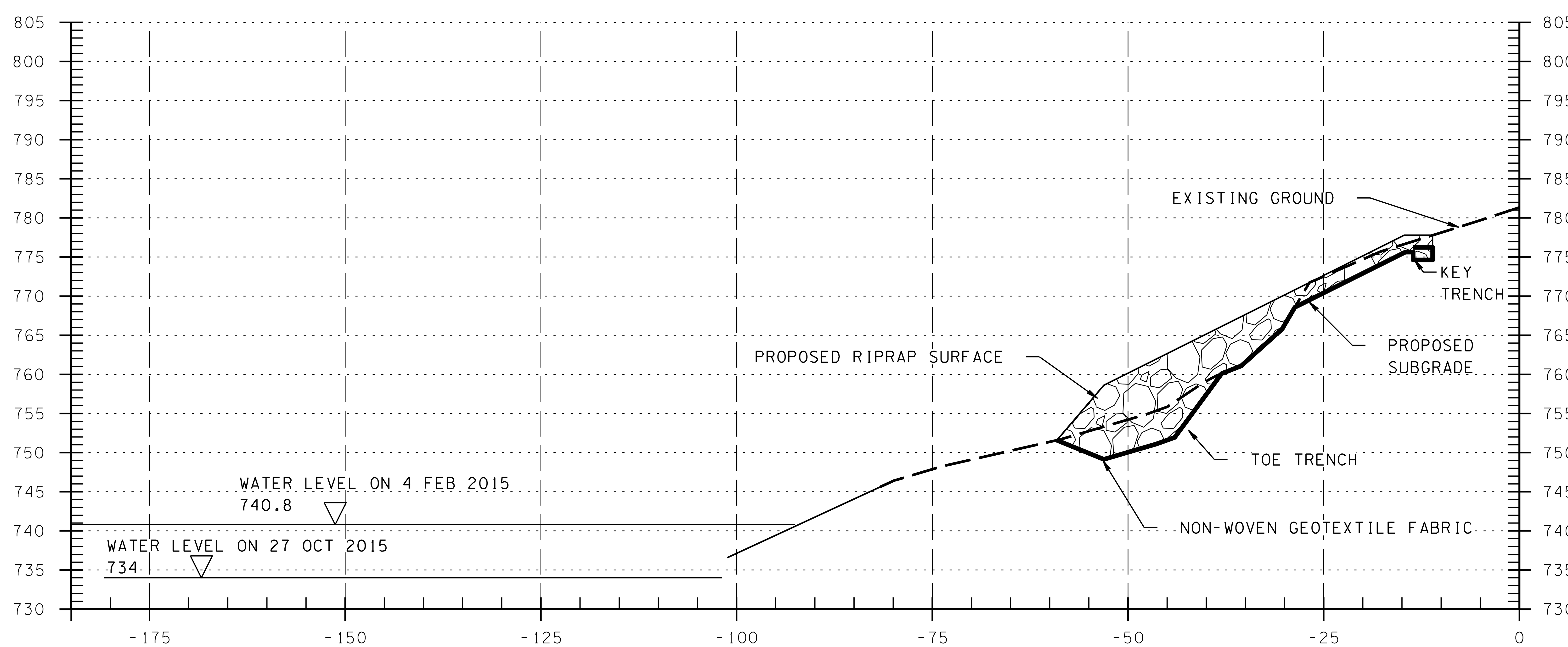
SITE PLAN
MINE SPOIL SURVEY - AREA 1
CROSS SECTIONS 3+50 TO 3+75

SHEET IDENTIFICATION
BF-S-112
SHEET X OF Y

FILE: $File$
DATE: 6/8/2016



SECTION A-A'
CROSS SECTION



STATION 4+00
CROSS SECTION

NOTES:

1. WATER LEVELS INDICATED FOR 4 FEB 2015 AND 27 OCT 2015 WERE TAKEN AT RANDOM AND ARE NOT INTENDED TO REPRESENT THE FULL RANGE OF POTENTIAL RIVER FLUCTUATION. LOWER AND HIGHER RIVER LEVELS MAY AND LIKELY WILL OCCUR DURING CONSTRUCTION.
2. FOR TYPICAL DETAILS, SEE DWG. BF-S-114.
3. DISTURBED SOIL OUTSIDE OF RIPRAP TO BE SEEDED WITH NATIVE GRASS.
4. END PROTECTION TO BE CONSTRUCTED AT UPSTREAM AND DOWNSTREAM LIMITS.
5. SURFACE OF RIPRAP SLOPE SHALL BE 1V:2H OR FLATTER.
6. RIPRAP THICKNESS SHALL BE A MINIMUM OF 30 INCHES.
7. SEE SPECIFICATION 35 31 19 PARAGRAPH 2.3.1 FOR RIPRAP GRADATION TABLE.
8. FOR DISPOSAL AREA INFORMATION, SEE SPECIFICATION 31 11 00 PARAGRAPH 3.6, FOR GOVERNMENT PRE-APPROVED LANDFILL LOCATION.

BCOES REVIEW

10 5 0 10 20FT
SCALE: 1"= 10'

US Army Corps of Engineers

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TN

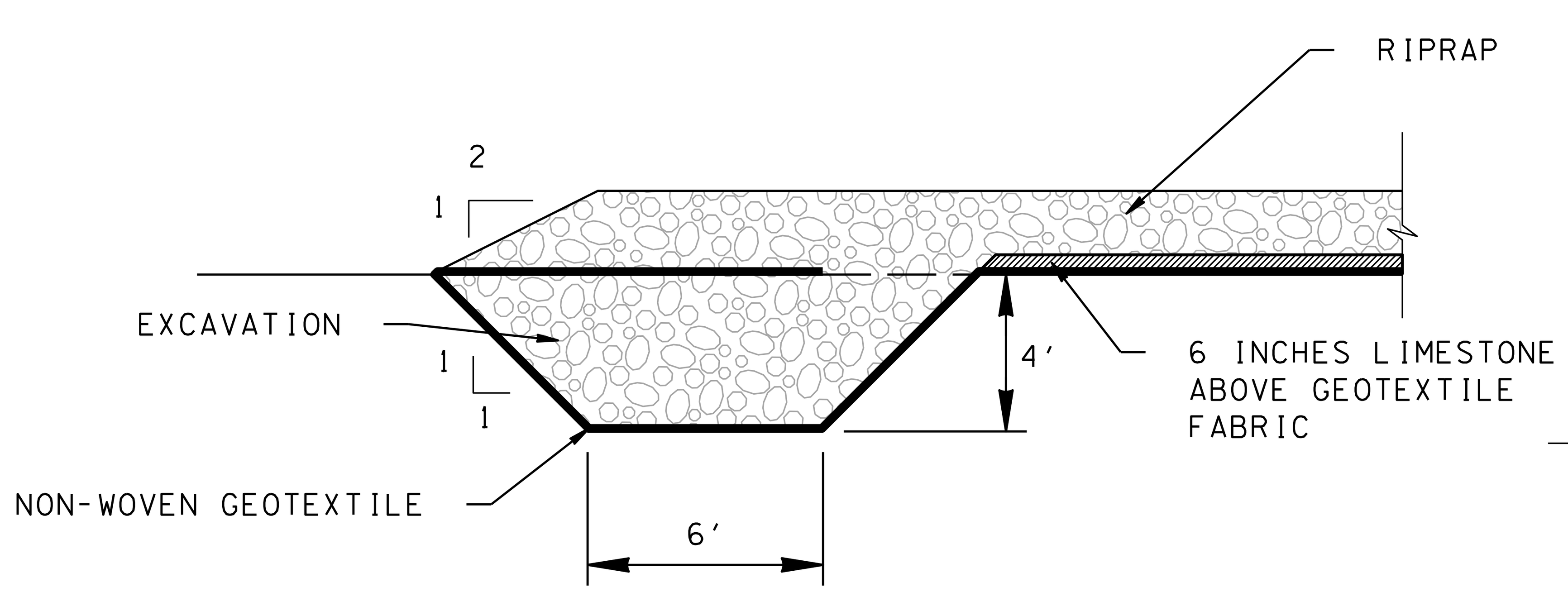
DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE, P.E.
PLOT SCALE: 1" = 10'
PLOT DATE: $DATE$
SIZE: ANSI D
FILE NAME: $FILE$
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

SITE PLAN
MINE SPOIL SURVEY - AREA 1
CROSS SECTIONS 4+00 & A-A'

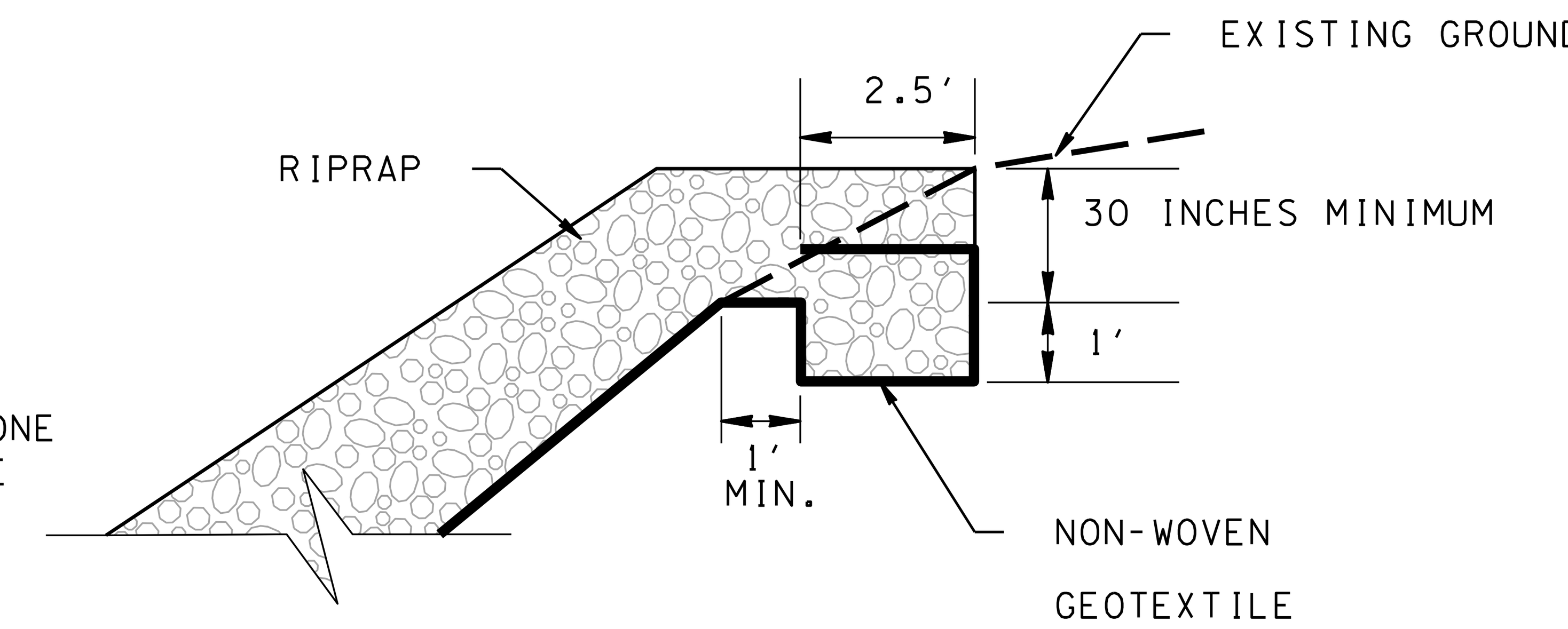
SHEET IDENTIFICATION
BF-S-113
SHEET X OF Y

FILE: $FILE$
DATE: 6/8/2016



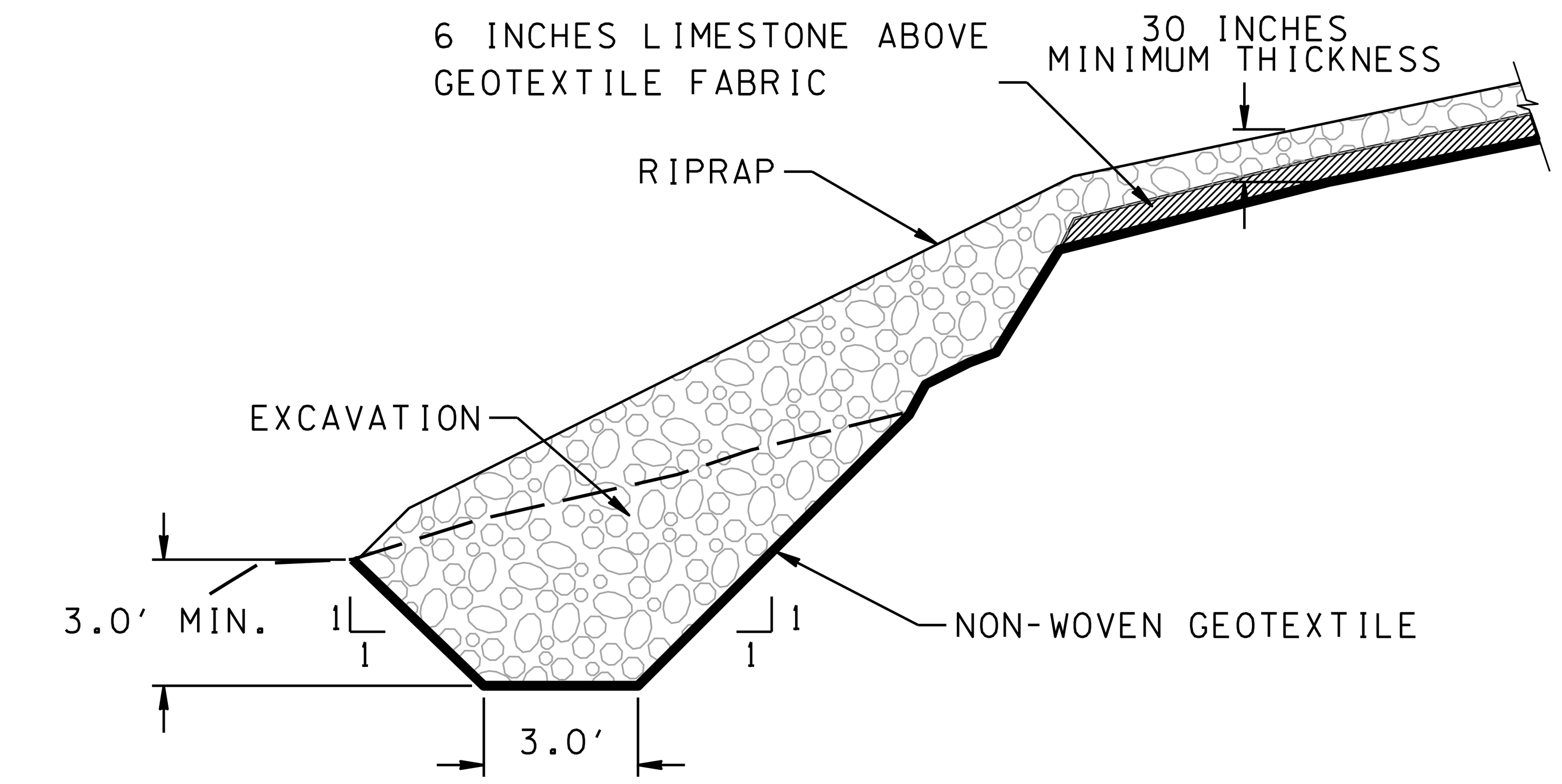
TYPICAL END PROTECTION DETAIL - PROFILE VIEW

NOT TO SCALE



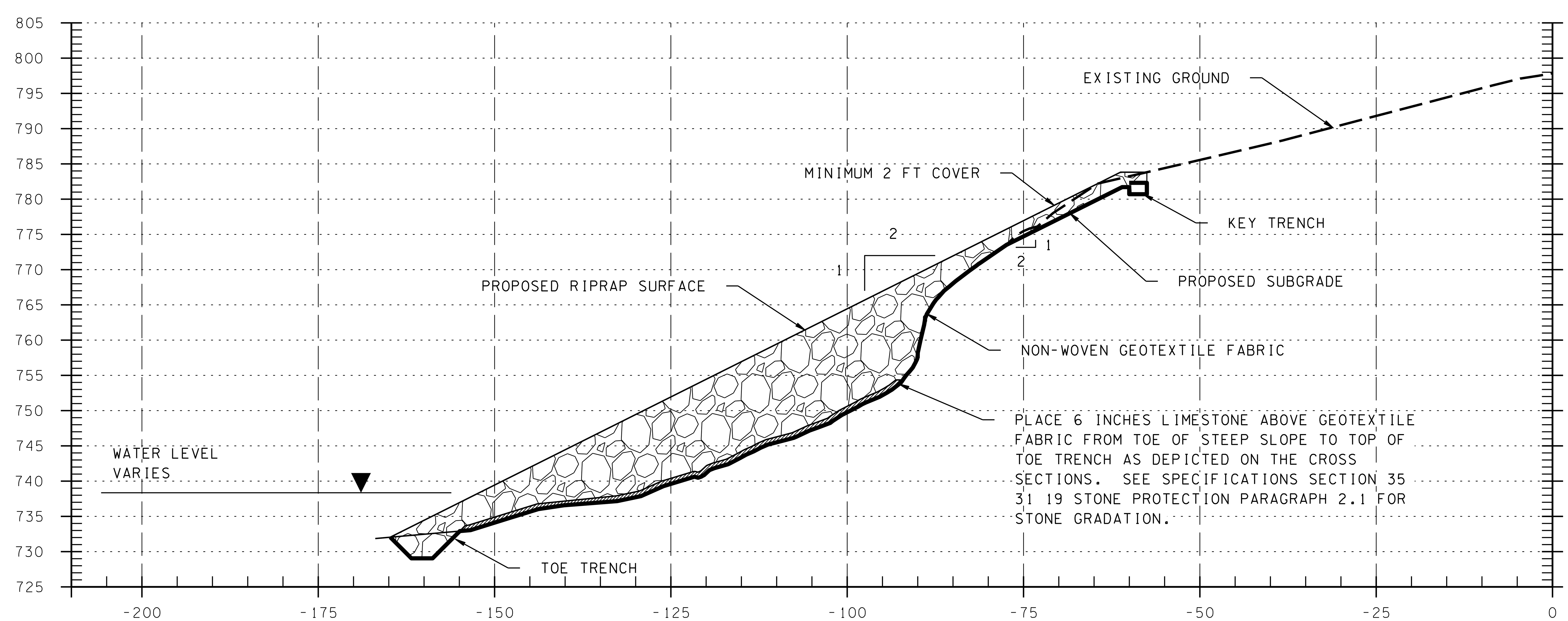
TYPICAL KEY TRENCH CROSS SECTION DETAIL

NOT TO SCALE



TYPICAL TOE TRENCH CROSS SECTION DETAIL

NOT TO SCALE



TYPICAL CROSS SECTION

BCOES REVIEW

10 5 0 10 20FT

SCALE: 1"= 10'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TN

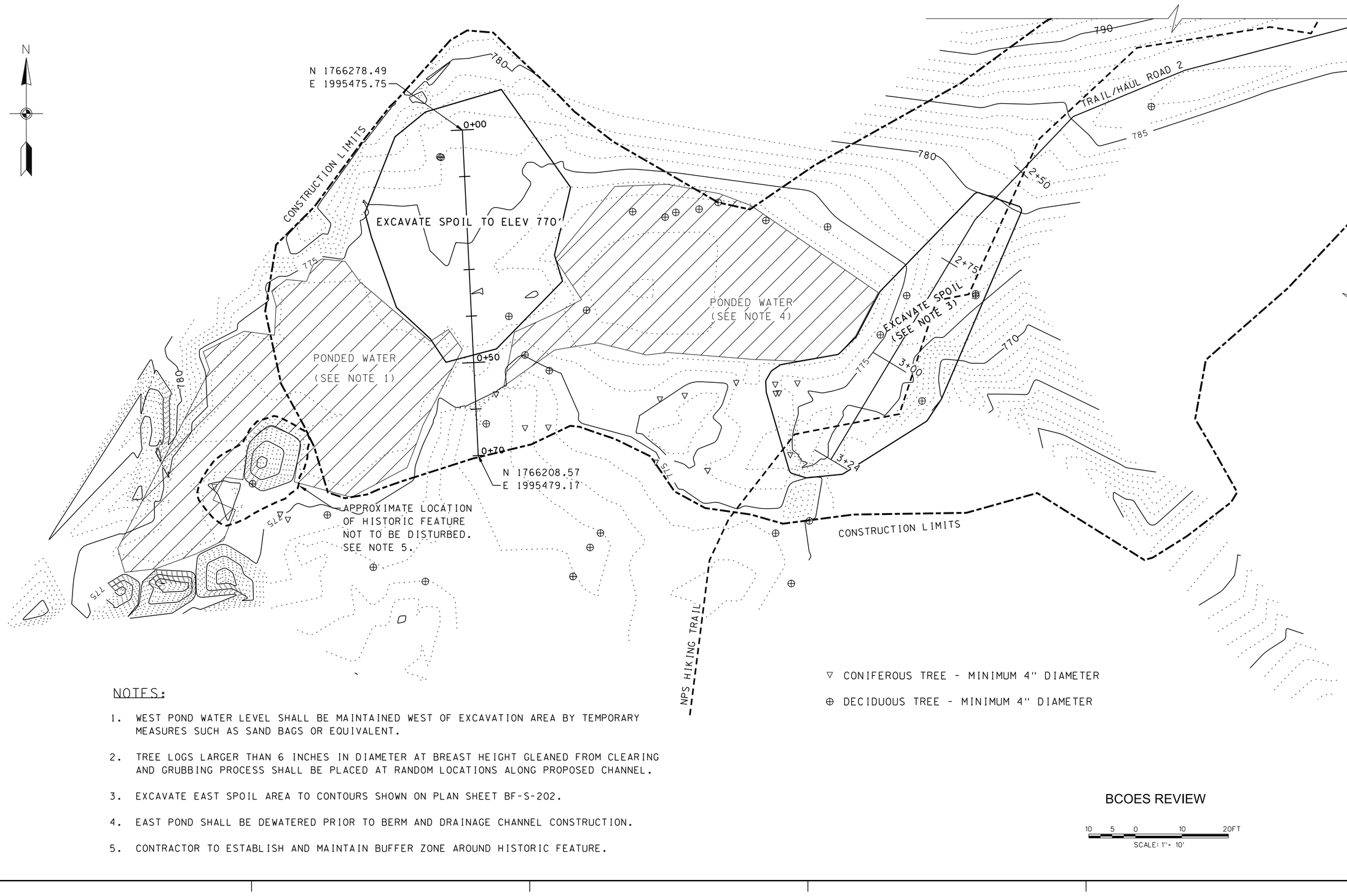
DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDE, P.E.
PLOT SCALE: 1" = 10'
PLOT DATE: 6/8/2016
SIZE: ANSI D
FILE NAME: $FILES$
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

SITE PLAN
MINE SPOIL SURVEY - AREA 1
TYPICAL CROSS SECTIONS & DETAILS

SHEET IDENTIFICATION
BF-S-114
SHEET X OF Y

FILE: $FILE$
DATE: 6/8/2016



NOTES:

1. WEST POND WATER LEVEL SHALL BE MAINTAINED WEST OF EXCAVATION AREA BY TEMPORARY MEASURES SUCH AS SAND BAGS OR EQUIVALENT.
2. TREE LOGS LARGER THAN 6 INCHES IN DIAMETER AT BREAST HEIGHT GLEANED FROM CLEARING AND GRUBBING PROCESS SHALL BE PLACED AT RANDOM LOCATIONS ALONG PROPOSED CHANNEL.
3. EXCAVATE EAST SPOIL AREA TO CONTOURS SHOWN ON PLAN SHEET BF-S-202.
4. EAST POND SHALL BE DEWATERED PRIOR TO BERM AND DRAINAGE CHANNEL CONSTRUCTION.
5. CONTRACTOR TO ESTABLISH AND MAINTAIN BUFFER ZONE AROUND HISTORIC FEATURE.

▽ CONIFEROUS TREE - MINIMUM 4" DIAMETER

⊕ DECIDUOUS TREE - MINIMUM 4" DIAMETER

BCOES REVIEW

10 5 0 10 20FT
SCALE: 1"= 10'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.

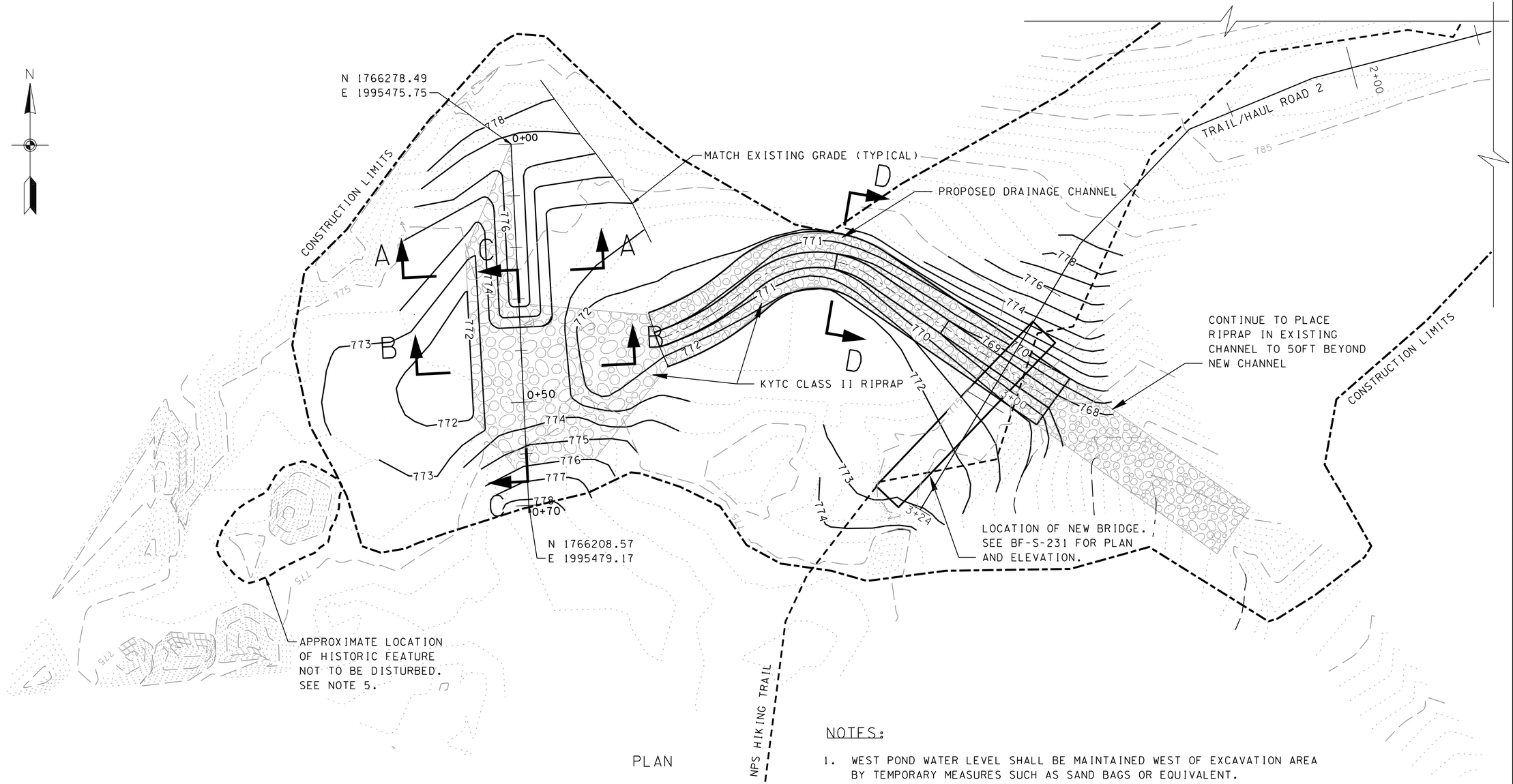
U.S. ARMY CORPS OF ENGINEERS NASHVILLE DISTRICT CITY, STATE	DESIGNED BY: MICHAEL A. BROWN	DATE: JANUARY 2016	
	DWN BY: JH	CKD BY: WBL	SOLICITATION NO.:
	SUBMITTED BY: JAMES R. WADDLE, PE	PLOT DATE: $DATE$	CONTRACT NO.:
	PLOT SCALE: 1	PLOT MODE: 1	FILE NUMBER:
	SIZE: ANSI D	FILE NAME: $File$	

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

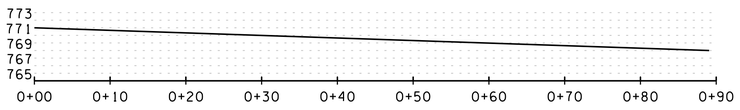
MINE SPOIL SURVEY
SITE PLAN - EXISTING CONDITIONS
AREA 2

SHEET IDENTIFICATION
BF-S-201
SHEET X OF Y

File: $FILE$
Plot Date: $DATE$



PLAN



PROFILE - PROPOSED DRAINAGE DITCH

SEE SHEET BF-S-230 FOR CROSS SECTIONS A-A; B-B; C-C; D-D

NOTES:

1. WEST POND WATER LEVEL SHALL BE MAINTAINED WEST OF EXCAVATION AREA BY TEMPORARY MEASURES SUCH AS SAND BAGS OR EQUIVALENT.
2. TREE LOGS LARGER THAN 6 INCHES IN DIAMETER AT BREAST HEIGHT GLEANED FROM CLEARING AND GRUBBING PROCESS SHALL BE PLACED AT RANDOM LOCATIONS ALONG PROPOSED CHANNEL.
3. EXCAVATE EAST SPOIL AREA TO CONTOURS SHOWN ON PLAN SHEET BF-S-202.
4. EAST POND SHALL BE DEWATERED PRIOR TO BERM AND DRAINAGE CHANNEL CONSTRUCTION.
5. CONTRACTOR TO ESTABLISH AND MAINTAIN BUFFER ZONE AROUND HISTORIC FEATURE.

BCOES REVIEW

10 5 0 10 20FT
SCALE: 1"= 10'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.
MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
CITY, STATE

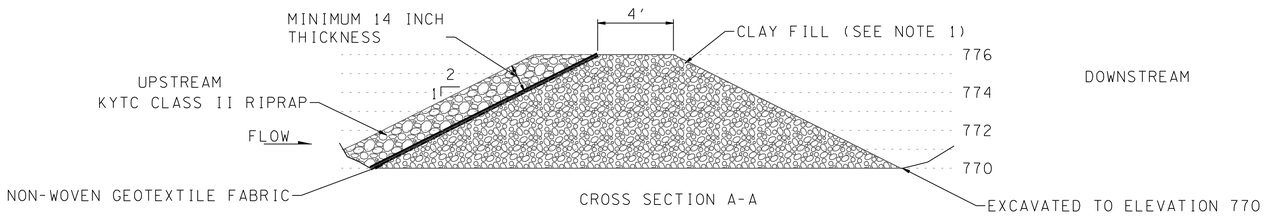
DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE, PE
PLOT SCALE: 1"=1'-0"
SIZE: ANSI D
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:
PLOT DATE: $DATE$
FILE NAME: $File$

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

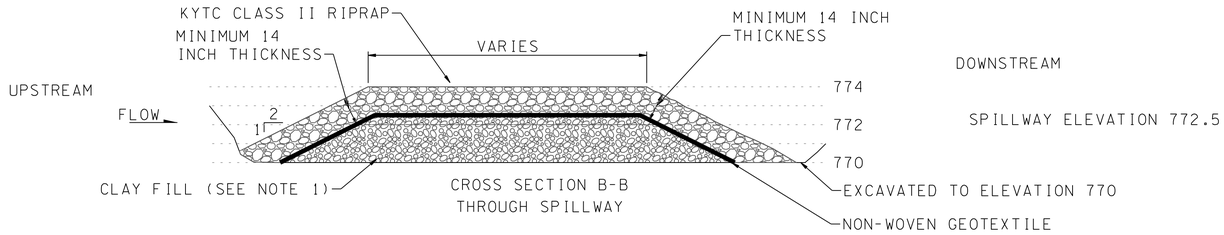
MINE SPOIL SURVEY
FINAL GRADING PLAN
AREA 2

SHEET IDENTIFICATION
BF-S-202
SHEET X OF Y

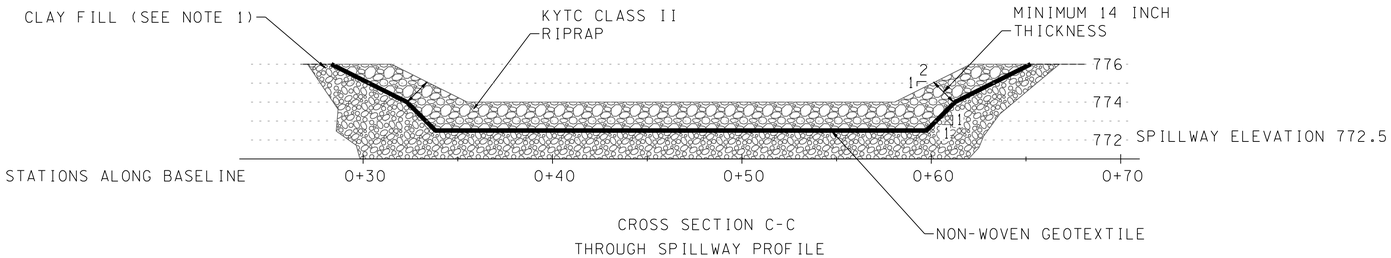
File: $FILE$
Plot Date: $DATE$



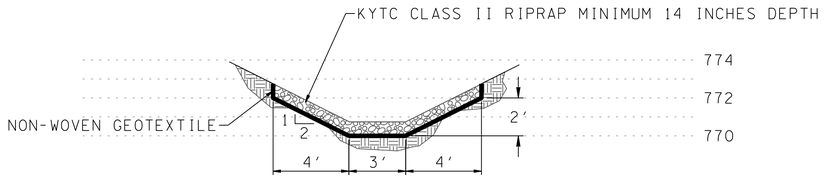
CROSS SECTION A-A
THROUGH MAIN BERM



CROSS SECTION B-B
THROUGH SPILLWAY



CROSS SECTION C-C
THROUGH SPILLWAY PROFILE



CROSS SECTION D-D
TYPICAL DRAINAGE CHANNEL DETAIL

NOTES:

1. MATERIALS USED FOR BERM SHALL BE CLASSIFIED BY ASTM D2487 AS CL, CL-ML, OR SC.

BCOES REVIEW

4 0 4 8FT
SCALE: 1"=4'-0"

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.
1			

MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
CITY, STATE

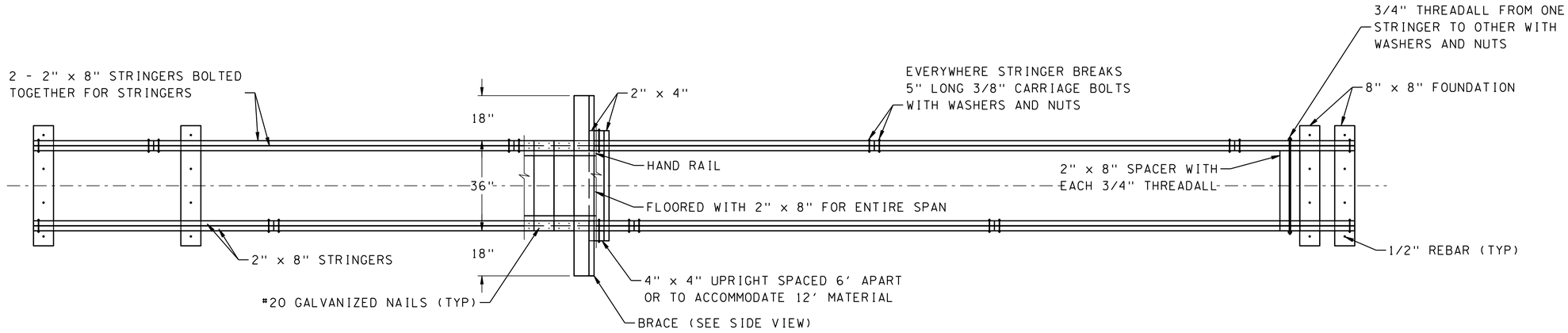
DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE, PE
PLOT SCALE: AS NOTED
SIZE: ANSI D
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:
PLOT DATE: AS NOTED
FILE NAME: $Files$

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

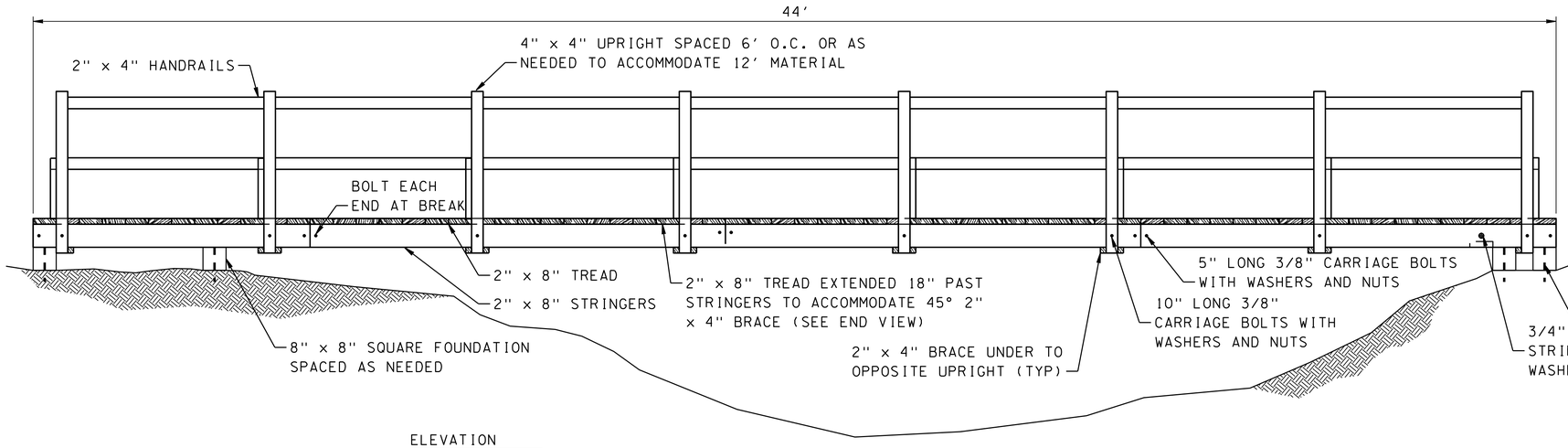
MINE SPOIL SURVEY
CROSS SECTIONS A-A; B-B; C-C; D-D
AREA 2

SHEET IDENTIFICATION
BF-S-230
SHEET X OF Y

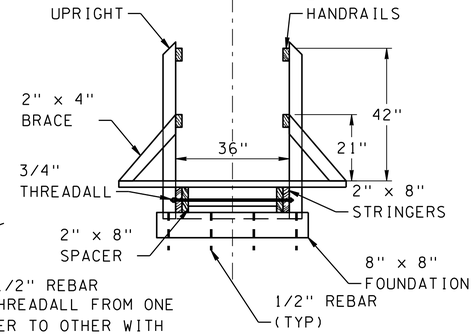
File: $FILE$
Plot Date: $DATE$



PLAN
SCALE: 1" = 2'



ELEVATION
SCALE: 1" = 2'



SIDE VIEW
SCALE: 1" = 2'

BCOES REVIEW

2 0 2 4FT
SCALE: 1"=2'-0"

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.
1			

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE, PE
PLOT SCALE: FULL SCALE
PLOT DATE: $DATE$
SIZE: ANSI D
FILE NAME: $File$
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

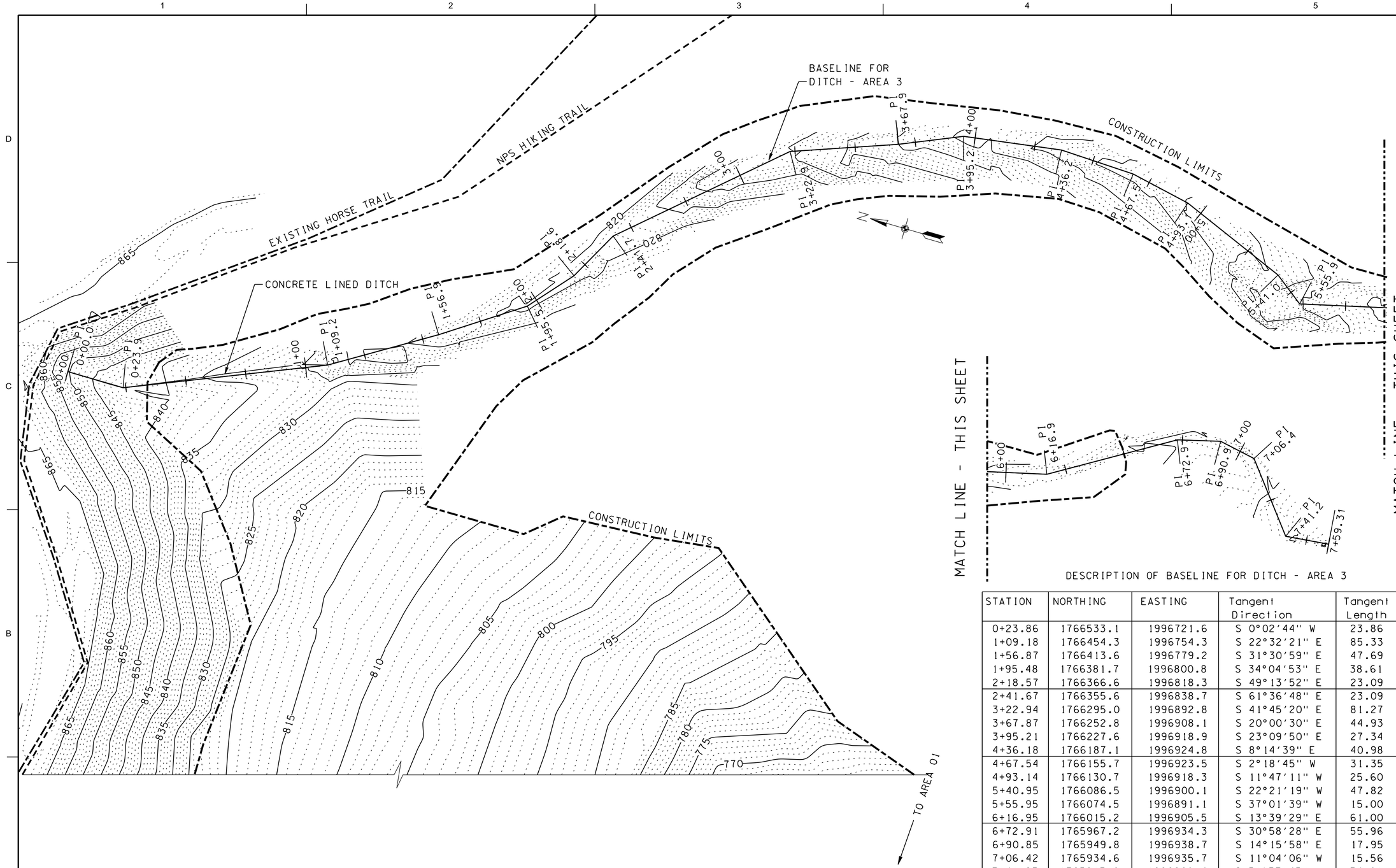
U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
CITY, STATE

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

TIMBER BRIDGE DETAILS
AREA 2

SHEET IDENTIFICATION
BF-S-231
SHEET X OF Y

File: $File$
Plot Date: $DATE$



DESCRIPTION OF BASELINE FOR DITCH - AREA 3

STATION	NORTHING	EASTING	Tangent Direction	Tangent Length
0+23.86	1766533.1	1996721.6	S 0°02'44" W	23.86
1+09.18	1766454.3	1996754.3	S 22°32'21" E	85.33
1+56.87	1766413.6	1996779.2	S 31°30'59" E	47.69
1+95.48	1766381.7	1996800.8	S 34°04'53" E	38.61
2+18.57	1766366.6	1996818.3	S 49°13'52" E	23.09
2+41.67	1766355.6	1996838.7	S 61°36'48" E	23.09
3+22.94	1766295.0	1996892.8	S 41°45'20" E	81.27
3+67.87	1766252.8	1996908.1	S 20°00'30" E	44.93
3+95.21	1766227.6	1996918.9	S 23°09'50" E	27.34
4+36.18	1766187.1	1996924.8	S 8°14'39" E	40.98
4+67.54	1766155.7	1996923.5	S 2°18'45" W	31.35
4+93.14	1766130.7	1996918.3	S 11°47'11" W	25.60
5+40.95	1766086.5	1996900.1	S 22°21'19" W	47.82
5+55.95	1766074.5	1996891.1	S 37°01'39" W	15.00
6+16.95	1766015.2	1996905.5	S 13°39'29" E	61.00
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6+90.85	1765949.8	1996938.7	S 14°15'58" E	17.95
7+06.42	1765934.6	1996935.7	S 11°04'06" W	15.56
7+41.23	1765913.0	1996908.4	S 51°37'45" W	34.81
7+59.31	1765895.0	1996910.2	S 5°44'11" E	18.08

PLAN - EXISTING CONDITIONS

AREA 3

FOR DETAILED PLANS AND PROFILES,
SEE SHEETS BF-S-306 - BF-S-308

BCOES REVIEW

20 0 20 40FT

SCALE: 1"=20'-0"

File: $FILE$
Plot Date: $DATE$

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.	MARK	APPR.	DESCRIPTION	DATE	APPR.
1								

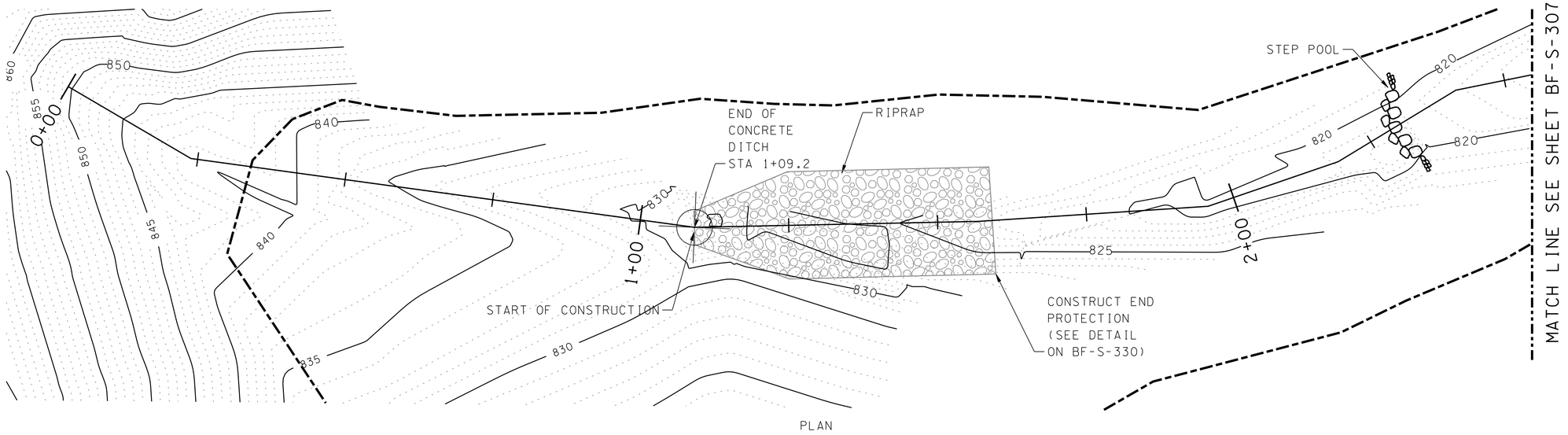
DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE, PE
PLOT SCALE: 1"=20'-0"
PLOT DATE: $DATE$
SIZE: ANSI D
FILE NAME: $File$
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TENNESSEE

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

MINE SPOIL SURVEY - AREA 3
SITE PLAN

SHEET IDENTIFICATION
BF-S-301
SHEET X OF Y



PROFILE

PLAN

BCOES REVIEW

10 0 10 20FT

SCALE: 1''=10'-0''

US Army Corps of Engineers®

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1							

DESIGNED BY: MICHAEL A. BROWN	CKD BY: WBL	DATE: JANUARY 2016	
DWN BY: JH		SOLICITATION NO.:	
SUBMITTED BY: JAMES R. WADDLE, PE		CONTRACT NO.:	
PLOT SCALE: 1 = 1'	PLOT DATE: $DATE$	FILE NUMBER:	
SIZE: ANSI D	FILE NAME: $File$		

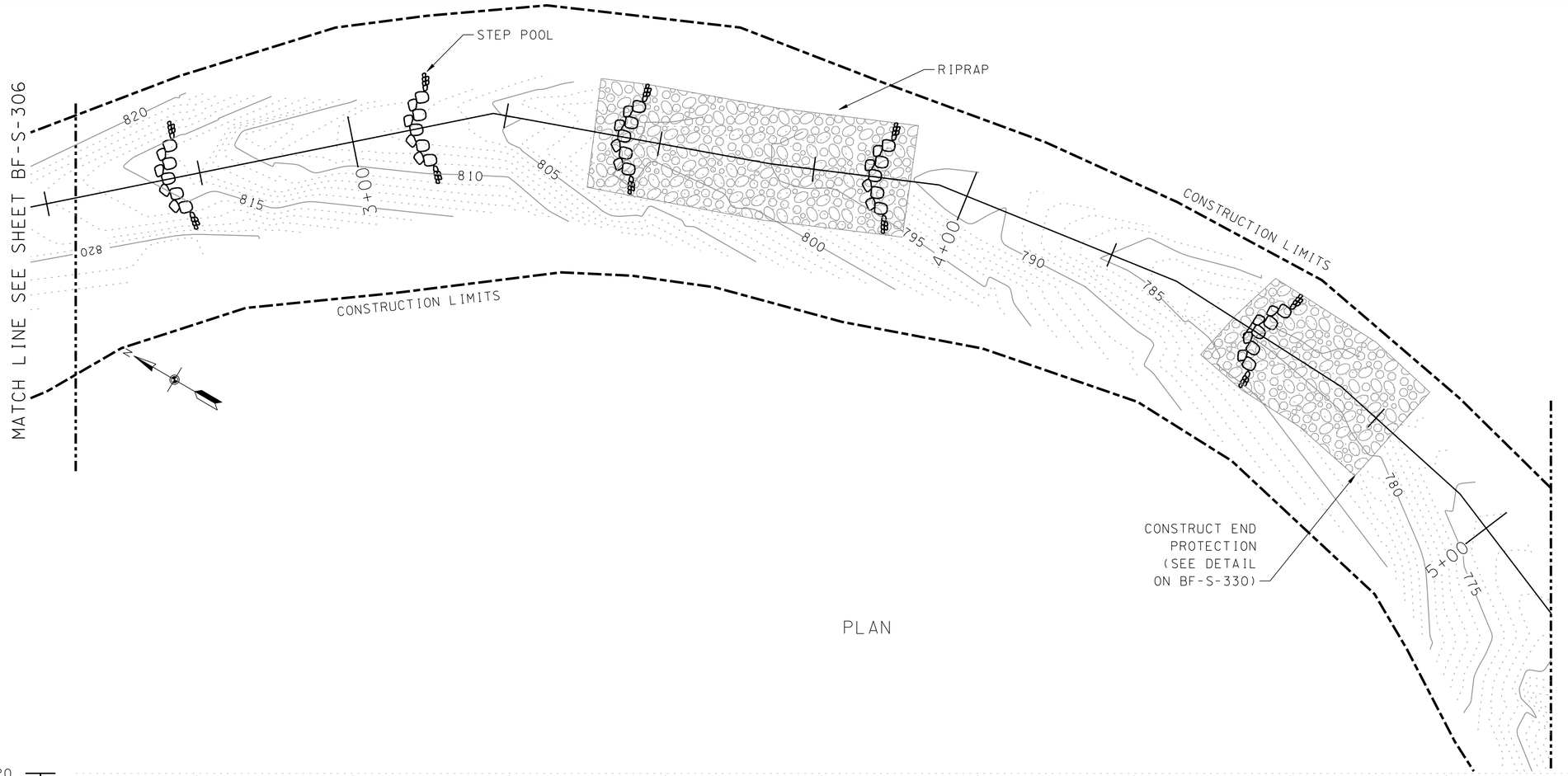
U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TENNESSEE

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

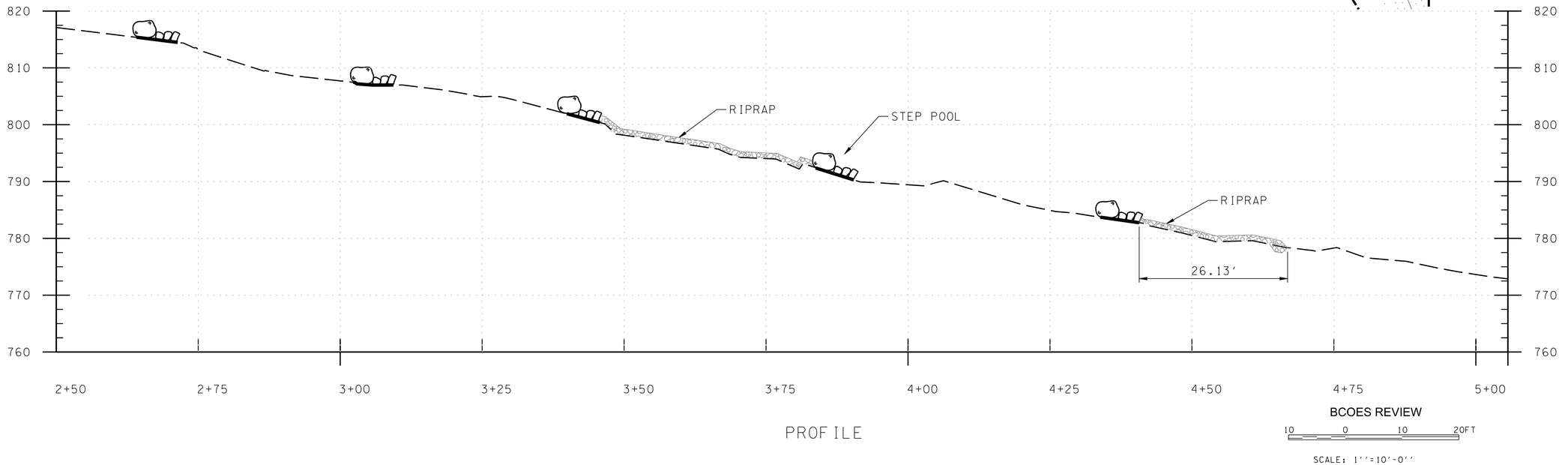
MINE SPOIL SURVEY - AREA 3
STA 0+00 - 2+50

SHEET IDENTIFICATION
BF-S-306
SHEET X OF Y

File: $File$
Plot Date: $DATE$



PLAN



PROFILE

BCOES REVIEW

10 0 10 20FT

SCALE: 1''=10'-0''

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.
1	ACCORDANCE W/MODIFICATION NO. 1	7/1/2005	TSR

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TENNESSEE

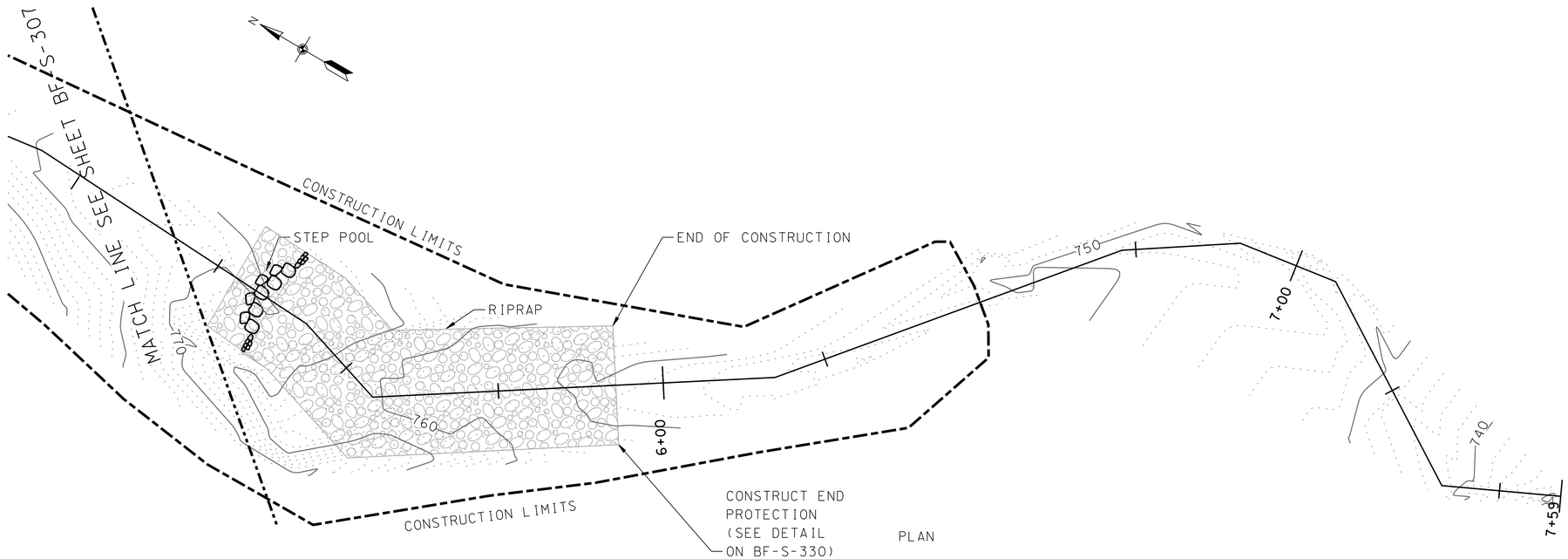
DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE, PE
PLOT SCALE: 1'=1'
PLOT DATE: $DATE$
SIZE: ANSI D
FILE NAME: $File$
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

MINE SPOIL SURVEY - AREA 3
STA 2+50 - 5+00

SHEET IDENTIFICATION
BF-S-307
SHEET X OF Y

File: $File$
Plot Date: $DATE$



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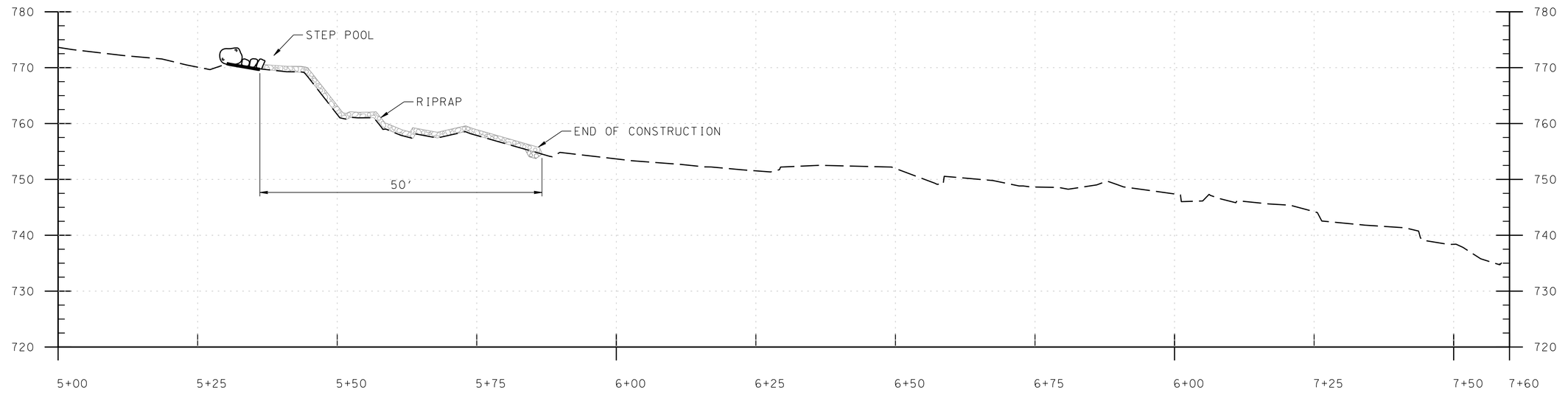


PROFILE

BCOES REVIEW

10 0 10 20FT

SCALE: 1''=10'-0''

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.
1	ACCORDANCE W/MODIFICATION NO. 1	7/1/2005	TSR				

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TENNESSEE

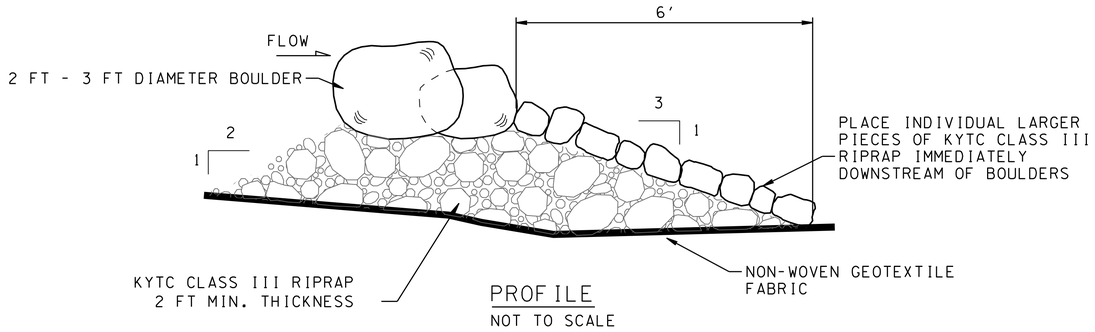
DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE, PE
PLOT SCALE: 1" = 1'
PLOT DATE: NAVD 88
SIZE: ANSI D
FILE NAME: $File$
DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

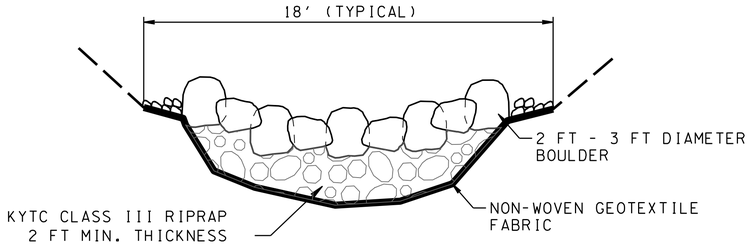
MINE SPOIL SURVEY - AREA 3
STA 5+00 - 7+60

SHEET IDENTIFICATION
BF-S-308
SHEET X OF Y

File: $FILE$
Plot Date: $DATE$



PROFILE
NOT TO SCALE



SECTION A-A
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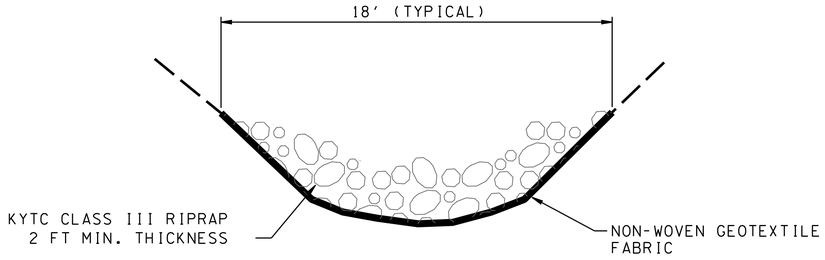

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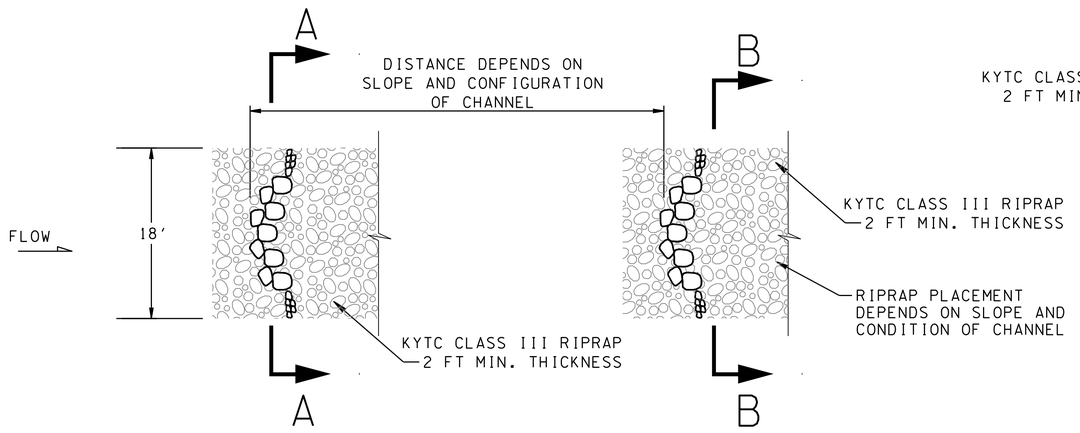
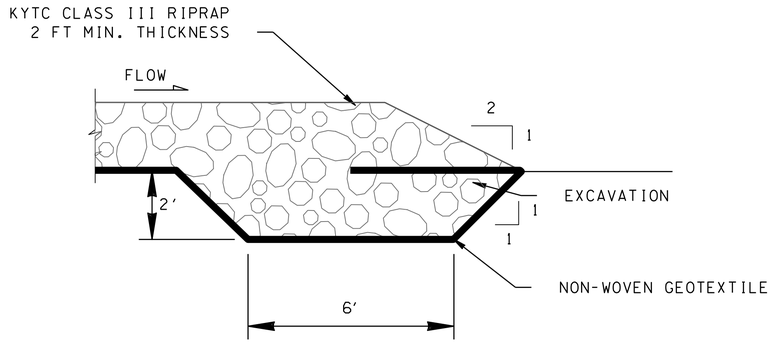


PLAN
NOT TO SCALE



TYPICAL END PROTECTION DETAIL - PROFILE
NOT TO SCALE

NOTES:

1. BOULDERS ARE TO BE PLACED IN AN ARC WITH THE BOW OF THE ARC POINTING UPSTREAM.

BCOES REVIEW

8 0 8 16FT
SCALE: 1"=8'-0"

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE	APPR.
1			

MARK	DESCRIPTION	DATE	APPR.

DATE: JANUARY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: MICHAEL A. BROWN
DWN BY: JH
CKD BY: WBL
SUBMITTED BY: JAMES R. WADDLE, PE
PLOT SCALE: AS SET
PLOT DATE: AS SET
SIZE: ANSI D
FILE NAME: $File$

U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT
NASHVILLE, TENNESSEE

WOLF CREEK DAM
BIG SOUTH FORK ESA COMPLIANCE PROJECT
BLUE HERON, MCCREARY COUNTY, KENTUCKY

MINE SPOIL SURVEY - AREA 3
STEP POOL CROSS SECTIONS AND DETAILS

SHEET IDENTIFICATION
BF-S-330
SHEET X OF Y

File: $FILE$
Plot Date: $DATE$

APPENDIX C

Species Description

- **Indiana Bat (*Myotis sodalis*)**
  M. sodalis was federally listed as Endangered in 1967, and, although important protections are in place, populations have continued to decline. Although the species ranges throughout most of the eastern portion of the United States, hibernating colonies are known only from Indiana, Missouri, and Kentucky where approximately 87 percent of the population hibernate in only 7 limestone caves. *M. sodalis*, during winter months, hibernate using caves as discussed above. However, during summer months, *M. sodalis* use trees with specific features. Potential *M. sodalis* summer habitat is described as trees with a diameter at breast height equal to and/or greater than 5 inches and that exhibit exfoliating bark, cracks, crevices, and/or hollows.

- **Gray Bat (*Myotis grisescens*)**
  M. grisescens, largest of its genus, was listed as a federal endangered species in 1976 (FWS 1976). Although gray bats occur throughout much of the midwest and southern United States, their populations are found mainly in Alabama, northern Arkansas, Kentucky, Missouri, and Tennessee (FWS1982). Gray bats are known from suitable caves throughout the Tennessee River Valley. Populations of gray bats have increased throughout portions of their range and the status of this species is considered to be improving (FWS 2003). Critical habitat has not been designated for this species. Gray bats are year-round residents of limestone caves or cave-like habitats. Most individuals migrate seasonally between hibernating and maternity caves. They generally enter hibernation by early November, and emerge in March and April (FWS 1982).

- **Blackside Dace (*Phoxinus cumberlandensis*)**
  The blackside dace was federally listed in June, 1987 (FWS, 1988). This species is known to inhabit northeastern Tennessee and southeastern Kentucky within the Cumberland River system (FWS 1988). Blackside dace are known to dwell in cool, upland streams with riparian zones with a dense canopy that shades and helps decrease the amount of runoff from land use practices (FWS, 1988). As reported in 2007 by the FWS, blackside dace are believed to be in approximately 110 streams in Bell, Harlan, Knox, Laurel, Letcher, McCreary, Pulaski, and Whitley counties, Kentucky and Campbell, Claiborne, and Scott counties, Tennessee (FWS 2011). The Blackside Dace Recovery Plan states “now the small populations are isolated from each other by extremely degraded habitat and the exchange of genetic material among some of these populations is likely infrequent or nonexistent” (FWS 1988).

- **Palezone Shiner (*Notropis albizonatus*)**

The Palezone shiner was federally listed as Endangered by the FWS in April, 1993. The Palezone shiner occurs in quiet waters and flowing pools in shallow to moderate depths over gravel substrates. The only known populations occur in small upland rivers, the Little South Fork of the Cumberland River in southeast Kentucky and Paint Rock River located in Alabama. Both streams have exceptional water quality and a diverse aquatic fauna. In addition to the Little South Fork and Paint Rock rivers, the only other locality where the species has been collected is in Cove Creek, a tributary to the Clinch River, Campbell County, Tennessee. The Palezone Shiner is included in Tennessee's list of Species in Need of Management.

- **Cumberland Darter (*Etheostoma susanae*)**
  The Cumberland darter is being "proposed" to be listed as endangered under the Endangered Species Act (FWS 2010). This species reaches approximately 3 inches in length and the extent of their range is Kentucky within McCreary and Whitley counties and Tennessee within Campbell and Scout counties (FWS 2010). O'Bara in 1991 and Thomas in 2007 discussed that there are 14 extant occurrences within Kentucky and Tennessee and those are restricted to short stream reaches (FWS 2010). The Cumberland Darter is known to inhabit "low-velocity, shallow, riffles and backwater areas of moderate to low-gradient stream reach with stable sand or sandy gravel substrates" (FWS 2006). A major threat to the Cumberland darter is silting from mining practices, silvicultural practices, road construction, and development (FWS, 2006). With the known populations in streams within the above listed counties, these threats are high from being isolated from one another by natural and manmade barriers (FWS 2006).

- **Duskytail Darter (*Etheostoma percnurum*)**
  The duskytail darter is a small fish endemic to the Cumberland and Tennessee River drainages. The duskytail darter was listed as an endangered species on April 27, 1993 (Federal Register 58(79): 25758-25763). At that time, in the Cumberland Basin, it was known to exist only within the BSF (FWS 1993). Subsequent surveys of the BSF documented its presence in 13 sites within the BSF). The duskytail darter was first described in the scientific literature in 1994 by R. E. Jenkins (Jenkins and Burkhead, 1994). At that time the fish was described in five other populations in streams of the Tennessee and Cumberland Rivers. One was in Virginia, in Copper Creek, and the rest were in Tennessee, in Citico Creek, Abrams Creek, Little River, and the South Fork Holston of the Tennessee River (Jenkins and Burkhead 1994).

  Three of the duskytail darter populations have since been described as separate species (R.E. Blanton and R.E. Jenkins 2008). The Big South Fork Cumberland

River population was named the tuxedo darter (*Etheostoma lemniscatum*); the Little River and South Fork Holston populations were named the marbled darter (*Etheostoma marmorpinnum*); and the Citico Creek, Abrams Creek, and Tellico River, populations were named the citico darter (*Etheostoma sitikuense*) (Blanton and Jenkins, 2008). The FWS recommended that the tuxedo darter and the other two new species in the species complex, be evaluated for consideration for listing under the ESA (FWS, 2008). Until then, all populations are considered the duskytail darter for ESA consultation purposes.

Davis and Cook (2010) characterized the microhabitat use of the tuxedo (duskytail) darter. The darter prefers glide habitat with an abundance of cobble and small boulder-sized rocks in slow-flowing, shallow areas (Davis and Cook 2010). The preferred glide habitats are typically found at the head and tail of pools. Davis and Cook (2010) also found that the darter was present during the summer in areas with an average depth between 32.9 cm and 89.2 cm. According to Davis (2010), suitable habitat within the BSF is separated by distances greater than 1 km (0.6 mi), and it is unknown whether the tuxedo (duskytail) darter is able to disperse across pool barriers.

- **Cumberland Bean (*Villosa trabalis*)**
  The Cumberland Bean is a long-term brooder, being gravid from late summer to following summer (Wilson, 2008). Native host for glochidia are fantail darter (*theostoma flabellare*) and the striped darter (*Etheostoma virgatum*) (Layzer and Madison, 1995). Other potential host have been found through labritory trial consist of; balck sculpin (*Cottus baileyi*), rainbow darter (*Etheostoma caeruleum*), greenside darter (*Etheostoma blennioides*), Johnny darter (*Etheostoma nigrum*), barcheek darter (*Etheostoma obeyense*), sooty darter (*Etheostoma olivaceum*), arrow darter (*Etheostoma sagitta*), and the snubnose darter (*Etheostoma simoterum*) (Parmalee and Bogan, 1998).

- **Cumberlandian Combshell (*Epioblasma brevidens*)**
  E. brevidens was historically restricted to, but widespread in the Tennessee and Cumberland Rivers and their major tributaries in the states of Virginia, Kentucky, Mississippi, Alabama, and Tennessee (FWS, 2004b). This species prefers a water depth of less than 3 feet, however, individuals had been found in deep water areas in the upper riverine portion of Old Hickory Reservoir downstream the Cordell Hull and Center Hill Reservoirs (FWS, 2004b). *E. brevidens* was federally listed as an Endangered species in 1997 and a recovery plan was written in 2004 (FWS, 2004b). TVA (2003) notes that current remnant populations only exist in the Tennessee River tributaries of Bear Creek and the Clinch, Powell, and Duck Rivers, and the Cumberland River tributaries of Buck

Creek and the Big South Fork. In Kentucky (KCWCS, 2005), *E. brevidens* occurs sporadically in the upper Cumberland River below Cumberland Falls.

Seven units of critical habitat have been identified within the Cumberland and Tennessee River drainages. These units are located on segments of Bear and Buck Creeks; Duck, Nolichucky, and Powell Rivers; the Clinch River and its major tributaries; and the Big South Fork and its tributaries (FWS, 2004b). According to the FWS Recovery Plan (2004b), this species is now considered extirpated from the main stems of the Cumberland and Tennessee Rivers. During the Corps' annual 2014 survey associated with the March 2014 BO, one Cumberlandian combshell specimen, approximately 9 year of age, was recorded in the affected reach of the BSF.

- **Cumberland Elktoe (*Alasmidonta atropurpurea*)**
  The Cumberland elktoe is currently found in 12 tributaries of the Cumberland River: Laurel Fork, Marsh Creek, Sinking Creek, Big South Fork, Rock Creek, North White Oak Creek, Clear Fork, North Prong Clear Fork, Crook Creek, White Oak Creek, Bone Camp Creek, and New River (FWS, 1991). Cumberland elktoe is typically found in medium-sized rivers and possibly into the headwater streams where it is often the only mussel present (Gordon and Layzer 1989). The Cumberland elktoe is typically found in relatively shallow flats, with sand and scattered cobble, and slow imperceptible currents (Paramelee and Bogan, 1998).

- **Fluted Kidneyshell (*Ptychobranchus subtentum*)**
  The fluted kidneyshell is typically found in sand and gravel substrates of riffle areas with fast current in small rivers and large creeks (Parmalee and Bogan 1998).Fish thought to be host for Fluted Kidneyshell glochidia are; rainbow darter (*Etheostoma caeruleum*), fantail darter (*Etheostoma flabellare*), barcheek darter (*Etheostoma obeyense*), redline darter (*Etheostoma rufilineatum*) (Wilson, 2008).

  The fluted kidneyshell was listed as endangered and critical habitat was added to the federal Endangered Species Act in 2013 (FWS). The critical habitat designation added in 2013 includes 24 units covering approximately 1181 river miles (1899 kilometers) in Alabama, Kentucky, Tennessee and Virginia (FWS 2013a). Specific to the Cumberland River system, these units are located in the upper reaches of tributaries within Dale Hollow Lake and Lake Cumberland: Jackson, Laurel, McCreary, Pulaski, Rockcastle and Wayne Counties, Kentucky and Fentress, Overton and Pickett Counties, Tennessee.

- **Littlewing Pearlymussel (*Pegais fibula*)**
  The littlewing pearly mussel was added to the federal list of endangered species in 1988 (FWS 1988). The littlewing pearlymussel occurs in riffle or run sections

of high-gradient streams, either under large, flat rocks or exposed on the surface of sand and gravel substrates (Ahlstedt in Neves 1991, Parmalee and Bogan 1998). Several species of fish are reported to serve as host include Black Sculpin (*Cottus baileyi*), Emerald Darter (*Etheostoma baileyi*), and the Greenside Darter (*Etheostoma blennioides*) (Wilson, 2008). This species is considered to occur in small river and creek habitats.

- **Oyster Mussel (*Epioblasma capsaeformis*)**
  This mussel inhabits medium size rivers and sometimes large rivers containing sand, gravel, cobble to boulder substrate (FWS, 2004b) however, Mirarchi et al (2004) noted that populations have been found in substrate containing gravel and some mud. This species prefers swift currents and a water depth of less than 3 feet (Parmalee and Bogan, 1998) and has been found in association with water willow (*Justicia Americana*) beds (FWS, 2004b). Potential fish hosts (FWS, 2004b) include the Banded sculpin (*Cottus carolinae*), Black sculpin (*Cottus baileyi*), Mottled sculpin (*Cottus bairdi*), Redline darter (*Etheostoma rufilineatum*), Wounded darter (*Etheostoma vulneratum*), Bluebreast Darter (*Etheostoma camarum*), Spotted darter (*Etheostoma maculatum*), and Dusky darter (*Percina sciera*). According to TVA (2003), since the 1970's, live individuals have been found in the Big South Fork and Buck Creek (Cumberland River watershed) and the Clinch, Duck, Little, Little Pigeon, Nolichucky, North Fork Holston, Paint Rock, Powell and Sequatchie Rivers (Tennessee River watershed). In Kentucky, sporadic collections occur in the upper Cumberland River below Cumberland Falls (KCWCS, 2005).

  The Oyster Mussel was federally listed as Endangered in 1997 and a recovery plan was written in 2004 (FWS, 2004b). Seven units of critical habitat have been identified within the Cumberland and Tennessee River watersheds and are located on segments of Bear and Buck Creeks; Duck, Nolichucky, and Powell Rivers; the Clinch River and its major tributaries; and the Big South Fork and its tributaries (FWS, 2004c). Oyster mussels are now only found in segments of the Duck, Nolichucky, and Clinch Rivers and is considered eliminated from the entire Cumberland River system and eliminated from the entire Tennessee River main stem and most of its tributaries (FWS, 2004b, 2004c). A nonessential experimental population (NEP) for 16 mussels including the Oyster Mussel has been established below Wilson Dam in Colbert County, Alabama (FWS, 2001b). This area is located between Tennessee River miles (TRM 259.4 - 246.0) and includes the lower 5 mile reaches of tributaries entering the Wilson Dam tailwaters (FWS, 2001b) that, under Section 10(j) of the Endangered Species Act, cannot be designated as critical habitat for a NEP (FWS, 2001b).

- **Pink Mucket (*Lampsilis abrupt)***
  The Pink Mucket was federally listed in 1976 and a recovery plan was written in 1985 (ESIS, 1996e). The Pink mucket is a wide ranging Interior Basin species historically inhabiting the Mississippi, Ohio, Cumberland, and Tennessee Rivers (Parmalee and Bogan, 1998) in the states of Louisiana Arkansas, Missouri, Illinois, Indiana Ohio, Pennsylvania, West Virginia, Virginia, Kentucky, Tennessee, and Alabama (FWS, 1997b). Pink muckets have been found in medium to large rivers, and riverine sections of impoundments (TVA, 2003). They have been collected in habitat ranging from silt to boulders, but the more typical habitat consists of cobble, gravel and sand with individuals found in water depths ranging from 0.8 to 8 m (2.6 – 26.2 feet) deep (ESIS, 1996e).

- **Spectaclecase (*Cumberlandia monodanta*)**
  Spectaclecase was historically widespread and found in 15 states and 45 streams now are thought to only occur in 10 states and 20 streams (USWFS, 2007). Although species evidence is absent for hundreds of mile of river systems, some strong populations can be found in the Meramec and Gasconade Rivers in Missouri, in the St. Croix River in Minnesota/Wisconsin, and possibly the Upper Clinch River in Tennessee (FWS, 2007). Spectaclecase are typically found in medium to large rivers in riffle and shoal areas with gravel, sand, and mud substrates. Extant populations are known to be located in 20 streams and in 10 states. In 2003, this species was present in 20 different river segments in Alabama, Arkansas, Illinois, Iowa, Kentucky, Minnesota, Missouri, Tennessee, Virginia, and Wisconsin with stable populations found in Meramec and Gasconade Rivers in Missouri, in the St. Croix River in Minnesota/Wisconsin, and perhaps also in the Upper Clinch River in Tennessee (FWS, 2003).

- **Fanshell (*Cyprogenia stegaria*)**
  The fanshell is an Interior Basin species (Parmalee and Bogan, 1998). This mussel was historically found in the Ohio, Wabash, Cumberland, and Tennessee, Rivers and their large tributaries (TVA, 2003) in Pennsylvania, West Virginia, Ohio, Indiana, Illinois, Kentucky, Tennessee, Alabama, and Virginia (FWS, 1991b). Fanshells have been collected in habitats containing course sand and gravel (Mirarchi et. al., 2004). Individuals have been found in water depths ranging from less than 3 feet (Parmalee and Bogan, 1998) to over 9 feet deep (Mirarchi et. al., 2004). The fanshell was federally listed as an Endangered species in 1990 and a recovery plan was written in 1991 (FWS, 1991b).

- **Tan Riffleshell (*Epioblasma florentina walkeri*)**

E. f. walkeri was added to the federal endangered species list in 1977 (FWS 1977). This subspecies (or form) is thought to be the eastern headwaters expression of *Epioblasma florentina* (*florentina*, if a subspecies); another subspecies (or form), *Epioblasma florentina curtisi*, occurred in headwater streams in southwestern Missouri and northwestern Arkansas (Parmalee and Bogan 1998). The historic distribution of this complex was limited to the Cumberland and Tennessee River systems in Alabama, Kentucky, Tennessee, and Virginia, and the White and St. Francis River systems in Missouri and Arkansas (FWS 1984, FWS 1986). Since the early 1970s, several individuals of the *E. f. walkeri* have been found in the Middle Fork Holston River (FWS 1984), in the upper Clinch River (Rogers, et al 2001) and, apparently, in the Big South Fork of the Cumberland River (Ahlstedt 2002). Individuals identified as this species also have been found in the Duck and Hiwassee rivers (Jenkinson 1988, Parmalee and Hughes 1994, respectively) and in a Hiwassee River tributary (TVA Heritage database record). Critical habitat has not been identified for this species. This species is considered to occur in small rivers and larger creeks.

- **Purple Cat's Paw (*Epioblasma obliquata obliquata*)**
  Catpaw's is thought to live in swift moving areas in medium to large rivers (Parmalee and Bogan, 1998). Historically Catpaws was found in tributaries of St. Clair and Erie Lake of ther Great Lake basin (Williams, 2007). It was found in most of the Ohio River drainages, the lower reaches of the Tennessee River, and the Cumberland River drainages (Parmalee and Bogan, 1998). Catspaw was listed as endangered by the FWS in 1990. In the late 1970s, an live species was captured from the Cumberland River, but a live species has not been reports since (Parmalee and Bogan, 1998). In 2001, Catspaw was approved for an Experimental Population to be reintroduced in the tailwaters of Wilson Dam, but no reintroductions have been made as of 2007 (Williams, 2007)

- **Rough Pigtoe (*Pleurobema plenum*)**
  Rough pigtoes are Interior Basin species (Parmalee and Bogan, 1998). Historically it was collected within the Ohio, Tennessee, and Cumberland River drainages in Alabama, Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Missouri, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia (ESIS, 1996d). Rough pigtoes were historically found in medium to large rivers with a firmly packed gravel and sand substrate (Parmalee and Bogan, 1998). Specimens have been collected in muddy sand in the Green River and sand in the Clinch River in water depths of 0.8 m (2.6 ft) and 1.0 m (3.3 ft) respectively (ESIS, 1996d). Relic individuals have been collected from water depths ranging

between 3.7 – 4.6 m (12 - 15 feet) deep in the Cumberland River in Smith County, Tennessee (Parmalee and Bogan, 1998).

The Rough Pigtoe was federally listed in 1976, and a recovery plan was written in 1984 (ESIS, 1996d). According to the FWS (1984b) the Rough pigtoe has been collected from 20 sites in the Green, Barren, Clinch, Tennessee, and Cumberland River systems. On the Cumberland, relic individuals were collected in Smith and Trousdale Counties in Tennessee and on the Tennessee River, upstream Chattanooga, Tennessee (Parmalee and Bogan, 1998). TVA (2003) encountered rough pigtoes in flowing reaches downstream of Pickwick, Wilson, Guntersville, and Watts Bar dams, and in the upstream reaches of Pickwick and Wheeler Reservoirs. In Alabama, rare, extant populations exist below Wilson Dam tailwaters and possibly below Guntersville Dam tailwaters on the Tennessee River (Mirarchi, et. al., 2004). In Kentucky, Rough pigtoes sporadically occur in the Green and Barren Rivers (KCWCS, 2005). In Tennessee, only a few relict specimens exist in remaining mussel beds of the lower Clinch and Holston rivers; and throughout the Tennessee and upper Cumberland Rivers (TABS, 2005f). The National Park FWS (NPS) (2003a) plans to propagate and restore freshwater mussels in a reach of the Green River near the Mammoth Cave National Park that is inhabited by seven federally endangered mussels including the Rough Pigtoe.

- **Orangefoot Pimpleback (*Plethobasus cooperianus*)**
  Historically it was found in parts of the Ohio, Cumberland, Tennessee and Wabash Rivers in the states of Alabama, Indiana, Kentucky, Ohio, Pennsylvania, and Tennessee (ESIS, 1996c). The species was once commonly found in the shoals of medium to large rivers with sand and gravel substrate (ESIS, 1996c). The Orangefoot pimpleback was federally listed in 1976 and a recovery plan was written in 1984 (ESIS, 1996c).

  Since the 1970s, it was found in the lower Ohio, middle reach of the Cumberland River, and flowing reaches of the Tennessee River (TVA, 2003). In recent years, a few individuals have been located in the tailwaters of Kentucky, Pickwick, Wilson, Guntersville, Watts Bar, and Fort Loudoun Dams with the most individuals encountered below Pickwick Dam (TVA, 2003). On the Cumberland River, populations were once commonly found from Clay to Stewart Counties, however, in 1980, only a relic population was identified in Smith County, Tennessee on the Cumberland River (Parmalee and Bogan, 1998; TABS, 2002f). Living individuals are now restricted to a few places on the Tennessee River and limited reproduction appears to be taking place in Hardin County, Tennessee

(TABS, 2002f), where Mirarchi et. al.(2004) noted the presence of Orangefoot pimplebacks in the tailwaters of Pickwick Dam. In Alabama, the Orangefoot pimpleback has not been reported since 1979 but it may exist in very few numbers below Wilson or Guntersville Dams (Mirarchi et. al., 2004). In Kentucky, (KCWCS, 2005) the Orangefoot pimpleback is sporadically found in the lower Ohio and Tennessee Rivers in western Kentucky. The National Park FWS (2003) plan to reintroduce the Orangefoot Pimpleback into the upper Cumberland River system in the Big South Fork National River and Recreational Area in Kentucky and Tennessee.

- **Virginia spiraea (*Spiraea virginiana*)**
  S. virginiana was listed as threatened in 1990, is a rare shrub that inhabits frequently disturbed, high gradient sections of second and third order streams (FWS 1990). It occurs "within the southern Blue Ridge and Appalachian (Cumberland) Plateaus physiographic provinces in the headwaters, or just over the divide, of streams that flow to the Ohio drainage basin" (FWS 1992). Historically, the species was known to occur in 39 populations in nine states ranging from southwestern Pennsylvania and south-central Ohio southwest along the Appalachian highlands to northwestern Georgia, with outlier sites in northwestern Alabama and central Kentucky (FWS 1992). Critical habitat has not been designated for this species.

  Virginia spiraea is no longer known to occur in Alabama or Pennsylvania and several populations in the other states have been extirpated. The only documented cause of extirpation of *Spiraea virginiana* has been human activity (FWS 1992). These actions include the impoundment of streams, road construction activities, and development. The species' present distribution includes 31 populations in seven states. Most of these populations are protected and are stable (FWS 2003).

  Populations of Virginia spiraea face several natural threats, in addition to human activities. The species exhibits poor capabilities for sexual reproduction, which complicates colonization of new sites by seed. As a consequence of mostly reproducing vegetatively, genetic diversity is low throughout its range and as few as 20 genotypes are known. Genetic fixation of the clonal material may have adverse effects on the breeding potential of the species in the future (FWS 1992). Invasive species such as Chinese privet (*Ligustrum sinense*), Japanese knotweed (*Polygonum cuspidatum*), Japanese meadowsweet (*Spiraea japonica*), and Multiflora rose (*Rosa multiflora*) could also be detrimental to populations of

Virginia spiraea. Virginia spiraea is considered to occur in gravel bars in large creeks or rivers.

- **Cumberland sandwort (*Arenaria cumberlandensis*)**
  Cumberland Sandwort was listed as Endangered in 1988 by the FWS under the ESA. Cumberland Sandwort is a member of the pink family (Caryophyllaceae). There are currently only nine know populations of Cumberland sandwort, one in Kentucky and the rest within Tennessee (FWS 1992). All nine populations are within the Big South Fork River watershed (FWS 1992).

  Present threats to the Cumberland Sandwort are due to human interaction such as, caving, camping, trampling, hiking, rappelling, and digging. Because of these threats to the survival of the Cumberland Sandwort a recovery plan was completed in 1996 (FWS 1992). Within Pickett State Park steps have been set forth to try and lesson the impacts to the Cumberland Sandwort. Boardwalks, fencing, and posting informational sign to keep people from trampling and disturbing the habitat have been emplaced and seem to have been very successful (FWS 1992).

- **Cumberland rosemary (*Conradina verticillata*)**
  Cumberland Rosemary was listed as endangered in 1991 by the FWS under the Endangered Species Act. There are currently seven populations of Cumberland Rosemary all of which are found within the Cumberland Plateau streams in Cumberland, Fentress, Morgan, Scott, and White Counties in Tennessee and McCreary County, Kentucky (Carman 2001).

  The only known cause of extirpation is inundation as a result of reservoir construction for recreational or hydroelectric purposes (FWS 1996). Although intolerant of prolonged inundation, the species is dependent upon yearly flooding that may reduce or eliminate competing vegetation along and in stream corridors. Additional threats include destruction of plants and habitat by campers, horseback riders, ATVs, and white-water rafters (FWS 1996). The mining of coal and exploration of gas and oil in the area may also adversely affect the species because those activities contribute to water pollution through sediment and fragment deposition and the leaching of chemicals from those particles (FWS 1996).

Appendix D

Planting List and Schematics

Permanent Grass Seeding

The following seed mixtures are for Permanent Grass seeded areas. Seed mix is to be planted between 1 Aug and 1 Dec or 15 Feb and 15 May. If these seeding dates cannot be met, then a temporary cover as listed should be planted. No seeding shall be performed between 01 December and 15 February or between 15 May and 1 Aug for permanent grasses.

Permanent Wetland and Riparian Seed Mix

Permanent wetland and riparian seed mix should be similar to Roundstone Native Seed Mix 202 – Native Passive Acid Mine Wetland Mix (excluding Button Bush (*Cephalanthus occidentalis*) and Giant Bur Reed (*Sparganium eurycarpum*). Recommend planting rate of 7lbs per acre. A list of species and rate of planting is required for review prior to planting. No plantings will take place until seed mix is approved by USACE biologist.

Mix 202 – Native Passive Acid Mine Wetland Mix

Scientific Name	Common Name	Planting Guide (PLS Oz.)
Elymus virginicus	Virginia Wild Rye	4.60
Panicum clandestinum	Deer Tongue Grass	2.60
Panicum rigidulum	Red Top Panicum	1.75
Carex lurida	Shallow Sedge	1.00
Carex vulpinoidea	Fox Sedge	2.00
Carex frankii	Frank's Sedge	1.00
Carex crinita	Nodding Sedge	1.10
Juncus effusus	Soft Rush	0.30
Scirpus cyperinus	Wool Grass	0.15

Permanent Grass Mix for All Remaining Areas

Permanent grass mix for all remaining areas should be similar to the listed plants below. Recommended planting rate of 9.00lbs per acre. A list of species and rate of planting is required for review prior to planting. No plantings will take place until seed mix is approved by USACE biologist.

Scientific Name	Common Name	Planting Guide (PLS Oz.)
Sorghastrum nutans	Indian Grass	3.125
Schizachyrium scoparium	Little Bluestem	3.125
Panicum virgatum	Switchgrass (Cave-in-Rock)	1.875
Sporobolus compositus	Tall Dropseed	1.875
Rudbeckia hirta	Blackeyed Susan	0.472
Coreopsis major	Greater Tickseed	0.598
Monarda fistulosa	Wild Bergamot	0.136
Cassia fasciculata	Partridge Pea	1.366
Heliopsis helianthoides	False Sunflower	1.14
Liatris squarrosa	Scaly Blazing Star	0.392

Heliopsis maximiiana	Maximilian Sunflower	0.626
Vernonia gigantea	Giant Ironweed	0.261
Solidago erecta	Showy Goldenrod	1.33

Temporary Seeding
No plantings will take place until seed mix is approved by USACE biologist.

Temporary Winter Seed Mix to be planted between 1 Dec and 15 Feb:

Scientific Name	Common Name	Planting Guide
	Winter Oats	15 lbs/acre
	Annual Rye	5 lbs/acre

Temporary Summer Seed Mix to be planted 15 May to 1 Aug

	German Millet	40 lbs/acre
	Sudan Grass	40 lbs/acre

Upland Area Plantings

Plantings will be along the d upland areas to include; top of bank of Blue Heron Spoils, along stream banks of Unnamed Tributary 3 Concrete Line Channel (whenever possible), and along access routes no longer in use as identified in the Landscaping Plan drawings. Trees shall be planted on 10' centers. See additional notations on 02-BC-64/57 and 64/58 for planting guidelines and restrictions. Layout plan as described in paragraph 1.5.6 Layout of Planting shall be provided to the Contracting Officer for approval prior to starting work. No plantings will take place until seed mix is approved by USACE biologist. Plants are to be alternated with even ratios.

Upland Area Plant Species:

SCIENTIFIC NAME	COMMON NAME	PLANTING GUIDE
Quercus alba*	White Oak	200 stems/acre
Carya ovata*	Shagbark Hickory	
Nyssa sylvatica*	Blackgum	
Quercus rubra*	Northern Red Oak	

APPENDIX E

Public Review Comments