Section 202 Levisa Fork
(Floyd County, Kentucky)
Flood Damage Reduction Project

SUMMARY OF ECOLOGICAL RESOURCE IMPACTS AND PROPOSED MITIGATION

For Proposed Structural Measures

Prepared for:

U.S. Army Corps of Engineers, Huntington District
502 Eighth Street
Huntington, West Virginia 25701-2070

Prepared by:

AMEC Earth & Environmental, Inc.
659 High Street, Suite 201
Worthington, Ohio 43085
(614) 430-0487

Contract # DACW69-03-D-0004
Work Order 0009

March 2006

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CONTENTS

TABLES

FIGURES

CHARTS

APPENDICES

Section 202 Levisa Fork (Floyd County, Kentucky)
Flood Damage Reduction Project
Summary of Ecological Resource Impacts and Proposed Mitigation
For Proposed Structural Measures

1.0 INTRODUCTION

1.1 Project Background

Floyd County, Kentucky is located within the Appalachian Mountains of Eastern Kentucky, in the watershed of the Levisa Fork of the Big Sandy River. Many communities within the floodplain of the Levisa Fork and its tributaries were devastated by the April 1977 flood, which is the flood of record for much of the region. Congressional reaction to this flood event resulted in legislation that mandated implementation of flood damage reduction measures within the region. The Levisa Fork (Floyd County, Kentucky) Flood Damage Reduction Project was initially authorized by Section 202 of the 1982 Water and Energy Development Appropriations Act (WEDAA).

The Huntington District of the Corps of Engineers (USACE) initiated the flood damage reduction study for Floyd County in 2002. The project's purpose is to develop a cost effective, socially acceptable, and environmentally sound plan to reduce financial and personal losses, and social and economic disruptions within the Floyd County portion of the Levisa Fork Basin.

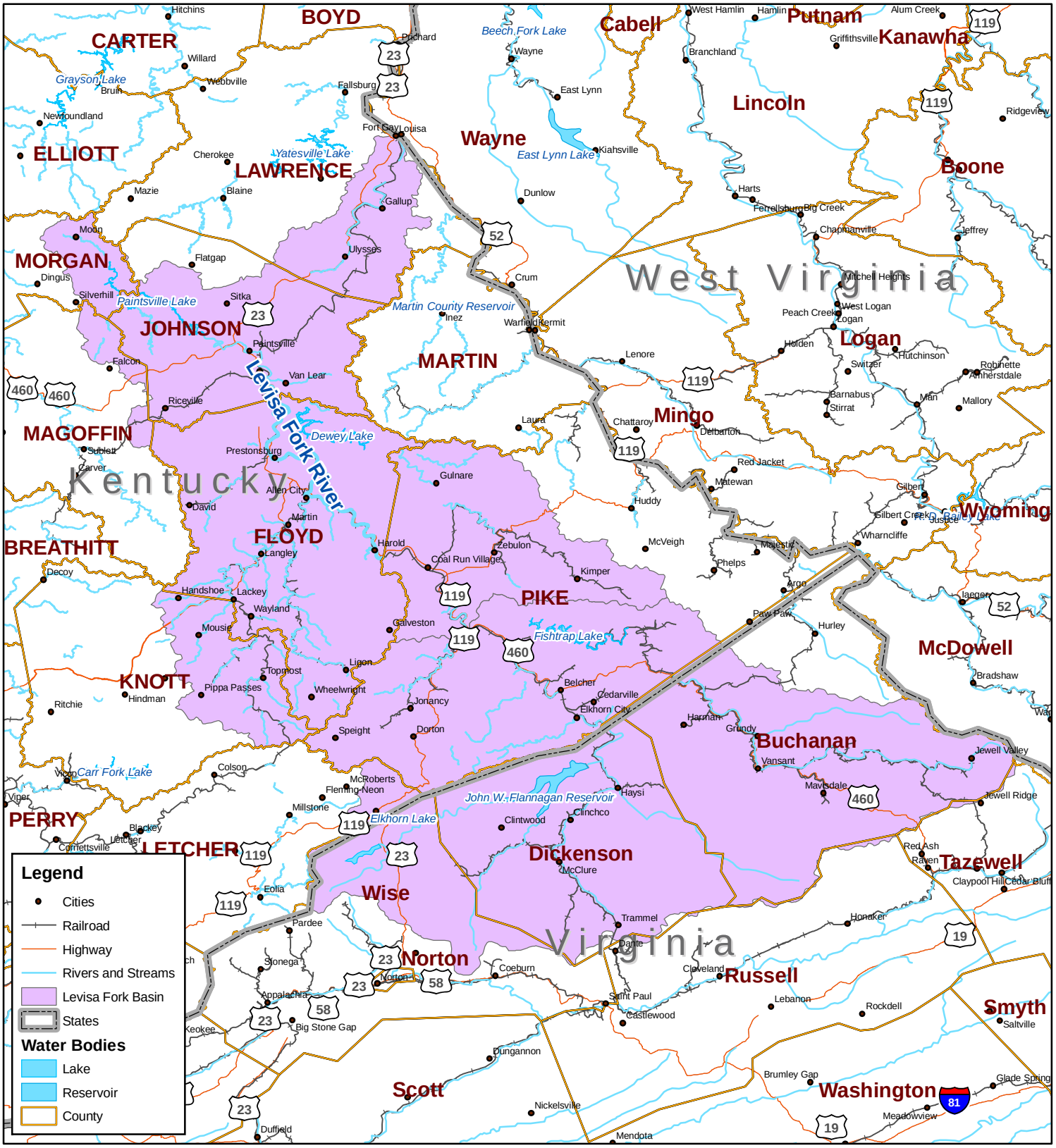
1.2 Study Area

The Section 202 Environmental Impact Statement (EIS) study area includes those floodplain areas that would be affected by a recurrence of the April 1977 flood within the Levisa Fork basin in Pike County, Kentucky. Excluded from the study area is the floodplain located within the Town of Martin floodwall protection area. A general map of the Section 202 study area is shown as **Figure 1**. The study area, primarily residential in nature, includes incorporated areas of Prestonsburg, Allen, Wayland, and Wheelwright, and unincorporated areas in Floyd County.

Based on the high estimated number of eligible structures and the size of the project area, the study area was divided into three implementation phases as described below and shown in Figure 1. Each will be detailed in a separate Detailed Project Report (DPR).

DPR 1 – Prestonsburg and Lower Levisa Fork: The first phase includes incorporated Prestonsburg and the area along the Levisa Fork downstream of Prestonsburg to the County boundary. This area is has Floyd County's densest development, with an estimated 1,300 eligible structures. The USACE is proposing both structural and nonstructural flood damage reduction measures within the Phase 1 area. A floodwall is proposed within the City of Prestonsburg.

DPR 2 – Mainstem – Upper Levisa Fork: The second phase includes the area upstream from Prestonsburg along the Levisa Fork. This area encompasses the remaining areas of most severe flooding, with an estimated 2,000 eligible structures. Only nonstructural flood damage reduction measures are proposed within the Phase 2 area.


BOYD
CARTER
ELLIOTT
LAWRENCE
MORGAN
JOHNSON
MAGOFFIN
BREATHITT
FLOYD
KNOTT
PERRY
LETCHER
PIKE
MARTIN
Wayne
Lincoln
Cabell
Putnam
Kanawha
Boone
Logan
Mingo
Wyoming
McDowell
Buchanan
Tazewell
Dickenson
Wise
Norton
Russell
Smyth
Washington
Scott
West Virginia
Kentucky
Virginia
Levisa Fork River
Dewey Lake
Fishtrap Lake
John W. Flannagan Reservoir
Martin County Reservoir
Paintsville Lake
Yatesville Lake
Beech Fork Lake
East Lynn Lake
Grayson Lake
Carr Fork Lake
Elkhorn Lake
Legend
Cities
Railroad
Highway
Rivers and Streams
Levisa Fork Basin
States
Water Bodies
Lake
Reservoir
County
Location Map
Levisa Fork Basin
Floyd County, KY
Notes
Figure 1
Projection: Kentucky Stateplane - South, NAD 27, US foot
Imagery courtesy of USACE- Huntington District
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amec
0 3 6 12 18
Miles

DPR 3 – Tributaries: The third phase includes remaining areas not included in DPRs 1 and 2, with an estimated 1,000 eligible structures. Only nonstructural flood damage reduction measures are proposed within the Phase 3 area.

1.3 Scope of Report

USACE is evaluating four alternatives for flood protection within Floyd County, as shown in **Table 1**. Alternative Plans 2, 3, and 4 each include voluntary nonstructural measures such as raising-in-place, evacuation, and floodproofing to provide flood damage reduction. In addition, Alternative Plan 2, the tentatively selected alternative, and Alternative Plan 3 each include a floodwall in the DPR-1 area within Prestonsburg, Kentucky. A complete description of the alternative development process is included in the Detailed Project Report-1/Draft Environmental Impact Statement (DPR-1/DEIS).

Table 1. Alternative Plans

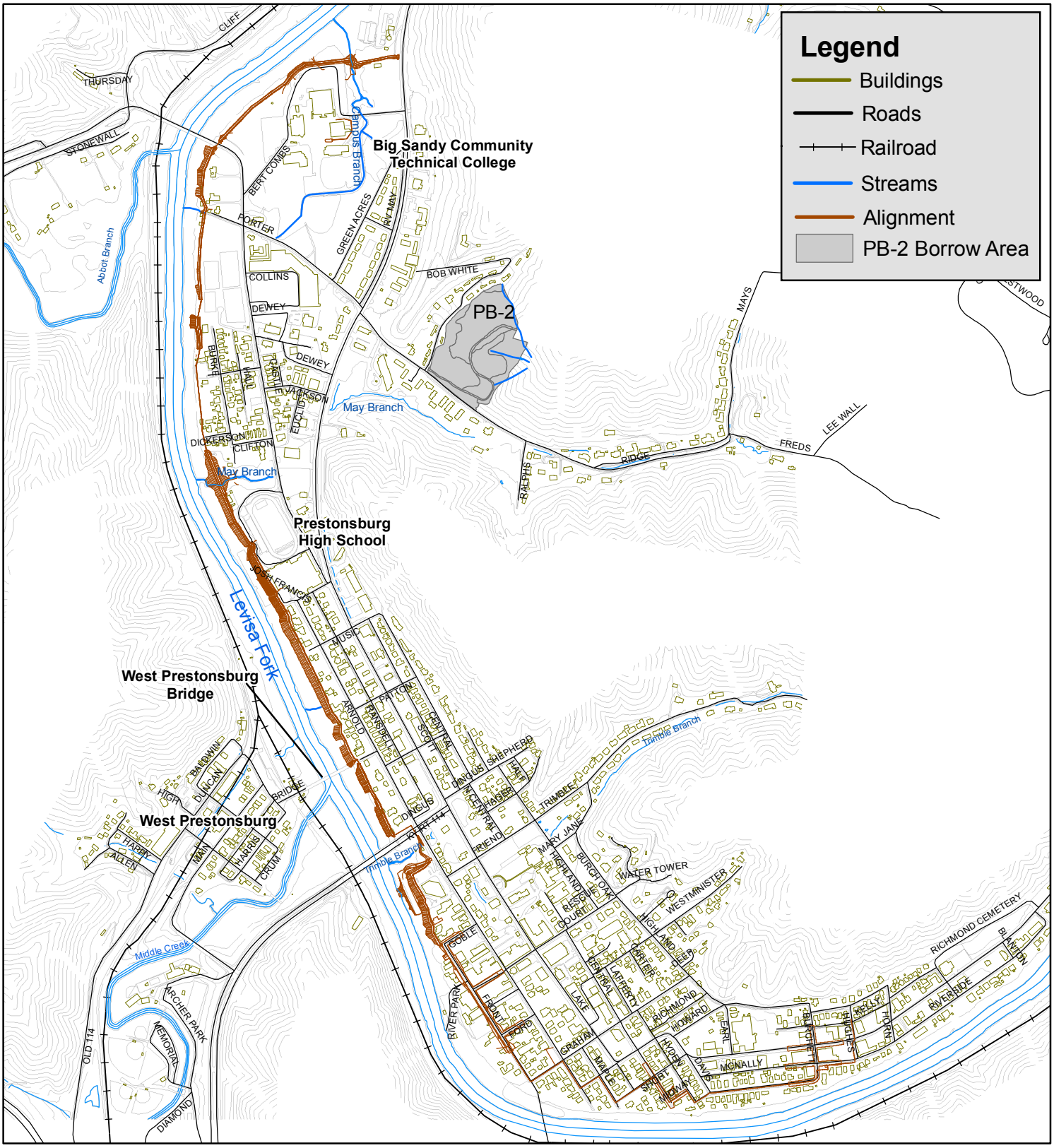
Alternative Plan No.	Name	Description
1	No Federal Action	No action by the Federal government to implement flood damage reduction program
2 *	Long Wall Ending at Big Sandy Community and Technical College plus Nonstructural Program	Includes floodwall plus voluntary nonstructural program. Floodwall alignment protects downtown Prestonsburg, Blackbottom neighborhood and Big Sandy Community and Technical College
3	Long Wall Ending at Blackbottom plus Nonstructural Program	Includes floodwall plus voluntary nonstructural program. Floodwall alignment protects downtown Prestonsburg and Blackbottom neighborhood.
4	Total Nonstructural Program	Includes voluntary nonstructural program only.
* *Tentatively Selected Alternative*		

This report summarizes ecological secondary source review, field investigations, impact assessment, and mitigation alternatives for the structural portion (Prestonsburg) of Alternative Plans 2 and 3 of DPR-1. The report has been prepared in response to a request for additional information regarding impacts from proposed floodwalls and proposed mitigation from the U.S. Fish and Wildlife Service and state agencies. Impacts and proposed mitigation for the evaluated alternatives are discussed.

2.0 PROPOSED STRUCTURAL MEASURES

2.1 Alternative Plan 2: Long Floodwall Ending at Big Sandy Community and Technical College

The proposed structural component would protect infrastructure, roadways, homes, and businesses in most of Prestonsburg through a combination of the floodwall, gates, raised roadways, curbs, and small wall sections in the downtown area. The plan's floodwall would prevent Levisa Fork overtopping in the Blackbottom area, which now causes flooding in the central business district as well as in Blackbottom. The floodwall would also extend to protect the Big Sandy Community and Technical College (BSCTC) and its campus. The floodwall alignment is shown in **Figure 2**.



Structural Measure #4 (Long Floodwall Ending At Big Sandy Community and Technical College)

Prestonsburg, KY

Notes

Figure 2

Projection: Kentucky Stateplane - South, NAD 27, US foot
Imagery courtesy of USACE- Huntington District

W:\USACE\Floyd-EIS\MXD\March2006\Fig4-2LongWall_CollegeStabil.mxd Mar. 10, 2006 DNB

amec

0 500 1,000 1,500 Feet

The floodwall extends around the downtown Prestonsburg area and ties into high ground upstream of the wastewater treatment plant, providing protection to downtown Prestonsburg, the Blackbottom neighborhood, and the BSCTC. The plan would also separate stormwater and wastewater collection in the downtown area, leading to a reduction in stormwater backup.

The alignment begins at the intersection of South Lake Drive and Hughes Street, and follows Riverside Drive, Central Avenue, and South Front Street consisting of 1,662 feet of gravity wall, eight stoplog closures at driveways with two stoplog storage buildings, and raised roadway pavement. To completely tie off the main downtown, a few sections of road will have to be raised in addition to constructing curbs and small wall sections.

The floodwall length would be approximately 14,600 feet, with wall heights ranging from less than one foot to 11 feet tall. A one-foot superiority is included in the wall height.

This alignment extends around the downtown area and ties into high ground before reaching the wastewater treatment plant and protects to the one percent chance event. The upstream section of the Long Wall alignment achieves this level of protection by raising roadways and construction of a gravity wall up to 2.5 feet in height.

An I-wall floodwall begins near Goble Street and follows the top of riverbank for 900 feet transitioning into an existing levee, which will be raised, near the existing downtown pump station. This section of I-wall averages 5 feet in height and has two pedestrian gate closures and one 24-foot wide by 5.2-foot tall gate closure at the access road to the lower bank parking area.

The existing downtown pump station would be upgraded with a 400 kilowatts (KW) generator to provide backup power. A new 5 foot by 5 foot box culvert 1,705 foot long would be constructed to collect interior drainage in the downtown area and transport it to the existing pump station.

The I-wall begins again on the downstream side of KY 114, the main access into downtown Prestonsburg, and continues for 8,272 feet along the top of the riverbank ending in the KY 321 embankment, just upstream of the wastewater treatment plant. This section of I-wall averages 8 foot in height and would have eight pedestrian openings and two 24 foot wide by 9.2 foot tall gate closures for access to the Prestonsburg High School lower parking area.

A new 108,000 gallons per minute (gpm) natural gas-powered pumping station would be located just downstream of the high school to pump the interior drainage over the floodwall during flood events. Additionally a gate well and ponding area would be required at the downstream end of the project between the BSCTC and the waste water treatment plant.

Property acquisition would extend to the edge of the Levisa Fork along the alignment. Landward of the floodwall, disturbed areas would be restored to at least their current condition in consultation with Floyd County and the City of Prestonsburg regarding the land's intended use.

2.2 Alternative Plan 3: Long Floodwall Ending at Blackbottom

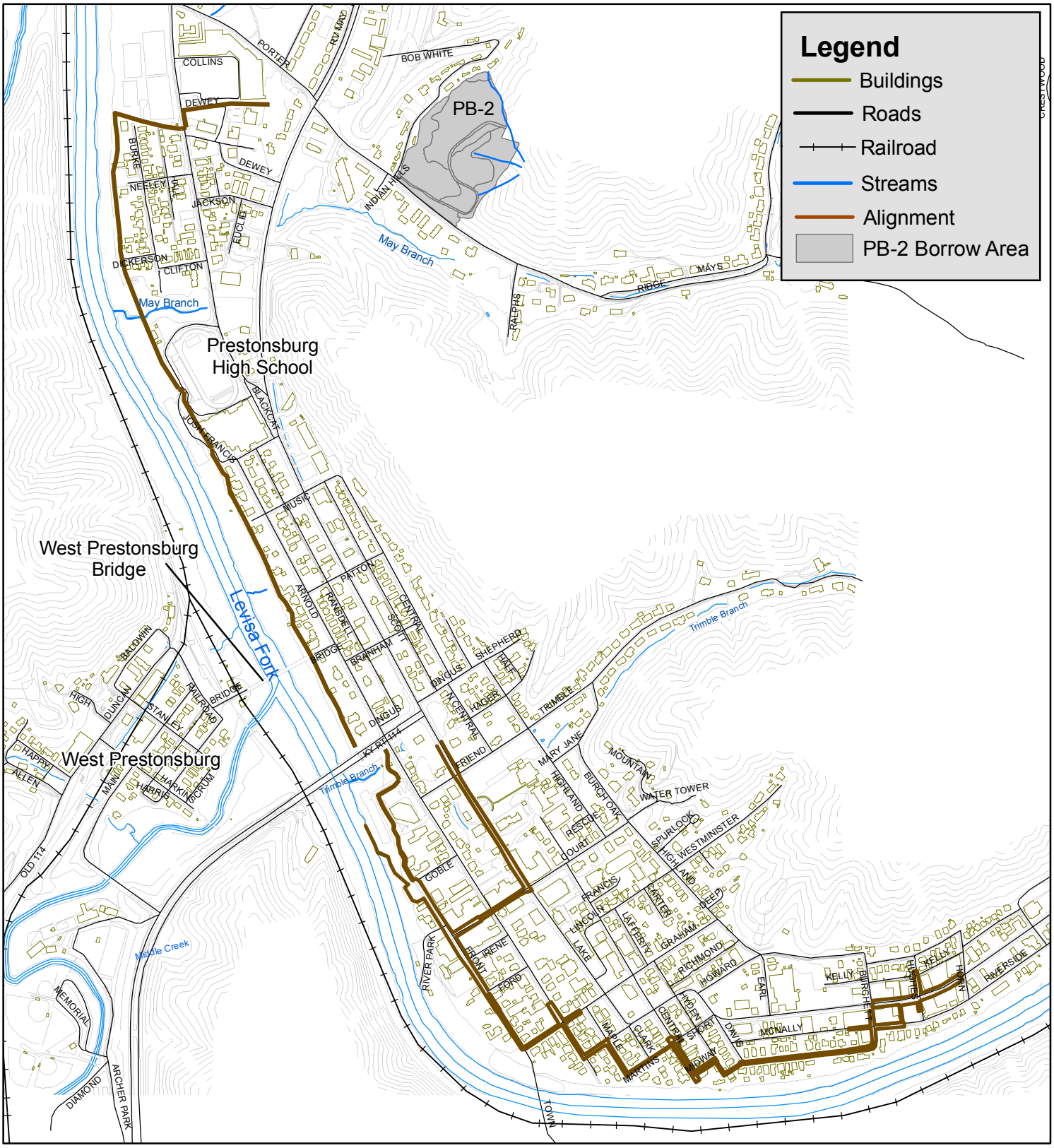
The proposed structural component would protect infrastructure, roadways, homes, and businesses in most of Prestonsburg through a combination of the floodwall, gates, raised roadways, curbs, and small wall sections in the downtown area. The plan's floodwall would prevent Levisa Fork overtopping in the Blackbottom area, which now causes flooding in the central business district as well as in Blackbottom. No flood insurance would be required for structures protected by the floodwall. The floodwall would not protect the BSCTC and its

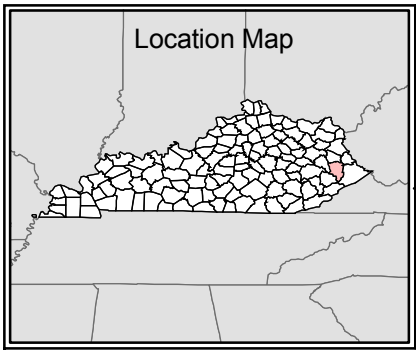
campus. BSCTC would be eligible to participate in the nonstructural program for eligible structures. The floodwall alignment is shown in **Figure 3**.

Outside the floodwall protection area, the voluntary nonstructural program would allow those who participate to reduce or eliminate flood insurance costs (See Alternative Plan 2).

This alignment extends around the downtown area, past the Blackbottom area and then turns away from the Levisa Fork to tie into high ground before reaching the college. The Blackbottom area is lower than the downtown area and is where the Levisa Fork overtops its banks during heavy rainfall events and begins to flood the central part of downtown Prestonsburg. This alignment would protect to the one percent chance event. This alignment would also provide protection to the substation and includes raised road, curbs and small wall sections in the downtown area. Non-structural measures would be used to provide protection for structures outside the floodwall including a ringwall around the science building at the college.

The floodwall length would be approximately 13,000 feet, with wall heights ranging from less than one foot to approximately ten feet tall along this length. A one-foot superiority is included in the wall height.





Structural Measure #5
(Long Floodwall Ending At BlackBottom)

Prestonsburg, KY

Notes

Figure 3

Projection: Kentucky Stateplane - South, NAD 27, US foot
Imagery courtesy of USACE- Huntington District

W:\USACE\Floyd-EIS\MXD\March2006\Fig4-3LongWall_Blackbottom.mxd Mar 10, 2006 DNB

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0 400 800 1,200 Feet

2.3 Slope Protection

The extent of slope protection needed was evaluated for the two feasible structural measures. Stone slope protection would be needed to protect the flood protection system from failure due to erosion of the riverbank. The right descending bank of Levisa Fork through the project generally has a steepened lower slope that ranges from 20 feet in height in the upstream portion of the project to about ten feet near the downstream limits. Slopes of this lower slope vary from 1 vertical:1.6 horizontal to 1vertical:1.9horizontal. These slopes appear only marginally stable and have a limited amount of vegetation. A natural bench or terrace that is between 20 and 60 feet wide is found at approximate elevation 610 feet above mean sea level (AMSL) throughout most of the project. This feature enhances the overall stability of the riverbank slopes and provides a limited buffer against global instability of the riverbank if erosion of the lower slope were to occur. An upper slope then extends from this lower terrace to the top of the riverbank. This slope is generally 20 to 25 feet high and has a slope of about 1 vertical :2 horizontal.

Isolated reaches of lower riverbank slope within the project limits exhibit flow geometries that are generally more conducive to erosion, such as short reaches outside bends in the channel. In other areas, in situ soil shear strength properties are marginal, and erosion of the riverbank would be a concern because of the potential for slope instability concerns. The lower riverbank slopes in both areas would need to be protected using an armored toe consisting of a wedge of 12-inch diameter stone. Applicable locations identified by the design team include the reach between Station 57+00 and 62+00 and between Station 105+00 and 124+00. Vegetation would be removed from the lower slope, and slopes would be graded prior to stone placement. The armored toe would be approximately ten feet wide and five feet high and its foundation would be placed about two feet below the normal river level. Vegetation would be allowed to naturally establish over this armored toe. A typical section of the lower bank stabilization is shown in **Figure 4**.

More numerous reaches of the upper slope would be protected from erosion by using stone. These areas have been identified as having higher potential for localized erosion of the upper slope due to high river velocities. Such erosion can lead to sliding or overturning failures of concrete structures, or slope failures through earthen flood control structures. Upper slopes in all identified reaches would be regraded to a stable geometry before placing a 3-foot thickness of 24-inch stone over a geotextile filter in these areas. This erosion protection system is mostly conventional and more proven than other configurations. The stone on the upper slopes must be kept clear of vegetation to ensure its functionality throughout the project's design life.

Vegetation riverward of the construction work limits would not be cleared for floodwall construction except as needed for construction access and for structural stability of the floodwall. Revegetation of disturbed areas with native species of grasses, wildflowers, shrubs, and trees would follow construction. An approximate 10-foot grassy access bench would be required along the riverward side of the floodwall to maintain a treeless environment along the structure. Disturbed areas and currently non-forested areas riverward of the buffer would be planted and seeded with native tree and shrub species to return the area to passive use and enhance the existing riparian corridor.

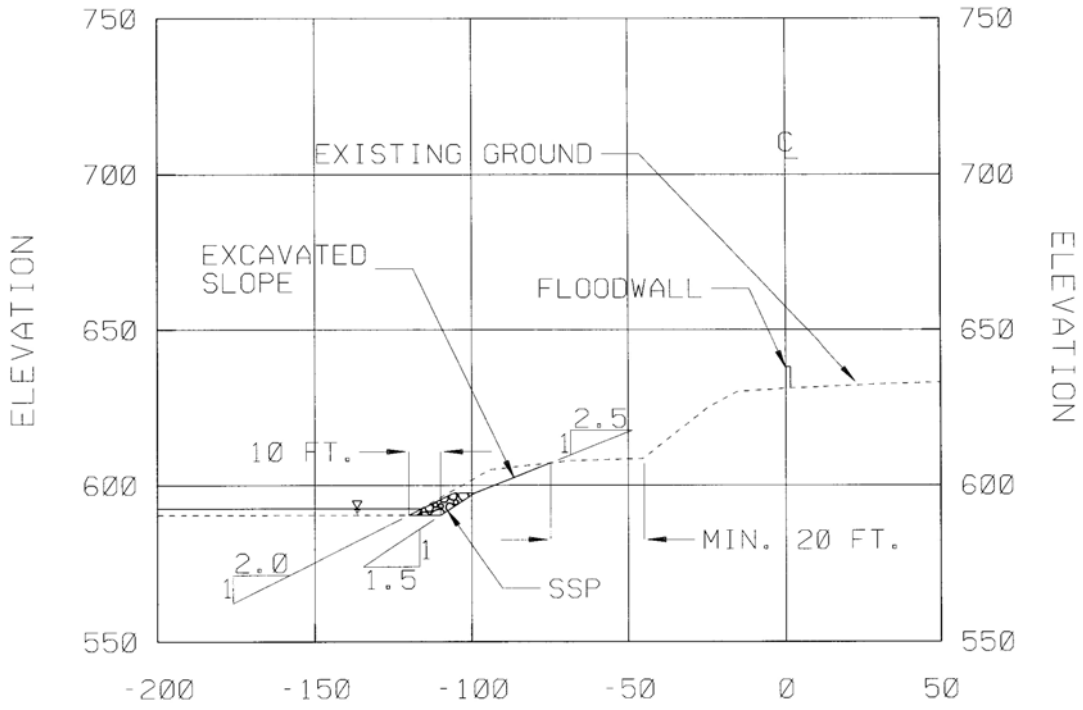
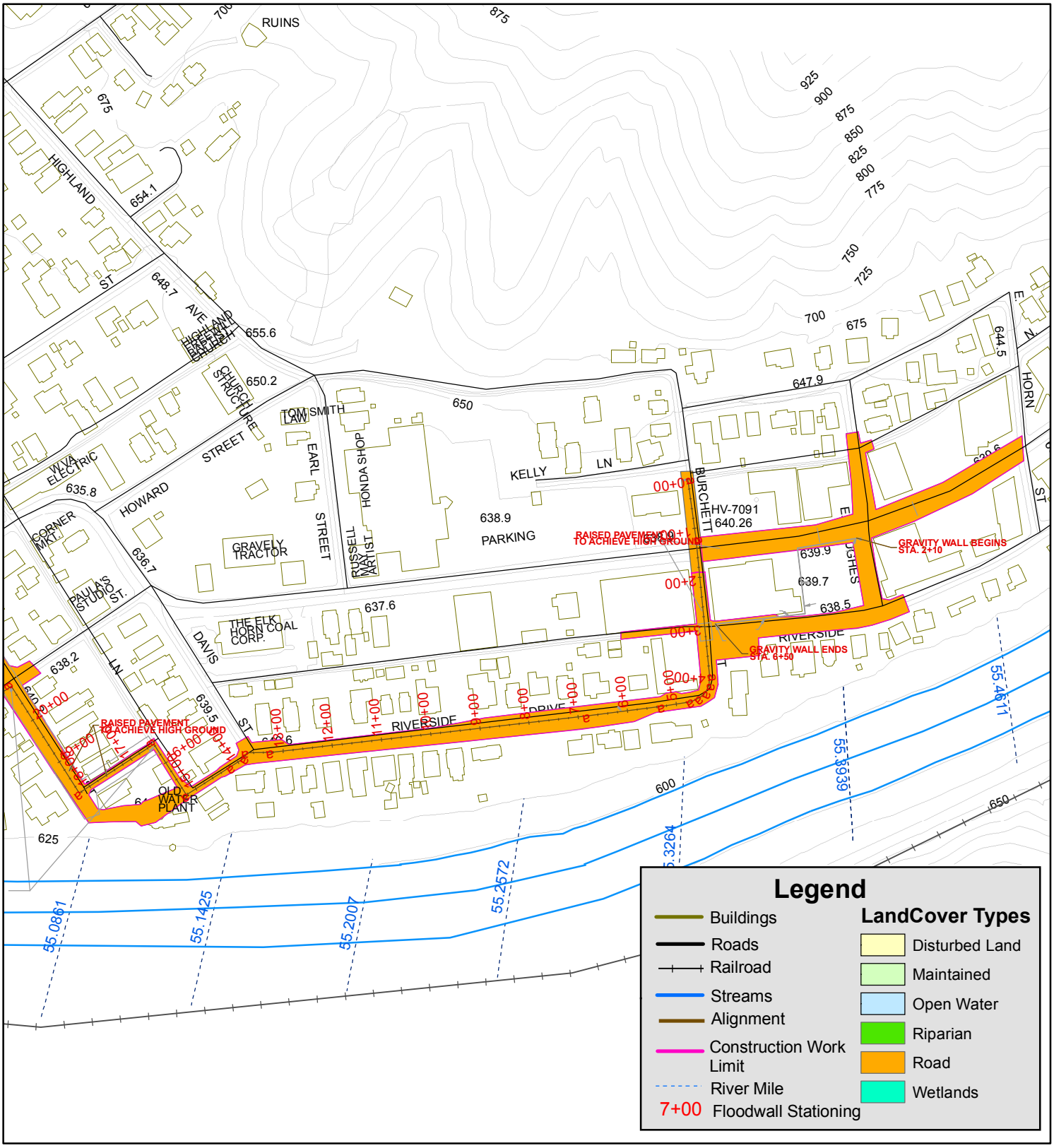


Figure 4. Typical Section, Lower Bank Stabilization for Levisa Fork

The proposed floodwall alignments, showing construction work limits and land cover within the construction work limits, are shown in **Figure 5**.



Land Cover Within The Construction Work Limits For Alternative Plans 2 & 3

Prestonsburg, KY

Notes

Projection: Kentucky Stateplane - South, NAD 27, US foot
Imagery courtesy of USACE- Huntington District

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Figure 5 (1 of 8)

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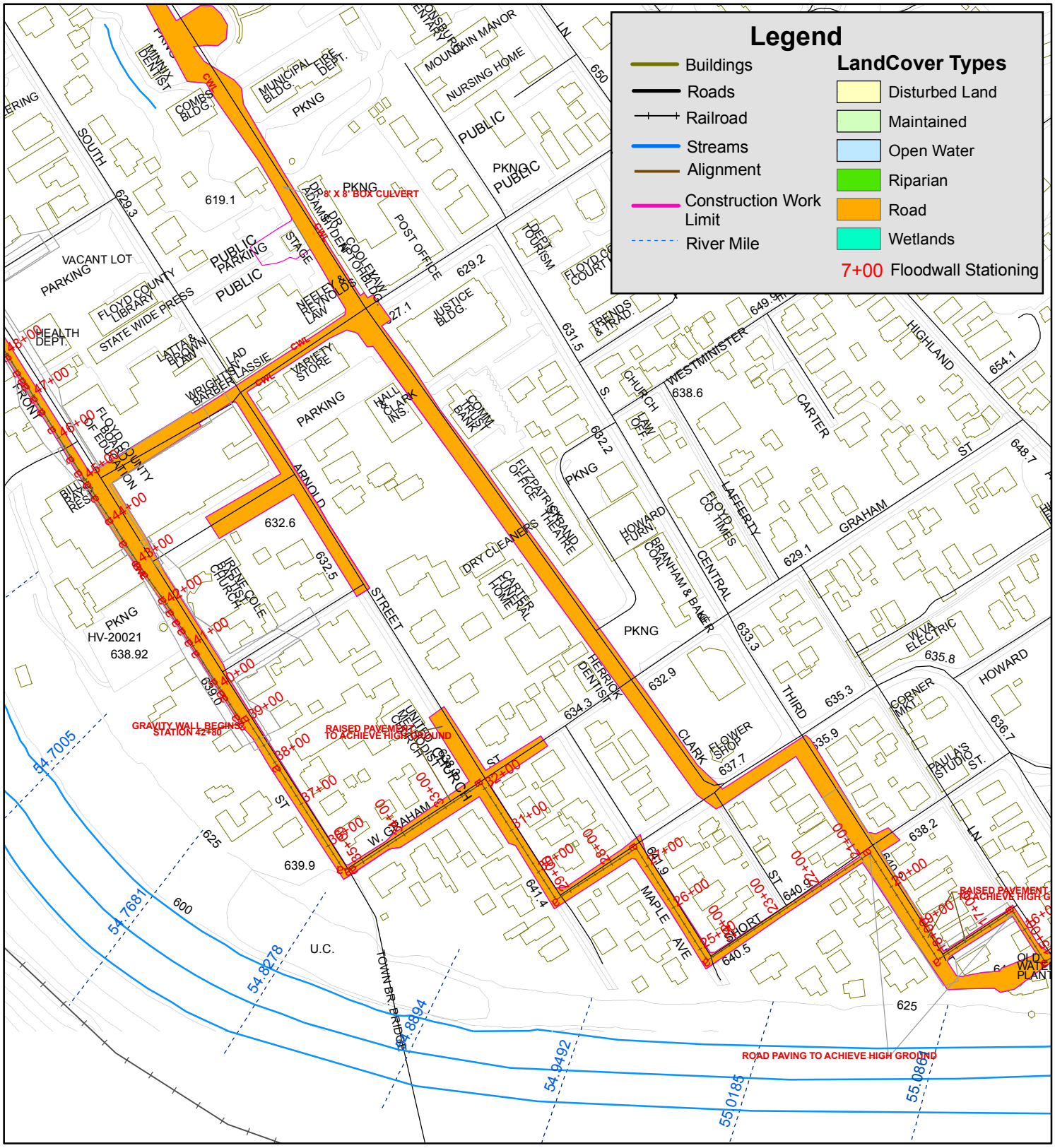
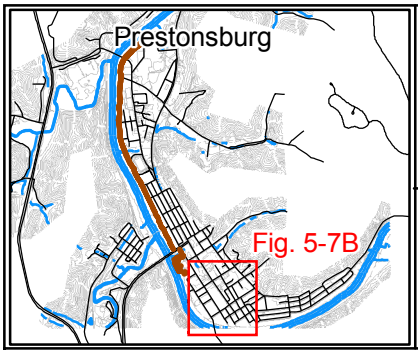
0 50100 200 300 Feet





Land Cover Within The Construction Work Limits For Alternative Plans 2 & 3

Prestonsburg, KY

Notes

Projection: Kentucky Stateplane - South, NAD 27, US foot
Imagery courtesy of USACE- Huntington District

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Figure 5 (2 of 8)

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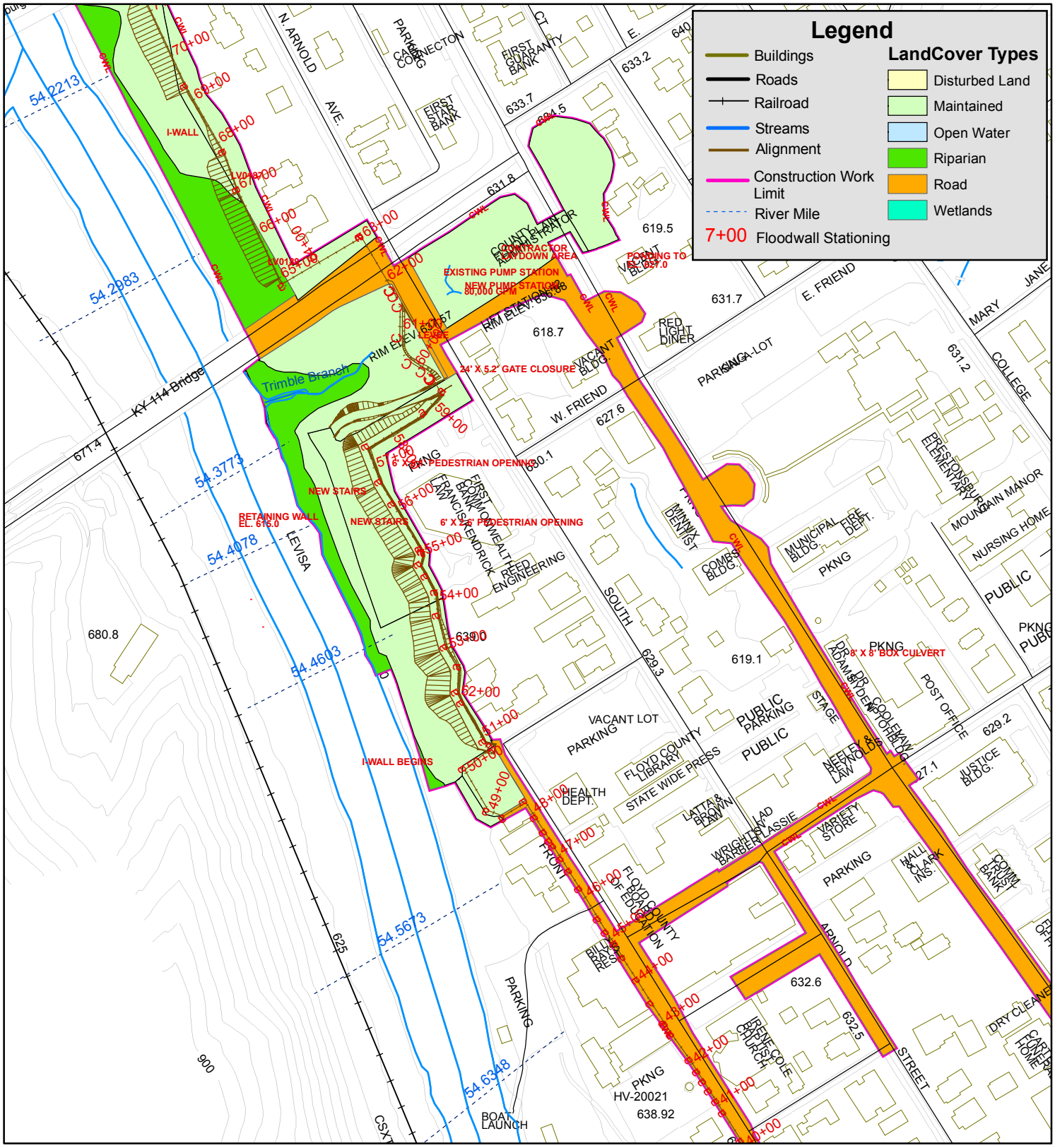

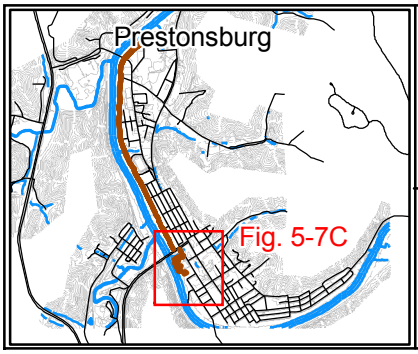

Land Cover Within The Construction Work Limits For Alternative Plans 2 & 3

Prestonsburg, KY

Notes

Projection: Kentucky Stateplane - South, NAD 27, US foot
Imagery courtesy of USACE- Huntington District

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Figure 5 (3 of 8)

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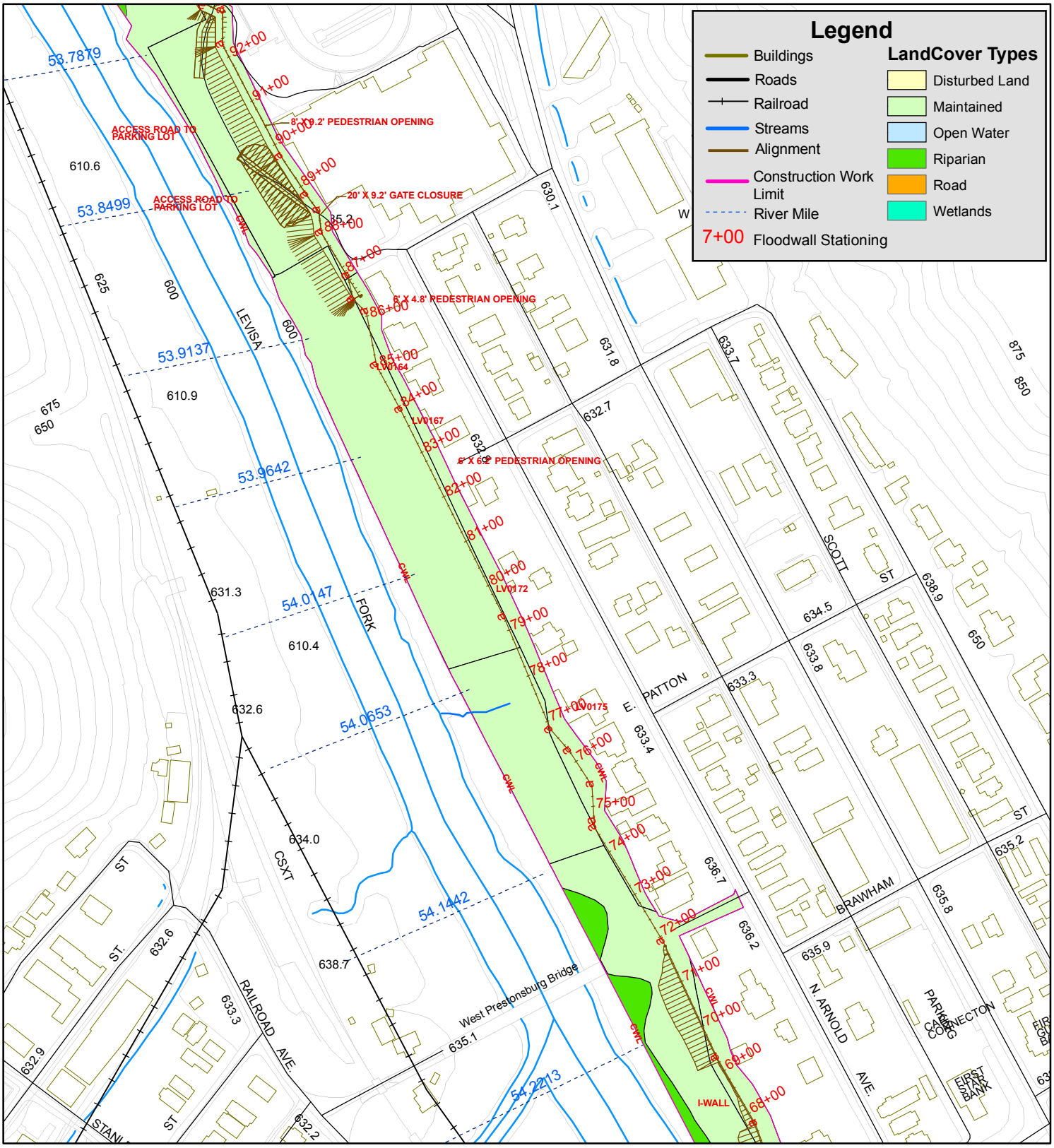
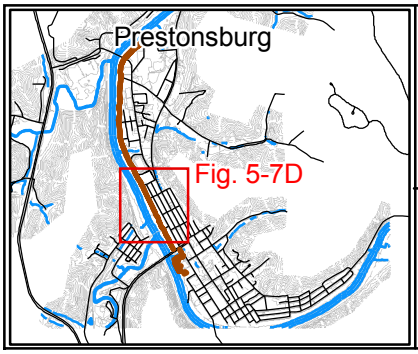
0 50100 200 300 Feet





Land Cover Within The Construction Work Limits For Alternative Plans 2 & 3

Prestonsburg, KY

Notes

Projection: Kentucky Stateplane - South, NAD 27, US foot
Imagery courtesy of USACE- Huntington District

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Figure 5 (4 of 8)

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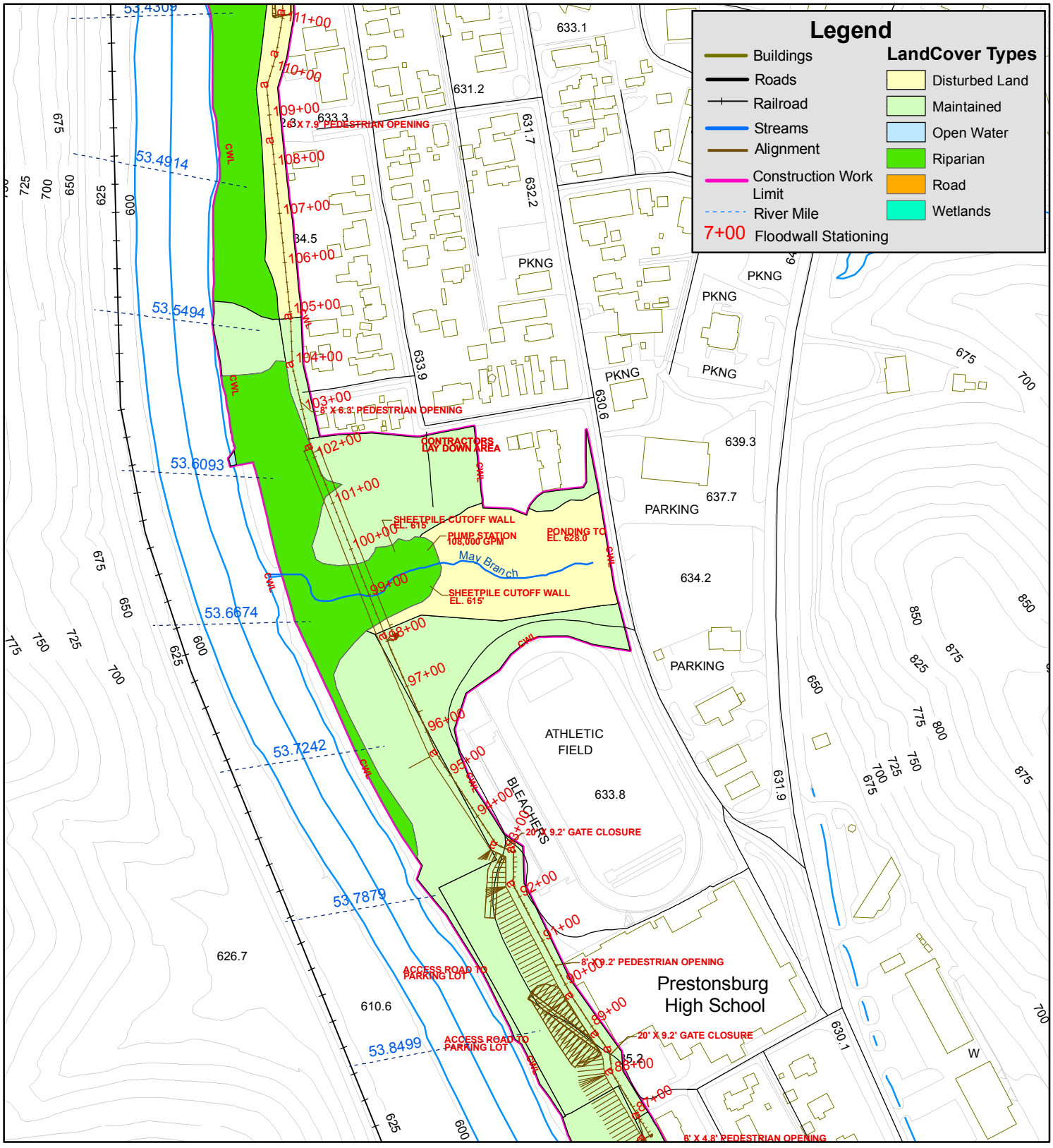

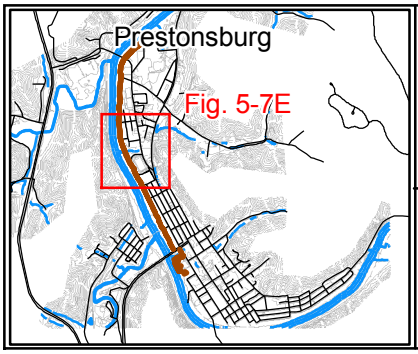

Land Cover Within The Construction Work Limits For Alternative Plan 2 & 3

Prestonsburg, KY

Notes

Projection: Kentucky Stateplane - South, NAD 27, US foot
Imagery courtesy of USACE- Huntington District

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Figure 5 (5 of 8)

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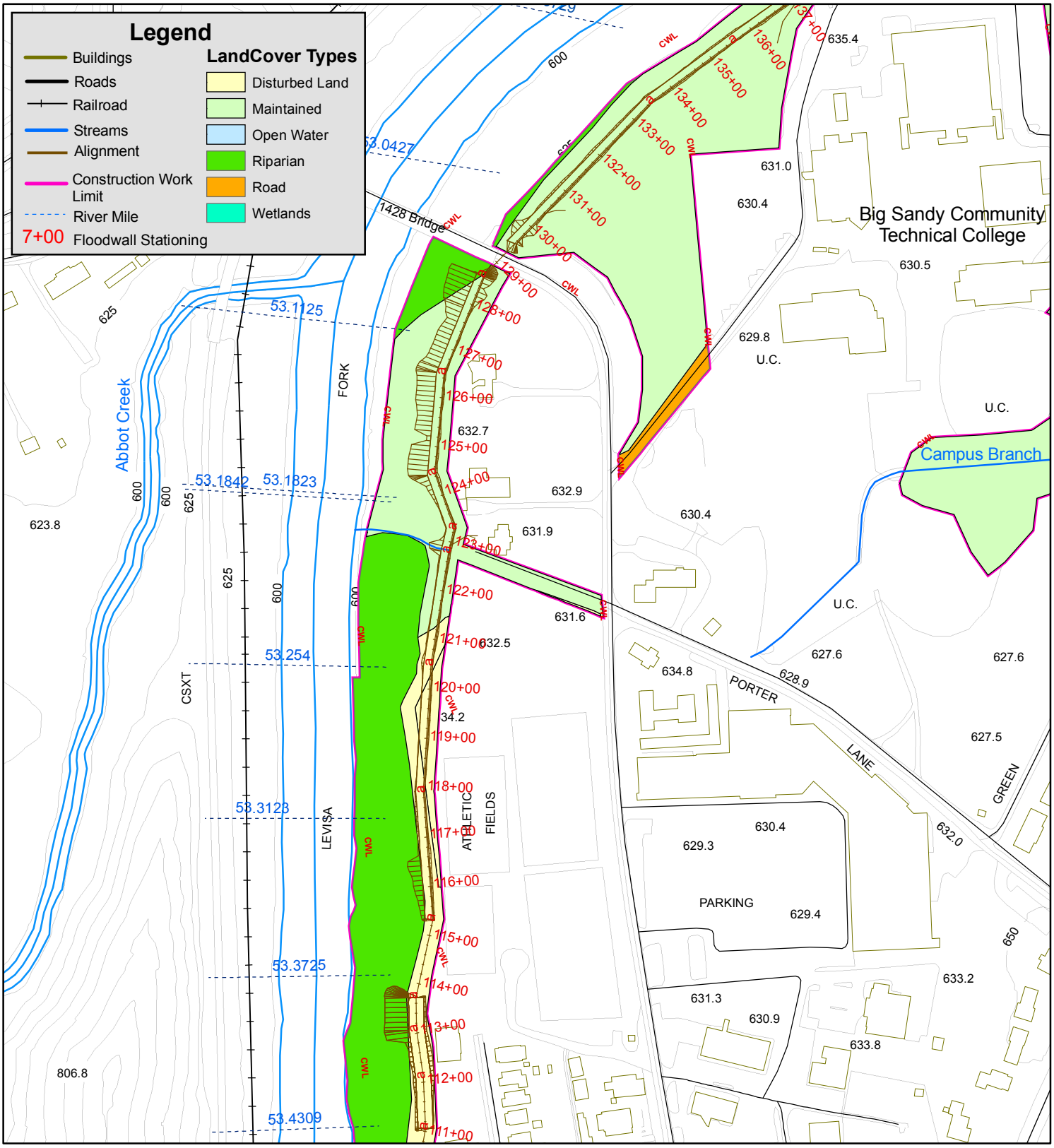

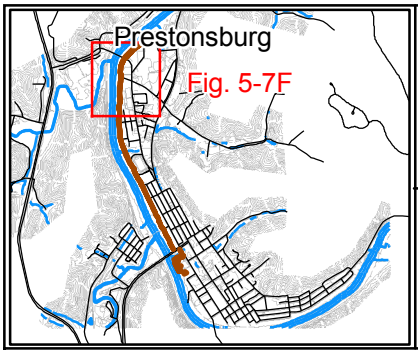

Land Cover Within The Construction Work Limits For Alternative Plan 2

Prestonsburg, KY

Notes

Projection: Kentucky Stateplane - South, NAD 27, US foot
Imagery courtesy of USACE- Huntington District

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Figure 5 (6 of 8)

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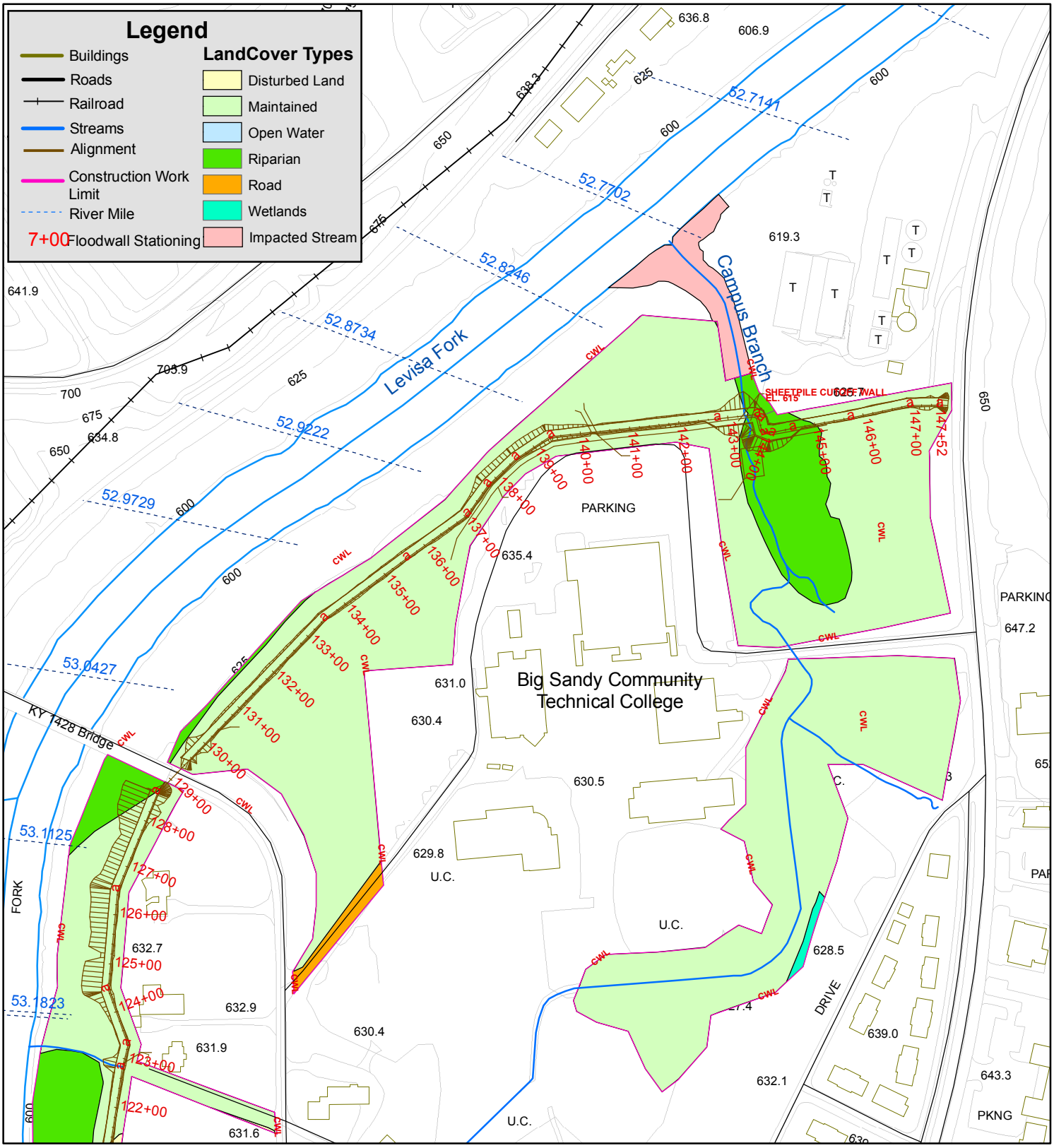
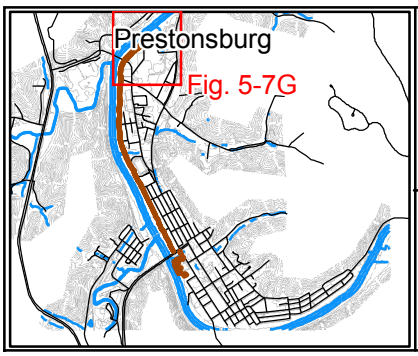
0 50100 200 300 Feet





Land Cover Within The Construction Work Limits For Alternative Plan 2

Prestonsburg, KY

Notes

Projection: Kentucky Stateplane - South, NAD 27, US foot
Imagery courtesy of USACE- Huntington District

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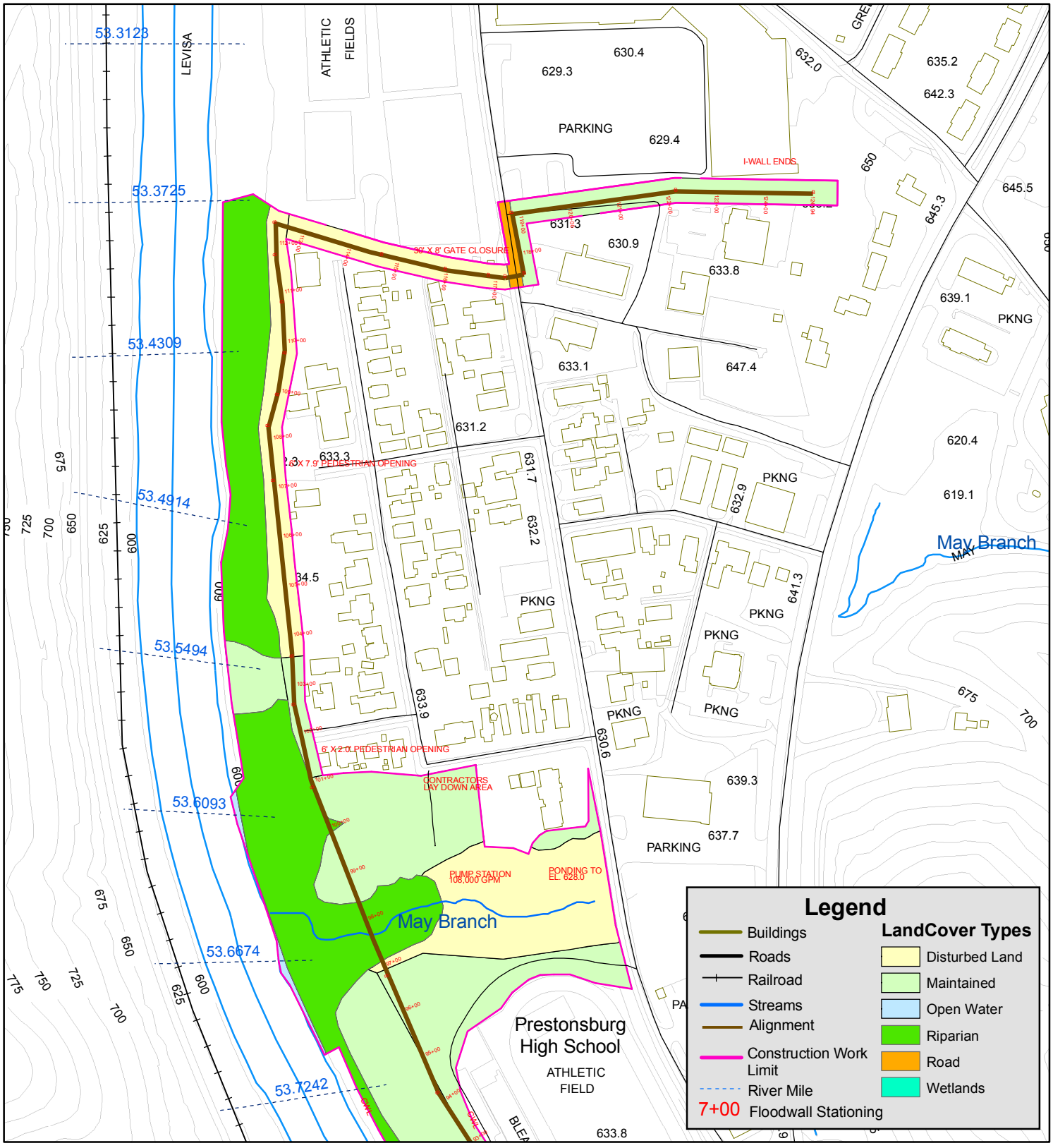
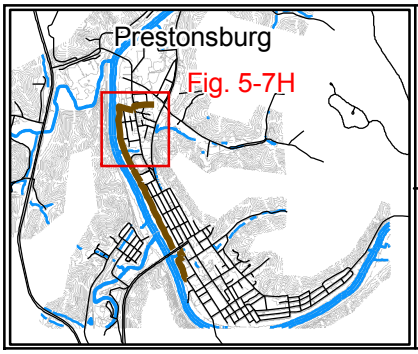
Figure 5 (7 of 8)

0 50100 200 300 Feet





Land Cover Within The Construction Work Limits For Alternative Plan 3

Prestonsburg, KY

Notes

Projection: Kentucky Stateplane - South, NAD 27, US foot
Imagery courtesy of USACE- Huntington District

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Figure 5 (8 of 8)

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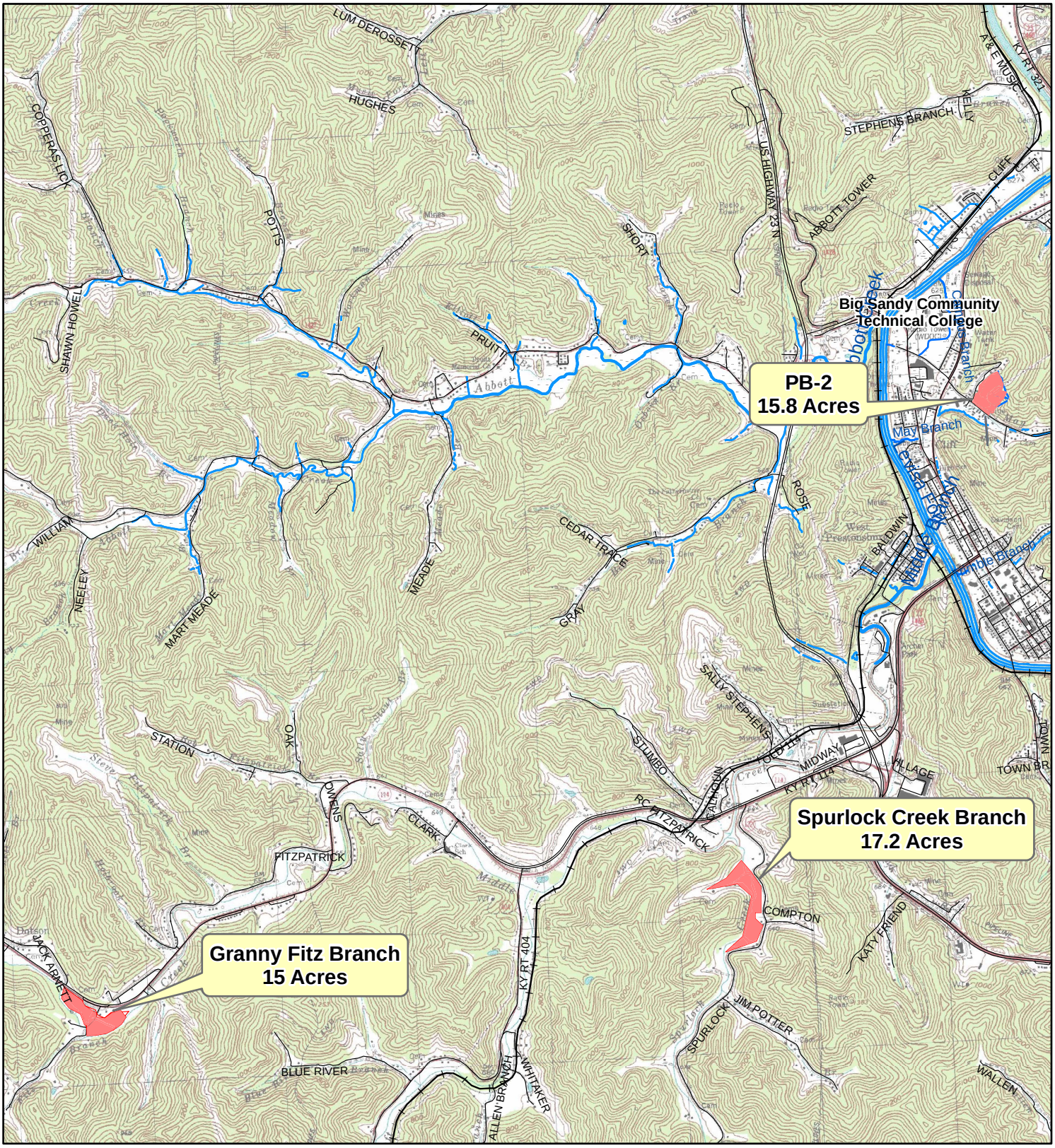
2.4 Borrow and Spoil Areas

Borrow areas provide a source of suitable soil or rock for construction. The USACE policy is to identify at least two borrow areas each capable of providing sufficient quantities of suitable materials to construct the project. Three soil borrow areas have been identified to provide random fill for the I-Wall construction. These areas are referred to as Prestonsburg (PB)-2 at 15.8 acres, Spurlock Creek at 17.2 acres, and Granny Fitz Branch at 15 acres. These proposed soil borrow areas are shown on **Figure 6**. No rock borrow areas have been identified. If rock borrow is needed, it would be obtained commercially.

In addition, USACE would coordinate with the Kentucky Transportation Cabinet (KTC) and local companies to identify potential alternate sources for borrow material that could satisfy suitability and timing requirements for this project. These materials could include excavated soil and rock from roadway construction or mine overburden.

The existing Dewey Dam spoil area is currently being evaluated as a possible spoil disposal area for approximately 20,000 cubic yards of material.



Potential Borrow Areas

Prestonsburg, KY

Notes

Figure 6

Projection: Kentucky Stateplane - South, NAD 27, US foot
Imagery courtesy of USACE- Huntington District

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0 1,500 3,000 4,500 Feet

3.0 AQUATIC RESOURCES

3.1 Methodology

The evaluation of aquatic resources in Floyd County included secondary source review and field investigation. Secondary sources included the United States Geological Service (USGS) topographic maps, aerial photographs, published reports, and information provided by regulatory agencies.

A limited habitat assessment was performed for the Levisa Fork. A stream assessment was performed in the two areas which would have toe protection for the floodwall. The Levisa Fork was inspected within the project area for potential aquatic sites such as pools, riffles, or bars. Special aquatic sites are defined as geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region. Types of special aquatic sites, as identified in 40 Code of Federal Regulations (CFR) 230.40-45, include sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes.

HEC-2 modeling prepared by the Huntington District USACE was reviewed for predicted velocity changes in the Levisa Fork associated with floodwall placement. Predicted changes in water velocity from implementing structural measures were evaluated with respect to potential impact on special aquatic sites in the Levisa Fork.

A surface water inventory was performed in 2004 to identify and evaluate tributary streams that could be impacted by the proposed floodwall alternatives. A total of three high gradient streams were located within the study area including Trimble Branch, May Branch, and an unnamed tributary to Levisa Fork at the Big Sandy Community and Technical College (referred to here as Campus Branch). Drainage to the Levisa Fork was identified as well. A limited surface water inventory was performed in early 2006 by the USACE for borrow areas.

Stream assessments followed the 2002 Kentucky Division of Water (KDOW) Methods for Assessing Biological Integrity of Surface Waters in Kentucky, when possible, and the 1999 Environmental Protection Agency (EPA) Rapid Bioassessment Protocol (RBP). RBP Habitat Assessment Field Data Sheets and Physical Characterization Quality Field Data Sheets were utilized for each stream analysis.

USACE Louisville District Eastern Kentucky Stream Assessment Protocol (EKSAP) was used to calculate the Ecological Integrity Index (EII) of stream reaches. The EII ranges from 0 (worst condition) – 1 (best condition), and provides an indication of headwater stream disturbance compared to the least disturbed stream in the region. The EII is multiplied by the length of the stream reach to obtain the amount of ecological integrity units (EIUs). No macroinvertebrate sampling was conducted. EKSAP was used to estimate the amount of EIUs for all stream reaches pre-project and post-project to determine project impacts. The change in EIUs indicate the amount of loss or gain in stream function.

Specific conductivity, a measure of the ability of water to pass an electrical current, was used as a key measure of habitat quality. Conductivity in water is affected by the presence of inorganic

dissolved solids, which raise the conductivity, and organic compounds which do not conduct electrical current very well and therefore lower the conductivity. Conductivity increases with increasing water temperature. Generally, streams supporting good mixed fisheries have a range between 150 and 500 microsiemens per centimeter (µS/cm). Conductivity outside this range can indicate that the water is not suitable for some fish or invertebrates (EPA, 1997).

3.2 Secondary Source Review

3.2.1 Surface Water

The Levisa Fork originates in Buchanan County, Virginia and flows to Millard, Kentucky where it is joined by its largest tributary, Russell Fork, and continues in a northwesterly direction to Prestonsburg, Kentucky. From Prestonsburg it flows nearly due north to its junction with Tug Fork at Louisa, Kentucky. The confluence of the Tug and Levisa Forks forms the Big Sandy River. The total length of the Levisa Fork is approximately 164 miles, of which 34 miles are in Virginia and the balance in Pike, Floyd, and Johnson Counties, Kentucky. The Levisa Fork drains a total of 2,326 square miles. The upper Levisa Fork drains portions of Pike County and Buchanan County, Virginia, while the lower Levisa Fork drains portions of Pike, Knott, Floyd, Johnson, Magoffin, Morgan, and Lawrence counties in Kentucky (USACE, 1998). Stream discharge rates at the mouth of the Levisa Fork range between 200 cubic feet per second (cfs) and the recorded maximum of 80,000 cfs, with a normal flow of 2,500 cfs.

The most significant tributaries of the lower Levisa Fork within Floyd County include Middle Creek, Beaver Creek, and Mud Creek. These tributaries discharge into the Levisa Fork at Prestonsburg, Allen, and Harold, respectively. Additional smaller tributaries that fall within the study areas include Abbott Creek, Brandykeg Creek, Bull Creek, Cow Creek, Johns Creek, Ivy Creek, Mare Creek, Little Paint Creek, Little Mud Creek, Praeter Creek, and Toler Creek. Tributary streams in Floyd County are generally short and steep resulting in a likelihood of flash flooding during heavy runoff periods, particularly in spring and early summer. Winter flooding can also occur, generally resulting from less intense but extended precipitation events when the ground is saturated, frozen, or snow-covered (BSADD, 2003).

Dewey Lake Reservoir in Floyd County lies within Johns Creek, an eastern tributary that discharges into the Levisa Fork near the northern border of Floyd County. The reservoir was completed and placed in operation in 1949 for the primary purpose of flood control, but also provides recreational resources and fish and wildlife enhancement to the area. The reservoir is the main feature of Jenny Wiley State Park. The reservoir has enough liquid storage capacity to withstand runoff from precipitation events of 6.9 and 7.3 inches during summer and winter months, respectively (BSADD 2003).

3.2.2 Surface Water Quality

The KDOW regulates and monitors water quality throughout Kentucky by delegation from the USEPA, Region 4. Typical water contaminant sources in Floyd County include mineral extraction and acid mine drainage, municipal point sources (e.g. package wastewater treatment plants), uncontrolled dumping, litter, septic tanks, and straight pipes (raw sewage) (BSADD, 2003). Previous channelization and riparian zone clearing have also impacted Levisa Fork water quality.

The KDOW is required to classify waters of the Commonwealth in 401 Kentucky Administrative Regulations (KAR) 5:026 for all legitimate uses listed in the Kentucky Revised Statutes (KRS) , 224.020(1). These classifications include the following:

- Warm Water Aquatic Habitat (WAH): surface waters and associated substrate that will support indigenous warm water aquatic life;

- Cold Water Aquatic Habitat (CAH): surface waters and associated substrate that will support indigenous aquatic life or self-sustaining or reproducing trout populations on a year-round basis;

- Primary Contact Recreation (PCR): waters suitable for full body contact during the recreational season of May 1 through October 31;

- Secondary Contact Recreation (SCR): waters suitable for partial body contact recreational, with minimal threat to public health due to water quality;

- Domestic Water Supply (DWS): surface waters that with conventional treatment are suitable for human consumption through a public water system, culinary purposes, or for use in any food or beverage processing industry and meet Safe Drinking Water Act requirements; and

- Outstanding Resource Water (ORW).

Waters of the Commonwealth not specifically classified are designated for the use of WAH, PCR, SCR, and DWS. The segments of Levisa Fork located in Pike and Lawrence Counties are designated WAH, PCR, SCR, and DWS. None of the surface waters located in Floyd and Johnson counties except for Dewey Reservoir are specifically classified in KAR 5:026. Dewey Reservoir is designated for WAH, PCR, SCR, and DWS.

The Clean Water Act (CWA) Section 303(d) requires states to identify waters that do not meet applicable water quality standards after the application of technology based controls. As defined in the CWA and federal regulations, water quality standards include the designated uses of a water body, the adopted water quality criteria and an antidegradation policy. As defined in Kentucky regulations, water quality standards are beneficial uses to be made of a waterbody and the established water quality objectives. The section 303(d) list must include a description of the pollutants causing the violation of the water quality standards (40 CFR 130.7(b)(iii)(4) and a priority ranking of the water quality limited segments, taking into account the severity of the pollution and the uses to be made of the waters (2004 303(d) List of Waters for Kentucky, Final Draft, March 2004).

In 2004, the KDOW listed the Levisa Fork within Floyd and Johnson counties from River Mile (RM) 65.0 to 97.3 as not supporting swimming due to pathogens. Beaver Creek within Floyd County was listed (RM 0.0 to 7.0) as not supporting aquatic life or swimming due to pathogens and siltation. In addition, Abbott Creek (RM 0.0 to 2.3) is considered an impaired stream segment for swimming due to pathogens based on Discharge Monitoring Reports gathered from Municipal Point Sources. Left Middle Fork (RM 0.0 to 8.4) is listed as not supporting aquatic life. River segments listed above all fall within one of the three project phases. Abbott Creek and the Levisa Fork segments are the only river segments listed above that are within the vicinity of the proposed floodwall in Prestonsburg. Suspected sources of pollutants were identified as resource extraction, land disposal, Municipal Point Sources, septic tanks, and straight pipes.

Based on 2000 KDOW stream assessments, the University of Kentucky's PRIDE Water Quality Assessment Report developed ranked scores for potential environmental impacts for 40 counties in Kentucky. Floyd County streams were ranked third most severely impacted (PRIDE Report I). Potential impacts were based on total impacted stream miles, the number of straight pipes and failing septic systems, capacity of package plants, number of illegal dumps, effluent capacity of wastewater treatment facilities, and the number of mines. In 2002, KDOW estimated 19.2 miles of impaired streams existed in Floyd County.

Fecal coliform bacteria pollution was identified as severely impacting the streams of five counties within the PRIDE Report. Two of the five counties, Floyd County and Johnson County, are located within the Big Sandy River Basin. Title 401 KAR 5:031 identifies applicable surface water standards, including fecal coliform, for waters of the Commonwealth. A summary table of these limits according to the designated use had been prepared in **Table 2**.

Table 2. Surface Water Standards for Waters of the Commonwealth

Designation	Limit	Time of Year
DWS	2000 colonies/100 ml (geometric mean)	All
PCR	200 colonies/100 ml in at least 5 samples per month; nor 400 colonies/100 ml in at least 20% sample per month	May 1 – Oct 31
SCR	1000 colonies/100 ml in at least 5 samples per month; nor 2000 colonies/100 ml in at least 20% sample per month	Nov 1 – Apr 30

Floyd County fecal coliform results indicated by PRIDE Report II have increased since 1993. Water samples collected in 1993 detected a median level of 26 colonies/100ml in Floyd County (minimum=1 colonies/100ml; maximum = 600; n = 26), whereas in 1999 the median level of fecal coliform was 6,000 colonies/100ml (minimum=10 colonies/100ml; maximum = 20,000; n = 10).

Elevated ammonia levels within three PRIDE Report counties were found including Johnson County and Floyd County within the Big Sandy River Basin (PRIDE Report IV). Floyd County levels were estimated to be on average 1.00 mg/L (n=10). Ammonia levels exceeding 0.05mg/L are typically considered to not support aquatic life (the instream limit included in 5:031 Section 4(g)).

Specific conductivity data for 2005 at two Levisa Fork PRIDE sampling locations in Floyd County were reviewed. At sampling station BP7 (behind BSCTC) specific conductivity during 2005 ranged from 466 to 532 µS/cm. At sampling station BP8 (south of Prestonsburg just downstream of the State Route 1426 bridge) specific conductivity during 2005 ranged from 469 to 536 µS/cm.

3.2.3 Aquatic Organisms

Floyd County. In Floyd County, 100 aquatic species have been observed, including 74 fish, 3 lamprey, 22 freshwater mussels, and one clam (Kentucky Department of Fish and Wildlife Resources (KDFWR, 2003)). The full diversity of habitats may not be observed within the entire county. Aquatic organisms that have been observed throughout Floyd County are listed in **Table 3.** Various streams have poor quality due to siltation and pathogen pollution. These streams would be expected to have a low diversity of aquatic species. The USGS Prestonsburg quadrangle was used to narrow down potential aquatic species that may reside within DPR-I

project boundaries. Within the DPR-I study area, 38 aquatic species are expected to occur including 35 fish, 2 freshwater mussels, and one clam (KDFWR, 2003).

The KDOW examined benthic macroinvertebrate surveys collected within Floyd County. Results for the Levisa Fork are shown in **Table 4**. Levisa Fork was determined to be in full support of aquatic life within Floyd County. Left Middle Fork (RM 0.0 to 8.4) was considered not in support of aquatic life. Left Fork Beaver Creek (RM 0.0 to 11.4 and 13.6 to 18.7) and Right Fork Beaver Creek (0.0 to 17.4) were listed as in partial support of aquatic life. These streams would be expected to have a low diversity of aquatic species.

Table 3. Aquatic Species Observed in Floyd County and Prestonsburg Quadrangle

Fish			
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
Banded Darter	*Etheostoma zonale*	Northern Studfish	*Fundulus catenatus*
Bigeye Chub	***Hybopsis amblops***	Quillback	*Carpiodes cyprinus*
Black Bullhead	***Ameiurus melas***	**Rainbow Darter**	***Etheostoma caeruleum***
Black Crappie	*Pomoxis nigromaculatus*	Rainbow Trout or Steelhead	*Oncorhynchus mykiss*
Blacknose Dace	***Rhinichthys atratulus***	Redear Sunfish	*Lepomis microlophus*
Blackside Darter	***Percina maculata***	Redfin or Grass Pickerel	*Esox americanus*
Bluegill	***Lepomis macrochirus***	River Carsucker	*Carpiodes carpio*
Bluntnose Minnow	***Pimephales notatus***	River Chub	*Nocomis micropogon*
Brindled Madtom	*Noturus miurus*	River Redhorse	*Moxostoma carinatum*
Brook Silverside	***Labidesthes sicculus***	**Rock Bass**	***Ambloplites rupestris***
Central Stoneroller	***Campostoma anomalum***	Rosyface Shiner	*Notropis rubellus*
Channel Catfish	*Ictalurus punctatus*	**Sand Shiner**	***Notropis stramineus***
Channel Darter	*Percina copelandi*	Sharpnose Darter	*Percina oxyrhynchus*
Common Carp	*Cyprinus carpio*	Shorthead Redhorse	*Moxostoma macrolepidotum*
Creek Chub	***Semotilus atromaculatus***	Silver Redhorse	*Moxostoma anisurum*
Dusky Darter	*Percina sciera*	**Silver Shiner**	*Notropis photogenisis*
Eastern Sand Darter	*Ammocrypta pellucida*	**Silverjaw Minnow**	***Ericymba buccata***
Elegant Madtom	*Noturus elegans*	Slenderhead Darter	*Percina phoxocephala*
Emerald Shiner	***Notropis atherinoides***	**Smallmouth Bass**	***Micropterus dolomieu***
Fantail Darter	***Etheostoma flabellare***	Smallmouth Buffalo	*Ictiobus bubalus*
Fathead Minnow	*Pimephales promelas*	Speckled Chub	*Macrhybopsis aestivalis*
Flathead Catfish	*Pylodictis olivaris*	**Spotfin Shiner**	***Cyprinella spiloptera***
Freshwater Drum	*Aplodinotus grunniens*	**Spotted Bass**	***Micropterus punctulatus***
Gilt Darter	*Percina evides*	Spotted Sucker	*Minytrema melanops*
Gizzard Shad	*Dorosoma cepedianium*	**Steelcolor Shiner**	*Cyprinella whipplei*
Golden Redhorse	***Moxostoma erythrurum***	Streamline Chub	*Erimystax dissimilis*
Green Sunfish	***Lepomis cyanellus***	Striped Bass	*Morone saxatilis*
Greenside Darter	***Etheostoma blennioides***	**Striped Shiner**	***Luxilus chrysocephalus***
Johnny Darter	***Etheostoma nigrum***	Suckermouth Minnow	*Phenacobius mirabilis*
Largemouth Bass	***Micropterus salmoides***	Threadfin Shad	*Dorosoma petenense*
Largescale Stoneroller	***Campostoma oligolepis***	Trout-Perch	*Percopsis omiscomaycus*
Logperch	***Percina caprodes***	Vareigate Darter	*Etheostoma variatum*
Longear Sunfish	*Lepomis megalotis*	White Crappie	*Poxomis annularis*
Longnose Gar	***Lepisosteus osseus***	**White Sucker**	***Catostomus commersoni***
Mimic Shiner	***Notropis volucellus***	**Yellow Bullhead**	***Ameiurus natalis***
Mottled Sculpin	*Cottus bairdi*	Lamprey	
Mountain Madtom	*Noturus eleutherus*	American Brook Lamprey	*Lampetra appendix*
Northern Hog Sucker	***Hypentelium nigricans***	Least Brook Lamprey	*Lampetra aepyptera*
Northern Pike	*Esox Lucius*	Northern Brook Lamprey	*Ichthyomyzon fosser*
Freshwater Mussel/Clam			
Butterfly	*Ellipsaria lineolata*	Pimpleback	*Quadrula pustulosa*
Ebonyshell	*Fusconaia ebena*	**Pink Heelsplitter**	***Potamilus alatus***
Elephantear	*Elliptio crassidens*	Pistolgrip	*Tritogonia verrucosa*
Flutedshell	*Lasmigona costata*	Plain Pocketbook	*Lampsilis cardium*
Fragile Papershell	*Leptodea fragilis*	Rabbitsfoot	*Quadrula cylindrica cylindrica*
Kidneyshell	*Ptychobranchus fasciolaris*	Round Hickorynut	*Obovaria subrotunda*
Little Spectaclecase	*Villosa lienosa*	Threehorn Wartyback	*Obliquaria reflexa*
Longsolid	*Fusconaia subrotunda*	Threeridge	*Amblema plicata*
Longsolid	*Fusconaia Subrotunda*	Wabash Pigtoe	*Fusconaia flava*
Mapleleaf	*Quadrula quadrula*	Wartyback	*Quadrula nodulata*
Monkeyface	*Quadrula metanevra*	**Asian Clam**	***Corbicula Fluminea***
Mucket	***Actinonaias ligamentina***		

Source: Kentucky Department of Fish and Wildlife Resources (KDFWR, 3/27/03)
Boldface type indicates observed within Prestonsburg Quadrangle

Table 4. Benthic Macroinvertebrate Species Observed by KDOW in the Levisa Fork at Auxier and/or Harold, 2002

Order	Family	Species	Order	Family	Species
Phylum Annedlida, Class Clitellata (worms)					
Haplotaxida	Tubificidae	*Branchiura sowerbyi*	Lumbriculida	Lumbriculidae	*Eclipidrilus sp*
Haplotaxida	Tubificidae	*Unid. Tubificidae sp*			
Phylum Arthropoda, Class Malacostraca, Order Decapoda (crayfish)					
Decapoda	Cambaridae	*Orconectes cristavarius*			
Phylum Arthropoda, Class Insecta, Order Coleoptera (beetles)					
Coleoptera	Elmidae	*Ancyronyx variegatus*	Coleoptera	Elmidae	*Optioservus trivittatus*
Coleoptera	Elmidae	*Dubiraphia minima*	Coleoptera	Elmidae	*Stenelmis crenata*
Coleoptera	Elmidae	*Dubiraphia sp (larvae)*	Coleoptera	Elmidae	*Stenelmis sandersoni*
Coleoptera	Elmidae	*Dubiraphia vittata*	Coleoptera	Elmidae	*Stenelmis sp(larvae)*
Coleoptera	Elmidae	*Macronychus glabratus*	Coleoptera	Gyrinidae	*Dineutus discolor*
Coleoptera	Elmidae	*Microcylloepus pusillus*	Coleoptera	Psephenidae	*Psephenus herricki*
Coleoptera	Elmidae	*Optioservus sp(larvae)*			
Phylum Arthropoda, Class Insecta, Order Diptera (flies)					
Diptera	Athericidae	*Atherix lantha*	Diptera	Chironomidae	*Polypedilum flavum*
Diptera	Chironomidae	*Ablabesmyia janta*	Diptera	Chironomidae	*Procladius sp*
Diptera	Chironomidae	*Conchapelopia/ Helopelopia sp*	Diptera	Chironomidae	*Pseudochironomus sp*
Diptera	Chironomidae	*Cricotopus bicinctus gr*	Diptera	Chironomidae	*Rheotanytarsus exiguus gr*
Diptera	Chironomidae	*Cricotopus/ Orthocladius gr*	Diptera	Chironomidae	*Stenochironomus sp*
Diptera	Chironomidae	*Dicrotendipes neomodestus*	Diptera	Chironomidae	*Tanytarsus sp*
Diptera	Chironomidae	*Orthocladius sp*	Diptera	Chironomidae	*Thienemannimyia gr*
Diptera	Chironomidae	*Paratanytarsus sp*	Diptera	Empididae	*Hemerodromia sp*
Diptera	Chironomidae	*Phaenopsectra/ Tribelos sp*	Diptera	Tipulidae	*Antocha saxicola*
Phylum Arthropoda, Class Insecta, Order Ephemeroptera (mayflies)					
Ephemeroptera	Baetidae	*Baetis intercalaris*	Ephemeroptera	Heptageniidae	*Stenonema exiguum*
Ephemeroptera	Baetidae	*Pseudocloeon ephippiatus*	Ephemeroptera	Heptageniidae	*Stenonema mediopunctatum*
Ephemeroptera	Baetidae	*Pseudocloeon sp*	Ephemeroptera	Heptageniidae	*Stenonema sp*
Ephemeroptera	Caenidae	*Caenis sp*	Ephemeroptera	Heptageniidae	*Stenonema terminatum*
Ephemeroptera	Ephemeridae	*Hexagenia munda*	Ephemeroptera	Isonychiidae	*Isonychia sp*
Ephemeroptera	Heptageniidae	*Stenacron interpunctatum*	Ephemeroptera	Tricorythidae	*Tricorythodes sp*
Phylum Arthropoda, Class Insecta, Order Megaloptera (Dobsonflies and Alderflies)					
Megaloptera	Corydalidae	*Corydalus cornutus*			

Table 4. Benthic Macroinvertebrate Species Observed by KDOW in the Levisa Fork at Auxier and/or Harold, 2002

Order	Family	Species	Order	Family	Species
Phylum Arthropoda, Class Insecta, Order Megaloptera (Dragonflies and Damselflies)					
Odonata	Calopterygidae	*Calopteryx maculata*	Odonata	Coenagrionidae	*Enallagma exsulans*
Odonata	Calopterygidae	*Hetaerina titia*	Odonata	Corduliidae	*Neurocordulia sp*
Odonata	Coenagrionidae	*Argia tibialis*	Odonata	Gomphidae	*Stylurus spiniceps*
Odonata	Coenagrionidae	*Argia translata*			
Phylum Arthropoda, Class Insecta, Order Trichoptera (Caddisflies)					
Trichoptera	Hydropsychidae	*Ceratopsyche sparna*	Trichoptera	Hydroptilidae	*Ochrotrichia sp*
Trichoptera	Hydropsychidae	*Cheumatopsyche sp*	Trichoptera	Leptoceridae	*Nectopsyche exquisita*
Trichoptera	Hydropsychidae	*Hydropsyche simulans*	Trichoptera	Leptoceridae	*Oecetis persimilis*
Trichoptera	Hydroptilidae	*Hydroptila sp*	Trichoptera	Leptoceridae	*Oecetis sp*
Phylum Mollusca, Class Bivalvia, Order Pelecypoda (mollusks)					
Pelecypoda	Corbiculidae	*Corbicula fluminea*			

KDOW (unpublished) 2002. Obtained from Randall Payne and Greg Pond.

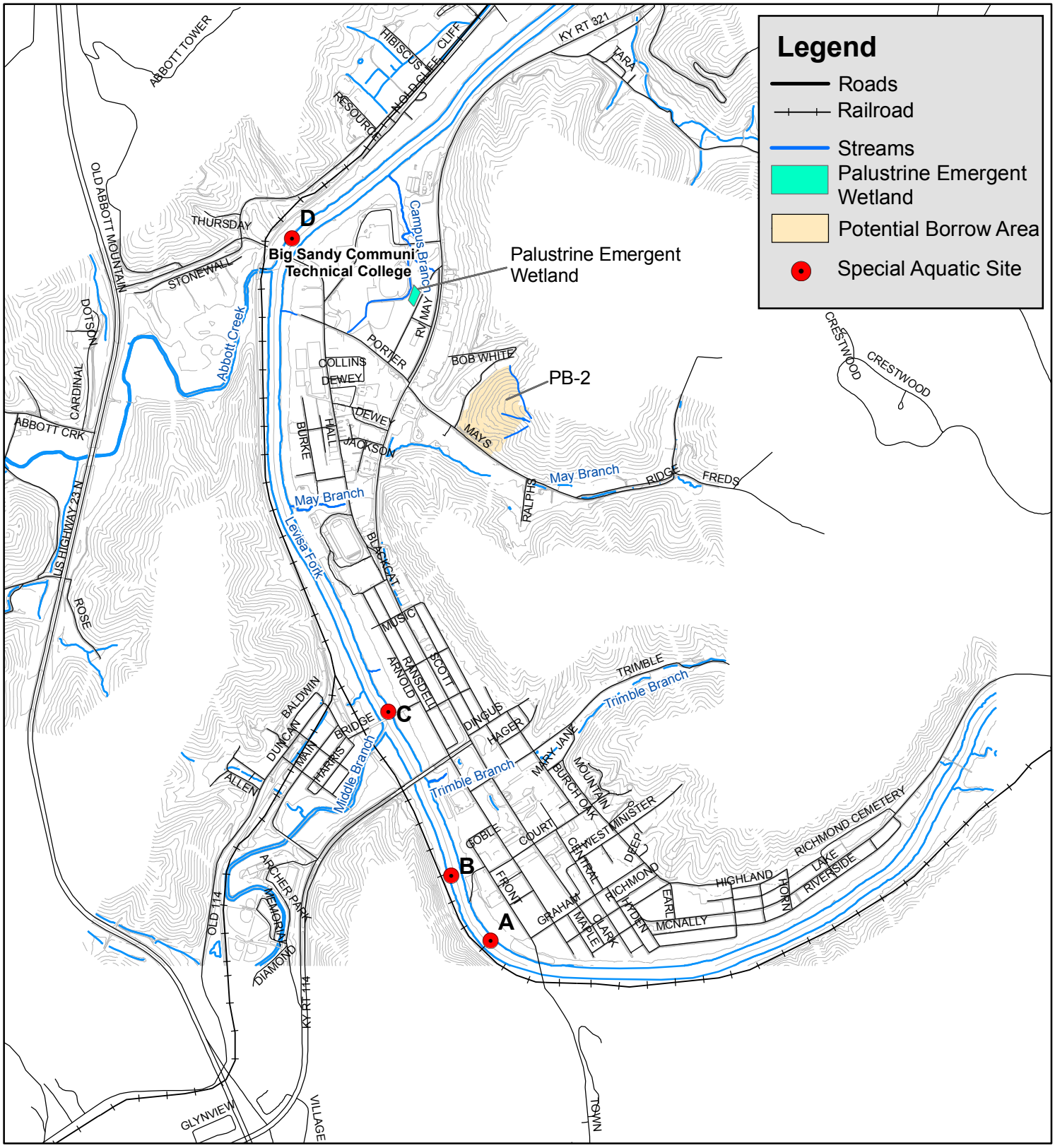
3.3 Results of Field Investigations within Structural Areas

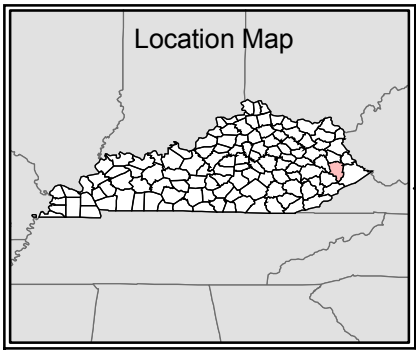
From June 27th through June 30th, 2004 AMEC staff located and assessed surface water that might be impacted by the proposed floodwall alternatives. A follow-up visit was performed on July 7, 2004. A total of five surface water occurrences were located within the main study area: Trimble Branch, May Branch, an unnamed tributary of the Levisa Fork (referred to in this report as Campus Stream), storm drainage behind North Arnold Avenue and storm drainage behind the new retail/grocery construction north of Prestonsburg High School. Surface water locations are shown in **Figure 7**.

Limited habitat assessments were conducted in November 2005 by the USACE at the two locations along the floodwall alignment where armored toe protection would be needed. The first location is behind the Community Bank at approximate River Station 53.7. The second location is behind the Methodist Church in the Blackbottom area at approximate River Station 52.6.

Field reconnaissance of new borrow areas was performed by the USACE in early 2006.

Photographs of surface waters are included as **Appendix A**. Habitat Assessment Field Data Sheets and Physical Characterization Quality Field Data Sheets are included as **Appendix B**. ESKAP calculator spreadsheets are included as **Appendix C**.





Surface Water Features And Wetlands

Prestonsburg, KY

Notes

Figure 7

Projection: Kentucky Stateplane - South, NAD 27, US foot
Imagery courtesy of USACE- Huntington District

W:\USACE\Floyd-EIS\MXD\March2006\Fig5-5_WaterFeatures.mxd Mar 12, 2006 DNB

amec

0 1,000 2,000 Feet

3.3.1 Levisa Fork

3.3.1.1 Special Aquatic Sites

Several streambed features, special aquatic sites, were identified in the Levisa Fork along the proposed floodwall alignments. These features are not always visible because of the Levisa Fork's changing water levels. They are generally visible only during low water conditions. The features noted during site reconnaissance include:

- **Site A**: A potential riffle area just upstream of the floodwall, at approximate RM 54.15.
- **Site B**: A vegetated shallow along the left bank at approximate RM 53.82. The bar surfaces are submerged except during low water conditions.
- **Site C**: A vegetated shallow along the right bank at approximate RM 53.45. The bar surfaces are submerged except during low water conditions.
- **Site D**: A vegetated shallow along the left bank at approximately RM 52.2. The bar surfaces are submerged except during low water conditions.

3.3.1.2 Bank Stabilization Locations

The Levisa Fork behind the Commonweath Bank was estimated at 30-45 feet wide, with approximately 95 percent run and 5 percent pool during the November 2005 evaluation. The substrate was characterized as a mixture of sand, silt, and clay, with mud and detritus as organic components. Erosion of banks was moderate at this location. This reach of stream has approximately 30 percent canopy cover during the growing season from deciduous trees located along the stream banks. Specific conductivity was measured at 804 µS/cm. The EII for this reach is calculated at 0.20.

The Levisa Fork reach in the Blackbottom area was also estimated at 30-45 feet wide during the November 2005 evaluation. The substrate was characterized as a mixture of sand, silt, and clay, with mud and detritus as organic components. Erosion of banks was moderately unstable, with approximately 30 percent of both banks showing areas of erosion. This reach of stream has approximately 50 percent canopy cover during the growing season from deciduous trees located along the stream banks. Specific conductivity was measured at 806 µS/cm. The EII for this reach is calculated at 0.25.

3.3.2 Trimble Branch

Trimble Branch is located north of and adjacent to the First Commonwealth Bank in downtown Prestonsburg (**Figure 8**). This stream emanates from a large culvert and runs approximately 300 feet to its confluence with the Levisa Fork. It is approximately 15 feet wide and an estimated three feet deep. Velocity was estimated at 1 foot per second. The effect of backwater conditions associated with the rise of the Levisa Fork, including deep sedimentation, is evident. The banks are bare up to approximately 15 feet. The heavily vegetated steep upper banks are very unstable. Canopy cover is approximately 50 percent during the growing season. Specific conductivity was not measured, as safe access to the stream was not possible because of the steep, unstable banks. The EII for this reach is calculated at 0.10.

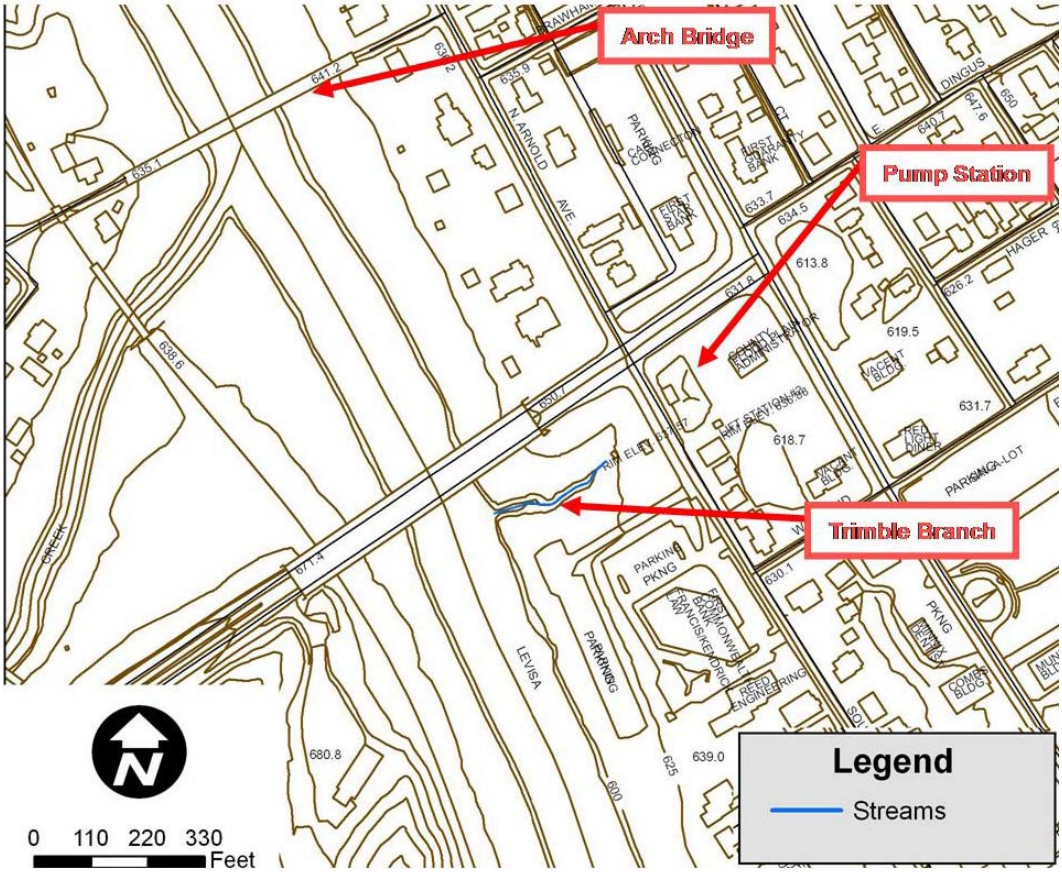


Figure 8. Trimble Branch

3.3.3 May Branch

May Branch is located north of and adjacent to the Prestonsburg High School (**Figure 9**). The stream emanates from a box culvert that is under a parking lot and road. This culvert was undergoing construction at the time of this assessment. The upper reach of May Branch is significantly different from the lower portion and therefore was assessed separately.

The upper reach of May Branch is approximately 360 feet in length and consists of 80 percent riffle, 5 percent run and 10 percent pool/glide habitat. The stream appears to have been channelized in the past, but has regained some natural dimension, pattern and profile. Water depth ranged from 0.10 feet to 0.55 feet. The stream width ranged from 2 to 6 feet wide. Frequent backwater conditions are likely based on the stream's appearance, but the lack of significant sediment in this upper portion of the stream indicates an ability to move particles through the system. The velocity was measured at one foot per second. There is neither canopy cover nor in-stream cover for this reach. Measured specific conductivity was 421 µS/cm. The calculated EII for this reach is 0.19

The lower reach of May Branch is approximately 374 feet in length, consisting of 75 percent pool and 25 percent run habitat. A number of debris jams consisting of fallen trees and trash were present. The sediment is several feet deep in places and appears to be a permanent condition. Backwater conditions occur because of excessively high water levels when the Levisa Fork rises, which result in sedimentation and high erosion. The banks along this reach are bare, contributing additional sediment. The presence of this deep sedimentation reflects the stream's inability to move its sediment load through the system. This

portion of May Branch has a nearly 100 percent canopy cover during the growing season from the large deciduous trees along the top of the bank. Specific conductivity was measured at 426 µS/cm. The EII for this reach is calculated at 0.18.

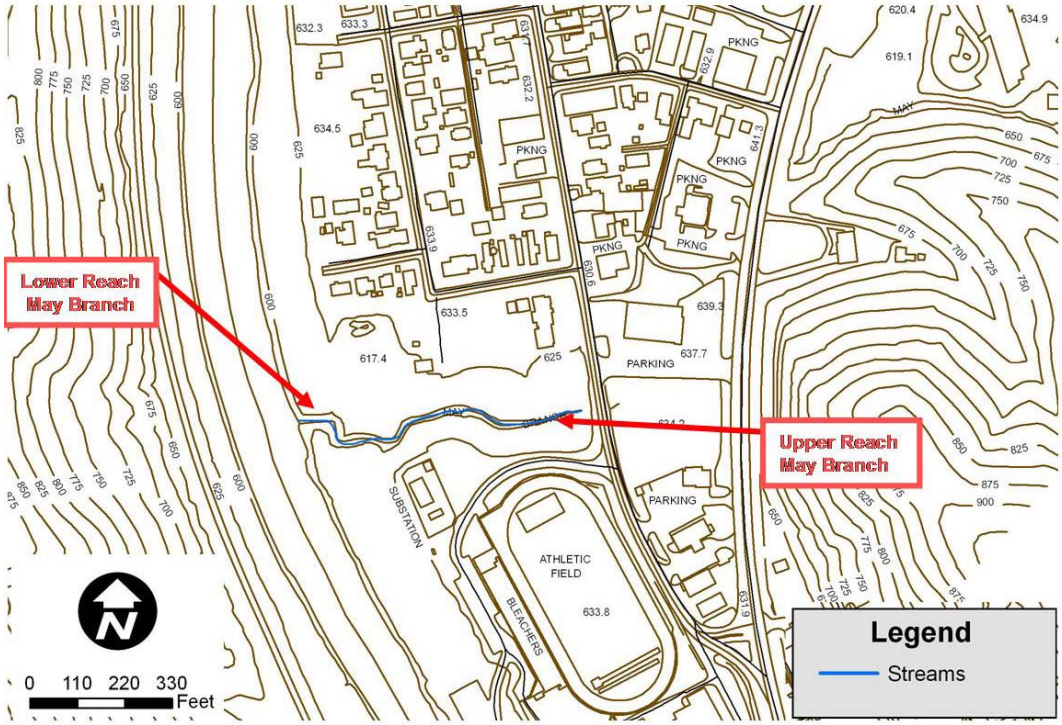


Figure 9. May Branch

3.3.4 Campus Branch

An unnamed tributary to the Levisa Fork (here called Campus Stream) on the campus of the BSCTC is divided into two sections of significantly different characteristics. This tributary runs along the eastern side of the Community College in Prestonsburg (**Figure 10)**. In the upper section, a cement trapezoidal channel conveys drainage from a storm drain southeast of the college to a culvert under the entrance road. The Campus Stream emanates from this culvert.

The middle reach of the Campus Stream emanates from the aforementioned culvert under the entrance road to the community college and runs from the culvert approximately 560 feet. The stream has limited dimension, pattern and profile and is still relatively unstable, with bank erosion an issue. This reach of stream has almost total canopy cover during the growing season from large deciduous trees located along the stream banks. Grounds keepers maintain the grass to the water's edge. Specific conductivity was measured at 409 µS/cm. The EII for this reach is calculated at 0.20.

The lower reach of this Campus Stream has no visible boundary; however, the conditions in this reach are vastly different from the upper reach. This reach flows for approximately 461 feet until its confluence with the Levisa Fork. The banks are highly unstable. There is an abundance of sediment gray in color and more than a foot deep in places, most likely a result of evident backwater conditions. The stream bed also contains large amounts of rubble such as large cement slabs, discarded pipes, trees and pruned limbs, yard waste, and man made materials. During the growing season shrubs and deciduous trees provide almost complete canopy cover. Towards its confluence with the Levisa Fork there is a drop in slope of

about 32 feet. Specific conductivity was measured at 397 µS/cm near the upstream portion of the reach. No measurements were taken further downstream due to the loss of surface flow. The EII for this reach is calculated at 0.22.

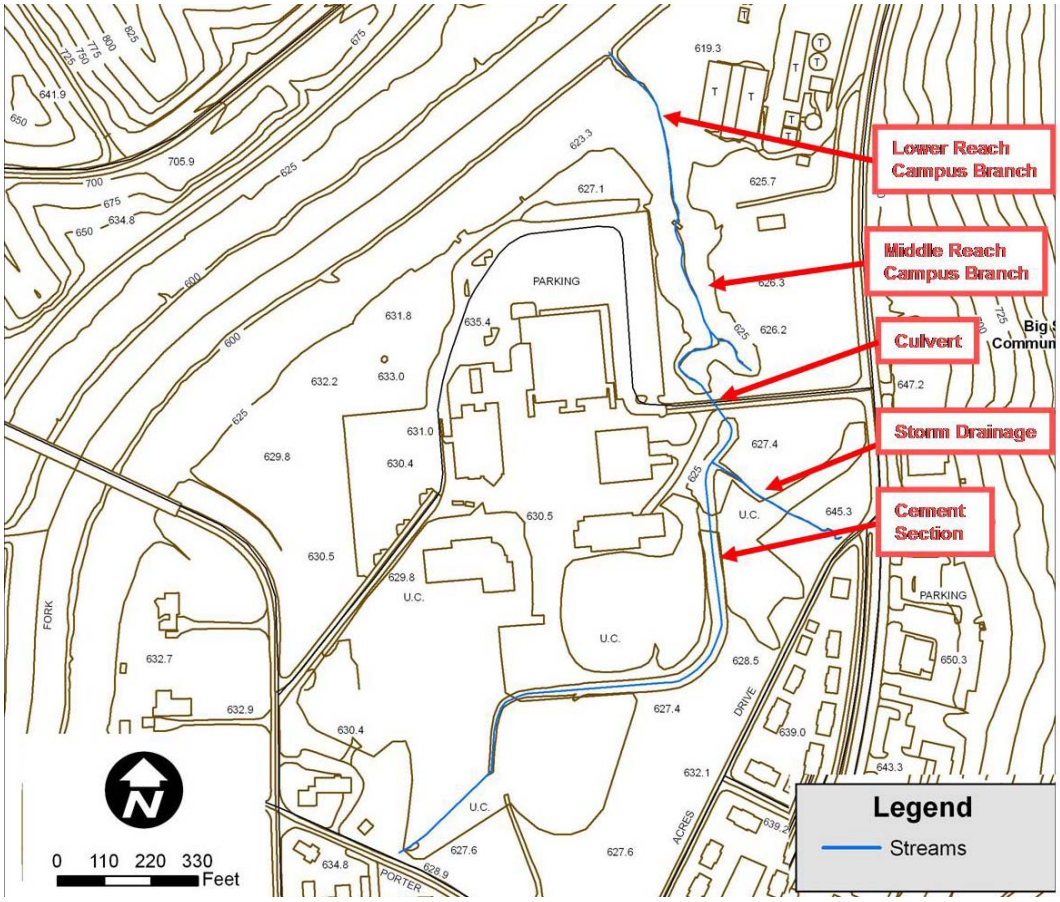


Figure 10. Campus Branch

3.3.5 Drainages

A storm drainage approximately 150 feet long was observed emanating from a culvert near a construction site south of the Big Sandy Community and Technical College. No flow was present at the time of the late June assessment. However, photos taken on June 8th during a site reconnaissance show mass wasting and bank slump when compared to photos taken on June 26th. The drainage area has since been filled as part of the construction of a grocery/retail center.

An approximate 115-foot grassy drainage was observed between the Arch Bridge and Prestonsburg High School. This drain had no flow at the time of assessment and no water quality measurements were taken. The drainage is heavily vegetated with grasses, shrubs and weeds. There are no trees giving canopy cover.

3.3.6 Borrow Areas

Borrow Area PB-2: No streams were noted. Four seeps in the bedrock were observed in borrow area PB-2. Seeps were located on very steep mountain slopes, which then ran along the base of the mountain. Minimal flow was observed in all seeps.

Spurlock Creek: One stream, Spurlock Creek, was noted. The stream traverses the mowed site and has very narrow riparian fringe (approximately 3 feet on each side). It is highly impacted, evidenced by downcutting and obvious water quality impairment (gray and red water), with little stream flow. Cover was rated at approximately 30 percent. The stream had a mud substrate, with water covering approximately half the available channel. The stream was evaluated as "marginal" using the Low Gradient Streams Habitat Assessment Field Data Sheet. No conductivity was measured.

Granny Fitz Branch: One stream, Granny Fitz Branch, was noted. Granny Fitz Branch is a small stream bordering the southern side of the open field, flowing along the base of an adjacent slope. The riparian corridor consists of a single row of trees on one side with grassy ground cover. Cover was rated at approximately 30 percent. The stream had a predominantly mud substrate with shallow pools. The stream was evaluated as "suboptimal" using the Low Gradient Streams Habitat Assessment Field Data Sheet. No conductivity was measured.

3.3.7 Summary

Surface water within the study has been affected by the Levisa Fork's recurrent flooding as well as human impact. Streams are generally of poor quality, with incised banks, excessive sediment, debris, and high specific conductivity. A summary of the study area streams is shown in Table 5 below.

Table 5. Study Area Surface Water

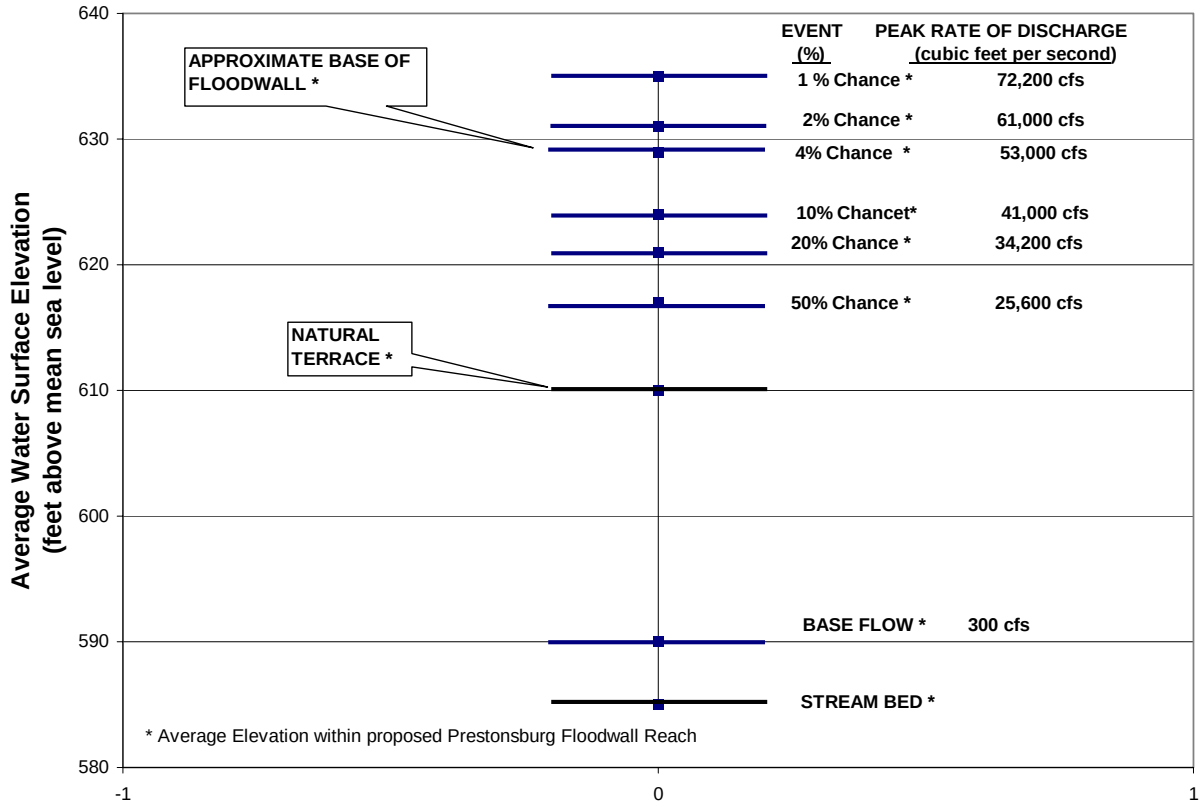
Stream	Type	Length (ft)	Conductivity (µS/cm)	Substrate	Canopy Cover (%)	Ecological Integrity Index (EII)
Levisa Fork behind Community Bank	Perennial	n/a	804	Sand, Silt, Clay	~ 30	0.2
Levisa Fork behind Methodist Church	Perennial	n/a	806	Sand, Silt, Clay	~ 50	0.25
Trimble Branch	Perennial	300	n/a	mud	50	0.10
May Branch Upper	Perennial	360	421	mud	0	0.19
May Branch Lower	Perennial	300	426	Debris, mud	100	0.18
Campus Stream Upper	n/a	922	431	Concrete	0	n/a
Campus Stream Middle	Intermittent	522	409	Silt and Pebbles	~100	0.20
Campus Stream Lower	Intermittent	482	397	Gray sediment, rubble	~100	0.22
Drainage Near Food Lion	n/a	150	No flow	mud	0	n/a
Drainage Near Arch Bridge	n/a	115	No flow	grass	0	n/a
PB-2 Borrow Area	n/a	n/a	n/a	n/a	n/a	n/a
Granny Fitz Borrow Area	Perrennial	n/a	-	mud	30	-
Spurlock Creek Borrow Area	Perrenial	n/a	-	mid	30	-

3.4 Impacts from Structural Measures of Alternative Plans 2 and 3

3.4.1 Levisa Fork

3.4.1.1 Abiotic Effects

Because of the local topography, the Levisa Fork water elevation and peak rate of discharge raises markedly with even a small storm event. Chart **1** shows the water elevation and peak rate of discharge for various storm events as predicted by Hydrologic Engineering Center (HEC)-2 modeling (USACE, 2005). As shown in the chart, the peak rate of discharge for a 50 percent chance event is approximately 85 times base flow in this area, with a corresponding rise in water elevation of approximately 27 feet.



Data source: HEC-2 Modeling Between River Stations 51 and 55, Prestonsburg, KY, USACE 2005

Chart 1. Levisa Fork Water Surface Elevation and Peak rate of discharge for Various Storm Events within Proposed Prestonsburg Floodwall Reach

Either proposed floodwall would be constructed along the top of the left bank of the Levisa Fork at approximate elevation 630-632 feet AMSL. This elevation represents average water elevation during a storm event with less than a four percent chance in this area. During smaller storm events, floodwaters would not rise to the base of the floodwall. The proposed armored toe bank stabilization could, however, affect the stream characteristics during these smaller events.

During storm events larger than about the four percent chance event, floodwaters would be more restricted within floodwall limits. Construction of either floodwall would change the overflow patterns of

the Levisa Fork at either end of the structures. Velocities and carrying capacities would change both within and adjacent to the upstream and downstream reaches of the floodwalls. The floodwall would reduce overall flood storage by eliminating floodplain flow for the lengths of the floodplain during large storm events.

Review of HEC-2 modeling for with and without floodwall scenarios indicate that changes resulting from the proposed floodwall would not be significant. Predicted changes in stream velocity for channel, left bank and right bank locations are shown in **Table 6** for a 50 percent chance event and a one percent chance event. Channel and left bank velocity is predicted to change less than 0.6 feet per second. The increase in velocity would be greatest along the right bank opposite the floodwall, with increases up to 2.5 feet per second.

Table 6. Existing Levisa Fork Velocity and Predicted Change with Proposed Floodwall

Levisa Fork	Base Flow (ft/sec)	50 Percent Chance Event		1 Percent Chance Event	
		Existing Stream Velocity (ft/sec)	Change with Floodwall (ft/sec)	Existing Stream Velocity (ft/sec)	Change with Floodwall (ft/sec)
Channel	0.3 – 2.7	4.0 – 8.0	0.1 – 0.5	5.8 – 11	0.3 – 0.6
Left Bank	n/a	1 – 3.7	-0.5 – 0	1.7 – 5.2	-0.6 – 0.3
Right Bank	n/a	0.8 – 4.3	0 – 1.3	1.3 – 5.1	0 – 2.5
Levisa Fork	Base Flow (cm/sec)	Existing Stream Velocity (cm/sec)	Change with Floodwall (cm/sec)	Existing Stream Velocity (cm/sec)	Change with Floodwall (cm/sec)
Channel	9-82	122 – 244	3 – 15	177 – 335	9 – 18
Left Bank	n/a	30 – 133	-15 – 0	52 – 158	-18 – 9
Right Bank	n/a	24 - 131	0 – 40	40 – 155	0 – 76

Data source: HEC-2 Modeling between River Stations 51 and 55, Prestonsburg, KY, USACE 2005

Anticipated channel stream velocities under floodwall and no-floodwall conditions are presented in **Charts 2 and 3.** Effects to upstream and downstream areas would be minor.

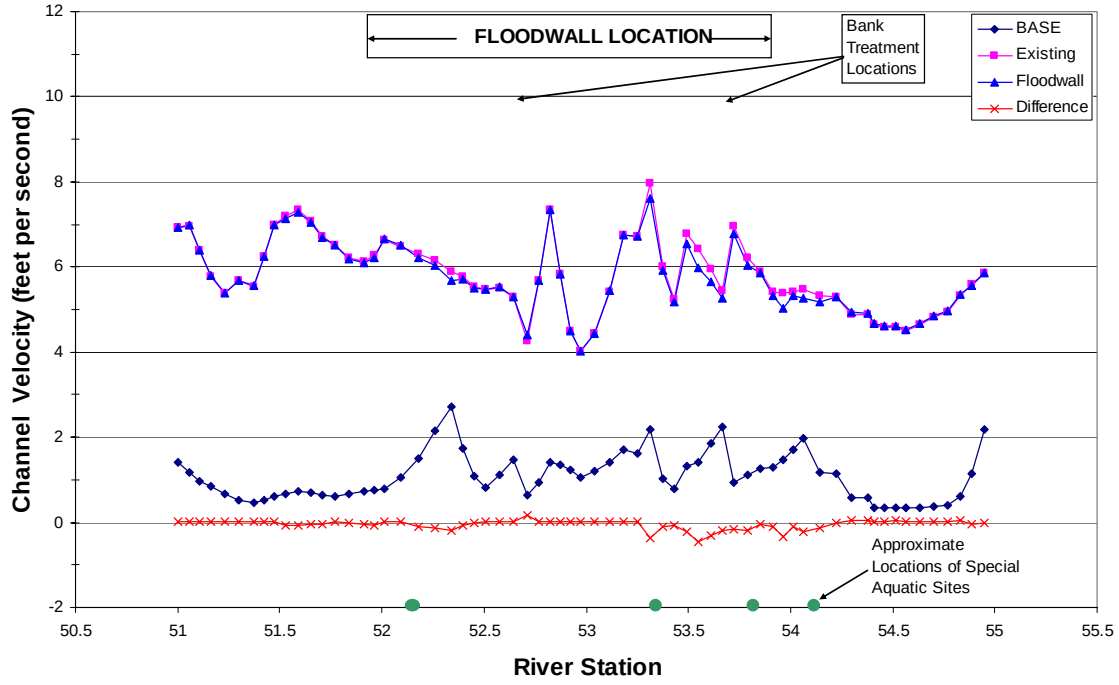


Chart 2. Channel Surface Velocities for Levisa Fork 50 Percent Chance Event within Prestonsburg, Kentucky

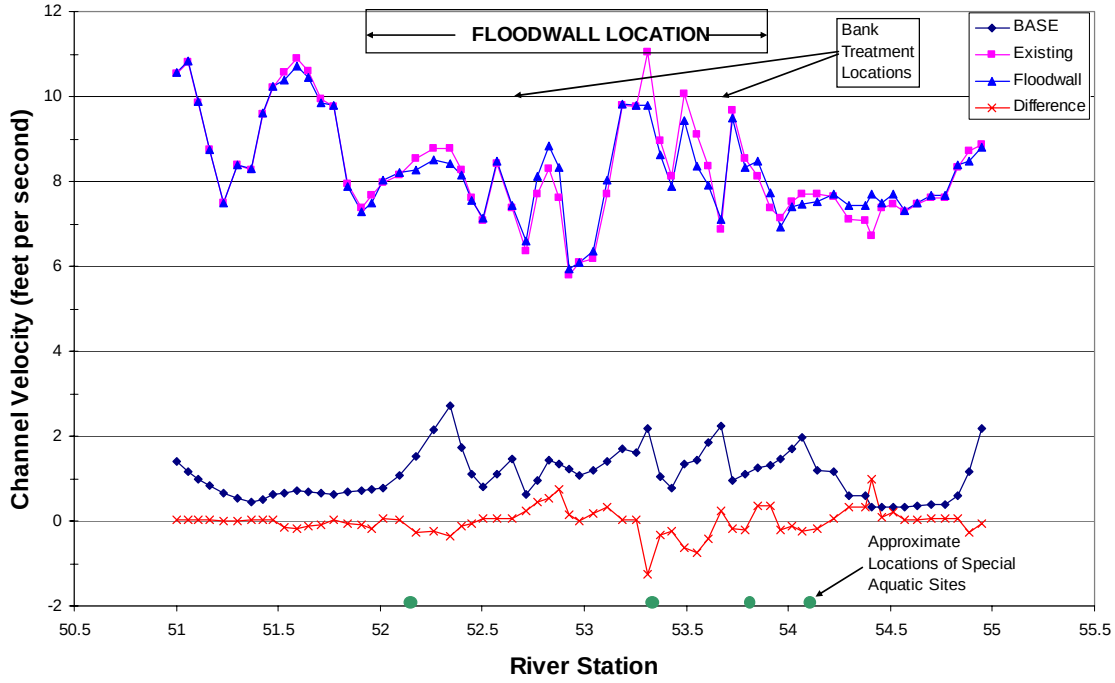


Chart 3. Channel Surface Velocities for Levisa Fork 1 Percent Chance Event within Prestonsburg, Kentucky

The ability of the stream reach in the vicinity of the proposed floodwalls to transport bed-load through the reach depends on the stream velocities and on the sizes of particles to be transported. The process can be described by the Hjulstrom Diagram. A Hjulstrom Diagram shows the relationship between water velocity, particle size, erosion, transportation, and deposition. Erosion is the picking up of sedimentary material, transportation is the carrying, and deposition is the dropping of the material. As shown on the diagram, mud or clay particles are generally considered to be less than 0.1 mm in diameter. Sand particles are between 0.1 and 4 mm in diameter. Gravel is generally considered to be between 4 mm and about 64 mm in diameter.

Existing channel surface velocities for base flow, 50 percent chance event and one percent chance events are shown superimposed on a Hjulstrom Diagram in **Chart 4**.

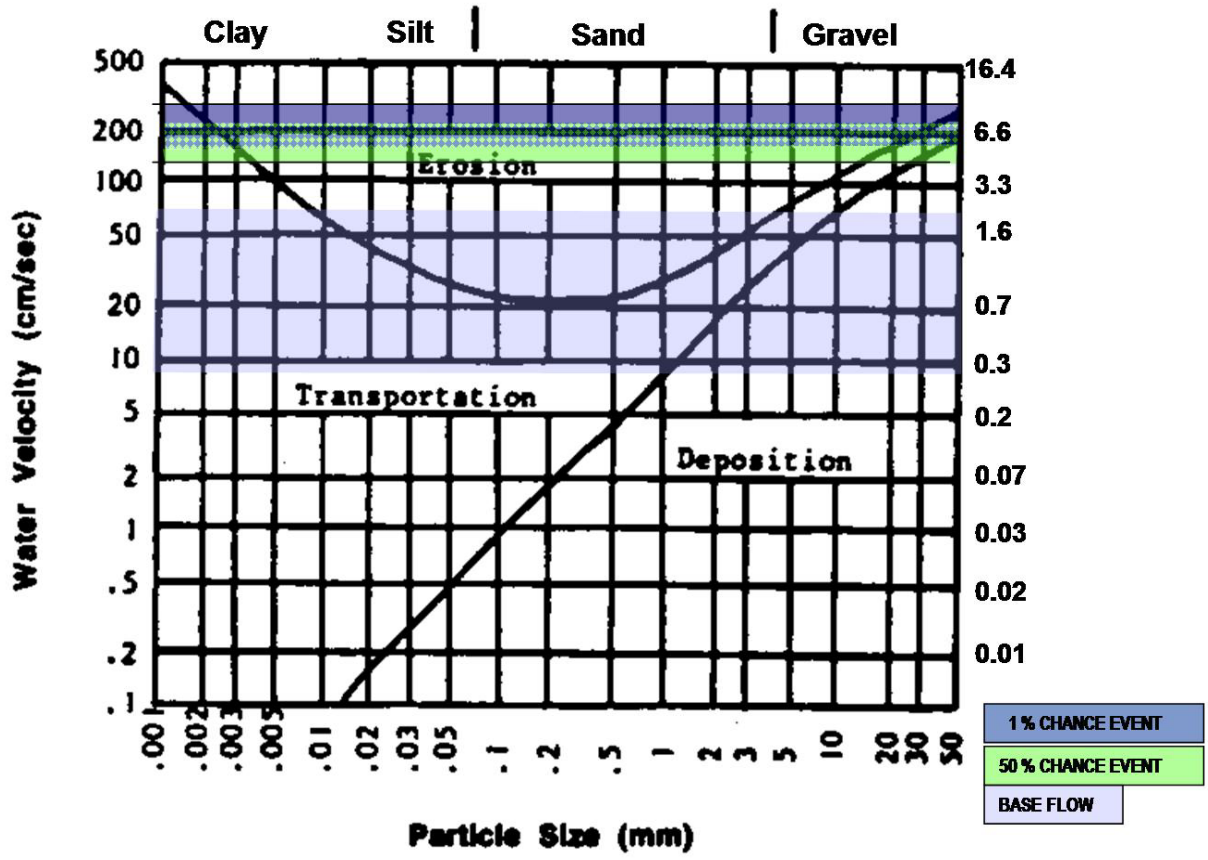


Chart 4. Hjulstrom Diagram Showing Range of Channel Surface Velocities for Levisa Fork, River Station 51-55, Prestonsburg, Kentucky

The Hjulstrom Diagram shows that under base channel flow conditions along this reach, particles less than approximately 1mm would be transported and not deposited. Particles between 0.01 and 1 mm would tend to be lifted from the streambed and carried along the Levisa Fork. Some particles between 1 mm and 5 mm (sand) could be lifted and moved, the distance moved depending on their size. Particles heavier than 5 mm (gravel) are not likely to be moved.

With a 50 percent chance storm event, particles less than approximately 25 mm (mud, sand and gravel) would be transported and not deposited along the channel. Particles between 0.002 mm and 15 mm would tend to be lifted from the streambed and carried along the Levisa Fork. Some particles larger than 15 mm could be lifted and moved, the distance moved depends on their size. Particles heavier than 50 mm are not likely to be moved.

With a one percent storm event, particles less than approximately 40 mm (mud, sand and gravel) would be transported and not deposited along the channel. Particles between 0.0015 mm and 20 mm would tend to be lifted from the streambed and carried along the Levisa Fork. Some particles larger than 20 mm could be lifted and moved, the distance moved depending on their size. Particles much larger than 50 mm would not be expected to be lifted and moved.

Some change in the size of particles transported, eroded, and deposited would be expected as a result of the floodwall and bank stabilization proposed under Alternative Plans 2 and 3. However, these changes are small with respect to the existing conditions and would not be considered a significant change. Slightly smaller and slightly larger particles would be lifted and moved due to changes in stream velocity. **Table 7** presents the approximate moveable particle size under existing and proposed conditions.

Table 7. Approximate Moveable Particle Size for Levisa Fork Storm Events within Prestonsburg Reach (River Station 51 – 55)

Stage	Water Elevation	Existing Conditions	With Floodwall and Bank Stabilization
		Moveable Particle * (mm)	Moveable Particle * (mm)
Base Flow	590	.01 – 5	.01 – 5
50 % Chance	617	.002 – 40	.0015 – 45
1% Chance	635	.0015 - 50	.0012 – 60

* Hjulstrom Diagram

3.4.1.2 Biotic Effects

Construction of either floodwall would have direct, short-term adverse effects on water quality of the **Levisa Fork** during the construction period. Adverse impacts would be minimized through the use of Best Management Practices (BMPs). Construction of either floodwall would occur over several months. Increased sedimentation would be expected from construction activities. Runoff from soil disturbance could cause a short-term increase in turbidity in adjacent streams and in the Levisa Fork. Spills or leakage of fuel or other petroleum products from construction equipment and vehicles could occur.

Removal of trees within the riparian corridor would occur where the pump stations would be constructed and where bank stabilization is necessary. This could cause increased sunlight reaching the Levisa Fork, which could in turn impact aquatic life.

Work occurring directly in the Levisa Fork includes bank stabilization (armored toe protection). Mobile organisms such as fish would presumably escape the area and gradually return once work is complete. Populations of immobile and slowly-moving aquatic organisms directly in the work area would be killed. The population would slowly rebuild from upstream once work is complete.

Direct, long-term beneficial impacts to the Levisa Fork would result from stabilization of the Trimble, May, and Campus Branches. Less erosion and sedimentation would occur from the stabilized banks. Water quality in the Levisa Fork would benefit from the project.

Special Aquatic Sites: The existing conditions show that lateral bars, pools and riffles within this reach are most likely formed, moved, and transformed periodically under existing conditions. Additional impacts to identified aquatic sites from the Proposed Action should be minor; however more effect from predicted velocity changes would be expected along the right bank of the Levisa Fork than along the left bank. Special aquatic site B, a vegetated shallow along the left bank at approximate RM 53.82, is closest to the proposed bank stabilization behind the First Commonwealth Bank.

3.4.2 Tributary Streams

3.4.2.1 Trimble Branch

The entire stream length from the culvert to the Levisa Fork would be cleared of all vegetation and the banks stabilized with rip rap. A new culvert would be constructed in conjunction with the upgraded pump station. Once construction is complete, Trimble Branch would flow within the stabilized streambed from the culvert to the Levisa Fork.

3.4.2.2 May Branch

Plans for May Branch within the project area include clearing all vegetation, grading the side slopes to a rough trapezoidal channel, and constructing a pump. The slopes of the channel would be stabilized with rip-rap and a channel-within-channel streambed would be recreated. Once construction is complete, May Branch would flow within the recreated streambed from the roadway culvert to the toe of the levee, where it would enter the pump station and another culvert. On the riverward side of the levee, water would exit the culvert and flow through a section stabilized with rip rap to the Levisa Fork. On the landward side of the pump station the channel would be used as a ponding area when necessary during high-water events. During normal flow, the May Branch would flow along the bottom of the channel through the pump station culvert to the Levisa Fork. During flood events, the May Branch would be blocked at the pump station and its flow, along with stormwater drainage from inside the floodwall/levee area, would collect in the streambed and be pumped over the wall into the Levisa Fork as necessary. Long-term water quality in the lower section of May Branch would be improved from existing conditions by the placement of rip rap to stabilize the banks. Bank stabilization would also provide a direct, long-term improvement in Levisa Fork water quality by lowering the amount of sediment transported.

May Branch would be periodically impacted by storage of stormwater during larger rainstorms. During these events, water from the Levisa would be higher than the outlet of the pump station causing the temporary closure of the pump outlet structure. This would initiate water storage in the channel area until the runoff reaches a specified storage elevation. Once this elevation is reached, the pumps would be activated in order to maintain the specified elevation. The stored runoff would be released when the Levisa returns to an elevation below the specified flood event. Temporary storage may cause an increase in sedimentation in May Branch, with the potential for contaminants in the stormwater runoff to settle. However, the degree of sedimentation should be small, as most of the sediment would be carried into the Levisa once the stored runoff is released.

3.4.2.3 Campus Branch

Plans for the Campus Branch within the project area include construction of a gate well and ponding area between the BSCTC and the waste water treatment plant. The stream would be culverted under the

floodwall/levee and stabilized with rip-rap in the area of the gate well. Once construction is complete, Campus Branch would flow within the existing streambed from the roadway culvert to the toe of the embankment, where it would enter the gate well and culvert. On the riverward side of the floodwall embankment, water would exit the culvert and use the existing streambed (lower reach) to the Levisa Fork. On the landward side of the floodwall and gate well, the stream would be used as a ponding area when necessary during high-water events. During normal flow, the Campus Branch would flow through the culvert to the Levisa Fork. During flood events, the Campus Branch would be blocked at the gate well and its flow, along with stormwater drainage from inside the floodwall/levee area, would collect in the streambed. The collected water would be released into the Levisa Fork once water levels decrease.

Campus Branch would be periodically impacted by storage of stormwater during larger rainstorms. During these events, the gate would be closed and water from the Levisa Fork would be stored in the channel area. The stored runoff would be released when the Levisa Fork returns to an elevation below the specified flood event. Temporary storage may cause an increase in sedimentation in Campus Branch, with the potential for contaminants in the stormwater runoff to settle. However, the degree of sedimentation should be small, as most sediments would be carried into the Levisa once the stored runoff is released.

3.4.2.4 Biotic Effects

Impacts to streams were evaluated by comparing the predicted post-project stream conditions with existing conditions. Short-term impacts would occur to **Trimble Branch, May Branch and Campus Branch** during construction. Impacts include loss of vegetation and canopy cover, grading, and modification of stream banks with rip rap as needed. Aquatic resources in these streams would be lost during construction, but could slowly reestablish once construction is complete. An assessment of this post-project scenario was conducted to evaluate the change in EIUs from existing conditions. A summary of expected impacts is contained in **Table 8.** Conditions are expressed in Ecological Integrity Units (EIU), which are a function of a stream's physical and chemical parameters. A worst-case scenario of stream condition was assumed for this evaluation, and the EII for post-project conditions was set at 0.10 for each stream reach impacted. These assumptions would be re-evaluated during the design and permitting process. Should the anticipated stream condition be better, mitigation costs would be lower.

Table 8. Summary of Impacts to Streams within the Proposed Project Length

Stream		Existing Conditions			Post-Project			
		Existing Length (feet)	Ecological Integrity Index (EII)	Ecological Integrity Units (EIU)	Condition	Length (feet)	Ecological Integrity Index (EII)	Ecological Integrity Units (EIU)
Trimble Branch	Entire Reach	300	0.1	30	Vegetation removal, grading, rip rap	300	0.1	30
	Total EIU Loss/Gain for Stream Reach							**0**
May Branch	Upper Reach	360	0.19	68.4	Limited vegetation removal, grading	332	0.1	33.2
	Lower Reach	374	0.18	67.3	Vegetation removal, grading, rip rap	80	0.1	8
	Total EIU Loss/Gain for Stream Reach							**94.5**
Campus Branch (Alternative Plan 3)	Upper	922	n/a	0	No change	922	n/a	0
	Middle Reach	560	0.2	112	Limited vegetation removal	489	0.1	48.9
	Lower Reach	461	0.22	101.4	No change	348	0.1	34.8
	Total EIU Loss/Gain for Stream Reach							**129.7**
Levisa Fork	Upper Reach	500	0.2	100	Vegetation removal, grading, rip rap, armored toe placement	500	0.1	50
	Lower Reach	1700	0.25	425	Vegetation removal, grading, rip rap, armored toe placement	1700	0.1	170
	Total EIU Loss/Gain for Stream Reach							**305**

3.4.3 Borrow Areas

A 100-foot buffer would be maintained between borrow limits and streams. No work is proposed in streams. However, use of borrow areas has the potential to impact surface water. The type of impacts could include changes in drainage patterns, increased sedimentation and erosion from soil disturbance, and spills or leaks of petroleum products from equipment and vehicles. A NPDES permit would be needed prior to borrowing. BMPs contained in the permit would be implemented to minimize adverse effects; therefore impacts from runoff and changes in drainage patterns would be expected to be minimal.

3.5 Mitigation

Based on informal consultation with regulatory agencies, compensatory mitigation would be needed for structural measures in Alternative Plans 2 and 3 because of impacts to aquatic habitat on the Levisa Fork and tributary streams.

3.5.1 Mitigation Strategies Considered

Alternative mitigation strategies evaluated include mitigation-in-place, off-site mitigation, and in-lieu fee compensation to KDFWR. Off-site mitigation for the tributaries was investigated but was not feasible. No other tributaries within or adjacent to the project area were identified to have mitigation potential. On the suggestion of regulatory agencies, field staff visited Fishtrap Lake and looked at various tributaries to see if they would provide suitable mitigation sites using stream restoration/enhancement. None of the streams reviewed were suitable mitigation sites.

3.5.2 Proposed Mitigation

Based on consultation with regulatory agencies, compensatory mitigation would be needed for impacts to May and Campus Branches and to the Levisa Fork. For Trimble Branch, no net loss of EIUs is anticipated, and therefore no mitigation would be needed.

In-lieu fee compensation is proposed for tributary streams affected. Based on the agreement concerning in-lieu mitigation fees between KDFWR and USACE, compensatory mitigation through the payment of in-lieu fees is available when project impacts can not be avoided, minimized, or mitigated on site. In-lieu fee recipients use the money to identify appropriate stream and wetland restoration opportunities in Kentucky with the intent to conduct mitigation projects as close to the impacted site as possible. In-lieu fees were estimated with the Eastern Kentucky Stream Assessment Protocol (EKSAP) calculator using the in-lieu compensatory mitigation ratio for perennial streams.

- For May Branch, approximately 28 feet and 294 feet of the upper and lower reach (respectively) will be culverted, which represents a complete loss of 322 feet of existing stream length. The remaining stream length (approximately 412 feet) is anticipated to have a reduction in Ecological Integrity (see Table 8). For both reaches, the EKSAP-calculated mitigation ratio ranged between 1.5 and 1.67. The estimated cost of in-lieu fee compensation would be $65,367 for the upper reach and $72,612 for the lower reach.

- For Campus Branch (Alternative Plan 2 only), approximately 71 feet and 113 feet of the middle and lower reach (respectively) will be culverted, which represents a complete loss of 184 feet of existing stream length. The remaining stream length (approximately 837 feet) is anticipated to have a reduction in Ecological Integrity (see Table 8). For both reaches, the EKSAP-calculated mitigation ratio ranged between 1.5 and 1.73. The estimated cost of in-lieu fee compensation would be $102,398 for the upper reach and $87,597 for the lower reach.

The total in-lieu fee compensatory mitigation cost for tributary streams would be approximately $327,974 for Alternative Plan 2 and $137, 979 for Alternative Plan 3.

Both mitigation-in-place and in-lieu fee compensation are still being considered for the Levisa Fork. The mitigation-in-place option for the Levisa Fork would incorporate measures to improve aquatic habitat in the areas disturbed by streambank stabilization. If mitigation-in-place is decided, a detailed mitigation plan would be included in the DPR-1/FEIS. For in-lieu fee compensation, approximately 500 feet of the upper reach (near Trimble Creek) and 1,800 feet of the lower reach (just downstream of May Branch) will be disturbed for placement of the armored toe and slope protection, with a reduction in Ecological Integrity (see Table 8). The post project EII for both reaches was estimated at 0.1. For the two sites, the EKSAP-calculated mitigation ratio ranged between 1.50 and 1.59. The estimated cost of in-lieu fee compensation would be $90,000 for the upper reach and $344,250 for the lower reach.

4.0 TERRESTRIAL RESOURCES WITHIN STRUCTURAL AREAS

4.1 Methodology

A secondary source review and a general field reconnaissance were performed within the structural project area. Aerial photos, maps, and previous reports were reviewed. Site reconnaissance was conducted in May and June 2004 to identify different vegetation communities. Site reconnaissance was conducted in May 2004 to identify different vegetation communities. Most of the study area is developed, with the exception of the riparian corridors and borrow areas. Land cover includes both developed and forested areas. On June 8 and 9, 2004, AMEC biologists identified the following three forest communities within the proposed project areas:

- Riparian forest
- Upland hardwood forest
- Upland pine forest.

As part of this evaluation, a Habitat Evaluation Procedure (HEP) analysis was applied to these three forest communities in the City of Prestonsburg and Borrow Area PB-2 that could be affected by construction of a floodwall. Animal reference species for the HEP were selected in consultation with the U.S. Fish and Wildlife Service (USFWS) and the KDFWR. Selection was based on habitat types available within the proposed structural disturbance area as well as the potential for various species to occur within these areas. Four species were selected to evaluate forested habitat within the project area: barred owl (*Strix varia*), downy woodpecker (*Picoides pubescens*), gray squirrel (*Sciurus carolinensis*), and eastern cottontail (*Sylvilagus floridanus*). USFWS Habitat Suitability Index (HSI) models were used to evaluate species' habitats. HSI scores range from 0.0 (poor quality) to 1.0 (good quality) and are defined in the published HSI models. The HEP is included as **Appendix D**.

Land cover within the proposed floodwall construction work limits (CWL) was identified during site reconnaissance, by reviewing proposed alignments, the Prestonsburg quadrangle USGS topographic map and aerial photographs. In addition, a USACE field botanist performed a floral inventory of the project area in 2003-2004. The floral inventory is included as **Appendix E**.

4.2 Literature Review

4.2.1 Vegetation

Floyd County is located within the Central Appalachian Ecoregion, specifically the Dissected Appalachian Plateau Ecoregion, which is composed of narrow ridges, deep coves, and narrow valleys. The majority of land cover in Floyd County is forest.

Mixed mesophytic forest is the normal climax vegetation type in this region; however, forest communities may vary in species composition based on topography, elevation, slope, aspect, soils, and other variables. Common tree species of mixed mesophytic forests include oaks (*Quercus* spp.), hickories (*Carya* spp.), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), yellow poplar (*Liriodendron tulipifera*), beech (*Fagus americana*), black cherry (*Prunus serotina*), black walnut (*Juglans nigra*), Eastern hemlock (*Tsuga canadensis*), shagbark hickory (*Caraya Ovata*) and many others.

Riparian forests, which are located adjacent to rivers, are often composed of the following species: box elder (*Acer negundo*), silver maple (*Acer saccharinum*), yellow buckeye (*Aesculus octandra*), river birch

(*Betula nigra*), American beech (*Fagus grandifolia*), green ash (*Fraxinus pennsylvanica*), sycamore (*Platanus occidentalis*), black willow (*Salix nigra*), and slippery elm (*Ulmus rubra*). Shrubs and vines of riparian forest habitats include brookside alder (*Alnus serrulata*), crossvine (*Bignonia capreolata*), elderberry (*Sambucus canadensis*), wild hydrangea (*Hydrangea arborescens*), privet (*Ligustum vulgare*), spicebush (*Lindera benzoin*), pawpaw (*Asimina triloba*), ironwood (*Carpinus caroliniana*), and poison ivy (*Toxicodendron radicans*). Common herbaceous species include giant ragweed (*Ambrosia trifida*), orange jewelweed (*Impatiens capensis*), yellow jewelweed (*Impatiens pallida*), water willow (*Justicia americana*), common horsetail (*Equisetum arvense*), and Virginia saxifrage (*Saxifraga virginensis*).

Old field and scrub/shrub uplands primarily include previously disturbed or cleared land that has been allowed to revegetate and is in various stages of early succession. Old field is used to describe open, non-forested land dominated by a variety of early successional species, including broomstraw (*Andropogon virginicus*) and other grasses and various forbs. Old field areas may also have scattered shrubs.

4.2.2 Wildlife

Floyd County is primarily forested and has a diverse wildlife population. Approximately 148 species of terrestrial wildlife have been recorded in Floyd County including 23 mammals, 101 birds, 7 reptiles, and 17 amphibians (KDFWR 2003). Terrestrial organisms that have been observed throughout Floyd County are listed in **Table 9**. The proposed project area does not include the full diversity of habitats that Floyd County and the wider Levisa Fork drainage area encompasses. Terrestrial wildlife species expected to be present within the three project phases would be those species typically found in riparian forests, open fields, or disturbed areas. The USGS Prestonsburg quadrangle was used to narrow down the potential species that may occur in the area of the proposed floodwall. Terrestrial wildlife observed within the USGS Prestonsburg quadrangle are identified in **Table 9**.

Table 9. Terrestrial Wildlife Species Observed in Floyd County and Prestonsburg Quadrangle

Common Name	Scientific Name	Common Name	Scientific Name
Mammals			
Allegheny Woodrat	*Neotoma magister*	Norway Rat	*Rattus norvegicus*
American Black Bear	*Ursus Americanus*	Pygmy Shrew	*Sorex hoyi*
Coyote	*Canis Latrans*	Smoky Shrew	*Sorex fumeus*
Eastern Chipmunk	*Tamias striatus*	Southeastern Shrew	*Sorex longirostris*
Eastern Cottontail	***Sylvilagus floridanus***	Southern Bog Lemming	*Synaptomys cooperi*
Eastern Fox Squirrel	***Sciurus niger***	Striped Skunk	*Mephitis mephitis*
Eastern Gray Squirrel	*Sciuris carolinenesis*	**Virginia Opossum**	***Didelphis virginiana***
Gray Fox	***Urocyon cinereoargenteus***	White-Footed Mouse	*Peromyscus leucopus*
House Mouse	*Mus musculus*	**White-Tailed Deer**	***Odocoileus virginianus***
Meadow Vole	*Microtus pennsylvanicus*	**Woodchuck**	***Marmota monax***
Northern Raccoon	***Procyon lotor***	Woodland Vole	*Microtus pinetorum*
Northern Short-Tailed Shrew	*Blarina brevicauda*		
Reptiles			
Common Garter Snake	*Thamnophis sirtalis*	Northern Fence Lizard	*Sceloporusc undulatus hyacinthinus*
Eastern Box Turtle	***Terrapene carolina***	Northern Ringneck Snake	*Diadophis punctatus edwardsii*
Northern Black Racer	*Coluber constrictor constrictor*	Northern Water Snake	*Nerodia sipedon sipedon*
Northern Copperhead	*Agkistrodon contortrix okasen*		
Amphibians			
American Toad	*Bufo americanus*	Northern Dusky Salamander	*Desmognathus fuscus fuscus*
Black Mountain Salamander	*Desmognathus welteri*	Northern Red Salamander	*Pseudotriton ruber ruber*
Cumberland Plateau Salamander	*Plethodon kentucki*	Northern Spring Peeper	*Pseudacris crucifer crucifer*
Green Frog	*Rana clamitans melanota*	Northern Two-Lined Salamander	*Eurycea bislineata*
Green Salamander	*Aneides aeneus*	Pickerel Frog	*Rana palustris*
Kentucky Spring Salamander	*Gyrinophilus porphyriticus duryi*	Ravine Salamander	*Plethodon richmondi*
Longtail Salamander	*Eurycea longicauda*	Seal Salamander	*Desmognathus monticola*
Mountain Chorus Frog	***Pseudacris brachyphona***		
Birds			
Acadian Flycatcher	***Empidonax virescens***	**House Finch**	***Carpodacus mexicanus***
American Crow	***Corvus Brachyrhynchos***	**House Sparrow**	***Passer domesticus***
American Goldfinch	***Carduelis tristis***	**Indigo Bunting**	***Passerina cyanea***
American Kestrel	*Falco sparverius*	**Kentucky Warbler**	***Oporornis formosus***
American Redstart	*Setophaga ruticilla*	Killdeer	*Charadrius vociferus*
American Robin	***Turdus migratorius***	**Louisiana Waterthrush**	***Seiurus motacilla***
American Tree Sparrow	*Spizella arborea*	**Mallard**	***Anas platyrhynchos***
Barn Swallow	***Hirundo rustica***	**Mourning Dove**	***Zenaida macroura***
Barred Owl	*Strix varia*	**Mute Swan**	***Cygnus olar***
Belted Kingfisher	***Ceryle alcyon***	**Northern Bobwhite**	***Colinus virginianus***
Black and White Warbler	***Mniotilta varia***	**Northern Cardinal**	***Cardinalis cardinalis***
Black-Capped Chickadee	***Poecile atricapilla***	**Northern Flicker**	***Colaptes auratus***
Blue Grosbeak	*Guiraca cairulea*	Northern Harrier	*Circus cyaneus*
Blue Jay	***Cyanocitta cristata***	**Northern Mockingbird**	***Mimus polyglottos***
Blue-Gray Gnatcatcher	***Polioptila caerulea***	**Northern Parula**	***Parula americana***

Table 9. Terrestrial Wildlife Species Observed in Floyd County and Prestonsburg Quadrangle

Common Name	Scientific Name	Common Name	Scientific Name
Blue-Headed Vireo	*Vireo solitarius*	Northern Rough-Winged Swallow	*Stelgidopteryx serripennis*
Blue-Winged Teal	*Anas discors*	**Orchard Oriole**	***Icterus spurius***
Blue-Winged Warbler	***Vermivora pinus***	Ovenbird	*Seiurus aurocapillus*
Black-Throated Green Warbler	*Dendroica virens*	**Peregrine Falcon**	***Falco peregrinus***
Broad-Winged Hawk	***Buteo Platypterus***	Pied-Billed Grebe	*Podilymbus podiceps*
Brown Thrasher	***Toxostoma rufum***	**Pileated Woodpecker**	***Dryocopus pileatus***
Brown-Headed Cowbird	***Molothrus Ater***	Prairie Warbler	*Dendroica discolor*
Bufflehead	*Bucephala albeola*	**Purple Martin**	***Progne subis***
Canada	*Branta canadensis*	**Red-Bellied Woodpecker**	***Melanerpes carolinus***
Carolina Chickadee	***Poecile carolinensis***	Red-Breasted Merganser	*Mergus serrator*
Carolina Wren	***Thryothorus ludovicianus***	**Red-Eyed Vireo**	***Vireo olivaceus***
Cedar Waxwing	*Bombycilla cedrorum*	Red-Shouldered Hawk	*Buteo lineatus*
Cerulean Warbler	*Dendroica cerulea*	Red-Tailed Hawk	*Buteo jamaicensis*
Chimney Swift	***Chaetura pelagica***	**Red-Winged Blackbird**	***Agelaius phoeniceus***
Chipping Sparrow	***Spizella passerina***	Ring-Necked Duck	*Aythya collaris*
Common Grackle	***Quiscalus quiscala***	**Rock Dove**	***Columba livia***
Common Loon	*Gavia immer*	**Ruby-Throated Hummingbird**	***Archiochus colubris***
Common Yellowthroat	***Geothlypis trichas***	Ruffed Grouse	*Bonasa umbellus*
Cooper's Hawk	***Accipiter cooperii***	Scarlet Tanager	*Piranga olivacea*
Doble-Crested Cormorant	*Phalacrocorax auritus*	**Song Sparrow**	***Melospiza melodia***
Downy Woodpecker	***Picoides pubescens***	**Summer Tanager**	***Piranga rubra***
Eastern Bluebird	***Sialia sialis***	**Tufted Titmouse**	***Baeolophus bicolor***
Eastern Kingbird	***Tyrannus tyrannus***	Tundra Swan	*Cygnus columbianus*
Eastern Meadowlark	*Sturnella magna*	**Turkey Vulture**	***Cathartes aura***
Eastern Phoebe	***Sayornis phoebe***	**White-Breasted Nuthatch**	***Sitta carolinensis***
Eastern Towhee	***Pipilo erythrophthalmus***	**White-Eyed Vireo**	***Vireo griseus***
Eastern Wood-Pewee	***Contopus virens***	Wild Turkey	*Meleagris gallopavo*
European Starling	***Sturnus vulgaris***	Wood Duck	*Aix sponsa*
Field Sparrow	***Spizella pusilla***	**Wood Thrush**	***Hylocichlamustelina***
Gray Catbird	***Dumetella carolinensis***	Worm-Eating Warbler	*Helmitheros vermivorus*
Great Blue Heron	*Ardea herodias*	**Yellow Warbler**	***Dendroica petechia***
Great Crested Flycatcher	***Myiarchus crinitus***	Yellow-Billed Cuckoo	*Coccyzus americanus*
Green Heron	***Butorides virescens***	**Yellow-Breasted Chat**	***Icteria virens***
Hairy Woodpecker	***Picoides villosus***	**Yellow-Throated Vireo**	***Vireo flavifrons***
Hooded Warbler	***Wilsonia citrina***	Yellow-Throated Warbler	*Dendroica dominica*
Horned Lark	*Eremophila alpestris*		

Source: Kentucky Department of Fish and Wildlife Resources (KDFWR, March 27, 2003)
Boldface type indicates observed within Prestonsburg Quadrangle

4.3 Results of Field Investigations within Structural Areas

Land cover within the proposed construction limits (includes floodwall alignment and borrow areas) include: riparian forest; upland mixed forest; disturbed land, emergent wetlands, maintained areas (including commercial and residential, lawn, institutional and urban/industrial, and landscaped areas).

Vegetation communities in the Prestonsburg structural study area were assessed using site reconnaissance, aerial photography, and existing topographic maps. Refer to **Figure 5** for land cover within the construction work limits.

Riparian Forest: Based on site reconnaissance, the riparian forests are generally low to medium quality and are dominated by a combination of only a few species including box elder, silver maple, yellow poplar, and sycamore. Riparian areas adjacent to the river (within approximately 100 feet) generally had little understory, except in disturbed areas where dense seedlings occur. Riparian areas further from the river seem to have a greater diversity of trees, shrubs, and herbaceous vegetation. There are no high quality or old growth bottomland forest communities within the proposed construction limits.

The HEP analysis indicates that riparian forest has an average HSI of 0.56 within the construction limits and may provide medium to good quality habitat for some species. However, the riparian forests within the construction limits do not provide good habitat for wildlife that require hard mast species. This results from the relatively low diversity of tree species in these riparian areas and an absence of hard mast-producing species. Although areas of the riparian corridor contain large mature trees, the riparian corridor within the project area is relatively narrow, and therefore, does not provide adequate cover/habitat for species that prefer large expanses of forest (i.e., barred owl). This is not reflected in the HEP analysis.

Upland Forest: Upland mixed forests within the project area typically contain a mixture of hardwoods (i.e., oaks, hickories) and pines (i.e., shortleaf pine (*Pinus echinata)*, Eastern white pine (*Pinus strobus*)). Areas within the construction corridor are adjacent to developed areas and are not extensive in nature. Upland hardwood forests within the borrow areas provide relatively good quality habitat for the species examined, with an overall HSI of 0.75. This is the result of relatively large canopy trees, the presence of hard mast-producing species, and adequate cover for small mammals. The upland pine forest within the borrow areas provides medium to good quality habitat for the species examined, with an overall HSI of 0.70.

Disturbed Land: Disturbed land within the Prestonsburg study area typically contains a significant amount of semi-woody vegetation, shrubs (i.e., blackberry), and seedlings. These areas may provide some habitat for species that require nonforested habitat; however, due to the disturbed nature of these areas, they are considered relatively low quality.

Soil Borrow Areas: Land use in the Spurlock Creek and the Granny Fitz borrow areas are open mowed field. Both sites also contain a stream with a very narrow riparian corridor. PB-2 land use includes upland pine forests along the lower slopes of the mountain and upland hardwood forests along the upper slopes. A roadway goes through the center of the area. Disturbed land is located along the roadway.

4.4 Impacts from Structural Measures in Alternative Plans 2 and 3

Alternative Plan 2: The floodwall would disturb approximately 63 acres of land. Nearly all of this land has been previously disturbed. Approximately 50 acres are currently vegetated (including maintained areas). The total disturbed amount includes temporary use for construction staging and access as well as the permanent floodwall and access footprint (see **Table 10**). Impacts to riparian forest habitat were evaluated by comparing the predicted post-project terrestrial habitat conditions with the anticipated terrestrial habitat losses associated with floodwall construction. Terrestrial habitat evaluations, included in **Appendix D,** provide detailed information on how HSI were calculated for current conditions (loss of habitat), and post conditions (preservation and creation of riparian forest habitat).

Table 10. Land Cover Impacts for Alternative Plan 2 (Long Wall Ending at BSCTC)

Existing Land Cover	Within Construction Work Limit		Within Construction Limits Riverward of Structural Footprint and Maintenance Buffer			Riverward of Construction Work Limits			
				Bottomland Forest			Bottomland Forest		
	Disturbance (acres)	Bottomland Forest Habitat Units Lost *	Disturbance (acres)	Created (acres)	Habitat Units Created	Existing Land Cover (acres)	Created (acres)	Habitat Units Created	Habitat Units Conserved
Disturbed	3.63	-	0.01	0.01	-	-	-	-	-
Paved	9.96	-	0.45	-	-	0.06	-	-	-
Wetland	0.06	-	-	-	-	-	-	-	-
Riparian	10.9	6.11	3.73	3.73	2.98	7.00	-	-	4.41
Maintained	38.7	-	10.35	10.35	8.28	3.11	3.11	2.49	-
TOTAL	**63.30**	**6.11**	**14.54**	**14.09**	**11.26**	**10.22**	**3.11**	**2.49**	**4.41**

* HSI = 0.56 for loss, 0.63 for preservation, 0.8 for creation

Vegetation directly in the alignment of the floodwall would be permanently removed and would no longer provide habitat for terrestrial organisms. In addition, an approximate 10-foot grass access buffer would be created along the riverward side of the floodwall. This habitat would be permanently converted to maintain a treeless environment along the concrete floodwall. The riparian corridor riverward of the CWL would not be cleared. However, acquisition of property would extend to the edge of the Levisa Fork along the alignment.

Disturbed areas outside the structural footprint would be revegetated following construction. Disturbed areas landward of the floodwall would be restored to at least their current condition in consultation with Floyd County and the City of Prestonsburg regarding the land's intended use. Due to the limited acreage converted and the relatively low quality of the existing habitat, this impact is not considered significant.

The acquired land between the floodwall buffer and the Levisa Fork would be permanently precluded from development and would return to passive use, which would provide an overall beneficial impact. Disturbed areas and currently nonforested areas riverward of the grass buffer would be planted and seeded with native tree and shrub species to enhance the existing riparian corridor.

The proposed project would be expected to have an overall beneficial impact to terrestrial resources. Although approximately 6.11 habitat units of existing bottomland forest would be cleared for construction of the floodwall, these losses would be offset by a gain of 18.16 habitat units of bottomland forest, resulting from the preservation and creation of riparian forest habitat riverward of the structure. Revegetation of the area would help to re-establish wildlife habitat, stabilize soil, and create more valuable habitat by planting native species of grasses, wildflowers, shrubs, and trees.

Alternative Plan 3: The floodwall would disturb approximately 39 acres of land. Nearly all of this land has been previously disturbed. Approximately 29 acres are currently vegetated (including maintained areas). The total disturbed amount includes temporary use for construction staging and access as well as the permanent floodwall and access footprint (see **Table 11**). Impacts would be similar in nature to those for Alternative Plan 2. However, this alternative would require only 3.98 habitat units of bottomland forest to be lost as a result of clearing for construction of the floodwall. This alternative would have a slightly lower impact on riparian forest habitat in the project area.

Table 11. Land Cover Impacts for Alternative Plan 3 (Long Wall Ending at Blackbottom)

Existing Land Cover	Within Construction Work Limit		Within Construction Limits Riverward of Structural Footprint and Maintenance Buffer			Riverward of Construction Work Limits			
				Bottomland Forest			Bottomland Forest		
	Disturbance (acres)	Bottomland Forest Habitat Units Lost *	Disturbance (acres)	Created (acres)	Habitat Units Created	Existing Land Cover (acres)	Created (acres)	Habitat Units Created	Habitat Units Conserved
Disturbed	3.39	-	1.80	1.80	1.44	-	-	-	-
Paved	7.08	-	0.33	-	-	0.06	-	-	-
Wetland	-	-	-	0.00	-	-	-	-	-
Riparian	7.11	3.98	2.85	2.85	2.28	2.22	-	-	1.40
Maintained	21.8	-	14.30	14.30	11.44	1.81	1.81	1.45	-
TOTAL	**39.35**	**3.98**	**19.28**	**18.95**	**15.16**	**4.09**	**1.81**	**1.45**	**1.40**

* HSI = 0.56 for loss, 0.63 for preservation, 0.8 for creation

Borrow Areas: Impacts to terrestrial resources in soil borrow areas would be expected to be similar in nature to the other cleared acres previously discussed. Due to the limited acreage converted and the relatively low quality of the existing habitat, this impact is not considered significant. However, disturbance of vegetation could facilitate the spread of invasive species. Transfer of soil from borrow areas could result in the transfer of invasive species. Invasive species can out-compete native vegetation; therefore management is necessary to prevent adverse impacts to terrestrial resources in the project area.

Impacts to Wildlife: Terrestrial wildlife within these areas would sustain direct impacts as a result of land clearing and construction of the proposed project. Relatively mobile animals (i.e. deer, birds, and rabbits) would be expected to evacuate the project area during construction activities. These species would be expected to relocate to adjacent undeveloped areas. This could have an impact on adjacent forest communities due to the potential increase of wildlife in those areas. However, this impact is likely insignificant because of the relatively small area that would be cleared during construction activities. In addition, much of the implementation area is adjacent to developed areas and would not be expected to contain a diverse and/or abundant wildlife population. Less mobile animals (e.g., salamanders, turtles) within the proposed implementation area would be expected to be negatively impacted by construction activities. For these species, direct mortality could occur during the actual construction event or ultimately result from habitat alteration.

Either floodwall would preclude passage of some wildlife species between the riparian and upland areas. However, because the structural implementation area is urban, this would not be a significant impact.

The spread of invasive species within the project area could have an adverse impact on wildlife habitat, as habitat could be reduced.

Disturbances caused by construction on the project site may affect wildlife in adjacent habitats by disrupting feeding, breeding, and nesting activities. Habitats on and surrounding the site may be used for breeding by migrant and resident songbirds. Increased noise levels created by operation of heavy machinery could cause birds to abandon their nests and may temporarily displace wildlife during construction. Once construction activities are complete, wildlife would likely resume use of the area. Long-term impacts to wildlife resources would be positive, since the existing riparian corridor would be enhanced.

Impacts to wildlife in borrow areas are not expected to be significant.

No indirect impacts are anticipated.

4.5 Mitigation

Based on informal consultation with regulatory agencies, a riparian corridor replanting plan would be needed for Alternative Plans 2 and 3 because of impacts to riparian habitat on the Levisa Fork and tributary streams.

This riparian corridor replanting plan was developed in consultation with regulatory agencies to ensure that impacts from clearing are compensated for in the post-project condition. Vegetation riverward of the CWL would not be cleared. However, acquisition of property would extend to the edge of the Levisa Fork along the alignment. Revegetation of disturbed areas with native species of grasses, wildflowers, shrubs, and trees would follow construction. An approximate 8-foot grass buffer would be created along the riverward side of the floodwall to maintain a treeless environment along the structure. Disturbed areas and currently non-forested areas riverward of the buffer would be planted and seeded with native tree and shrub species to return the area to passive use and enhance the existing riparian corridor. Landward of the floodwall, disturbed areas would be restored to at least their current condition in consultation with Floyd County and the City of Prestonsburg regarding the land's intended use.

4.5.1 Proposed Riparian Corridor Planting Plan

A list of riparian species for revegetation based on field guides, agency consultation, and field reconnaissance is presented in **Table 12**. Box elder and silver maple are highly abundant throughout the watershed, based on literature research and field surveys. These species may be planted, but are expected to establish themselves naturally. Revegetation using the suggested species list would enhance habitat quality of the riparian corridors along the floodwalls through the establishment of hard mast species and greater species diversity. Northern red oak (*Quercus rubra*), black walnut, yellow buckeye, and shellbark hickory (*Carya laciniosa)* would be planted only on the upper terrace of the Levisa Fork riparian corridor to increase survival rate.

Black walnut trees naturally contain a chemical called juglone which can inhibit the growth of some plants (Morton Arboretum, 2006). Most of the trees and shrubs plants recommended for revegetation are tolerant of juglone, as indicated in Table 12. To minimize potential for Black Walnut Toxicity, revegetation layout plans will be prepared by a landscape planner with special notes as needed.

Table 12. Proposed Riparian Species for Revegetation

Trees	
Black Cherry (T)	*Prunus serotina*
Black Willow(T)	*Salix nigra*
Black Walnut *	*Juglans nigra*
Green Ash	*Fraxinus pennsylvanica*
Northern Red Oak* (T)	*Quercus rubra*
Red Maple (T)	*Acer rubrum*
River Birch (T)	*Betula nigra*
Shellbark Hickory* (T)	*Carya laciniosa*
Sycamore (T)	*Platanus occidentalis*
Silver Maple (S)	*Acer saccharinum*
Yellow Buckeye*	*Aesculus octandra*
Tuliptree	*Liriodendron tulipifera*

Shrubs	
American Plum (T)	*Prunus americana*
Elderberry (T)	*Sambucus canadensis*
Raspberry (T)	*Rubus spp.*
River Cane	*Arundinaria gigantea*
Sassafras (T)	*Sassafras albinum*
Spicebush (T)	*Lindera benzoin*
Herbaceous Plants	
Downy Wild rye	*Elymus villosus*
Fowl Manna Grass	*Glyceria striata*
Riverbank Wild rye	*Elymus riparius*
River Oats (also called Spangle grass and Indian woodoats)	*Chasmanthium latifolium*
Wild rye	*Elymus virginicus*
Yellow Wingstem	*Verbesina alternafolia*

* Hard mast species
(T) Tolerant of Black Walnut Toxicity (Morton Arboretum, 2006)
(S) Sensitive to Black Walnut Toxicity (Morton Arboretum, 2006)

4.5.2 Invasive Species Management Plan

Invasive and exotic species are defined as "nonnative species whose introduction does or is likely to cause economic or environmental harm or harm to human health". These species have the ability to reduce biological diversity and impede natural succession and reforestation. Management of invasive species in the project area after construction and during the revegetation period is critical to allow this area to revegetate and to prevent the loss of riparian forest habitat riverward of the floodwall. Typical invasive species within the area are listed in **Table 13.**

Table 13. Invasive Species within Riparian Forest Habitat in Southeastern Kentucky

Common Name	Scientific Name	KY-EPPC Threat level
Birdsfoot trefoil	*Lotus corniculata*	
Common chickweed	*Stellaria media*	Significant
European black alder	*Almus glunnosa*	
Ground Ivy	*Glechoma hederacea*	Significant
Indiana strawberry	*Duschesnea indica*	Lesser
Japanese honeysuckle	*Lonicera japonica*	**Severe**
Japanese hops	*Humulus japonicus*	
Japanese knotweed	*Polygonum cuspidatum*	**Severe**
Multiflora rose	*Rosa multiflora*	**Severe**
Nepalese browntop	*Microstegium vimineum*	**Severe**
Perrywinkle	*Vinca minor*	Significant
Privet	*Ligustrum vulgare*	**Severe**
Chinese empress-tree	*Paulownia tomentosa*	Significant
Winter Creeper	*Euonymous fortunei*	**Severe**

Eco-Tech (2001); Kentucky Exotic Pest Plant Council (KY-EPPC) (2000)

During site reconnaissance of the general area, Japanese honeysuckle, Japanese hops, Japanese knotweed, mulitflora rose, Nepalese stilt grass, and privet were identified in the riparian corridor.

The goal of managing invasive species within the project area is prevention and early detection. Early detection helps control invasive species to a level that is not detrimental to the riparian corridor habitat

quality. Special consideration for exotic species with a severe threat of displacing native vegetation would be made. A general invasive species-monitoring plan would be devised for the control of these species riverward of the structural measures.

Should kudzu be encountered in borrow areas or near the construction work limits, a more detailed monitoring and eradication plan would be devised for kudzu. Kudzu can be highly disruptive to forest habitat by covering native species and eventually displacing them. This severe threat species was not observed within the construction work limits; however, it could be introduced into these project areas during soil excavation in borrow areas and transport if necessary measures are not taken. Detailed monitoring and maintenance plans, including annual reporting requirements, would be documented in the project Operation and Maintenance manual.

5.0 WETLAND RESOURCES WITHIN STRUCTURAL AREAS

5.1 Methodology

A thorough site reconnaissance combined with soil survey data for Floyd County, Kentucky and National Wetland Inventory (NWI) maps were used to identify potential wetlands within the Prestonsburg structural project area and the three borrow areas. Wetland habitat assessments were not conducted.

5.2 Literature Review

Floyd County has relatively few wetlands because of its topography. Within the county, approximately 1,975 total acres are classified NWI wetlands, representing less than one percent of the land area.

5.3 Results of Field Investigations within Structural Areas

Wetlands within the borrow areas and vicinity of the proposed structural alternatives were assessed using site reconnaissance, topographic maps, and aerial photos. Potential wetlands identified in the vicinity of Alternative Plan 2 include one palustrine emergent wetland, which comprises about 0.4 acres. This wetland is shown in **Figure 6**. No wetlands were identified within proposed borrow areas.

5.4 Impacts

One 0.4-acre palustrine emergent wetland is located at the edge of the Alternative Plan 2 CWL at the BSCTC. Approximately 0.06 acres is within the CWL. No structural elements are proposed within the wetland. The wetland is in part of the area planned for interior drainage collection during flood events. No adverse effect to this wetland is anticipated. No excavation, grading, or equipment staging is planned for this area. Periodic collection of interior drainage in this area may enhance this wetland.

5.5 Mitigation

No adverse effect to wetlands is anticipated. During project implementation, BMPs would be used to minimize the potential for release of fuels and other petroleum products.

Should the project plans change to adversely affect wetlands, additional documentation and permitting would be required. A formal wetland survey and delineation would be completed, with formal wetland boundaries used to establish buffer zones to avoid impacts if possible. A detailed mitigation plan, if needed, would be prepared.

6.0 RARE, THREATENED AND ENDANGERED SPECIES

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The Endangered Species Act of 1973. (ESA; 16 USC §1531 et seq.) is the primary law by which rare species are protected in the United States. Under the ESA, species may be listed as threatened or endangered. Endangered means a species is in danger of extinction throughout all or a significant portion of its range. Threatened means a species is likely to become endangered within the foreseeable future. The ESA is administered by the USFWS and National Marine Fisheries Service (NMFS) and requires all federal agencies to protect species and preserve their habitats. Section 7 of the ESA dictates that federal actions should not jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. Furthermore, Section 7(a) of the ESA requires formal consultation with the USFWS whenever a federal proponent anticipates taking any action that may affect a listed species or critical habitat.

6.1 Methodology

The potential to impact species of concern was evaluated through secondary source review, regulatory consultation, and site investigation.

Although the Indiana bat (*Myotis sodalis*) has not been documented within Floyd County (Kentucky State Nature Preserves Commission (KSNPC, 2002), a habitat and hibernacula study was deemed necessary by the USFWS. Eco-Tech, Incorporated, was subcontracted to conduct a hibernacula search for the federal endangered Indiana bat. Prior to field survey, a thorough search of existing cave and mine portal information for the project area and adjacent area was conducted. The field survey for hibernacula was done on September 22, 2004. The study area was walked to locate potential hibernacula for the Indiana bat. This included searching for caves and mine portals. If these were present, further evaluation would be provided. Cave-like dwellings (e.g., culverts, cisterns, and storm sewers) were also searched for within the project area. These features were evaluated for bat use.

Other Indiana bat characteristics that were rated include summer roosting habitat, food and water availability and quality, and interspersion of habitat components. A bat habitat assessment form was completed during the field survey. Although this form is for all bat species, it was filled out with emphasis on the habitat requirements of the Indiana bat. Notes and photographs of existing land cover were taken. As required by the Endangered Species Act, the best scientific methods were used to evaluate habitat for the species. Refer to **Appendix F** for assessment sheets and pictures of the survey area.

6.2 Literature Review

No federally listed species are recorded in Floyd County. Special-status species (species tracked by the Commonwealth of Kentucky) known to occur in Floyd County, Kentucky are listed in **Table 14**.

6.3 Results of Field Investigations within Structural Areas

The vascular plant survey did not identify state-listed species within the CWL or PB-2. It is possible that state-listed faunal species may occur or pass through the project area.

6.4 Impacts

Because the Alternative Plans 2 and 3 implementation areas potentially contain special status species, there is a potential for special status species to be directly impacted by construction of either floodwall alternative. The proposed project area provides summer roosting and foraging habitat for the Indiana bat (Libby et al, 2004). Therefore, this species could be adversely affected by implementation of the structural project alternative.

6.5 Mitigation

The Corps, in consultation with the USFWS and KDFWR, plans to conduct needed clearing activities during winter months (November 15 through March 31) to avoid potential direct impact (i.e., injury) to the Indiana bat. If tree removal would be required outside of this time frame, the Corps will coordinate with the USFWS and KDFWR to ensure the necessary precautions are implemented to avoid impact to the Indiana Bat.

Table 14. Special Status Species Known to Occur in Floyd County

SCIENTIFIC NAME	COMMON NAME	STATE STATUS	FEDERAL STATUS	HABITAT
Plants				
Erythronium rostratum	Yellow Troutlily	S	N	Mesic Ravine Forests.
Hydrophyllum virginianum	Eastern Waterleaf	S	N	Moist or Wet Woods, Open Wet Places.
Lathyrus venosus	Smooth Veiny Peavine	S	N	Rich Woods, Thickets, Banks of Streams.
Gastropods				
Patera panselenus	Virginia Bladetooth	S	N	Under Rocks and Logs on Wooded Floodplains, Hillsides, and Ravines (Hubrict 1985).
Bivalves				
Fusconaia subrotunda subrotunda	Longsolid	S	N	Gravel Bars and Deep Pools in Large Rivers and Large to Medium-Sized Streams (Ahlstedt 1984, Goodrich and Van Der Schalie 1944, Neel and Allen 1964, Parmalee 1967).
Quadrula cylindrica cyclindrica	Rabbitsfoot	T	N	Small to Large Rivers with Sand, Gravel, and Cobble and Moderate to Swift Current, Sometimes in Deep Water (Parmalee 1967, Bogan and Parmalee 1983).
Villosa linenosa	Little Spectaclecase	S	N	Inhabits Small to Medium-Sized Rivers, Usually in Shallow Water on a Sand/Mud/Detritus Bottom (Parmalee 1967, Gordon and Layzer 1989).
Insects				
Calopteryx dimidiata	Sparkling Jewelwing	N	N	Open, Sand-Bottomed Streams, Usually with Eel-Grass, is the Preferred Habitat in Florida. Also Occasionally Found in Rivers (Dunkle 1990).
Pseudanophthalmus hypolithos	Ashcamp Cave Beetle	T	N	Under Rocks at Back of Entrance Room of Old Quarry Cave and in Lower of Two Crawlways (Barr 1981). Abundant Cave Rat Debris was Present.
Mammals				
Ursus Americanus	American Black Bear	S	N	Prefers mixed deciduous-coniferous forests with a thick understory, but may occur in various situations including riverine habitat near small creeks and medium sized rivers.
Reptiles				

Table 14. Special Status Species Known to Occur in Floyd County

SCIENTIFIC NAME	COMMON NAME	STATE STATUS	FEDERAL STATUS	HABITAT
Lampropeltis Triangulum Elapsoides	Scarlet Kingsnake	S	N	Burrows in Soft Soils of Upland Oak and Oak-Hickory Forests, may also occur in Oak-pine.
Birds				
Podilymbus podiceps	Pied-Billed Grebe	E	N	Breeds along rivers, lakes, and reservoirs in shallow water surrounded by dense vegetation.
Falco peregrinus	Peregrine Falcon	E	N	Various open situations including suitable nesting habitats, mountains, open forested regions, and human population centers. Nests typically on ledges of rocky cliffs (Palmer 1988, Campbell et al. 1990).
Circus cyaneus	Northern Harrier	T	N	Marshes, meadows, grasslands, and cultivated fields, Perches on ground or stump posts. Nests on ground in low shrubs.
Ardea herodias	Great Blue Heron	S	N	Freshwater marshes, low gradient riverine habitat. Nests commonly in trees in forested areas.
Phalacrocorax auritus	Double-Crested Cormorant	H	N	Lakes, ponds, and large river systems. Nests on the ground or in trees
Anus Discors	Blue-Winged Teal	E	N	Marshes, ponds, sloughs, lakes, and sluggish streams. Commonly colonizes newly available habitats. Nests in tall grasses typically near water.
Fish				
Ichthyomyzon fosser	Northern Brook Lamprey	T	N	Small to Medium-Size Upland Streams Where Adults Live in Sand-Gravel Bottoms of Clean Riffles and Raceways (Burr and Warren 1986, Page and Burr 1991). Ammocoetes require Mixed Sand, Silt, and Debris in Quiet Water.
Percopsis Omiscomaycus	Trout-Perch	S	N	Lives in Clear, Small to Moderate-Size Streams in Pools or Raceways over Clean Sand or Mixed Sand and Gravel Bottoms.
Lampetra Appendix	American Brook Lamprey	S	N	Raceways, Riffles, and Flowing Margins of Permanently Flowing Streams and Rivers with Gravel, Sand and Sediment Bottoms (Burr and Warren 1986)

Source: Kentucky State Nature Preserves Commission 2002, Kentucky Department of Fish and Wildlife Resources, 2004.

KEY: (E) State-listed as Endangered; (LE) Federally-listed as Endangered; (N) Not listed; (S) State-listed as Special Concern; (H) Historic

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8.0 ACROYNMS AND ABBREVIATIONS

µS/cm	microsiemens per centimeter
AMSL	above mean sea level
BFE	the base flood elevation
BMP	Best Management Practices
BSADD	Big Sandy Area Development District
BSCTC	Big Sandy Community and Technical College
CAH	Cold Water Aquatic Habitat
CFR	Code of Federal Regulations
cfs	cubic feet per second
CWA	Clean Water Act
CWL	Construction Work Limit
DPR	Detailed Project Report
DPR-1/DEIS	Detailed Project Report-1/Draft Environmental Impact Statement
DWS	Domestic Water Supply
EII	Ecological Integrity Index
EIS	Environmental Impact Statement
EIU	Ecological Integrity Unit
EKSAP	Eastern Kentucky Stream Assessment Protocol
EPA	Environmental Protection Agency
ESA	Endangered Species Act
gpm	gallons per minute
HED	Hydrologic Engineering Center
HEP	Habitat Evaluation Procedure
HIS	Habitat Suitability Index
KAR	Kentucky Administrative Regulations
KDFWR	Kentucky Department of Fish and Wildlife Resources
KDOW	Kentucky Division of Water
KRS	Kentucky Revised Statues
KSNPC	Kentucky State Nature Preserves Commission
KTC	Kentucky Transportation Cabinet
KW	kilowatts
KY	Kentucky
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
NWI	National Wetland Inventory
ORW	Outstanding Resource Water
PCR	Primary Contact Recreation
PRIDE	Personal Responsibility in a Desirable Environment
RBP	Rapid Bioassessment Protocol
RM	River Mile
SCR	Secondary Contact Recreation
USACE	Huntington District of the Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Service
WAH	Warm Water Aquatic Habitat
WEDAA	Water and Energy Development Appropriations Act

APPENDIX A
Photographs

Photograph 1. Upper Cement Channel at Prestonsburg Community College

Photograph 2. Middle Campus Branch Reach

Photograph 3. Lower Campus Branch Reach

Photograph 4. Storm Drain behind Construction Area

Photograph 5. Upper May Branch Reach

Photograph 6. Lower May Branch Reach

Photograph 7. Drainage Ditch North of Arched Bridge

Photograph 8. Trimble Branch

Photograph 9. Seep in Borrow Area PB-1

Photograph 10. Borrow Area PB-1 Drainage/Seep

Photograph 11. Granny Fitz Branch

Photograph 12. Granny Fitz Branch

Photograph 13. Spurlock Creek Branch

Photograph 14. Spurlock Creek Branch

Photograph 15. Spurlock Creek Branch

APPENDIX B
Aquatic Habitat Data Sheets

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

Campus

STREAM NAME Lick Creek	LOCATION Prestonsburg
STATION # _____ RIVERMILE _____	STREAM CLASS G middle section
LAT _____ LONG _____	RIVER BASIN Levisa
STORET #	AGENCY AMEC
INVESTIGATORS Karri Blackman Kelly Phillips	
FORM COMPLETED BY Karri Blackman	DATE 6/27/04 TIME 245 AM (PM)
	REASON FOR SURVEY EIS

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
75 % ☐	%cloud cover	☐ 75 %
☑	clear/sunny	☑

Has there been a heavy rain in the last 7 days? ☑ Yes ☐ No

Air Temperature 25 °C

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

See attached photos taken 6/08/04 and 6/28/04.

STREAM CHARACTERIZATION

Stream Subsystem
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☑ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☑ Mixture of origins
☑ Other runoff

Catchment Area _____ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☑ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other _____
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☑ Grasses ☐ Herbaceous

dominant species present trees + grasses

INSTREAM FEATURES

Estimated Reach Length 159 m
Estimated Stream Width 1.0 m
Sampling Reach Area 484 m²
Area in km² (m²x1000) _____ km²
Estimated Stream Depth .03-.1 m
Surface Velocity (at thalweg) .05 m/sec

Canopy Cover
☐ Partly open ☐ Partly shaded ☑ Shaded

High Water Mark .8 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle 10 % ☐ Run 80 %
☐ Pool 10 %

Channelized ☐ Yes ☐ No
Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD .9 m²
Density of LWD _____ m²/km² **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☑ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present _____

Portion of the reach with aquatic vegetation _____ %

WATER QUALITY

Temperature 21 °C
Specific Conductance 409.3 us/cm
Dissolved Oxygen 9017 mg/L
pH 7.27
Turbidity 9.6 ntu
WQ Instrument Used Troll 9000

Water Odors
☐ Normal/None ☑ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☑ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☑ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☑ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other _____

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	0	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	61.8			
Sand	0.06-2mm (gritty)	25.84	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	12.36			
Clay	< 0.004 mm (slick)	combined w/ silt			

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	(X) 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (X)	(5) 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0

Total Score _____

Campus

Appendix A-1 High Gradient Stream Data Sheet

STREAM NAME: Lick (Campus)	LOCATION: Prestonsburg KY
STATION #: natural MILE:	BASIN/WATERSHED: Levisa
LAT.: LONG.:	COUNTY: Floyd USGS 7.5 TOPO:
DATE: 6/27/04 TIME: 2:45 ☐AM ☑PM	INVESTIGATORS: KP KB JP

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER: Now Past 24 hours: ☐ Heavy rain ☐ Steady rain ☐ Intermittent showers ☑ Clear/sunny
Has there been a heavy rain in the last 7 days? ☑ Yes ☐ No
Air Temperature 77 °C. Inches rainfall in past 24 hours ____ in.
75 % Cloud Cover

P-Chem: Temp(°C) 69.32 D.O. (mg/l) 9017 %Saturation ____ pH(S.U.) 7.27 Cond. 409.3 ☐ Grab

Turbidity: 9.6 NTU
ORP: 172

INSTREAM WATERSHED FEATURES: (average)
Stream Width 3.5 ft
Range of Depth ____ ft
Average Velocity .17 ft/s
Discharge ____ cfs
Est. Reach Length 522

LOCAL WATERSHED FEATUREES:
Predominant Surrounding Land Use:
☐ Surface Mining ☐ Deep Mining ☐ Oil Wells ☐ Land Disposal
☐ Construction ☐ Commercial ☐ Industrial ☐ Row Crops
☑ Forest ☐ Pasture/Grazing ☐ Silviculture ☑ Urban Runoff/Storm Sewers

?

Hydraulic Structures: ☐ Dams ☐ Bridge Abutments ☐ Island ☐ Waterfalls ☑ Other debris jams (boulder riprap)

Stream Flow: ☐ Dry ☐ Pooled ☑ Low ☐ Normal ☐ High ☐ Very Rapid or Torrential

Stream Type: ☐ Perennial ☑ Intermittent ☐ Ephemeral ☐ Seep

Riparian Vegetation: (Dom. Tree/Shrub Taxa)
Dominate Type: ☐ Trees ☐ Shrubs ☑ Grasses ☐ Herbaceous
Number of strata 2 trees + grass

Canopy Cover: ☐ Fully Exposed (0-25%) ☐ Partially Exposed (25-50%) ☐ Partially Shaded (50-75%) ☑ Fully Shaded (75-100%)

Channel Alterations: ☐ Dredging ☑ Channelization (☑ Full ☐ Partial)

Substrate ☐Est. ☐P.C.	Riffle 10 %	Run 90 %	Pool 10 %
Silt/Clay (<0.06 mm)			
Sand (0.06 – 2 mm)			
Gravel (2-64 mm)			
Cobble (64 – 256 mm)			
Boulders (>256 mm)			
Bedrock			

rip rap run

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is <0.3 m/s, deep is >0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1 0
8 Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0

Total Score [ ] NOTES/COMMENTS:

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

Campus

STREAM NAME Lick Creek	LOCATION Prestonsburg
STATION # _____ RIVERMILE _____	STREAM CLASS Lower Reach
LAT _____ LONG _____	RIVER BASIN Levisa
STORET #	AGENCY AMEC
INVESTIGATORS Kelly Phillips Karri Blackman Mike Olgis	
FORM COMPLETED BY Karri Blackman	DATE 6/27/04 TIME 3:00 AM (PM)
	REASON FOR SURVEY EIS

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
75% ☐	%cloud cover	☐ 75%
☑	clear/sunny	☑

Has there been a heavy rain in the last 7 days? ☑ Yes ☐ No

Air Temperature 25 °C

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

See attached photos taken 6/28/04.

STREAM CHARACTERIZATION

Stream Subsystem
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☑ Mixture of origins
☑ Other runoff

Catchment Area _____ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☑ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other _____
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☑ Shrubs ☐ Grasses ☐ Herbaceous
dominant species present trees + shrubs

INSTREAM FEATURES

Estimated Reach Length 147 m
Estimated Stream Width 1.8 m
Sampling Reach Area _____ m^2
Area in km^2 (m^2x1000) _____ km^2
Estimated Stream Depth 0 m
Surface Velocity (at thalweg) 0 m/sec

Canopy Cover
☐ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark _____ m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle _____ % ☐ Run _____ %
☐ Pool _____ %

Channelized ☑ Yes ☐ No
Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD _____ m^2
Density of LWD _____ m^2/km^2 **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae
dominant species present no aquatic veg
Portion of the reach with aquatic vegetation _____ %

WATER QUALITY

Temperature 18.8 °C
Specific Conductance 397
Dissolved Oxygen 8720
pH 6.85
Turbidity 20.79
WQ Instrument Used Troll 9000

Water Odors
☐ Normal/None ☑ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☑ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☑ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☑ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other _____

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	30%
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm	100%			
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Creek	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT_____ LONG_____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)

Loss of flow due to debris

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 (0)
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 (0)
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0

Total Score _____

Appendix A-1 High Gradient Stream Data Sheet

STREAM NAME: Campus	LOCATION:
STATION #: Bad Reach MILE:	BASIN/WATERSHED:
LAT.: LONG.:	COUNTY: USGS 7.5 TOPO:
DATE: TIME: ☐AM ☐PM	INVESTIGATORS:

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER: Now Past 24 hours — Has there been a heavy rain in the last 7 days?
☐ ☐ Heavy rain ☐ Yes ☐ No
☐ ☐ Steady rain Air Temperature ____ °C. Inches rainfall in past 24 hours ____ in.
☐ ☐ Intermittent showers ____ % Cloud Cover
☐ ☐ Clear/sunny

P-Chem: Temp(°C) 6.59 D.O. (mg/l) 8.72 %Saturation ____ pH(S.U.) 6.85 Cond. 397 ☐ Grab

ORP 58 TurB 20.9

INSTREAM WATERSHED FEATURES:
Stream Width ____ ft
Range of Depth ____ ft
Average Velocity ____ ft/s
Discharge ____ cfs
Est. Reach Length 482

LOCAL WATERSHED FEATUREES:
Predominant Surrounding Land Use:
☐ Surface Mining ☐ Construction ☐ Forest
☐ Deep Mining ☐ Commercial ☐ Pasture/Grazing
☐ Oil Wells ☐ Industrial ☐ Silviculture
☐ Land Disposal ☐ Row Crops ☐ Urban Runoff/Storm Sewers

Hydraulic Structures:
☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ____

Stream Flow:
☐ Dry ☐ Pooled ☐ Low ☐ Normal
☐ High ☐ Very Rapid or Torrential

Stream Type:
☐ Perennial ☐ Intermittent
☐ Ephemeral ☐ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
☐ Trees ☐ Shrubs
☐ Grasses ☐ Herbaceous
Number of strata ____

Canopy Cover:
☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

Channel Alterations:
☐ Dredging
☐ Channelization
(☐Full ☐Partial)

Substrate ☐Est. ☐P.C.	Riffle ____%	Run ____%	Pool ____%
Silt/Clay (<0.06 mm)			
Sand (0.06 – 2 mm)			
Gravel (2-64 mm)			
Cobble (64 – 256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (6)
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)

Loss of flow due to debris

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME Upper May	LOCATION Prestonsburg
STATION # _____ RIVERMILE _____	STREAM CLASS G
LAT _____ LONG _____	RIVER BASIN Levisa
STORET #	AGENCY AMEC
INVESTIGATORS Karri Blackmon Mike Olgis	
FORM COMPLETED BY Karri. Blackmon	DATE 6/28 TIME 9:00 (AM) PM
REASON FOR SURVEY EIS	

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
30 % ☑	%cloud cover	☑ 30%
☑	clear/sunny	☑

Has there been a heavy rain in the last 7 days? ☐ Yes ☐ No

Air Temperature 28 °C

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

See attached photos taken 6/7/04 and 6/28/04.

STREAM CHARACTERIZATION

Stream Subsystem: ☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type: ☐ Coldwater ☑ Warmwater

Stream Origin:
- ☐ Glacial
- ☐ Non-glacial montane
- ☐ Swamp and bog
- ☐ Spring-fed
- ☑ Mixture of origins
- ☑ Other runoff

Catchment Area _____ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☑ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other _____
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☐ Trees ☐ Shrubs ☑ Grasses ☐ Herbaceous

dominant species present grasses

INSTREAM FEATURES

Estimated Reach Length 92 m
Estimated Stream Width 1.5 m
Sampling Reach Area _____ m^2
Area in km^2 (m^2x1000) _____ km^2
Estimated Stream Depth .2 m
Surface Velocity (at thalweg) .3 m/sec

Canopy Cover no canopy
☐ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark .762 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle 80 % ☐ Run 5 %
☐ Pool 15 %

Channelized ☑ Yes ☐ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD _____ m^2 no large woody debris in stream
Density of LWD _____ m^2/km^2 (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present no aquatic veg

Portion of the reach with aquatic vegetation 0 %

WATER QUALITY

Temperature 21 °C
Specific Conductance 421
Dissolved Oxygen 9369.8 ug/L
pH 7.168
Turbidity 5.9 nts
WQ Instrument Used Troll 9000

Water Odors
☐ Normal/None ☑ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☑ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☑ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☑ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other _____

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	0
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	1.96	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	69.6			
Sand	0.06-2mm (gritty)	12.74	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	15.69			
Clay	< 0.004 mm (slick)	combined with silt			

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0

Total Score _____

Appendix A-1 High Gradient Stream Data Sheet

STREAM NAME: MAY BRANCH UPPER REACH	LOCATION:
STATION #: MILE:	BASIN/WATERSHED:
LAT.: LONG.:	COUNTY: USGS 7.5 TOPO:
DATE: TIME: ☐AM ☐PM	INVESTIGATORS:

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER: Now Past 24 hours / Has there been a heavy rain in the last 7 days?
- ☐ ☐ Heavy rain ☑ Yes ☐ No
- ☐ ☐ Steady rain
- ☐ ☐ Intermittent showers — Air Temperature 82 °F °C. Inches rainfall in past 24 hours 0 in.
- ☑ ☑ Clear/sunny — 30 % Cloud Cover

P-Chem: Temp(°C) 70.994 D.O. (mg/l) 9369.885 %Saturation ____ pH(S.U.) 7.168 Cond. 421,277 µs/cm ☑ Grab

29.466 Hg - Baromet.
72,762 mV - ORP
5,892 nts - turb.

INSTREAM WATERSHED FEATURES:
Stream Width 6-2 ft
Range of Depth .1-.55 ft
Average Velocity 1 ft/s
Discharge ____ cfs
Est. Reach Length 360

LOCAL WATERSHED FEATUREES:
Predominant Surrounding Land Use:

☐ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☑ Urban Runoff/Storm Sewers

Hydraulic Structures:
☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ____

Stream Flow:
☐ Dry ☐ Pooled ☑ Low ☐ Normal
☐ High ☐ Very Rapid or Torrential

Stream Type:
☑ Perennial ☐ Intermittent
☐ Ephemeral ☐ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
☐ Trees ☑ Shrubs
☑ Grasses ☐ Herbaceous
Number of strats 2 grass(s) + shrubs

Canopy Cover:
☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

Channel Alterations:
☐ Dredging
☑ Channelization
(☑ Full ☐ Partial)

Substrate ☐ Est. ☐ P.C.	Riffle 80 %	Run <5 %	Pool 15 %
Silt/Clay (<0.06 mm)			
Sand (0.06 – 2 mm)			
Gravel (2-64 mm)			
Cobble (64 – 256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is <0.3 m/s, deep is >0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0

Total Score [ ] NOTES/COMMENTS:

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME Lower May	LOCATION Prestonsburg
STATION # _____ RIVERMILE _____	STREAM CLASS G
LAT _____ LONG _____	RIVER BASIN Levisa
STORET #	AGENCY AMEC
INVESTIGATORS Karri Blackman Mike Olgis	
FORM COMPLETED BY Karri Blackman	DATE 6/28 TIME 12:30 AM (PM)
REASON FOR SURVEY EIS	

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
30 % ☑	%cloud cover	☑ 30 %
☑	clear/sunny	☐

Has there been a heavy rain in the last 7 days? ☐ Yes ☐ No

Air Temperature 28 °C

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

See attached photos taken 6/7/04 and 6/28/04

STREAM CHARACTERIZATION

Stream Subsystem: ☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type: ☐ Coldwater ☑ Warmwater

Stream Origin: ☐ Glacial ☐ Non-glacial montane ☐ Swamp and bog ☐ Spring-fed ☑ Mixture of origins ☑ Other runoff

Catchment Area _____ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☑ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other _____
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present _____ trees

INSTREAM FEATURES

Estimated Reach Length 92 m
Estimated Stream Width 4.5 m
Sampling Reach Area _____ m^2
Area in km^2 (m^2x1000) _____ km^2
Estimated Stream Depth .1-.2 m
Surface Velocity (at thalweg) .3 m/sec

Canopy Cover
☐ Partly open ☐ Partly shaded ☑ Shaded

High Water Mark 1.2 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle 0 % ☐ Run 75 %
☐ Pool 25 %

Channelized ☑ Yes ☐ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD _____ m^2
Density of LWD _____ m^2/km^2 (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present no aquatic veg

Portion of the reach with aquatic vegetation 0 %

WATER QUALITY

Temperature 22.3 °C
Specific Conductance 426
Dissolved Oxygen 9333 mg/L
pH 7.15
Turbidity 11.98 nts
WQ Instrument Used Troll 9000

Water Odors
☐ Normal/None ☑ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☑ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☑ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☑ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oil
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☑ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other _____

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☐ No n/a

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	0	Muck-Mud	black, very fine organic (FPOM)	100 %
Gravel	2-64 mm (0.1"-2.5")	0			
Sand	0.06-2mm (gritty)	25	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	75%			
Clay	< 0.004 mm (slick)	combined			

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 X 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score _____

Appendix A-1 High Gradient Stream Data Sheet

STREAM NAME: MAY BRANCH LOWER REACH | LOCATION:

STATION #: | MILE: | BASIN/WATERSHED:

LAT.: | LONG.: | COUNTY: | USGS 7.5 TOPO:

DATE: | TIME: ☐AM ☐PM | INVESTIGATORS:

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER: Now Past 24 hours | Has there been a heavy rain in the last 7 days?
☐ ☐ Heavy rain ☐ Yes ☑ No
☐ ☐ Steady rain — Air Temperature 82 °C. Inches rainfall in past 24 hours 0 in.
☐ ☐ Intermittent showers — 30 % Cloud Cover
☑ ☑ Clear/sunny

P-Chem: Temp(°C) [illegible] D.O. (mg/l) [illegible] %Saturation ____ pH(S.U.) 7.15 Cond. 426.0 ☐Grab

93334 µg/L
72.22°F
PRESSURE-
ORP -0.2
TURB. - [illegible] 11.98

INSTREAM WATERSHED FEATURES:	LOCAL WATERSHED FEATUREES: Predominant Surrounding Land Use:		
Stream Width ~10 ft	☐ Surface Mining	☐ Construction	☑ Forest
Range of Depth .1-.2 ft	☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
Average Velocity 1 ft/s	☐ Oil Wells	☐ Industrial	☐ Silviculture
Discharge ____ cfs	☐ Land Disposal	☐ Row Crops	☑ Urban Runoff/Storm Sewers
Est. Reach Length 300			

Hydraulic Structures:
☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☑ Other WOOD JAMS

Stream Flow:
☐ Dry ☐ Pooled ☑ Low ☐ Normal
☐ High ☐ Very Rapid or Torrential

Stream Type:
☑ Perennial ☐ Intermittent
☐ Ephemeral ☐ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
☑ Trees ☑ Shrubs
☑ Grasses ☐ Herbaceous
Number of strata 3 BIG TREES, GRASS, SHRUBS

Canopy Cover:
☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☑ Fully Shaded (75-100%)

Channel Alterations:
☐ Dredging
☑ Channelization
(☐Full ☐Partial)

Substrate ☐Est. ☐P.C.	Riffle 0 %	Run 75 %	Pool 25 %
Silt/Clay (<0.06 mm)			
Sand (0.06 – 2 mm)			
Gravel (2-64 mm)			
Cobble (64 – 256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 (0)
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 (0)
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0

Total Score [ ] NOTES/COMMENTS:

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Levisa Fork	LOCATION Behind Bank, Prestonsburg, KY	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN Levisa	
STORET #	AGENCY USACE	
INVESTIGATORS Janet Cote, Amanda Dethman		
FORM COMPLETED BY Janet Cote	DATE 4/21 TIME 11:23 (AM) PM	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
100 %	%cloud cover	☐ ___ %
☐	clear/sunny	☐

Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No

Air Temperature 54 °C

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

STREAM CHARACTERIZATION

Stream Subsystem
☐ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☒ Warmwater

Stream Origin
☐ Glacial ☐ Spring-fed
☐ Non-glacial montane ☒ Mixture of origins
☐ Swamp and bog ☐ Other _____

Catchment Area _____ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☑ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other _____
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☐ Some potential sources
☑ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☑ Herbaceous

dominant species present _____

INSTREAM FEATURES

Estimated Reach Length _____ m

Estimated Stream Width 10-14 m

Sampling Reach Area _____ m^2

Area in km^2 (m^2x1000) _____ km^2

Estimated Stream Depth _____ m

Surface Velocity (at thalweg) _____ m/sec

Canopy Cover
☐ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark _____ m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle 0 % ☐ Run 95 %
☐ Pool 5 %

Channelized ☐ Yes ☑ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 1 m^2

Density of LWD _____ m^2/km^2 **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present _____

Portion of the reach with aquatic vegetation _____ %

WATER QUALITY

Temperature _____ °C

Specific Conductance 804 usem

Dissolved Oxygen _____

pH _____

Turbidity _____

WQ Instrument Used YSI Hydrolab

Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☑ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☑ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☑ None
☐ Other _____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☑ Other Trash

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	40%
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	40%
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)	40%	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	40%			
Clay	< 0.004 mm (slick)	20%			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Levisa Fork	LOCATION Behind Bank, Prestonburg
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN Levisa
STORET #	AGENCY USACE
INVESTIGATORS Janet Cote, Amanda Dethman	
FORM COMPLETED BY Janet Cote	DATE 11-21 TIME 11:24 (AM) PM — REASON FOR SURVEY EIS

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 (3)	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0

Total Score _____

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Levisa Fork	LOCATION Behind Methodist Church, Prestonsburg, KY
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN Levisa
STORET #	AGENCY USACE
INVESTIGATORS Amanda Dethman, Janet Cote.	
FORM COMPLETED BY Amanda Dethman.	DATE 11-21 TIME 1:30 AM (PM) / REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
100 %☑	%cloud cover	☐ ___ %
☐	clear/sunny	☐

Has there been a heavy rain in the last 7 days? ☐ Yes ☐ No

Air Temperature 54° C

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

STREAM CHARACTERIZATION

Stream Subsystem
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☑ Warmwater

Stream Origin
☐ Glacial ☐ Spring-fed
☐ Non-glacial montane ☑ Mixture of origins
☐ Swamp and bog ☐ Other _____

Catchment Area _____ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other _____
☑ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☑ Herbaceous

dominant species present _____

INSTREAM FEATURES

Estimated Reach Length _____ m
Estimated Stream Width 10-14 m
Sampling Reach Area _____ m^2
Area in km^2 (m^2x1000) _____ km^2
Estimated Stream Depth _____ m
Surface Velocity (at thalweg) _____ m/sec

Canopy Cover
☑ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark _____ m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle _____ % ☐ Run _____ %
☐ Pool _____ %

Channelized ☐ Yes ☐ No

Dam Present ☐ Yes ☐ No

LARGE WOODY DEBRIS

LWD 5 m^2
Density of LWD _____ m^2/km^2 **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present _____

Portion of the reach with aquatic vegetation _____ %

WATER QUALITY

Temperature _____ °C
Specific Conductance 806 usem
Dissolved Oxygen _____
pH _____
Turbidity _____
WQ Instrument Used _____

Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☑ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☑ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☑ Other Trash

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	50%
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	40%
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)	40 %	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	40 %			
Clay	< 0.004 mm (slick)	20 %			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Levisa Fork	LOCATION Behind Methodist Church, Prestonsburg, KY
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN Levisa
STORET #	AGENCY USACE
INVESTIGATORS Amanda Dethman, Janet Cote	
FORM COMPLETED BY Amanda Dethman	DATE 11-21 TIME 1:30 AM (PM)
REASON FOR SURVEY EIS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 (16)	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 **(17)** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 **(6)**	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 **(6)**	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	**(5)** 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 **(7)** 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 **(6)**	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 **(6)**	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 **(6)**	5 4 3	2 1 0

Total Score _____

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Spurlock Creek	LOCATION Prestonsburg, KY (TP-15, 16)	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN Levisa Fork	
STORET #	AGENCY U.S. Army Corps of Engineers	
INVESTIGATORS		
FORM COMPLETED BY Amanda Dethman	DATE 2-17-06 TIME 11:02 (AM) PM	REASON FOR SURVEY Borrow Site Investigation Floyd Co. Sec. 202

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0

Total Score 96 (Marginal)

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Granny Fitz Branch	LOCATION Prestonsburg, KY (TP-13)
STATION #_____ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN Levisa Fork
STORET #	AGENCY U.S. Army Corps of Engineers
INVESTIGATORS	
FORM COMPLETED BY Amanda Dethman	DATE 2-17-06 TIME 11:30 (AM) PM
REASON FOR SURVEY Borrow Site Investigation Floyd Co. Sec. 202	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 (3)	2 1 0

Total Score 113 (Suboptimal)

APPENDIX C
ESKAP Calculator Sheets

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)
****(Family Level Taxonomy - All Habitats)****

Project ID:	**Prestonsburg Floodwall Project**
Stream/Reach:	**Unnamed Tributary to Levisa on Campus of Community College**
	Upper (midsection, after concrete channel and culvert)
Assessment Objectives:	**Assess stream for current condition**

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.20	Ecological Integrity Index (Habitat Integrity + Conductivity)

Variables	Measure	Units	
>>>>>>>	Enter quantitative or categorical measure from Field Data Sheet in shaded cells		
RBP Habitat Parameters			
1. Epifaunal Substrate	4	no units	
2. Embeddedness	3	no units	
3. Velocity/Depth Regime	8	no units	
4. Sediment Deposition	5	no units	
5. Channel Flow Status	6	no units	
6. Channel Alteration	8	no units	
7. Freq. Of Riffles (bends)	5	no units	
8. Bank stability (both combined)	4.5	no units	
9. Veg. Protection (both combined)	2	no units	
10. Riparian Width (both combined)	2	no units	
Total Habitat Score	**47.5**	no units	**Subindex**
Habitat Integrity Index			**0.10**
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	**NA**	no units	**NA**
Conductivity	**409**	microMHOs	**0.31**

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EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)
****(Family Level Taxonomy - All Habitats)****

Project ID:	**Prestonsburg Floodwall Project**
Stream/Reach:	**Unnamed Tributary to Levisa on Campus of Community College Lower Section**
Assessment Objectives:	**Assess stream for current condition**

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.22	Ecological Integrity Index (Habitat Integrity + Conductivity)

	Variables	Measure	Units	
>>>>>>>	Enter quantitative or categorical measure from Field Data Sheet in shaded cells			
	RBP Habitat Parameters			
	1. Epifaunal Substrate	0	no units	
	2. Embeddedness	0	no units	
	3. Velocity/Depth Regime	0	no units	
	4. Sediment Deposition	0	no units	
	5. Channel Flow Status	0	no units	
	6. Channel Alteration	13	no units	
	7. Freq. Of Riffles (bends)	0	no units	
	8. Bank stability (both combined)	0	no units	
	9. Veg. Protection (both combined)	4	no units	
	10. Riparian Width (both combined)	2	no units	
	Total Habitat Score	**19**	no units	**Subindex**
	Habitat Integrity Index			**0.10**
	Macroinvertebrate Data - Family Level (All Habitats)			
	11. Family Taxa Richness	0	# of taxa sampled	
	12. Family EPT Richness	0	# of EPT species sampled	
	13. % Ephemeroptera	0	% Mayflies (0-100)	
	14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
	15. mFBI	0	no units	
	Macroinvertebrate Bioassessment	**NA**	no units	**NA**
	Conductivity	**397**	microMHOs	**0.34**

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EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)
****(Family Level Taxonomy - All Habitats)****

Project ID:	**Prestonsburg Floodwall Project**
Stream/Reach:	**May Branch - Upper section**
	Upper Section
Assessment Objectives:	**Assess stream for current conditions**

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.19	Ecological Integrity Index (Habitat Integrity + Conductivity)

	Variables	Measure	Units	
>>>>>>>	Enter quantitative or categorical measure from Field Data Sheet in shaded cells			
	RBP Habitat Parameters			
	1. Epifaunal Substrate	3	no units	
	2. Embeddedness	14	no units	
	3. Velocity/Depth Regime	10	no units	
	4. Sediment Deposition	8	no units	
	5. Channel Flow Status	13	no units	
	6. Channel Alteration	8	no units	
	7. Freq. Of Riffles (bends)	16	no units	
	8. Bank stability (both combined)	6	no units	
	9. Veg. Protection (both combined)	6	no units	
	10. Riparian Width (both combined)	4	no units	
	Total Habitat Score	**88**	no units	**Subindex**
	Habitat Integrity Index			**0.10**
	Macroinvertebrate Data - Family Level (All Habitats)			
	11. Family Taxa Richness	0	# of taxa sampled	
	12. Family EPT Richness	0	# of EPT species sampled	
	13. % Ephemeroptera	0	% Mayflies (0-100)	
	14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
	15. mFBI	0	no units	
	Macroinvertebrate Bioassessment	**NA**	no units	**NA**
	Conductivity	**421**	microMHOs	**0.28**

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EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)
****(Family Level Taxonomy - All Habitats)****

Project ID:	**Prestonsburg Floodwall Project**
Stream/Reach:	**May Branch - Lower section**
Assessment Objectives:	**Assess stream for current conditions**

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.18	Ecological Integrity Index (Habitat Integrity + Conductivity)

	Variables	Measure	Units	
>>>>>>>	Enter quantitative or categorical measure from Field Data Sheet in shaded cells			
	RBP Habitat Parameters			
	1. Epifaunal Substrate	0	no units	
	2. Embeddedness	0	no units	
	3. Velocity/Depth Regime	0	no units	
	4. Sediment Deposition	0	no units	
	5. Channel Flow Status	6	no units	
	6. Channel Alteration	7	no units	
	7. Freq. Of Riffles (bends)	0	no units	
	8. Bank stability (both combined)	0	no units	
	9. Veg. Protection (both combined)	2	no units	
	10. Riparian Width (both combined)	2	no units	
	Total Habitat Score	**17**	no units	**Subindex**
	Habitat Integrity Index			**0.10**
	Macroinvertebrate Data - Family Level (All Habitats)			
	11. Family Taxa Richness	0	# of taxa sampled	
	12. Family EPT Richness	0	# of EPT species sampled	
	13. % Ephemeroptera	0	% Mayflies (0-100)	
	14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
	15. mFBI	0	no units	
	Macroinvertebrate Bioassessment	**NA**	no units	**NA**
	Conductivity	**426**	microMHOs	**0.27**

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EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)
****(Family Level Taxonomy - All Habitats)****

Project ID:	**Prestonsburg Floodwall Project**
Stream/Reach:	**Trimble Branch**
Assessment Objectives:	**Assess stream for current conditions**

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.10	Ecological Integrity Index (Habitat Integrity + Conductivity)

Variables	Measure	Units	
>>>>>>>	Enter quantitative or categorical measure from Field Data Sheet in shaded cells		
RBP Habitat Parameters			
1. Epifaunal Substrate	1	no units	
2. Embeddedness	1	no units	
3. Velocity/Depth Regime	2	no units	
4. Sediment Deposition	0	no units	
5. Channel Flow Status	6	no units	
6. Channel Alteration	2	no units	
7. Freq. Of Riffles (bends)	1	no units	
8. Bank stability (both combined)	0	no units	
9. Veg. Protection (both combined)	3	no units	
10. Riparian Width (both combined)	1	no units	
Total Habitat Score	**17**	no units	**Subindex**
Habitat Integrity Index			**0.10**
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	**NA**	no units	**NA**
Conductivity	**n/a**	microMHOs	**0.10**

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EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (VERSION 2002.6)
****(Genus/species Level Taxonomy - All Habitats)****

Project ID:	**Floyd County 202**
Stream/Reach:	**Levisa Fork Site I**
Assessment Objectives:	**Estimate quality/integrity of stream ecosystem using Genus Level Taxonomy and Sampling All Habitats**

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.20	Ecological Integrity Index (Habitat Integrity + Conductivity)

Variables	Measure	Units	
Enter quantitative or categorical measure from Field Data Sheet in shaded cells			
RBP Habitat Parameters			
1. Epifaunal Substrate	11	no units (0-20)	
2. Embeddedness	13	no units (0-20)	
3. Velocity/Depth Regime	10	no units (0-20)	
4. Sediment Deposition	14	no units (0-20)	
5. Channel Flow Status	15	no units (0-20)	
6. Channel Alteration	14	no units (0-20)	
7. Freq. Of Riffles (bends)	8	no units (0-20)	
8. Bank stability (both combined)	15	no units (0-20)	
9. Veg. Protection (both combined)	10	no units (0-20)	
10. Riparian Width (both combined)	9	no units (0-20)	
Total Habitat Score	**119**	no units	**Subindex**
Habitat Integrity Index			**0.29**
Macroinvertebrate Data - *Genus/species Level (All Habitats)*			
11. Genus/species Taxa Richness	0	# of taxa sampled	
12. Genus/species EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. % Clingers	0	% Clingers (0-100)	
16. mHBI	0	no units	
Macroinvertebrate Bioassessment	**NA**	no units	**NA**
Conductivity	**804**	microMHOs	**0.10**

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (VERSION 2002.6)
****(Genus/species Level Taxonomy - All Habitats)****

Project ID:	**Floyd County 202**
Stream/Reach:	**Levisa Fork Site II**
Assessment Objectives:	**Estimate quality/integrity of stream ecosystem using Genus Level Taxonomy and Sampling All Habitats**

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.25	Ecological Integrity Index (Habitat Integrity + Conductivity)

Variables	Measure	Units	
Enter quantitative or categorical measure from Field Data Sheet in shaded cells			
RBP Habitat Parameters			
1. Epifaunal Substrate	15	no units (0-20)	
2. Embeddedness	12	no units (0-20)	
3. Velocity/Depth Regime	10	no units (0-20)	
4. Sediment Deposition	17	no units (0-20)	
5. Channel Flow Status	17	no units (0-20)	
6. Channel Alteration	17	no units (0-20)	
7. Freq. Of Riffles (bends)	6	no units (0-20)	
8. Bank stability (both combined)	11	no units (0-20)	
9. Veg. Protection (both combined)	13	no units (0-20)	
10. Riparian Width (both combined)	12	no units (0-20)	
Total Habitat Score	**130**	no units	**Subindex**
Habitat Integrity Index			**0.40**
Macroinvertebrate Data - *Genus/species Level (All Habitats)*			
11. Genus/species Taxa Richness	0	# of taxa sampled	
12. Genus/species EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. % Clingers	0	% Clingers (0-100)	
16. mHBI	0	no units	
Macroinvertebrate Bioassessment	NA	no units	NA
Conductivity	806	microMHOs	0.10

APPENDIX D
Habitat Evaluation Procedure Analysis

Section 202 Levisa Fork
(Floyd County, Kentucky)
Flood Damage Reduction Project

HABITAT EVALUATION PROCEDURE ANALYSIS

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Contract # DACW69-03-D-0004
Work Order 0009

January, 2005

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HABITAT EVALUATION PROCEDURE ANALYSIS
CONTENTS

FIGURES

TABLES

APPENDICES

HABITAT EVALUATION PROCEDURE ANALYSIS

1.0 INTRODUCTION

1.1 Project Description

Floyd County, Kentucky is located within the Appalachian Mountains of Eastern Kentucky, in the watershed of the Levisa Fork of the Big Sandy River. Many communities within the floodplain of the Levisa Fork and its tributaries were devastated by the April 1977 flood, which is the flood of record for much of the region. Congressional reaction to this flood event resulted in legislation that mandated implementation of flood damage reduction measures within the region. The Levisa Fork (Floyd County, Kentucky) Flood Damage Reduction Project was initially authorized by Section 202 of the 1982 Water and Energy Development Appropriations Act (WEDAA). The project's purpose is to develop a cost effective, socially acceptable, and environmentally sound plan to reduce financial and personal losses, and social and economic disruptions within the Floyd County portion of the Levisa Fork Basin.

The project study area includes those Levisa Fork basin floodplain areas in Floyd County that would be affected by a recurrence of the April 1977 flood. The study area, primarily residential in nature, includes incorporated areas of Prestonsburg, Allen, Wayland, and Wheelwright, and unincorporated areas in Floyd County. The study area is divided into three project phases. Phase 1 includes the City of Prestonsburg and the community of Auxier. Phase 2 includes the several communities as well as unincorporated areas southeast of Prestonsburg. Phase 3 includes several communities as well as unincorporated areas south of Prestonsburg. The U.S. Army Corps of Engineers (USACE), Huntington District is proposing both structural and nonstructural flood damage reduction measures within the Phase 1 area. Potential structural measures include a floodwall/levee alignment in the Phase 1 area within the City of Prestonsburg. Only nonstructural flood damage reduction measures are proposed within the Phase 2 and 3 areas.

1.2 Scope of the Evaluation

AMEC Earth & Environmental, Inc. (AMEC) was contracted by the USACE Huntington District to evaluate environmental conditions and potential impacts from the proposed project. As part of this evaluation, AMEC performed a preliminary Habitat Evaluation Procedure (HEP) analysis of undeveloped areas in the City of Prestonsburg that could be affected by construction of a floodwall or levee. This report provides an evaluation of habitat quality within these areas.

2.0 STUDY AREA

2.1 Study Area Location

The study area includes the riparian corridor on the eastern (right) bank of the Levisa Fork in Prestonsburg from the Big Sandy Community and Technical College to a residential area beyond the First Commonwealth Bank, approximately 1.5 miles long. The study area includes the shoreline of the Levisa Fork to the top of bank (second bench) where local residences have maintained lawns and manicured areas, riparian corridors of tributary streams within the proposed construction work limits (CWL), and proposed ponding areas within the CWL. The proposed structural alignment area in Prestonsburg is shown in **Figure 1.**

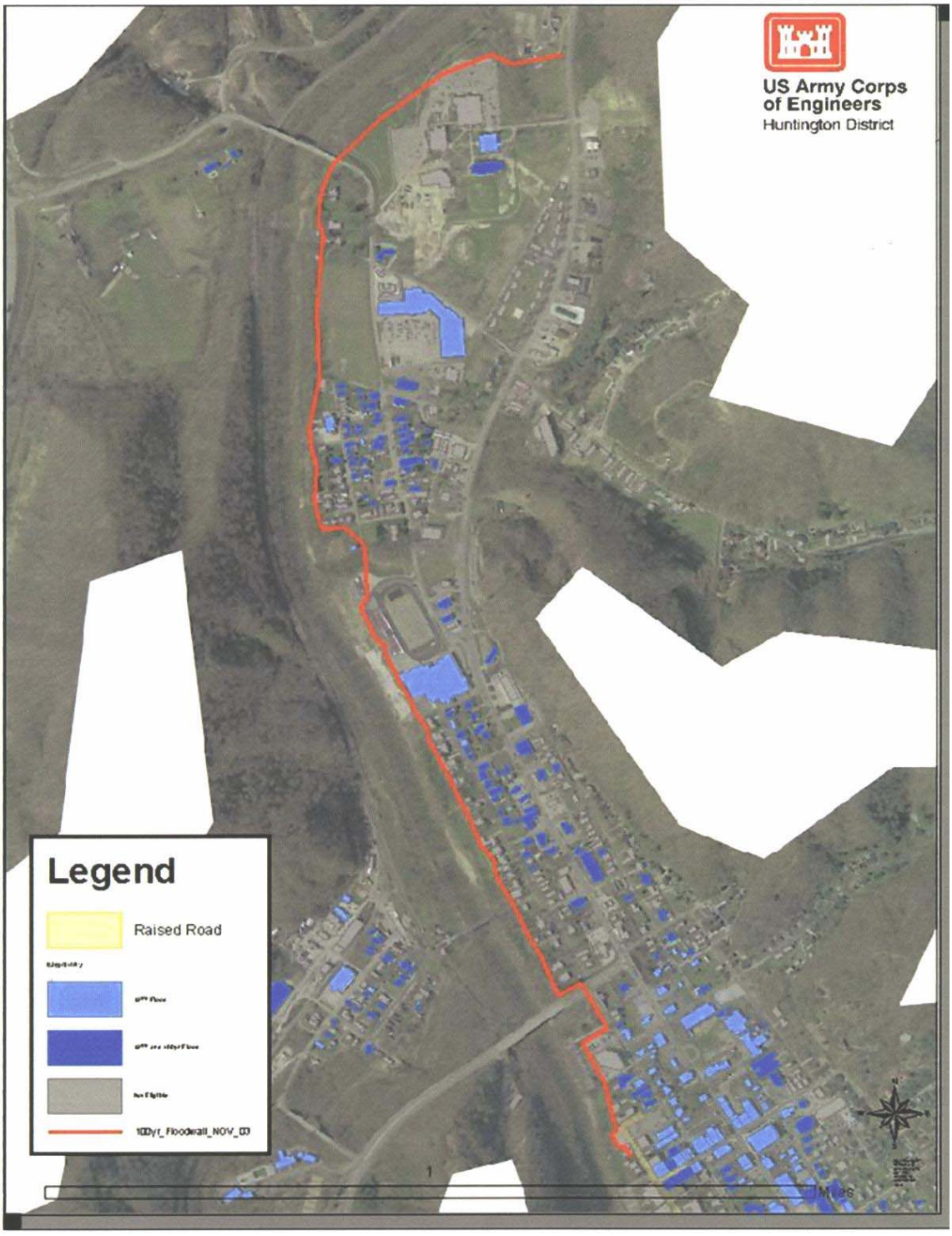

Figure 1. Floodwall Alignment Area for all Alternatives, Levisa Fork of Big Sandy River, Prestonsburg, KY. *Base map provided by Huntington District.*

Three borrow areas within close proximity to the proposed project are being considered and were included in this evaluation. Each borrow area is approximately 15 acres in size; two are located to the east and one to the west of the Levisa Fork. The first borrow site is located on a west facing hillside on the northeast corner of Bob White Lane and Mays Branch Road intersection, located to the east of the project. The second borrow site is a west-facing hillside with a previously cut-slope next to Sam and Tonio's Restaurant, located across Rt. 321 North from the Big Sandy Community and Technical College. The third borrow site is located on Cliff Road, off N1428, across the river to the west of the College. This area is on an east- and south-facing slope that has been extensively impacted by a cutting and land excavation operations. Proposed borrow areas are shown in **Figure 2**.

2.2 Study Area Land Cover

Land cover within the proposed floodwall construction area was identified during site reconnaissance, by reviewing proposed alignments, the Prestonsburg quadrangle USGS topographic map and aerial photographs. In addition, a USACE field botanist performed a floral inventory of the project area in 2003-2004 (Bailey, 2004).

Site reconnaissance was conducted in May 2004 to identify different vegetation communities. Most of the study area is developed, with the exception of the riparian corridors and the borrow areas. Land cover includes both developed and forested areas. On June 8 and 9, 2004, AMEC biologists identified the following three forest communities within the proposed project areas:

- Riparian forest
- Upland hardwood forest
- Upland pine forest.

HEP analysis was performed on these three forest communities.

3.0 STUDY AREA SAMPLE PLOT DESCRIPTIONS

Representative areas for each type of forest community were selected for HEP analysis, as shown on Figure 3. At each location, one-tenth (0.1) acre plots were established to collect forest species and structure information. These plots are described in Table 1. Data collected at these plots is included as Appendix A.

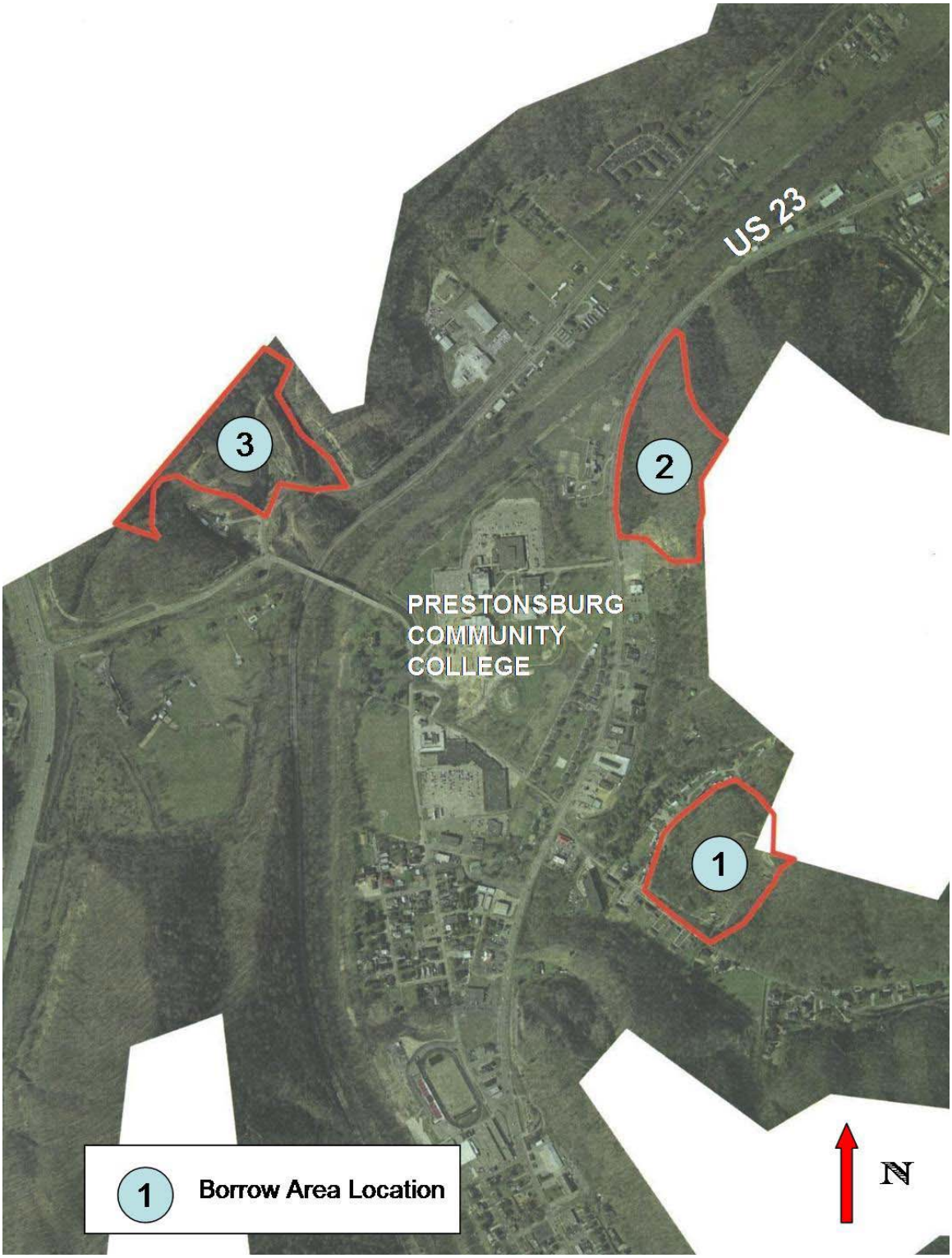

Figure 2. Borrow sites #1, 2, and 3, Prestonsburg, KY. *Base map provided by Huntington District.*

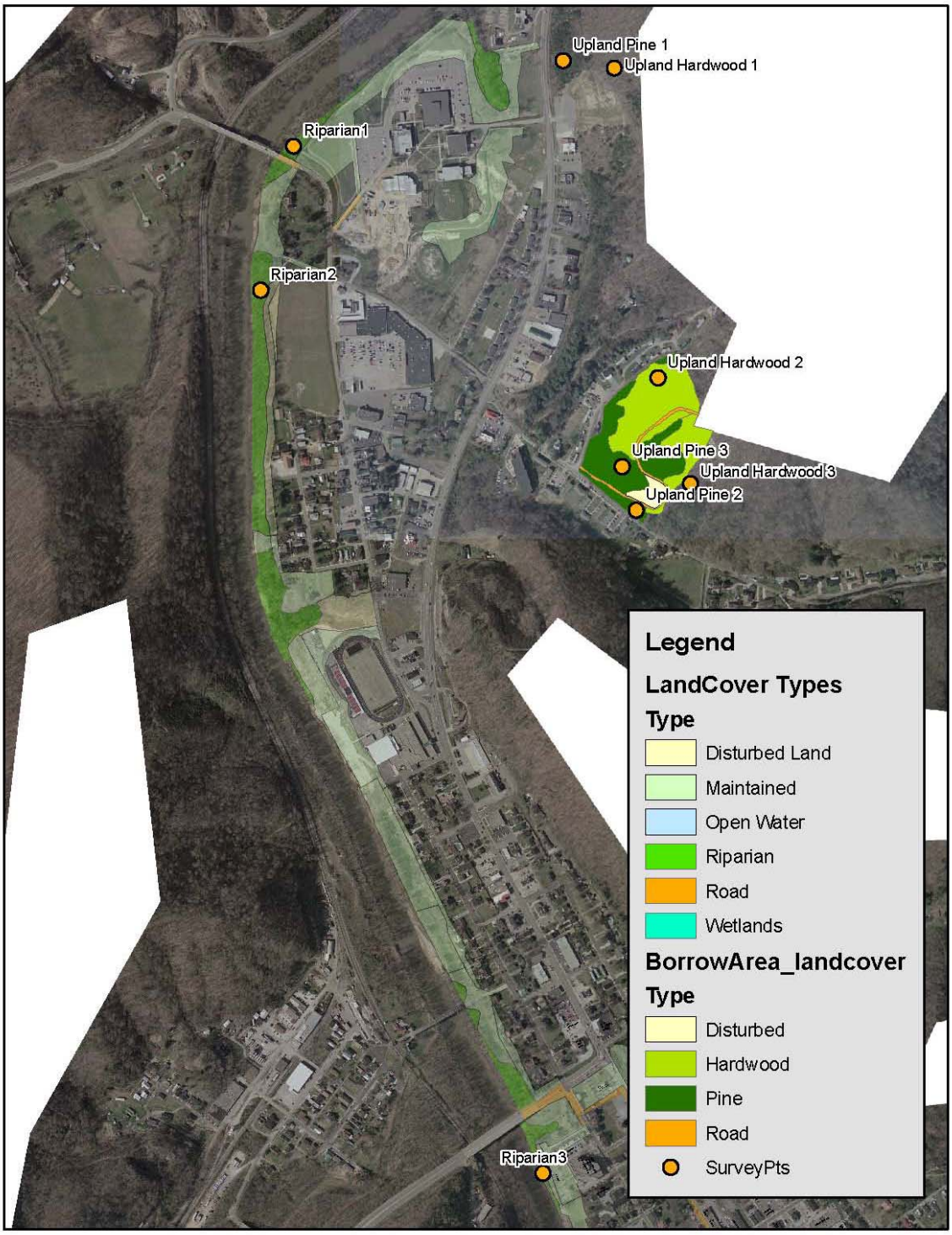

Figure 3. Study Area Sample Plot Locations.
Base map provided by Huntington District.

Table 1. Description of Plot Locations

Plot	Location	Description
Riparian Forest Plot 1	Within CWL along Levisa Fork	The riparian forest at this location is dominated by mature sycamore (*Platanus occidentalis*) and silver maple (*Acer saccharinum*); no small trees or seedlings are present. Canopy cover is approximately 90%; total basal area is approximately 253 ft2/acre. Dbh of trees ranges from approximately 12 to 30 inches, averaging approximately 21 inches. No hard mast species are present in the canopy or subcanopy. The ground surface within this area is almost completely covered by herbaceous plants (i.e., various grasses and *Bohmeria cylindrica*). No shrubs are present at this location.
Riparian Forest Plot 2	Within CWL along Levisa Fork	The riparian forest at this location is dominated by box elder (*Acer negundo*) and silver maple. However other canopy species include red maple (*Acer rubrum*), red elm (Ulmus rubra), and black willow (*Salix nigra*). Canopy cover is approximately 95-100%; total basal area is approximately 230 ft2/acre. Average dbh of canopy trees is approximately 11 inches with few, if any, canopy trees exceeding 20 inches dbh. No hard mast species are present in the canopy or subcanopy. The ground surface within this area is almost completely covered by herbaceous plants (various grasses, *Impatiens capensis, and Bohmeria cylindrica*). Shrub crown cover (made up of seedlings primarily) is approximately 15%.
Riparian Forest Plot 3	Within CWL along Levisa Fork	This plot was located along the bank of the Levisa. The riparian forest at this location is dominated by silver maple and box elder. Other tree species include red elm and red maple. Canopy cover is approximately 95%; total basal area is approximately 328 ft2/acre. Average dbh of canopy trees is approximately 13 inches with several canopy trees exceeding 20 inches dbh. No hard mast species are present in the canopy or subcanopy. The ground surface within this area is relatively bare; no shrubs are present in this area.
Upland Hardwood Plot 1	Within Borrow Area 1	The upland hardwood forest at this location is composed of a variety of species including red elm, red maple, blackgum (*Nyssa sylvatica*) , sweetgum (*Liquidambar styraciflua*), mockernut hickory (*Carya tomentosa*), American beech (*Fagus grandifolia*), buckeye (*Aesculus octandra*), yellow-poplar (*Liriodendron tulipifera*), white oak (*Quercus alba*), Virginia pine (*Pinus virginiana*), sourwood (*Oxydendrum arboreum*), and flowering dogwood (*Cornus florida*). Canopy cover is approximately 95-100%; total basal area is approximately 138 ft2/acre. Average dbh of canopy trees is approximately 11 inches with no, if any, canopy trees exceeding 20 inches dbh. Hard mast species are present in the canopy and subcanopy. Shrub crown cover (made up of seedlings primarily) is approximately 30%.
Upland Hardwood Plot 2	Within Borrow Area 2	The upland hardwood forest at this location is composed almost entirely of American beech; other canopy species include sugar maple (*Acer saccharum*), mockernut hickory, and sweetgum. Canopy cover is approximately 70%; total basal area is approximately 178 ft2/acre. Average dbh of canopy trees is approximately 20 inches. Hard mast species are present in the canopy or subcanopy. Shrub crown cover (made up of seedlings primarily) is approximately 65%.
Upland Hardwood Plot 3	Within Borrow Area 2	The hardwood forest at this location seems to be relatively young with a few mature emergent oaks. Other canopy and subcanopy species include: flowering dogwood, mockernut hickory, American beech, red maple, sugar maple, shortleaf pine (*Pinus echinata*), sweetgum, and blackgum. Seedlings present include: American beech, sassafras (*Sassafras albidum*), red maple, sourwood, black cherry (*Prunus serotina*), and red bud (*Cercis Canadensis*). Canopy cover was approximately 80%; canopy cover of emergent oaks was approximately 15%. Average dbh of canopy trees is approximately 6 inches with

Table 1. Description of Plot Locations

Plot	Location	Description
		large emergent trees averaging 15 inches; total basal area was approximately 73 ft2/acre. Hard mast species are present in the canopy and subcanopy. Shrub crown cover (made up of seedlings primarily) is approximately 20%. Herbaceous ground cover was approximately 50%.
Upland Pine Plot 1	Within Borrow Area 1	The pine forest at this location is dominated primarily by relatively small Virginia pines. Scattered hardwoods include sycamore, yellow-poplar, and sweetgum. Canopy cover is approximately 95-100%; total basal area is approximately 124 ft2/acre. Average dbh of canopy trees is approximately 6 inches. No hard mast species are present in the canopy or subcanopy. Shrub crown cover (made up of seedlings primarily) is approximately 35%.
Upland Pine Plot 2	Within Borrow Area 2	The canopy of the upland pine forest at this location is dominated by shortleaf pine. However other canopy species include Virginia pine, mockernut hickory, and black oak (*Quercus velutina*). Subcanopy species include beech, sourwood, black gum, sweetgum, and red maple. Canopy cover is approximately 50%; total basal area is approximately 133 ft2/acre. Average dbh of canopy trees is approximately 11 inches with few canopy trees exceeding 20 inches dbh. Hard mast species are present in the canopy and subcanopy (approximately 20% cover). American beech seedlings are thick in this area, creating a shrub crown cover (made up of seedlings primarily) of approximately 100%.
Upland Pine Plot 3	Within Borrow Area 2	The pine forest at this location is dominated by relatively small Virginia pines. Other canopy and subcanopy species include red maple, black oak, American beech, flowering dogwood, eastern white pine (*Pinus strobus*), and hickory (*Carya spp.*). Canopy cover is approximately 60%; total basal area is approximately 100 ft2/acre. Average dbh of canopy trees is approximately 6 inches with few, if any, canopy trees exceeding 20 inches dbh. Hard mast species are present in the canopy and subcanopy (approximately 20% cover). Various seedlings are abundant in this area, creating a shrub crown cover (made up of seedlings primarily) of approximately 50%. Seedling species include Virginia pine, sourwood, eastern white pine, flowing dogwood, hickory, beech, oaks, and American holly (*Ilex opaca*).

4.0 SPECIES SELECTION

Animal reference species for the HEP were selected in consultation with the U.S. Fish and Wildlife Service (USFWS) and the Kentucky Department of Fish and Wildlife Resources. Selection was based on habitat types available within the proposed structural disturbance area as well as the potential for various species to occur within these areas. Four species were selected to evaluate forested habitat within the project area: barred owl (*Strix varia*), downy woodpecker (*Picoides pubescens*), gray squirrel (*Sciurus carolinensis*), and eastern cottontail (*Sylvilagus floridanus*). Table 2 presents information pertaining to the species selected for the HEP. USFWS Habitat Suitability Index (HSI) models were used to evaluate species' habitats.

Table 2. Species Selected for the HEP

SPECIES	HABITAT TYPE	GUILD	STRATUM	HSI Model Reference
Downy woodpecker	Bottomland hardwood, mixed woods	Invertebrate carnivore	Tree boles	Schoeder 1983
Barred owl	Bottomland hardwood, mixed woods	Vertebrate carnivore	Arial	Allen 1987
Gray squirrel	Bottomland hardwood, mixed woods	Herbivore	Tree canopy/shrub	Allen 1982
Eastern Cottontail	Variety of forested and non-forested habitats	Herbivore	Ground	Allen 1984

4.1 Downy Woodpecker

The downy woodpecker is known to occur in Floyd County, and would be expected to occur in forests within the project area. The downy woodpecker inhabits a variety of forested habitats, including bottomland hardwood and riparian forest. This species primarily eats insects and nests in cavities; it prefers soft snags for nest sites.

Habitat quality for the downy woodpecker was assessed based on the HSI model published by the USFWS (Schoeder 1983). The HSI model is based on food and reproductive needs of the downy woodpecker as an indication of overall habitat suitability. Ideal basal area ranges from approximately 40 ft^2/acre to approximately 90 ft^2/acre. Habitat suitability increases with an increase in snag density (as measured by snags/acre). The model is appropriate to be used with both deciduous and evergreen forests. Variables used in evaluating potential habitat for this species include:

V1 – Basal area/acre
V2 – Number of snags > 6 inches dbh/acre

4.2 Barred Owl

The barred owl is not listed as occurring in Floyd County; however, Floyd County is within its range. The barred owl is widely distributed throughout North America and inhabits mixed woodlands, boreal forest, mixed transitional forest, and deciduous forest, including bottomland and riparian habitats. This species requires an expansive forest area that contains large mature and decadent trees that provide cavities suitable for security and reproduction.

Habitat quality for the barred owl was assessed based on the HSI model published by the USFWS (Allen 1987). The HSI model is based on reproduction requirements. It is assumed that the existence of suitable nest cavities is present in mature stands. The model is appropriate to be used with both deciduous and evergreen forests. Variables used in evaluating potential habitat for this species pertain to reproductive habitat quality and include:

V1 – Number of trees >20 inches dbh/acre
V2 – Mean dbh of overstory trees
V3 – Percent canopy closure

4.3 Gray Squirrel

The gray squirrel is known to occur in Floyd County and is common in hardwood and mixed hardwood-coniferous forests. Generally, optimal habitat for gray squirrels includes a closed canopy forests with a well-developed understory. In addition, good habitat requires the presence of mast-producing trees, especially hard mast species that provide winter food.

Habitat quality for the gray squirrel was assessed based on the HSI model published by the USFWS (Allen 1982). Note: This model was created to use with deciduous forests only. Variables used in evaluating potential habitat for this species include:

V1 – Percent canopy closure of trees that produce hard mast
V2 – Diversity of tree species that produce hard mast
V3 – Percent tree canopy closure
V4 – Average dbh of overstory trees
V5 – Percent shrub crown cover

4.4 Eastern Cottontail

The eastern cottontail is known to occur in Floyd County and is common in a variety of successional and transitional habitats. Good habitat usually consists of well-distributed escape and cover interspersed with grassland community that contains an abundance of forbs. Persistent herbaceous vegetation and woody vegetation provide winter cover and food for the Eastern cottontail.

Habitat quality for the Eastern cottontail was assessed based on the HSI model published by the USFWS (Allen 1984). This model was created to use for a variety of habitats, both forested and non-forested. The HEP model in this evaluation has been simplified to produce conservative estimates of habitat quality. Variables used in evaluating potential habitat for this species include:

V1 – Percent shrub crown closure
V2 – Percent tree canopy cover
V3 – Percent persistent herbaceous cover
V4 – Diversity Index

5.0 HABITAT EVALUATION FOR STUDY AREA

Habitat quality for selected species was evaluated for each forest habitat type within forested areas found within the study area. HSI scores range from 0.0 (poor quality) to 1.0 (good quality) and are defined in the published HSI models. During data collection, percent of herbaceous cover was collected, but persistent herbaceous cover was not identified. Therefore, for the purposes of this evaluation, all herbaceous cover was assumed to be persistent herbaceous cover.

5.1 Riparian Forest

A relatively narrow strip of riparian forest (approximately 20 - 350 feet wide) is present along the Levisa Fork within the project area. This riparian forest is primarily dominated by silver maple and box elder. Sycamore is also common and dominant in some areas. Other common tree species present include red maple, yellow-poplar, river birch (*Betula nigra)*, and black willow.

5.1.1 Habitat Evaluation for Downy Woodpecker

According to the HEP model, the ideal basal area for the downy woodpecker is approximately 45 to 90 ft^2/acre with over 5 snags per acre. Variable values for the riparian forest sample plots are provided in **Table 3** below.

Table 3. Downy Woodpecker in Riparian Forest

Variable No.	Variable	Riparian Plot 1	Riparian Plot 2	Riparian Plot 3	Average	HSI[1] Score
V1	Basal Area/Acre	253 ft^2	230 ft^2	328 ft^2	270 ft^2	0.5
V2	No. of snags > 6 in dbh/acre	0	10	20	10	1.0

[1]HSI values obtained from published HSI model (Schoeder 1982)

The HSI for the downy woodpecker is equal to the lowest life requisite value; therefore, the HSI value for the downy woodpecker is 0.5. This score indicates that the riparian forest within the project area provides medium quality habitat for this species. The basal area of the riparian forest is higher than generally preferred by the downy woodpecker; however, the presence of snags provides both nesting and feeding opportunities for this species.

5.1.2 Habitat Evaluation for Barred Owl

According to the HEP model, an ideal forest for the barred owl contains large mature trees (>20 inches dbh) with a relatively closed canopy (55-100%). Variable values for the riparian forest sample plots are provided in **Table 4** below.

Table 4. Barred Owl in Riparian Forest

Variable No.	Variable	Riparian Plot 1	Riparian Plot 2	Riparian Plot 3	Average	SI[1]
V1	No. of trees> 20"/acre	60	0	30	30	1.0
V2	Mean dbh (in) of canopy trees	21	11.3	13	15.1	0.7
V3	Percent canopy cover	90	95-100	95	95	1.0

[1]SI values were obtained from USFWS HSI Model (Allen 1987).

The HSI for the barred owl is calculated as follows:

$$HSI = (SI_{V1} \times SI_{V2})^{1/2} \times SI_{V3}$$

$$HSI = (0.7)^{1/2} \times 1.0$$

$$HSI = 0.84$$

Based on HEP analysis, riparian hardwood forests in the project area provide good habitat for the barred owl.

5.1.3 Habitat Evaluation for Gray Squirrel

According to the HEP model, the ideal habitat for the gray squirrel includes a forest with numerous hard mast-producing species, relatively high average dbh (15-20 inches), and approximately 25% shrub cover. Variable values for the riparian forest sample plots are provided in **Table 5** below.

Table 5. Gray Squirrel in Riparian Forest

Variable No.	Variable	Riparian Plot 1	Riparian Plot 2	Riparian Plot 3	Average	SI[1]
V1	Percent canopy closure of hard mast species	0	0	0	0	0
V2	No. of species that produce hard mast	0	0	0	0	0
V3	Percent canopy cover	90	95-100	95	95	0.8
V4	Mean dbh (in) of canopy trees	21	11.3	13	15.1	1.0
V5	Percent shrub crown cover	0	15	0	5	0.82

[1] SI values were obtained from USFWS HSI Model (Allen 1982).

Winter Food

$= (SI_{V1} \times SI_{V2})^{1/2}$

$= 0.0$

Cover/Reproduction

$= (SI_{V3} \times SI_{V4})^{1/2} \times SI_{V5}$

$= (0.8)^{1/2} \times 0.82$

$= 0.73$

The HSI for the gray squirrel is equal to 0.0, the lowest of the values obtained for Winter Food or Cover/Reproduction because the riparian forest provides no hard mast-producing species. Habitat quality of the riparian forest is poor for the gray squirrel due to the lack of winter food.

5.1.4 Habitat Evaluation for Eastern Cottontail

Variable values for the riparian forest sample plots are provided in **Table 6** below.

Table 6. Eastern Cottontail in Riparian Forest

Variable No.	Variable	Riparian Plot 1	Riparian Plot 2	Riparian Plot 3	Average	SI[1]
V1	Percent shrub crown closure	0	<15	0	5	0.3
V2	Percent tree canopy cover	90	95-100	95	95	0.2
V3	Percent persistent herbaceous cover	100	100	20	73	0.5
V4	Diversity Index				>1.5	1.0

[1] SI values were obtained from USFWS HSI Model (Allen 1984).

The HSI for the eastern cottontail is based on the winter cover/food index (WCFI) and a Diversity index. The HSI is determined by the following equation:

$HSI = (WCFI \times SI_{V4})^{1/2}$

The WCFI for the Eastern cottontail is calculated as follows:

$WCFI = (4(SI_{V1}) + SI_{V2})/5 + SI_{V3}$

$WCFI = (1.2 + 0.2)/5 + 0.5$

$WCFI = 0.78$

SIV4 is based on the Diversity index (DI). The DI is normally calculated using the perimeter of cover types containing winter cover/food in the study area. To establish a conservative estimate of habitat quality, DI is assumed to be optimal and therefore, SIV4 is assumed to be 1.0. For the purposes of this evaluation, the entire study area was assumed to have winter cover/food. Therefore, the HSI for the eastern cottontail is:

$HSI = (0.78 \times 1.0)^{1/2}$

$HSI = 0.88$

The HEP indicates that the riparian forest within the project area is considered to be relatively good quality for the Eastern cottontail. This is primarily due to the large amount of herbaceous ground cover.

5.2 Upland Hardwood Forest

The upland hardwood forest within the project area may be described as a mixed mesophytic forest. A HEP analysis was performed in representative areas within two of the proposed borrow sites.

5.2.1 Habitat Evaluation for Downy Woodpecker

According to the HEP model, the ideal basal area for the downy woodpecker is approximately 45 to 90 ft^2/acre with over 5 snags per acre. Variable values for the upland hardwood forest sample plots are provided in **Table 7** below.

Table 7. Downy Woodpecker in Upland Hardwood Forest

Variable No.	Variable	Upland Hardwood Plot 1	Upland Hardwood Plot 2	Upland Hardwood Plot 3	Average	HSI Score[1]
V1	Basal Area/Acre	138 ft^2	174 ft^2	73 ft^2	128 ft^2	0.6
V2	No. of snags > 6 in dbh/acre	0	10	10	6.7	1.0

[1] HSI values were obtained from USFWS HSI Model (Schoeder 1983).

The HSI for the downy woodpecker is equal to the lowest life requisite value; therefore, the HSI value for the upland hardwood forest is 0.6.

5.2.2 Habitat Evaluation for Barred Owl

According to the HEP model, an ideal forest for the barred owl contains large mature trees (>20 inches dbh) with a relatively closed canopy (55-100%). Variable values for the upland hardwood sample plots are provided in **Table 8** below.

Table 8. Barred Owl in Upland Hardwood Forest

Variable No.	Variable	Upland Hardwood Plot 1	Upland Hardwood Plot 2	Upland Hardwood Plot 3	Average	SI[1]
V1	No. of trees> 20"/acre	0	50	0	17	1.0
V2	Mean dbh (in) of canopy trees	11	20	5	12	0.5
V3	Percent canopy cover	95-100	70	80	83	1.0

[1]SI values were obtained from USFWS HSI Model (Allen 1987).

The HSI for the barred owl is calculated as follows:

$$HSI = (SI_{V1} \times SI_{V2})^{1/2} \times SI_{V3}$$

$$HSI = (0.5)^{1/2} \times 1.0$$

$$HSI = 0.7$$

Based on HEP analysis, upland hardwood forests in the project area provide good habitat for the barred owl. The habitat value of Hardwood Plot 2 is considerably better than Hardwood Plots 1 and 3, primarily due to its large mature trees. Because the hardwood forest at Plots 1 and 3 contain few, if any, large mature trees (>20 inches dbh), these locations provide relatively poor quality habitat for the barred owl.

5.2.3 Habitat Evaluation for Gray Squirrel

According to the HEP model, the ideal habitat for the gray squirrel includes a forest with numerous hard mast-producing species, relatively high average dbh (15-20 inches), and approximately 25% shrub cover. Variable values for the upland hardwood forest sample plots are provided in **Table 9** below.

Table 9. Gray Squirrel in Upland Hardwood Forest

Variable No.	Variable	Upland Hardwood Plot 1	Upland Hardwood Plot 2	Upland Hardwood Plot 3	Average	SI[1]
V1	Percent canopy closure of hard mast species	15-20%	60%	10%	29%	0.8
V2	No. of species that produce hard mast	4	1	4	3	0.8
V3	Percent canopy cover	95-100%	70%	80%	82%	0.9
V4	Mean dbh (in) of canopy trees	11	20	6	12	0.7
V5	Percent shrub crown cover	30	65	20	38	0.9

[1] SI values were obtained from USFWS HSI Model (Allen 1982).

Winter Food

$$= (SI_{V1} \times SI_{V2})^{1/2}$$

$$= (0.64)^{1/2}$$

= 0.8

Cover/Reproduction

= $(SI_{V3} \times SI_{V4})^{1/2} \times SI_{V5}$

= $(0.63)^{1/2} \times 0.9$

= 0.7

The HSI for the gray squirrel is equal to the lowest of the values obtained for Winter Food or Cover/Reproduction, which is 0.7. Based on the HEP analysis, the upland hardwood forest provides relatively good habitat for the gray squirrel, primarily due to the presence of hard mast-producing species such as oaks, hickories, buckeye, and beech.

5.2.4 Habitat Evaluation for Eastern Cottontail

Variable values for the upland hardwood forest sample plots are provided in **Table 10** below.

Table 10. Eastern Cottontail in Upland Hardwood Forest

Variable No.	Variable	Upland Hardwood Plot 1	Upland Hardwood Plot 2	Upland Hardwood Plot 3	Average	SI[1]
1	Percent shrub crown closure	30	65	20	38	1.0
2	Percent tree canopy cover	95-100	70	80	83	0.5
3	Percent persistent herbaceous cover	25	<5	50	26	0.2
4	Diversity Index					1.0

[1] SI values were obtained from USFWS HSI Model (Allen 1984).

The HSI is based on the winter cover/food index (WCFI) and a Diversity index. The HSI is determined by the following equation:

HSI = (WCFI x SI_{V4})1/2

The WCFI for the Eastern cottontail is calculated as follows:

WCFI = $(4(SI_{V1}) + SI_{V2})/5 + SI_{V3}$

WCFI = (4 + 0.5)/5 + 0.2

WCFI = 1.1

Since the WCFI is greater than 1.0, it is reduced to 1.0 for the model.

SIV4 is based on the Diversity index (DI). The DI is calculated using the perimeter of cover types containing winter cover/food in the study area. To establish a conservative estimate of habitat quality, DI is assumed to be optimal and therefore, SIV4 is assumed to be 1.0. For the purposes of this evaluation, the entire study area was assumed to have winter cover/food. Therefore, the HSI for the eastern cottontail is:

HSI = (1.0 x 1.0) 1/2

HSI = 1.0

The HEP indicates that the upland forest within the project area is considered to be good quality habitat for the Eastern cottontail. This is primarily due to shrub cover available within the forest.

5.3 Upland Pine Forest

Upland pine-dominated forests are not present within the CWL but do occur within proposed borrow areas. A HEP analysis was performed in representative areas within two of the proposed borrow sites.

5.3.1 Habitat Evaluation for Downy Woodpecker

According to the HEP model, the ideal basal area for the downy woodpecker is approximately 45 to 90 ft2/acre with over 5 snags per acre. Variable values for the upland pine forest sample plots are provided in **Table 11** below.

Table 11. Downy Woodpecker in Upland Pine Forest

Variable No.	Variable	Upland Hardwood Plot 1	Upland Hardwood Plot 2	Upland Hardwood Plot 3	Average	HSI Score[1]
V1	Basal Area/Acre	124 ft^2	133 ft^2	100 ft^2	119 ft^2	0.7
V2	No. of snags > 6 in dbh/acre	0	0	10	3	0.6

[1] HSI values were obtained from USFWS HSI Model (Schoeder 1983).

The HSI for the downy woodpecker is equal to the lowest life requisite value; therefore, the HSI value for the downy woodpecker is 0.6, indicating that pine forests in the project area provide medium quality habitat for the downy woodpecker.

5.3.2 Habitat Evaluation for Barred Owl

According to the HEP model, an ideal forest for the barred owl contains large mature trees (>20 inches dbh) with a relatively closed canopy (55-100%). Variable values for the upland pine sample plots are provided in **Table 12** below.

Table 12. Barred Owl in Upland Pine Forest

Variable No.	Variable	Upland Pine Plot 1	Upland Pine Plot 2	Upland Pine Plot 3	Average	SI[1]
V1	No. of trees> 20"/acre	0	10	10	7	1.0
V2	Mean dbh (in) of canopy trees	6	11	6	8	0.25
V3	Percent canopy cover	100	50	60	70	1.0

[1]SI values were obtained from USFWS HSI Model (Allen 1987).

The HSI for the barred owl is calculated as follows:

$$HSI = (SI_{V1} \times SI_{V2})^{1/2} \times SI_{V3}$$

$$HSI = 0.5 \times 1.0$$

$$HSI = 0.5$$

In general upland pine forests within the project area would be expected to provide medium quality habitat for the barred owl.

5.3.3 Habitat Evaluation for Gray Squirrel

As the HEP model was created for deciduous forests only, HEP was not used to determine habitat suitability for the gray squirrel for the pine forest community.

5.3.4 Habitat Evaluation for Eastern Cottontail

Variable values for the upland hardwood forest sample plots are provided in **Table 13** below.

Table 13. Eastern Cottontail in Upland Pine Forest

Variable No.	Variable	Upland Pine Plot 1	Upland Pine Plot 2	Upland Pine Plot 3	Average	SI[1]
V1	Percent shrub crown closure	35	100	60	65	0.9
V2	Percent tree canopy cover	95-100	50	50	65	0.7
V3	Percent persistent herbaceous cover	25	0	60	28	0.2
V4	Diversity Index					1.0

[1] SI values were obtained from USFWS HSI Model (Allen 1984).

The HSI is based on the winter cover/food index (WCFI) and a Diversity index. The HSI is determined by the following equation:

$$HSI = (WCFI \times SI_{V4})^{1/2}$$

The WCFI for the Eastern cottontail is calculated as follows:

$$WCFI = (4(SI_{V1}) + SI_{V2})/5 + SI_{V3}$$

$$WCFI = (3.6 + 0.7)/5 + 0.2$$

$$WCFI = 1.06$$

Since the WCFI is greater than 1.0, it is reduced to 1.0 for the model.

SIV4 is based on the DI. The DI is calculated using the perimeter of cover types containing winter cover/food in the study area. To establish a conservative estimate of habitat quality, DI is assumed to be optimal and therefore, SI_{V4} is assumed to be 1.0. For the purposes of this evaluation, the entire study area was assumed to have winter cover/food. Therefore, the HSI for the eastern cottontail is:

$$HSI = (1.0 \times 1.0)^{1/2}$$

$$HSI = 1.0$$

The HEP indicates that the upland pine forest within the project area is considered to be good quality habitat for the Eastern cottontail. This is primarily due to the shrub cover available within the forest.

5.4 Summary of Study Area Habitat Quality

Table 14 summarizes the results of the study area HEP.

Table 14. Study Area Habitat Suitability Index (HSI)Values

Forest Type	Downy Woodpecker	Barred Owl	Gray Squirrel	Eastern Cottontail	Average HSI
Riparian Forest	0.5	0.84	0.0	0.88	0.56
Upland Hardwood Forest	0.6	0.7	0.7	1.0	0.75
Upland Pine Forest	0.6	0.5	Not applicable	1.0	0.70

Riparian Forest: Based on the HEP analysis, riparian forest has an average HSI of 0.56 within the construction limits and may provide medium to good quality habitat for some species. However, the riparian forests within the construction limits do not provide good habitat for wildlife that require hard mast species. This results from the relatively low diversity of tree species in these riparian areas and an absence of hard mast-producing species. Although areas of the riparian corridor contain large mature trees, the riparian corridor within the project area is relatively narrow, and therefore, does not provide adequate cover/habitat for species that prefer large expanses of forest (i.e., barred owl). This is not reflected in the HEP analysis.

Upland Forest: Upland hardwood forests within the borrow areas provide relatively good quality habitat for the species examined, with an overall HSI of 0.75. This is the result of relatively large canopy trees, the presence of hard mast-producing species, and adequate cover for small mammals. The upland pine forest within the borrow areas provides medium to good quality habitat for the species examined, with an overall HSI of 0.70.

6.0 HABITAT EVALUATION FOR REFERENCE SITE LOCATIONS

In order to determine appropriate mitigation options, reference sites were identified for high quality riparian forest habitat. USGS topographic maps and aerials were utilized to identify potential sites prior to the field site exploration. Field reconnaissance for a model site was conducted in various locations along the riparian corridor of the Levisa Fork on July 27, 2004. The majority of the watershed was deemed disturbed by development and residential areas. The wildlife area upstream of Fishtrap Lake (i.e. near the Virginia border) was explored because the area was not currently developed. However, the wildlife area was highly disturbed by invasive species (e.g., kudzu (*Pueraria Montana*) and Japanese knotweed (*Polygonum cuspidatum*)).

6.1 Sampling Locations

A model site was located south of the project area along the Levisa Fork in the vicinity of a small tributary to the Levisa Fork (**Figure 4**). The site was characteristic of a riparian forest, and was similar to the riparian areas within the Floyd County CWL. The area was not developed and contained a greater diversity of species compared with other areas within the watershed including hard mast species (i.e., yellow buckeye). Although black walnut (*Juglans nigra*) was not present with the reference plots, black walnut was observed growing adjacent to the river in nearby areas.

A HEP analysis was conducted on the three reference plots to compare riparian habitat quality between the reference site and project area. In general, the habitat of the model site is considered better quality due to increased species diversity as well as the abundance of large-diameter mature trees. The habitat quality of the model site was used to estimate the proposed habitat units gained by the revegetation and enhancement mitigation plan.

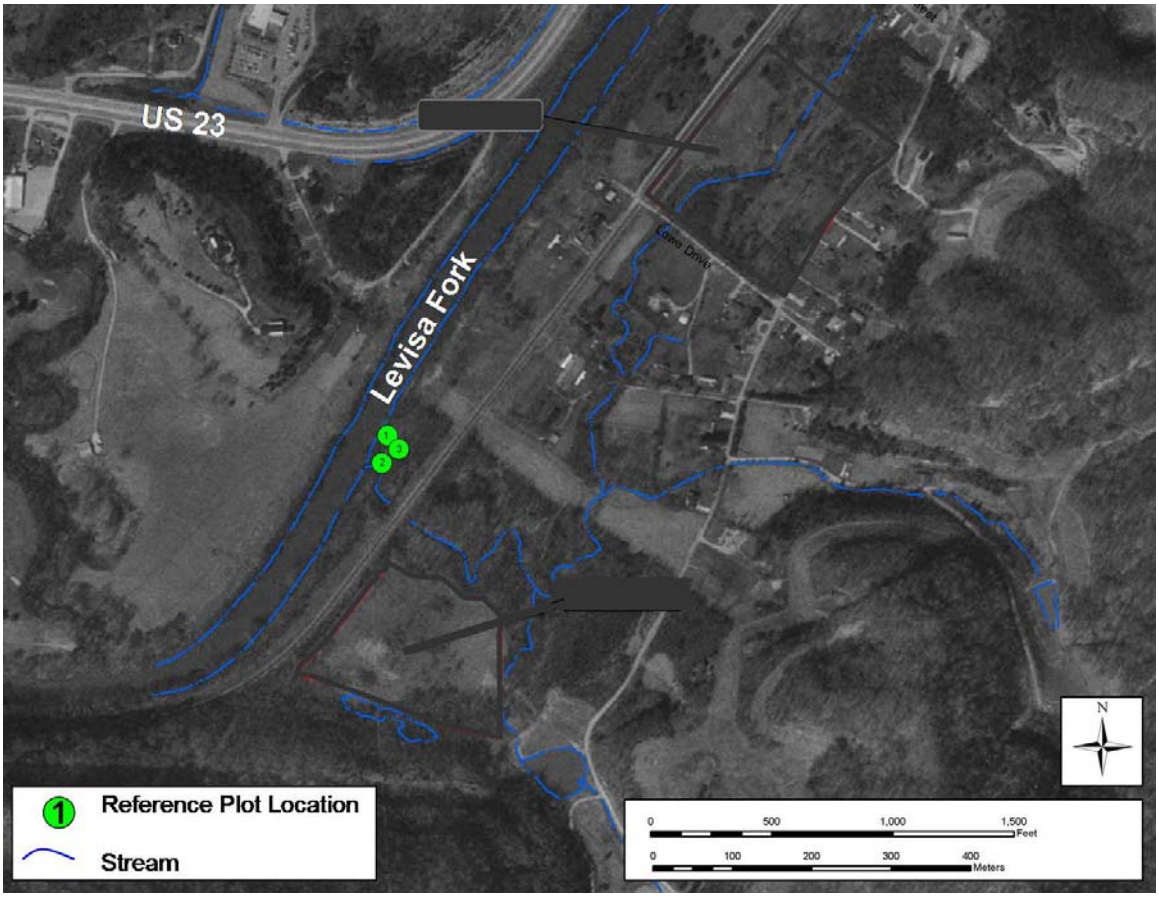

Figure 4. Reference Area Sample Plot Locations

6.2 Plot Descriptions

A narrative description of riparian forest plots is provided in **Table 15**. Tree species identified within the riparian corridor of the Levisa Fork during field reconnaissance include black cherry (*Prunus serotina*), black walnut, box elder, green ash (*Fraxinus pennsylvanica*), red maple, river birch (*Betula nigra*), silver maple, sycamore, yellow buckeye, and yellow-poplar. Yellow buckeye and black walnut were the only hard mast species identified within the riparian corridor. Northern red oak (*Quercus rubra*) and shellbark hickory (*Carya laciniosa*) were not observed. Shrub species identified include elderberry (*Sambucus canadensis*), raspberry (*Rubus* spp.), river cane (*Arundinaria gigantea*), sassafras (*Sassafras albidum*), and spicebush (*Calacanthus floridus*).

Table 15. Reference Sample Location Descriptions

PLOT	LOCATION	DESCRIPTION
Reference Plot 1	Immediately adjacent to the Levisa Fork	The riparian forest at this location is dominated by box elder in both the canopy and subcanopy. Silver maple and green ash are also present, but are not dominant at this location. Canopy cover is approximately 95%; total basal area is approximately 108 ft^2/acre. Dbh of canopy trees ranges from approximately 5 to 20 inches, averaging approximately 12 inches. No hard mast species are present in the canopy or subcanopy. The understory is relatively sparse at this location; only a few scattered buckeye shrubs are present. Herbaceous cover is approximately 65%.
Reference Plot 2	Immediately adjacent to a tributary of the Levisa Fork	The riparian forest at this location is dominated by mature silver maple; yellow buckeye and slippery elm are also present in the canopy and box elder is present in the subcanopy. Canopy cover is approximately 75%; total basal area is approximately 263 ft^2/acre. Dbh of canopy trees ranges from approximately 13 to 36 inches, averaging approximately 24 inches. Yellow buckeye, which is considered a hard mast species, is present in the canopy. The forest at this location has a relatively well developed understory, consisting primarily of young buckeye and young box elder. Herbaceous cover is approximately 25%.
Reference Plot 3	Slightly upslope from the Levisa Fork	The riparian forest at this location is dominated by box elder; other canopy species include black cherry, silver maple, and yellow-poplar. Canopy cover is approximately 85%; total basal area is approximately 191 ft^2/acre. Dbh of canopy trees ranges from approximately 5 to 20 inches, averaging approximately 12 inches. No hard mast species are present at this location. The forest at this location has a relatively sparse understory and dense herbaceous cover, dominated by *Microstegium vimineum*.

6.3 Habitat Evaluation

6.3.1 Habitat Evaluation for Downy Woodpecker

Variable values for the reference sample plots are provided in **Table 16** below.

Table 16. Reference Area HEP Analysis for Downy Woodpecker

Variable	Variable	Plot 1	Plot 2	Plot 3	Average	HSI Score
V1	Basal Area/Acre	108	263	191	187	0.5
V2	No. of snags > 5.9 in dbh/acre	20	20	0	13	1.0

[1] HSI values were obtained from USFWS HSI Model (Schoeder 1983).

Habitat for the downy woodpecker is based on a food component and a reproduction component. Basal area is representative of the food component and snag density (no. of snags >6"/acre) is representative of the reproduction component. The two components represent life requisite values. A basal area of 198 ft^2 per acre is equivalent to a suitability index (SI) of 0.5, and an

average of 13 snags per acre is equivalent to an SI of 1.0. The HSI for the downy woodpecker is equal to the lowest life requisite value; therefore, the HSI value for the downy woodpecker is 0.5. This indicates that the reference riparian site provides medium quality habitat for the downy woodpecker.

6.3.2 Habitat Evaluation for Barred Owl

Variable values for the reference sample plots are provided in **Table 17** below.

Table 17. Reference Area HEP Analysis for Barred Owl

Variable	Variable	Plot 1	Plot 2	Plot 3	Average	SI
V1	No. of trees> 20"/acre	10	50	20	27	1.0
V2	Mean dbh (in) of canopy trees	12	24	12	16	0.8
V3	Percent canopy cover	95	75	85	85	1.0

[1]SI values were obtained from USFWS HSI Model (Allen 1987).

The HSI for the barred owl is calculated as follows:

$$HSI = (SI_{V1} \times SI_{V2})^{1/2} \times SI_{V3}$$

$$HSI = 0.9$$

The HSI model indicates the reference site could provide good quality habitat for the barred owl.

6.3.3 Habitat Evaluation for Gray Squirrel

Variable values for the reference sample plots are provided in **Table 18** below.

Table 18. Reference Area HEP Analysis for Gray Squirrel

Variable	Variable	Plot 1	Plot 2	Plot 3	Average	SI
V1	Percent canopy closure of hard mast species	0	5	0	1.7	0.05
V2	No. of species that produce hard mast	0	1	0	0.3	0.2
V3	Percent canopy cover	95	75	85	85	0.9
V4	Mean dbh (in) of canopy trees	12	24	12	16	1.0
V5	Percent shrub crown cover	5	60	10	25	1.0

[1] SI values were obtained from USFWS HSI Model (Allen 1982).

Winter Food

$$HSI = (SI_{V1} \times SI_{V2})^{1/2}$$

$$HSI = 0.1$$

Cover/Reproduction

$$HSI = (SI_{V3} \times SI_{V4})^{1/2} \times SI_{V5}$$

$$HSI = 0.95$$

The HSI for the gray squirrel equals the lowest of the values obtained for winter food and cover/reproduction. Therefore the HSI is 0.1. This indicates that the reference riparian site provides relatively poor winter habitat for the gray squirrel.

6.3.4 Habitat Evaluation for Eastern Cottontail

Variable values for the reference forest sample plots are provided in **Table 19** below.

Table 19. Reference Area HEP Analysis for Eastern Cottontail

Variable No.	Variable	Reference Riparian Plot 1	Reference Riparian Plot 2	Reference Riparian Plot 3	Average	SI[1]
V1	Percent shrub crown closure	5	60	10	25	1.0
V2	Percent tree canopy cover	95	75	85	85	0.4
V3	Percent persistent herbaceous cover	65	25	100	63	0.4
V4	Diversity Index					1.0

[1] SI values were obtained from USFWS HSI Model (Allen 1984).

The HSI is based on the winter cover/food index (WCFI) and a Diversity index. The HSI is determined by the following equation:

$HSI = (WCFI \times SI_{V4})^{1/2}$

The WCFI for the Eastern cottontail is calculated as follows:

$WCFI = ((4(SI_{V1}) + SI_{V2})/5) + SI_{V3}$

$WCFI = (4 + 0.4)/5 + 0.4$

$WCFI = 1.28$

Since the WCFI is greater than 1.0, it is reduced to 1.0 for the model.

SIV4 is based on the DI. The DI is calculated using the perimeter of cover types containing winter cover/food in the study area. To establish a conservative estimate of habitat quality, DI is assumed to be optimal and therefore, SIV4 is assumed to be 1.0. For the purposes of this evaluation, the entire study area was assumed to have winter cover/food. Therefore, the HSI for the eastern cottontail is:

$HSI = (1.0 \times 1.0)^{1/2}$

$HSI = 1.0$

The HEP indicates that the reference riparian forest within the project area is considered to be good quality habitat for the Eastern cottontail. This is primarily due to the shrub cover available within the forest.

6.4 Summary of Reference Area Habitat Quality

Table 20 summarizes the results of the reference area HEP.

Table 20. Reference Area Habitat Suitability Index (HSI)Values

Forest Type	Downy Woodpecker	Barred Owl	Gray Squirrel	Eastern Cottontail	Average HSI
Riparian Forest	0.5	0.9	0.1	1.0	0.63

Based on the HEP analysis, riparian forest within the model location may provide medium to good quality habitat for some species. Hard mast species were not abundant, but at least one hard mast species (yellow buckeye) was present at the model location.

7.0 HABITAT EVALUATION FOR POST-PROJECT CONDITIONS

7.1 Revegetation Plan

Vegetation riverward of the CWL would not be cleared. However, acquisition of property would extend to the edge of the Levisa Fork along the alignment. Revegetation of disturbed areas with native species of grasses, wildflowers, shrubs, and trees would follow construction. An approximate 8-foot grass buffer would be created along the riverward side of the floodwall to maintain a treeless environment along the structure. Disturbed areas and currently non-forested areas riverward of the buffer would be planted and seeded with native tree and shrub species to return the area to passive use and enhance the existing riparian corridor. Landward of the floodwall, disturbed areas would be restored to at least their current condition in consultation with Floyd County and the City of Prestonsburg regarding the land's intended use.

A proposed list of riparian species for revegetation based on field guides, agency consultation, and field reconnaissance is located in **Table 21**. Based on literature research and field surveys, box elder and silver maple are highly abundant throughout the watershed. These species may be planted but are expected to establish themselves naturally as well. Revegetation using the suggested species list would enhance habitat quality of the riparian corridors along the floodwalls through the establishment of hard mast species and greater species diversity. Northern red oak, black walnut, yellow buckeye, and shellbark hickory would be planted only on the upper terrace of the Levisa Fork riparian corridor to increase survival rate.

Table 21. Proposed Riparian Species for Revegetation

Trees	
Black Cherry	*Prunus serotina*
Black Willow	*Salix nigra*
Black Walnut *	*Juglans nigra*
Green Ash	*Fraxinus pennsylvanica*
Northern Red Oak*	*Quercus rubra*
Red Maple	*Acer rubrum*
River Birch	*Betula nigra*
Shellbark Hickory*	*Carya laciniosa*
Sycamore	*Platanus occidentalis*
Silver Maple	*Acer saccharinum*
Yellow Buckeye*	*Aesculus octandra*
Yellow-poplar	*Liriodendron tulipifera*
Shrubs	
American Plum	*Prunus americana*
Elderberry	*Sambucus canadensis*
Raspberry	*Rubus spp.*
River Cane	*Arundinaria gigantea*
Sassafras	*Sassafras albinum*
Spicebush	*Lindera benzoin*
Herbaceous Plants	
Downy Wild rye	*Elymus villosus*
Fowl Manna Grass	*Glyceria striata*
Riverbank Wild rye	*Elymus riparius*
River Oats (also called Spangle grass and Indian woodoats)	*Chasmanthium latifolium*
Wild rye	*Elymus virginicus*
Yellow Wingstem	*Verbesina alternafolia*

* Hard mast species

7.2 Habitat Evaluation

To analyze post-project riparian forest conditions, it was assumed that the riparian forest in 50 years within the project area would be similar to the reference location (Section 7.0). The proposed mitigation plan would increase the number of species and percent cover of hard mast species in relation to pre-project conditions.

7.2.1 Habitat Evaluation for Downy Woodpecker

Since variables used to assess habitat suitability for the downy woodpecker are not dependent on hard mast species, the HSI value of 0.5 from the reference site location analysis was assumed to provide a good estimate for post-project conditions for the downy woodpecker.

7.2.2 Habitat Evaluation for Barred Owl

Since variables used to assess habitat suitability for the barred owl are not dependent on hard mast species, the HSI value of 0.9 from the reference site location analysis was assumed to provide a good estimate for post-project conditions for the barred owl.

7.2.3 Habitat Evaluation for Gray Squirrel

For this analysis, it was assumed that approximately 75 percent of species planted on the upper terrace would consist of hard mast species. A maximum of 80 percent of all seedlings planted is expected to survive. Since hard mast species would be less tolerable to conditions along the Levisa Fork, such as flooding, the percentage of survival for hard mast species would likely be less than 80 percent. No hard mast species would be planted on the lower terrace. Therefore, for the analysis of post-project conditions, it was estimated that the overall canopy cover for hard mast species in the riparian corridor would be approximately 30 percent. Four hard mast species were found suitable for planting on the upper terrace during revegetation. These species include the black walnut, northern red oak, shellbark hickory (*Carya laciniosa*), and yellow buckeye. All other variables were estimated using the reference site location results. Variable values for the post-project conditions are provided in **Table22** below.

Table 22. Post-Project Conditions HEP Analysis for Gray Squirrel

Variable No.	Variable	Riparian corridor 50 years later	SI
V1	Percent canopy closure of hard mast species	30	0.8
V2	No. of species that produce hard mast	4	1.0
V3	Percent canopy cover	85	0.9
V4	Mean dbh (in) of canopy trees	16	1.0
V5	Percent shrub crown cover	25	1.0

[1] SI values were obtained from USFWS HSI Model (Allen 1982).

A 30 percent canopy closure of hard mast species is equivalent to a SI of 0.8, and an average of two hard mast species in the bottomland forest is equivalent to a SI of 1.0.

Winter Food

$$HSI = (SI_{V1} \times SI_{V2})^{1/2}$$

$$HSI = 0.9$$

Cover/Reproduction

$$HSI = (SI_{V3} \times SI_{V4})^{1/2} \times SI_{V5}$$

$$HSI = 0.95$$

The HSI for the gray squirrel equals the lowest of the values obtained for winter food and cover/reproduction. The HSI for the gray squirrel would be 0.9 during post-project conditions.

7.2.4 Habitat Evaluation for Eastern Cottontail

Since variables used to assess habitat suitability for the eastern cottontail are not dependent on hard mast species, the HSI value of 0.9 from the reference site location analysis was assumed to provide a good estimate for post-project conditions for the eastern cottontail.

7.3 Summary of Post-Project Riparian Corridor Habitat Quality

A summary of the post-project riparian corridor habitat is provided in **Table 23**.

Table 23. Post Project Habitat Suitability Index (HSI)Values

Forest Type	Downy Woodpecker	Barred Owl	Gray Squirrel	Eastern Cottontail	Average HSI
Riparian Forest	0.5	0.9	0.9	0.9	0.8

Based on the HEP analysis, riparian forest that would result from the proposed mitigation plan may provide medium to good quality habitat for some species. Hard mast species were not abundant in either the project area or reference area, however the proposed mitigation plan includes hard mast species planting in the upper terrace. Planting of hard mast species would improve the overall HSI to 0.8 for post-project conditions.

8.0 REFERENCES

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APPENDIX A

FIELD DATA

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FIELD DATA

Riparian Plot 1 – Trees

Stratum	Species	Diameters (inches)
Canopy	Sycamore (*Platanus occidentalis*)	21, 15, 26, 18, 22, 25, 17, 30
Canopy	Silver maple (*Acer saccharinum*)	20, 12

- Percent canopy cover – 90%
- Percent shrub cover - 0%
- Percent herbaceous cover – 100%
- Mean dbh of canopy trees – 21 inches

Notes: Open stand of mature sycamore trees mostly. No shrub cover. Herbaceous cover primarily Boehmeria cylindrica. Plot located just north of bridge on south end of campus.

Riparian Plot 2 – Trees

Stratum	Species	Diameters (inches)
Canopy	Box elder (*Acer negundo*)	13, 10, 14, 8, 10, 13, 9, 14, 12, 12, 14
Canopy	Slippery elm (*Acer rubra*)	12
Canopy	Red maple (*Acer rubrum*)	8, 8, 7
Canopy	Silver maple (*Acer saccharinum*)	12, 13, 14, 13, 13, 14, 8, 14, 14, 8, 8
Canopy	Black willow (*Salix nigra*)	10, 12, 14, 9
Subcanopy	Silver maple (*Acer saccharinum*)	4, 5, 3, 3, 3, 4, 6, 2
Subcanopy	Box elder (*Acer negundo*)	3, 3, 4, 3, 4
---	Snag	10

- Percent canopy cover – 95-100%
- Percent shrub cover - <15%
- Percent herbaceous cover – 100%
- Mean dbh of canopy trees – 11 inches

Notes: Riparian forest adjacent to Levisa Fork. Shrub cover consists of box elder seedlings. Herbaceous cover consists of various grasses, false-nettle (*Boehmeria cylindrica*), and jewel-weed (*Impatiens sp*.).

Riparian Plot 3 – Trees

Stratum	Species	Diameters (inches)
Canopy	Box elder (*Acer negundo*)	14, 12, 13, 12, 10
Canopy	Slippery elm (*Acer rubra*)	27
Canopy	Silver maple (*Acer saccharinum*)	9, 10, 6, 14, 13, 13, 12, 9, 18, 17, 17, 6, 6, 7, 12, 18, 18, 21, 6, 15, 25
Canopy	Red maple (*Acer rubrum*)	6
Subcanopy	Red maple (*Acer rubrum*)	5
Subcanopy	Box elder (*Acer negundo*)	5, 6, 4, 4, 2
Subcanopy	Silver maple (*Acer saccharinum*)	2, 2
---	Snag	9, 13

- Percent canopy cover – 95%
- Percent shrub cover - 0%
- Percent herbaceous cover – 20%
- Mean dbh of canopy trees – 13 inches

Notes: Riparian forest directly north of River Park parking lot. Plot (43.5' x 100'). Riparian forest very narrow in this area (<50' wide).

Upland Hardwood Plot 1 - Trees

Stratum	Species	Diameters (inches)
Canopy	Elm (*Ulmus* sp.)	6
Canopy	Virginia pine (*Pinus virginiana*)	7, 5, 8, 7, 8, 8
Canopy	Black gum (*Nyssa sylvatica*)	7
Canopy	Red maple (*Acer rubrum*)	6, 5, 5, 7, 7
Canopy	Sweetgum (*Liquidambar styraciflua*)	7, 14, 7
Canopy	Hickory (*Carya* sp.)	13, 8, 10
Canopy	American beech (*Fagus grandifolia*)	7, 7, 9, 8
Canopy	Yellow buckeye (Aesculus octandra)	(6, 5, 6), (4, 4, 10)
Canopy	Yellow-poplar (*Liriodendron tulipifera*)	13
Canopy	White oak (*Quercus alba*)	13, 6, 10, 8, 12, 6
Subcanopy	Red maple (*Acer rubrum*)	2, 2, 3, 3
Subcanopy	Black gum (*Nyssa sylvatica*)	4
Subcanopy	Flowering dogwood (*Cornus florida*)	4, 3
Subcanopy	Elm (*Ulmus* sp.)	3
Subcanopy	Hickory (*Carya* sp)	4, 4, 4
Subcanopy	Sweetgum (*Liquidambar styraciflua*)	3
Subcanopy	Sourwood (*Oxydendrum arboreum*)	8
Subcanopy	Red mulberry (*Morus rubra*)	6
--	Snag	6

- Percent canopy cover – 95-100%
- Percent shrub cover - 30%
- Percent herbaceous cover – 25%
- Mean dbh of canopy trees – 11 inches
- Percent cover of hard mast species >10 in dbh – 15-20%

Notes: Upland hardwood forest inhabited by a variety of species. Seedlings make up most of shrub stratum and include species represented in canopy and subcanopy; additional species include black cherry (Prunus serotina) and pawpaw (Asimina triloba).

Upland Hardwood Plot 2 - Trees

Stratum	Species	Diameters (inches)
Canopy	Sweetgum (*Liquidambar styraciflua*)	20
Canopy	Hickory (*Carya* sp.)	12
Canopy	American beech (*Fagus grandifolia*)	26, 20, 23, 18, 21
Canopy	Sugar maple (*Acer saccharum*)	5
Subcanopy	Red maple (*Acer rubrum*)	2
Subcanopy	Sugar maple (*Acer saccharum*)	2, 4, 2, 3
Subcanopy	American beech (*Fagus grandifolia*)	4, 3, 2, 2, 2, 3, 3, 2
---	Snag	13

- Percent canopy cover – 70%
- Percent shrub cover - 65%
- Percent herbaceous cover – <5%
- Mean dbh of canopy trees – 20 inches
- Percent cover of hard mast species >10 in dbh – 60%

Notes: Upland hardwood forest dominated by relatively large beech trees. Shrub layer entirely beech and sugar maple seedlings. Herbaceous plants scarce; scattered Christmas tree fern.

Upland Hardwood Plot 3 – Trees

Stratum	Species	Diameters (inches)
Canopy	Red maple (*Acer rubrum*)	6, 5, 4
Canopy	American beech (*Fagus grandifolia*)	5, 5, 5, 4
Canopy	White oak (*Quercus alba*)	12, 9
Canopy	Mockernut hickory (*Carya tomentosa*)	6, 6, 4, 5
Canopy	Shortleaf pine (*Pinus echinata*)	3, 3
Canopy	Sugar maple (*Acer saccharum*)	6, 5
Canopy	Black oak (*Quercus velutina*)	4, 18
Canopy	Northern red oak (*Quercus rubra*)	6, 7
Canopy	Black gum (*Nyssa sylvatica*)	5, 4, 3
Canopy	Shagbark hickory (*Carya ovata*)	4
Canopy	Sweetgum (*Liquidambar styraciflua*)	7
Subcanopy	Flowering dogwood (*Cornus florida*)	3, 4
Subcanopy	Mockernut hickory (*Carya tomentosa*)	2
Subcanopy	American beech (*Fagus grandifolia*)	2, 4, 3, 4, 5, 2, 3, 3, 3, 2, 2
Subcanopy	Red maple (*Acer rubrum*)	2, 2, 2, 2, 2, 3
Subcanopy	Northern red oak (*Quercus rubra*)	4
Subcanopy	White oak (*Quercus alba*)	3, 2
Subcanopy	Black gum (*Nyssa sylvatica*)	2, 2, 3
	Snag	6, 24

- Percent canopy cover – 80%, large emergent oaks – 15%
- Percent shrub cover - 20%
- Percent herbaceous cover –50%
- Mean dbh of canopy trees – 6 inches
- Percent cover of hard mast species >10 in dbh – 15%

Notes: Relatively young hardwood stand. Few emergent large trees with other smaller trees forming a relatively short canopy (approx. 40'). Relatively open understory. Shrub species include blueberry (*Vaccinium* sp). Seedling species include beech, sassafras, sweetgum, red maple, sourwood, black cherry, and redbud.

Upland Pine Plot 1 – Trees

Stratum	Species	Diameters (inches)
Canopy	Virginian pine (*Pinus virginiana*)	2, 5@3, 11@4, 9@5, 4@6, 4@7, 5@8, 9, 9, 10, 10, 11
Canopy	American sycamore (*Platanus occidentalis*)	4, 4, 4, 4, 9
Canopy	Yellow-poplar (*Liriodendron tulipifera*)	4
Canopy	Sweetgum (*Liquidambar styraciflua*)	11, 14
Canopy	Sassafras (*Sassafras albidum*)	3, 3
Subcanopy	Sassafras (*Sassafras albidum*)	2, 2
Subcanopy	Green ash (*Fraxinus pennsylvanica*)	3
Subcanopy	Flowering dogwood (*Cornus florida*)	2, 2, 3, 3
Subcanopy	Elm (*Ulmus* sp.)	4, 2
Subcanopy	Sweetgum (*Liquidambar styraciflua*)	2
	Snag	2, 3, 2, 3, 3

Percent canopy cover – 95-100%

Percent shrub cover - 35%
Percent herbaceous cover –25%
Mean dbh of canopy trees – 6 inches
Percent cover of hard mast species >10 in dbh – 0%

Notes: Primarily a pine-dominated stand with scattered large hardwoods. Lots of hardwood seedlings. Pines may have been planted. Pines mostly in the canopy, even small-diameter pines. Mixed pine-hardwood in some areas.

Upland Pine Plot 2 – Trees

Stratum	Species	Diameters (inches)
Canopy	Shortleaf pine (*Pinus echinata*)	7, 8, 18, 8, 10, 10, 8, 7, 9, 5, 17
Canopy	Oak (*Quercus* sp.)	24
Canopy	Virginian pine (*Pinus virginiana*)	10, 10
Canopy	Hickory (*Carya* sp.)	14
Subcanopy	American beech (*Fagus grandifolia*)	4, 4, 3, 2, 4, 3
Subcanopy	Sourwood (*Oxydendrum arboreum*)	3, 5, 5, 2, 5
Subcanopy	Black gum (*Nyssa sylvatica*)	3
Subcanopy	Hickory (*Carya* sp.)	5
Subcanopy	Sweetgum (*Liquidambar styraciflua*)	4, 6
Subcanopy	Virginian pine (*Pinus virginiana*)	3

- Percent canopy cover – 50%
- Percent shrub cover - 100%
- Mean dbh of canopy trees – 11 inches
- Percent cover of hard mast species >10 in dbh – 20%

Notes: Primarily a pine-dominated stand with scattered large hardwoods. Seedling/shrub coverage include beech, oaks, dogwood, black cherry, sourwood, yellow-poplar, red maple, and winged sumac (*Rhus copallina*). Most of seedlings are beech.

Upland Pine Plot 3 – Trees

Stratum	Species	Diameters (inches)
Canopy	Virginia pine (*Pinus virginiana*)	3, 7@4, 6@5, 7@6, 7, 7, 7@8, 9, 10
Canopy	Eastern white pine (*Pinus strobus*)	8
Canopy	Black oak (*Quercus velutina*)	20
Subcanopy	American beech (*Fagus grandifolia*)	3, 3, 3, 2
Subcanopy	Sourwood (*Oxydendrum arboreum*)	4, 2
Subcanopy	Red maple (*Acer rubrum*)	3, 2, 2, 2
Subcanopy	Dogwood (*Cornus florida*)	2, 3, 2, 2
Subcanopy	Eastern white pine (*Pinus strobus*)	5, 5
Subcanopy	Hickory (*Carya* sp.)	2
	Snag	18

- Percent canopy cover – 60%
- Percent shrub cover - 50%
- Mean dbh of canopy trees – 6 inches
- Percent cover of hard mast species >10 in dbh – 20%

Notes: Primarily a pine-dominated stand with scattered large hardwoods. Seedling/shrub coverage include Virginia pine, sour wood, Eastern white pine, flowering dogwood, hickory, beech, southern magnolia, oak, and American holly.

Reference Plot 1 – Trees

Stratum	Species	Diameters (inches)
Canopy	Silver maple (*Acer saccharinum*)	21, 10
Canopy	Green ash (*Fraxinus pennsylvanica*)	8
Canopy	Box elder (*Acer negundo*)	13, 8, 10, 5, 9, 10, 11, 12, 20, 20, 12, 7
Subcanopy	Box elder (*Acer negundo*)	10, 7, 5, 4, 4, 4, 4, 4, 2
snag		11, 14

- Percent canopy cover – 95%
- Percent shrub cover – 5%
- Percent herbaceous cover – 65%
- Mean dbh of canopy trees – 12”

Reference Plot 2 – Trees

Stratum	Species	Diameters (inches)
Canopy	Red elm (*Ulmus rubra*)	13
Canopy	Silver maple (*Acer saccharinum*)	13, 21, 30, 35, 36
Canopy	Buckeye (*Asculus octadra*)	21
Subanopy	Buckeye (*Asculus octadra*)	2, 3, 3, 4, 5, 7
Subcanopy	Box elder (*Acer negundo*)	2, 3, 4, 4, 4
Subcanopy	Silver maple (*Acer saccharinum*)	4
Snag		24, 13

- Percent canopy cover – 75%
- Percent shrub cover – 60%
- Percent herbaceous cover – 25%
- Mean dbh of canopy trees – 24”

Reference Plot 3 - Trees

Stratum	Species	Diameters (inches)
Canopy	Box elder (*Acer negundo*)	14, 11, 5, 5, 13, 9, 9, 16, 12, 8, 12, 20, 16, 20, 13, 11, 12, 8
Canopy	Yellow-poplar (*Liriodendron tulipifera*)	9
Canopy	Black cherry (*Prunus serotina*)	10, 10
Canopy	Silver maple (*Acer saccharinum*)	12
Subcanopy	Sweetgum (*Liquidambar styraciflua*)	5
Subcanopy	Box elder (*Acer negundo*)	4, 5, 5, 5, 5, 8
Snag		6, 6, 4

- Percent canopy cover – 85%
- Percent shrub cover – 10%
- Percent herbaceous cover – 100%
- Mean dbh of canopy trees – 12”

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APPENDIX B

PHOTOGRAPHS

Looking north from arch bridge along Levisa Fork in Prestonsburg, KY. May 6, 2004.

Looking at Trimble Branch entering Levisa Fork, Prestonsburg, KY. May 6, 2004.

River Park, looking south along Levisa Fork in Prestonsburg, KY. May 6, 2004.

Unnamed tributary beside High School Stadium in Prestonsburg, KY. May 6, 2004.

Levisa Fork behind High School Stadium in Prestonsburg, KY. May 6, 2004

Looking toward Levisa Fork from Memorial Park, Prestonsburg, KY. May 6, 2004.

Walking Trail at Prestonsburg Community College. May 6, 2004

Campus Branch, Lower Section, Prestonsburg Community College, May 6, 2004.

Looking towards Levisa Fork at Prestonsburg Community College, May 6, 2004.

Campus Branch, Middle Section, Prestonsburg Community College. May 6, 2004.

APPENDIX E
Vascular Plant Survey

August 2004

Vascular Plant Survey for Floyd County Section 202 Project, Prestonsburg, Kentucky

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Final Report

Prepared for U. S. Army Corps of Engineers
Huntington District
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VASCULAR PLANY SURVEY
FLOYD COUNTY SECTION 202 PROJECT
PRESTONSBURG, KENTUCKY

INTRODUCTION

A survey of vascular plants was conducted for the Floyd County Section 202 project, Prestonsburg KY in 2004. Prestonsburg, Floyd County, Kentucky is located on the Levisa Fork River. The U.S. Army Engineer Huntington District is proposing alternatives for a levee alignment for the Floyd County Basin Section 202 Project in the town of Prestonsburg. The study was accomplished in the riparian corridor on the right descending bank in Prestonsburg along the alignment for all levee alternatives and the three borrow area sites being considered for the project. The surveyed area includes the area of the long alignment alternative on the eastern shore, inclusive of all eight alternatives presently proposed, for the town of Prestonsburg. This survey reach extends from the Big Sandy Community and Technical College to a residential area beyond the First Commonwealth Bank, approximately 1.5 miles long. This corridor includes the shoreline of the Levisa Fork to the top of bank (second bench) where the local residences have their lawns and manicured areas. Three borrow areas within close proximity to the proposed project are being considered and were included in this survey.

Each borrow area is approximately 15 acres in size; two are located to the east and one to the west of the Levisa Fork. The first borrow site is located on a west facing hillside on the northeast corner of Bob White Lane and Mays Branch Road intersection, located to the east of the project. The second borrow site is a west-facing hillside with a previously cut-slope next to Sam and Tonio's Restaurant, located across Rt. 321 North from the Big Sandy Community and Technical College. The third borrow site is located on Cliff Road, off N1428, across the river to the west of the College. This area is on an eastern and south-facing slope that has been extensively impacted by a cutting and land excavation operations. Refer to Appendix II for maps of all sites.

The objective of the study was to survey the vascular flora of the riparian corridor and borrow areas of the Levisa Fork in the town of Prestonsburg with special attention to rare species, native or non-native status, and the distribution of flora, including dominant species, at the various sites surveyed.

LITERATURE SURVEY

Vascular plants were identified using nomenclature according to the "Manual of Vascular Plants of Northeastern United States and Adjacent Canada", Gleason and Cronquist (1992). The Kentucky State Nature Preserves Commission report (2002) entitled "Kentucky's Native Flora Status and Trends in Rare Plants", reported three species of special concern as the only known occurrences of rare plants in Floyd County. Another local vascular plant survey completed recently (2003) prepared by Kentucky Transportation Cabinet for Pike County, entitled " The Terrestrial and Aquatic Ecological

Assessment for the Proposed US 23 Congestion Relief Build Alternatives", listed plants found in that specific area for the purpose of NEPA documentation.

METHODOLOGY

All proposed project and borrow sites were visited twice. The survey was initiated in October, 2003 and conducted on 30 Oct 03, surveying the early autumn flora. During that time the trees were still in leaf and the fall plants were still visually apparent. The spring vegetation was surveyed May 17 – 20, 2004; the early spring plants were still intact for the purpose of species identification. The final survey was conducted in July 26-30, 2004. Vascular plants were identified (Appendix I) using nomenclature according to Gleason and Cronquist (1992).

The riparian corridor on the eastern shore was surveyed from the river to the top of the bank (second bench where the yards and homes are located). This survey did not include the plants in yards and lawn areas established at the top of bank. It does include the three borrow areas presently under consideration. All three borrow sites have been disturbed to some degree; this survey includes the impacted areas that have been previously opened up and all the intact wooded portion of each site. Site 3 was the most disturbed site surveyed, however 100 feet of the undisturbed wooded edge on this site was also included in this survey. Photographs and maps of all areas surveyed are in Appendix II.

RESULTS AND DISCUSSION

Summary of Vascular Plant Taxonomy.

The survey recorded 303 taxa of vascular plants representing 88 families and 220 genera. The family with the greatest number of species was Asteraceae. For a complete list of taxa refer to Appendix 1. For the number of plant families, genera and species represented at each site refer to Table 1.

Location	Total Number represented: 88 Plant Families	220 Genera	303 Species
Riparian corridor	64	133	163
Borrow Site #1	59	124	157
Borrow Site #2	66	134	172
Borrow Site #3	67	121	154

Table 1. Comparison between numbers of plant families, genera, and species for surveyed sites at Prestonsburg, KY.

Native species.
Native species comprise 76 percent of the flora (230 species), while 24 percent (73 species) are non-native taxa (Appendix I).

Rare species.
The three monitored species of special concern for Floyd County are: *Erythronium rostratum,* Yellow Trout Lilly, *Hydrophyllum virginianum*, Eastern Waterleaf and *Lathyrus venosus*, Smooth Veiny Peavine. The three species did not occur on any sites surveyed.

Noxious species and Invasive species.
Kentucky does not have a designated state noxious weed list in accordance with the Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 et seq.). However there are a number of invasive species on the sites surveyed. These species often form monoculture stands, limiting biodiversity.

SUMMARY AND CONCLUSIONS

The Vascular flora of sites surveyed in Prestonsburg included 303 species. The forest is primarily deciduous hardwood with 41 tree species, 18 shrub species and 10 vine species in the sub canopy layer, and 234 species of herbaceous plants in the understory identified during the study. Non-native species comprise 24 percent (73 species). Invasive species have an impact on the sites surveyed by limiting the biodiversity of the plant community. The vascular flora within the surveyed area in all levee alternatives being considered for this project is very homogeneous. The three borrow sites are more diverse upland areas despite the previously disturbed and impacted nature of the three areas.

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APPENDIX I

FAMILY	GENUS SPECIES	COMMON NAME	GH	N/N-N	Align. Alts.	Borrow sites 1	2	3
Pteridophytes	***Pteridophytes***	(ferns)						
DRYOPTERIDACEAE	Polystichum acrostichoides (Michx.) Schott.	Christmas Fern	H	N	X	X	X	X
EQUISETACEAE	Equisetum arvense L.	Horsetail	H	N	X			
LYCOPODIACEAE	Lycopodium flabelliforme Blanchard	Groundpine	H	N			X	
OPHIOGLOSSACEAE	Botrichium dissectum Spreng..	Cutleaf Grapefern	H	N		X		
OPHIOGLOSSACEAE	B. oneidense House	Bluntmnose Grapefern	H	N			X	
POLYPODIACEAE	Adiantum pedatum L.	Maidenhair Fern	H	N		X	X	X
POLYPODIACEAE	Asplenium platyneuron (L.) Oakes	Ebony Spleenwort	H	N		X	X	X
POLYPODIACEAE	Dennstaedtia puntilobula (Michx.) Moore	Hay scented Fern	H	N		X	X	X
POLYPODIACEAE	Phegopteris hexagonoptera Fee	Broad Beech Fern	H	N		X	X	
Gymnosperms	***Gymnosperms***	(plants with cones)						
CUPRESSACEAE	Juniper virginiana L.	Red Cedar	T	N			X	
PINACEAE	Pinus strobus L.	White Pine	T	N	X			
PINACEAE	P. virginiana Mill.	Scrub Pine	T	N		X	X	X
PINACEAE	Tsuga canadensis (L.)Carriere	Hemlock	T	N	X			
Angiosperms	***Angiosperms***	(flowering plants)						
ACANTHACEAE	Justicia americana L.	Water Willow	H	N	X			
ACANTHACEAE	Ruellia caroliniensis (Walt) Steud	Carolina Petunia	H	N			X	
ACERACEAE	Acer negundo L.	Box Elder	T	N	X			
ACERACEAE	A. rubrum L.	Red Maple	T	N		X	X	X
ACERACEAE	A. saccharum Marsh	Sugar Maple	T	N				X
ACERACEAE	A. Saccharinum L.	Silver Maple	T	N	X,D			
ALISMATACEAE	Sagittaria latifolia Willd.	Duck Potatoe	H	N	X			
AMARANTHACEAE	Amaranthus spinosus L.	Spiny Amaranth	H	N-N	X			
AMARYLLIDACEAE	Hypoxis hirsuta (L.) Coville	Yellow Stargrass	H	N		X		
ANACARDIACEAE	Rhus coppallina L.	Winged Sumac	S	N		X	X	X
ANACARDIACEAE	R. glabra L.	Smooth Sumac	S	N		X	X	X
ANACARDIACEAE	R. typhina L.	Staghorn Sumac	S	N		X	X	X
ANACARDIACEAE	Toxicodendron radicans (L.) Kuntze	Poison Ivy	V	N	X	X	X	X
ANNONACEAE	Asimina triloba (L.) Dunal.	Pawpaw	S	N	X	X	X	X
APIACEAE	Aegopodium podograria L.	Goutweed	H	N-N	X			
APIACEAE	Cryptotaenia canadensis L.	Honewort	H	N	X	X	X	X

FAMILY	GENUS SPECIES	COMMON NAME	GH	N/N-N	Align. Alts.	Borrow sites 1	2	3
APIACEAE	Daucus carota L.	Wild Carrot	H	N-N	X	X	X	X
APIACEAE	Dentaria diphylla Michx.	Two-leaved Toothwort	H	N			X	
APIACEAE	D. heterophylla Nutt.	Toothwort	H	N	X	X	X	X
APIACEAE	D. lacinata MuhlU	Cutleaf Toothwort	H	N			X	X
APIACEAE	Erysimum repandum L.	Treacle mustard	H	N-N		X		
APIACEAE	Falcaria sioides (Wibel) Ashchers.	Sickleweed	H	N-N	X			
APIACEAE	Osmorhiza claytoni (Michx.) Clarke	Hairy Sweet Ciceley	H	N			X	
APIACEAE	Sanicula trifoliata Bicknell	Trifoliate Snakeroot	H	N				X
APIACEAE	Zizia aptera	Golden Alexanders	H	N	X			
APOCYNACEAE	Apocynum sibiricum Jacq.	Clasping-leaved Dogbane	H	N-N	X			
ARACEAE	Arisaema triphyllum (L.) Schott	Jack-in -the-Pulpit	H	N				X
ARALIACEAE	Arailia nudicaulis L.	Wild Sarsparilla	H	N	X			
ARALIACEAE	Hedera helix L.	English Ivy	V	N-N	X			
ARISTOLOCHIACEAE	Aristolochia serpentaria L.	Virginia serpentaria	H	N			X	
ARISTOLOCHIACEAE	Asarum heterophyllum Ashe	Heartleaf	H	N			X	
ARISTOLOCHIACEAE	A. shuttleworthii Britton and Baker	Giant Wild Ginger	H	N			X	
ASCLEPIADACEAE	Asclepias quadrifolia Jacq.	Four-leaved Milkweed	H	N			X	
ASTERACEAE	Ambrosia artemisiifolia L.	Common Ragweed	H	N	X	X	X	X
ASTERACEAE	A. trifida L.	Giant Ragweed	H	N	X			
ASTERACEAE	Antennaria plantaginifolia (L.) Richards	Plantain-leaf Pussytoes	H	N		X	X	X
ASTERACEAE	Arctium minus (Hill) Bernh.	Common Burdock	H	N-N	X	X		X
ASTERACEAE	Artemisia vulgaris L.	Common Mugwort	H	N-N	X	X	X	X
ASTERACEAE	Aster divaricatus L.	Wood Aster	H	N	X			
ASTERACEAE	A. dumosus L.	Bushy Aster	H	N	X			
ASTERACEAE	A. cordifolius L.	Blue Wood Aster	H	N	X		X	
ASTERACEAE	Bellis perennis L.	English Daisy	H	N		X	X	X
ASTERACEAE	Bidens frondosa L.	Beggar-ticks	H	N	X			
ASTERACEAE	Chrysanthemum leucanthemum L.	Daisy	H	N		X	X	X
ASTERACEAE	Cichorium intybus L.	Chicory	H	N			X	
ASTERACEAE	Cirsium vulgare (Savi) Tenore	Common Thistle	H	N-N		X	X	X
ASTERACEAE	Elephantopus carolinianus Willd.	Elephant's-foot	H	N	X			
ASTERACEAE	Erigeron canadensis L.	Horseweed	H				X	
ASTERACEAE	E. philadelphicus L.	Philadelphia Fleabane	H	N	X	X	X	X
ASTERACEAE	Eupatorium altissimum L.	Tall Thoroughwort	H	N		X	X	
ASTERACEAE	E. coelestinum L.	Mistflower	H	N	X			

FAMILY	GENUS SPECIES	COMMON NAME	GH	N/N-N	Align. Alts.	Borrow sites 1	2	3
ASTERACEAE	E. fistulosum Barratt	Common Joe Pye Weed	H	N		X	X	X
ASTERACEAE	E. purpureum L.	Joe Pye Weed	H	N		X		
ASTERACEAE	E. rugosum Houtt.	White Snakeroot	H	N	X			
ASTERACEAE	E. sessifolium L.	Upland Boneset	H	N		X	X	
ASTERACEAE	Galinsoga cilata (Raf.) Blake	Raceweed	H	N-N	X			
ASTERACEAE	Hieracium gronovii L.	Hairy Hawkweed	H	N		X	X	X
ASTERACEAE	H. venosum L.	Rattlesnake Weed	H	N		X	X	X
ASTERACEAE	Krigia biflora (Walt.) Blake	Cynthia	H	N		X		
ASTERACEAE	Lactuca biennis (Muench) Fernald	Tall Blue Lettuce	H	N		X		
ASTERACEAE	L. scariola L.	Prickly Lettuce	H	N-N		X		
ASTERACEAE	Prenanthes alba L.	White Lettuce	H	N			X	
ASTERACEAE	P. trifolata (Cass) Fernald	Lion's Foot	H	N		X		
ASTERACEAE	Pyrrhopappus carolianus (Walter) D.C.	False Dandelion	H	N-N	X			
ASTERACEAE	Rudbeckia hirta L.	Black Eyed Susan	H	N	X			
ASTERACEAE	Senecio smallii Britton	Small Ragwort	H	N		X		
ASTERACEAE	Solidago graminifolia (L.) Salisb.	Grass-leaved Goldenrod	H	N	X	X	X	X
ASTERACEAE	S. nemoralis Ait.	Goldenrod	H	N	X	X	X	X
ASTERACEAE	S. rugosa Ait	Wrinkled leaf Goldenrod	H	N		X	X	X
ASTERACEAE	Sonchas oleraceus L.	Annual Sowthistle	H	N-N		X	X	X
ASTERACEAE	Taraxacum officinale Weber	Dandelion				X	X	X
ASTERACEAE	Tussilago farfara L.	Coltsfoot	H	N		X	X	X
ASTERACEAE	Verbesina alternifolia (L.) Britton ex Kearney	Yellow Ironweed	H	N	X	X	X	X
ASTERACEAE	Vernonia noveboracensis (L.) Michx	New York Ironweed	H	N	X	X	X	X
ASTERACEAE	Xanthium pensylvanicum Wallr.	Smooth-body Cocklebur	H	N	X			
AIZOACEAE	Mollugo verticilliata L.	Carpetweed	H	N-N	X			
BALSAMINACEAE	Impatiens capensis Meerb.	Jewelweed	H	N	X	X	X	X
BALSAMINACEAE	I. pallida Nutt.	Pale Jewelweed	H	N	X		X	
BERBERIDACEAE	Podophyllum peltatum L.	May-apple	H	N		X	X	X
BETULACEAE	Betula nigra L.	River Birch	H	N	X			
BIGNONIACEAE	Bignonia capreolata L.	Crossvine	V	N		X	X	X
BIGNONIACEAE	Campsis radicans (L.) Seeman.	Trumpet Creeper	S	N-N	X			X
BORAGINACEAE	Cynoglossum virginianum L.	Wild Comfrey	H	N			X	
BRASSICACEAE	Brassica rapa L.	Bird's rape	H	N-N	X			
BRASSICACEAE	Conringia orientalis (L.) Dumont	Hare's Ear Mustard	H	N-N	X			
BRASSICACEAE	Dentaria diphylla Michx	Two-leaved Toothwort	H	N	X			

FAMILY	GENUS SPECIES	COMMON NAME	GH	N/N-N	Align. Alts.	Borrow sites 1	2	3
BRASSICACEAE	D. laciniata Muhl.	Cutleaf Toothwort	H	N	X			
BRASSICACEAE	Lepidium densiflorum Schrad.	Dense-flowered Peppergrass	H	N-N	X	X	X	X
BRASSICACEAE	Rorippa sylvestris (L.) Bess.	Creeping Yellow Cress	H	N-N	X			
CAMPANULACEAE	Specularia perfoliata (L.) A. DC.	Venus Looking Glass	H	N		X		
CANNABINACEAE	Humulus japonicus Sieb. and Zucc.	Japanese Hops	H	N-N	X			
CAPPARACEAE	Cleome spinosa Jacq.	Spiderflower	H	N-N	X			
CAPRIFOLIACEAE	Lonicera japonica Thunb.	Japanese Honeysuckle	S	N-N	X	X	X	X
CAPRIFOLIACEAE	Sambucus canadensis L.	Elderberry	S	N	X			
CAPRIFOLIACEAE	Valerianella locusta (L.) Betche	Blue Corn Salad	H	N-N				X
CAPRIFOLIACEAE	Viburnum acerifolium L.	Mapleleaf Viburnum	S	N		X	X	X
CAPRIFOLIACEAE	V. rafinesquianum Schultes	Downy Arrowwood	S	N		X		
CARYOPHYLLACEAE	Silene virginica L.	Fire Pink	H	N		X	X	X
CELASTRACEAE	Celastrus scandens L.	Bittersweet	V	N			X	
CELASTRACEAE	Euonymus americanus L.	Strawberry Bush	S	N	X			
CELASTRACEAE	E. alatus (Thunb.) Sieb.	Winged Euonymus	S	N-N	X			
CHENOPODIACEAE	Chenopodium album L.	Lambs Quarters	H	N	X	X	X	X
CLUSIACEAE	Ascyrum hypericoides	St. Andrew's Cross	H	N		X	X	X
CLUSIACEAE	Hypericum mutilum L	Small flowered St. Johnswort	H	N	X			
CONVOLVULACEAE	Convolvulus sepium L.	Hedge Bindweed	H	N	X			
CORNACEAE	Cornus florida L.	Flowering Dogwood	T	N		X	X	X
CORYLACEAE	Carpinus caroliniana Walt.	American Hornbeam	T	N	X			
CORYLACEAE	Carya laciniosa (Michx.f.) Loud	Shellbark hickory	T	N		X	X	X
CORYLACEAE	Ostrya virginiana (Mill.) K. Koch	Hop Hornbeam	T	N		X	X	X
CRASSULACEAE	Sedum acre L.	Mossy stonecrop	H	N		X	X	X
CYPERACEAE	Carex annectens Bickn.	Sedge	H	N				X
CYPERACEAE	C. digitalis Willd.	Sedge	H	N		X	X	X
CYPERACEAE	C. platyphylla Carey	Sedge	H	N		X	X	X
CYPERACEAE	C. swanii (fernald) Mack	Sedge	H	N		X	X	X
CYPERACEAE	C. vulpinoidea Michx.	Foxtail Sedge	H	N	X			
CYPERACEAE	Cyperus esculentes L.	Nut Sedge	H	N-N	X			
DISCOREACEAE	Discorea quaternata (Walt.) J.F.Gmel.	Wild Yam	H	N		X	X	X
ELAEAGNACEAE	Elaeagnus umbellata Thumb.	Autumn Olive	T	N-N			X	
ERICACEAE	Epigaea repens L.	Trailing arbutus	H	N				X
ERICACEAE	Vaccinium pallidum Ait.	Upland Low Blueberry	S	N		X	X	X
ERICACEAE	V. vacillans Torr.	Late Lowland Blueberry	S	N		X	X	X

FAMILY	GENUS SPECIES	COMMON NAME	GH	N/N-N	Align. Alts.	Borrow sites 1	2	3
ERICACEAE	Oxydendron arboretum (L.) DC	Sourwood	T	N	X	X	X	X
FABACEAE	Albizia julibrissin Durazzini	Mimosa	T	N-N	X	X	X	X
FABACEAE	Amphicarpa bracteata (L.) Fernald	Hog Peanut	H	N	X			
FABACEAE	Cassia fasciculata Michx.	Partridge Pea	H	N		X		X
FABACEAE	Cercis canadensis L.	Redbud	T	N		X	X	X
FABACEAE	Coronilla varia L.	Crown Vetch	H	N-N	X		X	X
FABACEAE	Desmodium ciliare (Muhl.) D.C.	Desmodium	H	N				X
FABACEAE	D. laevigatum (Nutt.) DC.	Smooth Desmodium	H	N			X	
FABACEAE	D. nudiflorum (L.) DC	Desmodium	H	N			X	
FABACEAE	D. paniculatum (L.) D.C.	Desmodium	H	N		X	X	X
FABACEAE	D. perplexum Schubert	Desmodium	H	N			X	
FABACEAE	D. rigidum (Ell.) DC.	Desmodium	H	N		X	X	X
FABACEAE	D. rotundifolium DC.	Round leaved Desmodium	H	N		X		
FABACEAE	Lespedeza virginica L.	Lespedeza	H	N-N		X	X	X
FABACEAE	Lotus corniculatus L.	Birdsfoot Trefoil	H	N-N	X	X	X	X
FABACEAE	Melilotus officinalis (L.) Lam.	Yellow Bushclover	H	N-N	X	X	X	X
FABACEAE	Pueraria lobata (Willd.) Ohwi	Kudzu	H	N-N	X			
FABACEAE	Robinia psuedo-acacia L.	Black Locust	H	N	X	X	X	X
FABACEAE	Trifolium agrarium L.	Yellow Hop Clover	H	N-N	X	X	X	X
FABACEAE	T. campestre Schreber	Low Hop Clover	H	N-N			X	
FABACEAE	T. pratense L.	Red Clover	H	N-N	X	X	X	X
FABACEAE	T. repens L.	White Clover	H	N	X	X	X	X
FAGACEAE	Fagus grandifolia Ehrh.	American Beech	T	N		X	X	X
FAGACEAE	Quercus alba L.	White Oak	T	N		X, D	X, D	X, D
FAGACEAE	Q. ilicifolia Wang.	Scrub Oak	T	N				X
FAGACEAE	Q. rubra L.	Red Oak	T	N	X	X	X	X
FAGACEAE	Q. palustris Nuenchn.	Pin Oak	T	N	X			
FAGACEAE	Q. Prinus L.	Chestnut Oak	T	N		X	X	X
FAGACEAE	Q. velutina Lam.	Black Oak	T	N		X	X	X
FUMARIACEAE	Cordalis flavula (Raf.) DC	Yellow Corydalis	H	N	X			X
GENTIANACEAE	Sabatia angularis (L.) Pursh	Rose Pink	H	N			X	
GERANIACEAE	Geranium columbinum L.	Long stalked Crane'sbill	H	N-N		X	X	X
GERANIACEAE	G. maculatum L.	Wild Geranium	H	N				X
HAMAMELIDACEAE	Liquidambar styraciflua L.	Sweet Gum	T	N	X	X	X	X
HIPPOCASTANACEAE	Aesculus octandra Marsh	Yellow Buckeye	T	N		X	X	X

FAMILY	GENUS SPECIES	COMMON NAME	GH	N/N-N	Align. Alts.	Borrow sites 1	2	3
IRIDACEAE	Sisyrinchium angustifolium Mill.	Blue Eyed Grass	H	N		X	X	
JUGLANDACEA	Carya ovata (Mill.) K.Koch	Shagbark Hickory	T	N		X	X	X
JUGLANDACEA	C. tomentosa Nutt.	Mockernut Hickory	T	N		X	X	X
JUNCACEAE	Juncus effusus L.	Common Rush	H	N	X			
JUNCACEAE	J. tenuis Willd.	Yard Rush	H	N	X			
LAURACEAE	Lindera benzoin (L.) Blume	Spicebush	S	N		X	X	X
LAURACEAE	Sassafrass albidum (Nutt.) Nees	Sassafrass	T	N		X	X	X
LAMIACEAE	Cunila origanoides L. Britton	Wild Oregano	H	N		X		
LAMIACEAE	Collinsonia canadensis L.	Horse Balm	H	N	X			
LAMIACEAE	Glechoma hederacea L.	Ground Ivy	H	N-N	X			
LAMIACEAE	Lamium purpureum L.	Purple Dead Nettle	H	N-N	X			
LAMIACEAE	Monarda clinopodia L.	White Beebalm	H	N				X
LAMIACEAE	Perilla frutescens (L.) Britton	Beefstake Plant	H	N-N	X			
LAMIACEAE	Prunella vulgaris L.	European Sealfheal	H	N-N	X	X	X	X
LAMIACEAE	Pycnanthemum incanum (L.) Michx	Hoary Mountain Mint	H	N		X		X
LAMIACEAE	P. pycnanthemoides (Leav.) Fernald	Southern Mountain Mint	H	N		X	X	
LAMIACEAE	Salvia lyrata L.	Wild Sage	H	N		X	X	X
LAMIACEAE	Scutellaria incana Biehler	Downy Skullcap	H	N			X	
LAMIACEAE	S. nervosa Pursh	Veined Skullcap	H	N		X	X	
LILIACEAE	Allium vineale L.	Wild Garlic	H	N-N	X			
LILIACEAE	Hemerocallis fulva L.	Oange Day Lily	H	N-N	X			
LILIACEAE	Disporum maculatum (Buckl.) Britt	Mandarin	H	N		X		
LILIACEAE	Medeola Virginiana L.	Indian Cucumber Root	H	N		X	X	X
LILIACEAE	Smilacina racemosa (L.) Desf.	Plumelily	H	N		X	X	X
LILIACEAE	Smilax glauca Walt.	Saw Brier	V	N		X	X	X
LILIACEAE	S. rotundifolia L.	Greenbrier	V	N	X	X	X	X
LILIACEAE	Trillium grandiflorum (Michx.) Salisb.	White Trillium	H	N				X
LILIACEAE	Uvularia grandiflora J.E. Smith	Large flowered Bellwort	H	N			X	X
LIMNANTHACEAE	Floerkea proserpinachoides Willd.	False Mermaid Weed	H	N	X			
LOBELIACEAE	Lobelia inflata L.	Indian Tobacco	H	N		X	X	X
LOBELIACEAE	L. siphilitica L.	Great Blue Lobelia	H	N	X			
MAGNOLIACEAE	Liriodendron tulipifera L.	Tuliptree	T	N	X	X	X	X
MAGNOLIACEAE	Magnolia acuminata L.	Cucumber Tree	T	N		X	X	X
MENISPERMACEAE	Menispermun canadense L.	Canada Moonseed	H	N	X			
MORACEAE	Morus rubra L.	Red Mulberry	T	N	X		X	

FAMILY	GENUS SPECIES	COMMON NAME	GH	N/N-N	Align. Alts.	Borrow sites 1	2	3
NYSSACEAE	Nyssa slyvatica Marsh.	Black Gum	T	N		X	X	X
OLEACEAE	Fraxinus americana L.	White Ash	T	N	X	X	X	X
OLEACEAE	F. pennsylvanica Marsh.	Green Ash	T	N	X			X
OLEACEAE	Ligustrum vulgare L.	Privet	S	N-N	X	X	X	X
ONAGRACEAE	Circaea canadensis Hill	Enchanter's Nightshade	H	N-N	X			
ONAGRACEAE	Ludwigea palustris (L.) Ell.	Marsh Purslane	H	N	X			
ONAGRACEAE	Oenothera biennis L.	Common Evening Primrose	H	N	X	X	X	X
ONAGRACEAE	O. parviflora L.	Northern Evening Primrose	H	N	X			
OROBANCHACEAE	Conopholus americana (L.F.) Wallr.	Cancer root	SAP					X
OXALIDACEAE	Oxalis corniculata L.	Creeping Lady's Sorrel	H	N-N		X		
OXALIDACEAE	O. europaea L.	European Wood Sorrel	H	N	X	X	X	X
OXALIDACEAE	O. stricta L.	Upright Yellow Wood Sorrel	H	N			X	
OXALIDACEAE	O. violacea L.	Violet Wood Sorrel	H	N	X			
PAPAVERACEAE	Sanguinaria canadensis L.	Bloodroot	H	N		X	X	X
PHYTOLACCACEAE	Phytolacca americana L.	Pokeberry	S	N	X	X	X	X
PLANTAGINACEAE	Plantago lanceolata L.	Lance-leaf Plantain	H	N-N	X	X	X	X
PLANTAGINACEAE	P. major L.	Great Plantain	H	N-N		X	X	X
PLANTAGINACEAE	P. rugelii Dcne.	Common Plantain	H	N-N	X	X		X
PLANTAGINACEAE	P. virginica L.	Dwarf Plantain	H	N				X
PLATANACEAE	Platanus occidentalis L.	Sycamore	T	N	X,D	X	X	
POACEAE	Andropogon virginicus L.	Broomsedge	H	N		X	X	X
POACEAE	Cynodon dactylon (L.) Pers	Bermuda Grass	H	N-N	X			
POACEAE	Dactylis glomerata L.	Orchard Grass	H	N-N	X		X	
POACEAE	Danthonia compressa Aust.	Mountain Oatgrass	H	N	X			
POACEAE	Echinochloa crusgalli (L.) Beauv	Barnyard Grass	H	N	X	X	X	X
POACEAE	Elymus riparius Wieg.	Wild Rye	H	N	X			
POACEAE	E. virginicus L.	Virginia Wild Rye	H	N	X			
POACEAE	Festuca elatior L.	Meadow Fescue	H	N-N			X	
POACEAE	Hystrix patula Moench	Bottlebrush Grass	H	N	X			
POACEAE	Microstegium vimineum (Trin.)	Eulalia grass	H	N-N	X	X	X	X
POACEAE	Panicum anceps Michx.	Flat-stemmed Panic Grass	H	N	X			
POACEAE	P. clandestinum L..	Deertongue Grass	H	N	X	X	X	X
POACEAE	P. commutatum Schultes	Variable Panic Grass	H	N		X	X	X
POACEAE	P. rigidulum Bosc. Ex Nees.	Red Top Panic Grass	H	N	X			
POACEAE	Phragmites communis Trin.	Reed	H	N	X			

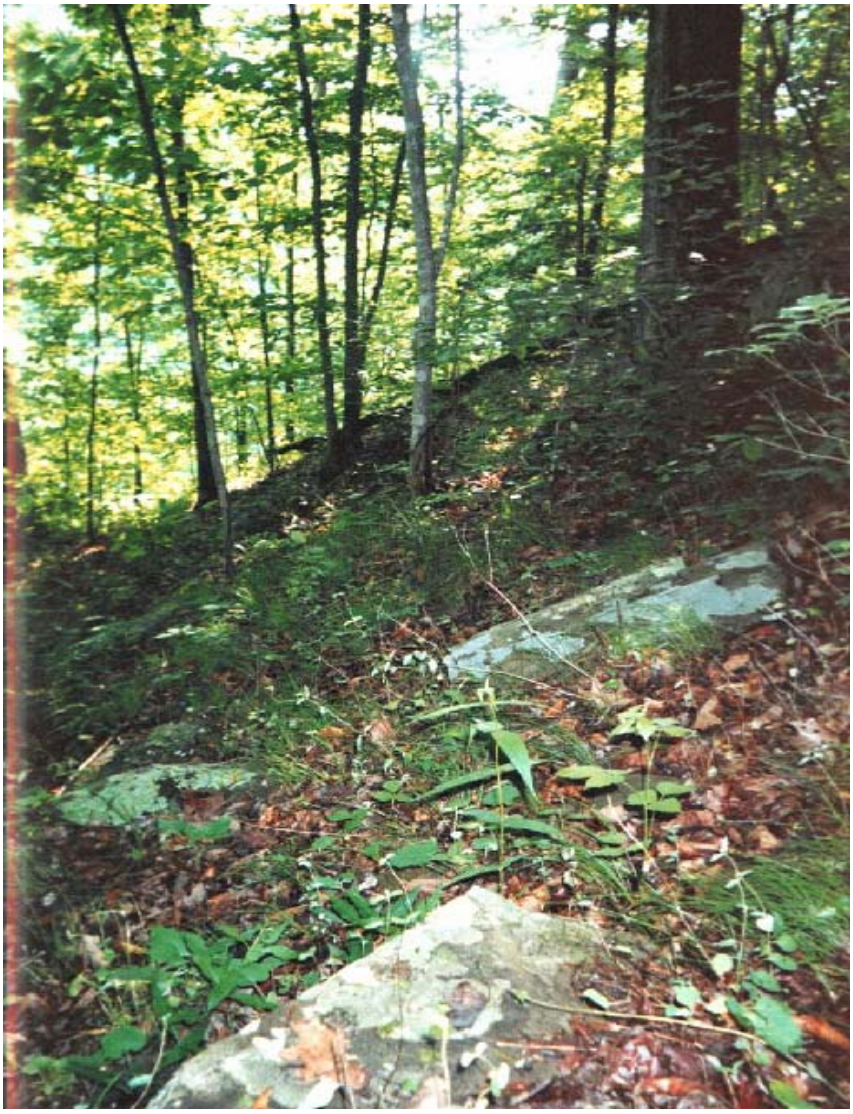
FAMILY	GENUS SPECIES	COMMON NAME	GH	N/N-N	Align. Alts.	Borrow sites 1	2	3
POACEAE	Poa pratensis L.	Kentucky Bluegrass	H	N-N	X		X	
POACEAE	P. sylvestris Gray	Woodland Bluegrass	H	N	X		X	
POACEAE	P. trivialis L.	Rough Bluegrass	H	N-N	X	X	X	X
POACEAE	Setaria faberii Herrm.	Foxtail Grass	H	N-N		X		
POACEAE	S. glauca (L.) Beauv.	Yellow Foxtail Grass	H	N-N		X	X	X
POACEAE	Sorghum halepense (L.) Pers.	Johnson Grass	H	N-N	X			
POACEAE	Uniola latifolia Michx.	Sea Oats	H	N-N	X			
POLYGONACEAE	Polygonum cespitosum Blume	Asiatic Water Pepper	H	N-N	X			
POLYGONACEAE	P. convulvulus L.	Black Bindweed	H	N-N	X			
POLYGONACEAE	P. cuspidatum Sieb. & Zucc.	Japanese Knotweed	H	N-N	X	X	X	X
POLYGONACEAE	P. pensylvanicum L.	Pennsylvania Smartweed	H	N	X			
POLYGONACEAE	Rumex acetosella L.	Sheep Sorrel	H	N-N				X
POLYGONACEAE	R. crispus L.	Yellow Dock	H	N-N	X			
POLYGONACEAE	Tovara virginiana (L.) Raf.	Virginia Knotweed	H	N	X			X
PORTULACACEAE	Stellaria media (L.) Cyrillo	Common Chickweed	H	N-N	X			
PYROLACEAE	Chimaphila maculata (L.) Pursh.	Spotted Wintergreen	H	N		X	X	
PYROLACEAE	Monotropa uniflora L.	Indian Pipes	H	N		X		
PRIMULACEAE	Lysimachia cilata L.	Fringed Loosestrife	H	N	X			
PRIMULACEAE	L. lanceolata Walt.	Lance-leaf Loosestrife	H	N		X	X	X
PRIMULACEAE	L. nummularia L.	Moneywort	H	N-N	X	X	X	X
RANUNCULACEAE	Anemone thalictroides (L.) Spach	Rue Anemone	H	N			X	X
RANUNCULACEAE	A. virginiana L.	Anemone	H	N	X			
RANUNCULACEAE	Cimifuga racemosa (L.) Nutt.	Black Snakeroot	H	N		X	X	X
RANUNCULACEAE	Clematis virginiana L.	Virgin's Bower	V	N	X			
RANUNCULACEAE	Ranunculus abortivus L.	Crowfoot	H	N	X	X	X	X
ROSACEAE	Agrimonia parviflora Ait.	Small Flowered Agrimony	H	N	X			
ROSACEAE	Dechesnea indica (Andr.) Focke	Indian Strawberry	H	N-N	X	X	X	X
ROSACEAE	Geum canadense Jacq.	White Avens	H	N	X			
ROSACEAE	G. virginianum L.	Virginia Avens	H	N		X	X	X
ROSACEAE	Potentilla simplex Michx.	Common Cinquefoil	H	N	X	X	X	X
ROSACEAE	Prunus serotina Ehrh	Wild Black Cherry	T	N		X	X	X
ROSACEAE	Rosa carolina L.	Pasture Rose	S	N			X	X
ROSACEAE	R. multiflora Thunb.	Multiflora Rose	S	N-N	X	X	X	X
ROSACEAE	Rubus allegheniensis Porter	Alleghany Blackberry	H	N	X	X	X	X
ROSACEAE	R. occidentalis L.	Black Raspberry	H	N	X	X	X	X

FAMILY	GENUS SPECIES	COMMON NAME	GH	N/N-N	Align. Alts.	Borrow sites 1	2	3
ROSACEAE	R. vixalacer Bailey	Dewberry	V	N		X	X	X
RUBIACEAE	Galium aparine L	Cleavers	H	N	X	X	X	X
RUBIACEAE	G. circaezans Michx.	Wild liquorice	H	N		X	X	X
RUBIACEAE	Houstonia tenuifolia Nutt.	Slenderleaved Summer Bluet	H	N			X	
SALICACEAE	Salix fragilis L.	Crack Willow	H	N-N	X			
SALICACEAE	S. nigra Marsh.	Black Willow	T	N	X			
SAXIFRAGACEAE	Heuchera arborescens L.	Rough Heuchera	H	N		X	X	X
SAXIFRAGACEAE	Hydrangea arborescens L.	Wild Hydrangea	S	N	X	X	X	X
SAXIFRAGACEAE	Saxifaga micranthidifolia (Haw.) Britton	Lettuce Saxifrage	H	N		X		
SCROPHULARIACEAE	Gratiola neglecta Torr	Clammy Hedge Hyssop	H	N	X			
SCROPHULARIACEAE	Penstemon laevigatus Ait.	Smooth Beardstongue	H	N	X	X	X	X
SCROPHULARIACEAE	Verbascum thapsus L.	Mullein	H	N-N		X	X	X
SCROPHULARIACEAE	Veronica polita Fries	Wild Speedwell	H	N-N	X			
SIMAROUBACEAE	Ailanthus altissima (Mill.) Swingle	Tree of Heaven	T	N-N	X	X	X	X
SOLANACEAE	Physalis heterophylla Nees	Common Ground Cherry	H	N	X			
SOLANACEAE	Solanum americanum Mill.	Black Nightshade	H	N	X			
SOLANACEAE	S. carolinense L.	Horse-nettle	H	N	X			
TYPHACEAE	Typha latifolia L.	Cattails	H	N			X	
TILIACEAE	Tilia americana L.	Basswood	T	N	X	X	X	X
ULMACEAE	Celtis occidentalis L.	Hackberry	T	N	X			
ULMACEAE	Ulmus rubra Muhl.	Red Elm	T	N	X	X	X	X
URTICACEAE	Boehmeria cylindrical (L.) Sw.	False Nettle	H	N	X			
URTICACEAE	Lapotea canadensis Webb.	Wood Nettle	H	N-N	X			
URTICACEAE	Pilea pumila (L.) Gray	Clearweed	H	N	X	X	X	X
URTICACEAE	Urtica gracilis Ait.	Wild Nettle	H	N-N	X			
VIOLACEAE	Viola blanda Willd.	Sweet White Violet	H	N		X	X	X
VIOLACEAE	V. papilionaceae Pursh.	Common Blue Violet	H	N	X	X	X	X
VITACEAE	Parthenocissus quinquefolia (L.) Planch.	Virginia Creeper	V	N	X	X	X	X
VITACEAE	Vitex aestivalis Michx.	Summer Grape	V	N	X	X	X	X

APPENDIX II

Levisa Fork River, Prestonsburg, KY. Levee alignments to be on left shore in photo.

Riparian forest along the Levisa Fork River, Prestonsburg, KY.

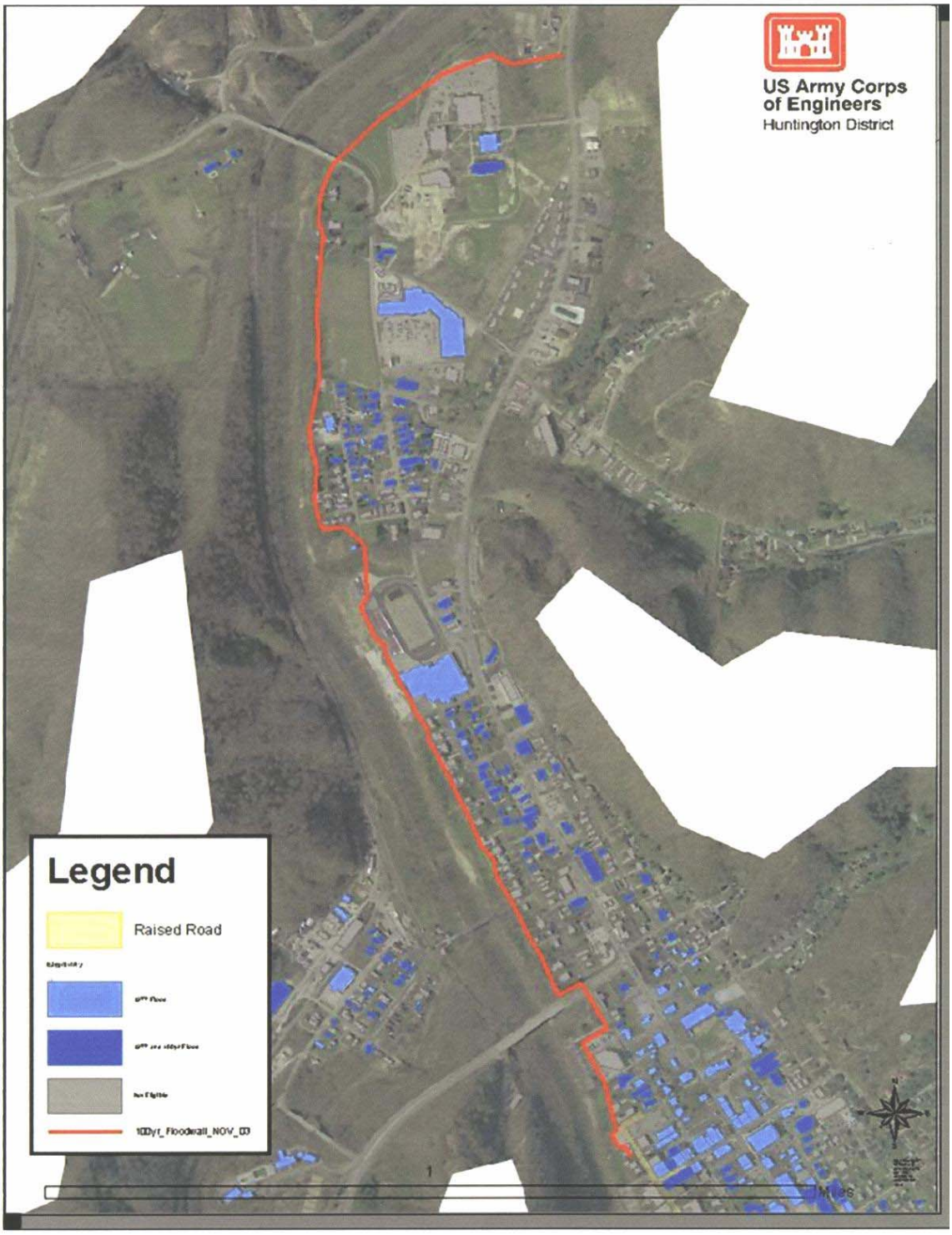


Borrow site #1, Bob White Lane, Prestonsburg, KY

Borrow site #2, Prestonsburg, KY.

Borrow site #2, deciduous upland forest.

Borrow site #3, Cliff Road, Prestonsburg, KY.



Levee Alignment area for all alternatives, Levisa Fork River, Prestonsburg, KY.
Base map provided by Huntington District.

Borrow sites #1,2,and 3, Prestonsburg, KY.
Base map provided by Huntington District.

APPENDIX F
Bat Hibernacula Survey

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FIELD SURVEY FOR INDIANA BAT (*Myotis sodalis*) HIBERNACULA FOR PROPOSED FLOOD REDUCTION ACTIVITIES IN FLOYD COUNTY, KENTUCKY

Prepared for:
AMEC EARTH & ENVIRONMENTAL, INCORPORATED
LOUISVILLE, KENTUCKY

Prepared by:
Gary W. Libby
J. Eric Spencer

SEPTEMBER 2004

I. INTRODUCTION

Eco-Tech, Incorporated, was contracted to conduct a search for hibernacula for the federally endangered Indiana bat (*Myotis sodalis*) along the right bank of Levisa Fork in Prestonsburg, Floyd County, Kentucky, where floodwalls and levees are proposed for flood damage reduction (see attached project location maps). Potential hibernacula for Indiana bats may include caves or mine portals.

II. SPECIES STATUS, DISTRIBUTION, AND NATURAL HISTORY

A. Species Status

The Indiana bat was listed as an endangered species on March 11, 1967 by the United States Fish and Wildlife Service (USFWS). As with all federally endangered species, it is protected by the Endangered Species Act (ESA) of 1973 (Public Law 93-205) (United States Congress 1973), as amended. Several years following its listing, an Indiana bat recovery plan was developed by biologists (i.e., the recovery team) and reviewed by the USFWS. Since that time the recovery plan has been revised to reflect recent studies and surveys. The Indiana Bat Recovery Plan outlines criteria for protecting and recovering the species (Brady *et al.* 1983, USFWS 1999).

Although most of the hibernacula have been protected, the Indiana bat still appears to continue a 5% decline in range-wide population every two years. Currently, researchers are focusing studies on summer habitat, heavy metals, the influence of pesticides, and genetic variability within the species in attempts to find causes for the continuous declines in populations.

B. Distribution

The range of the Indiana bat includes most of the eastern United States. It occurs from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida (Barbour and Davis 1969). The majority (85%) of the range-wide population hibernates in nine Priority 1 hibernacula (sites that currently and/or historically contained more than 30,000 individuals), which are located in Indiana (three sites), Kentucky (three sites), and Missouri (three sites) (USFWS 1999).

Some Indiana bats migrate long distances from their hibernacula to find suitable summer habitat to raise offspring. Until recently it was thought that the entire species, with the exception of some males, migrated north and west from their hibernacula to forested areas in Missouri, Indiana, Kentucky, Iowa, Ohio, and Michigan during the summer (Barbour and Davis 1969). Currently, reproductive Indiana bats have been documented from the following states Illinois, Indiana, Iowa, Kentucky, Michigan, Missouri, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia.

C. Natural History

Winter Habitat

During the short days of autumn (late August through early October), Indiana bats roost under sloughing bark and in cracks of dead, partially dead, and live trees (Humphrey *et al.* 1977, Gardner *et al.* 1991, J. MacGregor *et al.* 1999). Roost trees used by Indiana bats during the autumn range from

4.7 to 26.4 inches in dbh (diameter at breast height) and occur in forested, semi-forested and open habitats within 1.4 miles of the hibernacula (Kiser and Elliott 1996). Depending on local weather conditions, Indiana bats normally enter the hibernaculum in October and remain there through April (Hall 1962, LaVal and LaVal 1980). An abandoned iron mine in Missouri historically contained 139,000 Indiana bats. Most of the hibernacula with large colonies are located in Arkansas, Illinois, Indiana, Kentucky, Missouri, New York and Tennessee (USFWS 1999). Smaller hibernacula are located in Alabama, Connecticut, Florida, Georgia, Iowa, Maryland, Massachusetts, Michigan, Mississippi, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Vermont, Virginia, and West Virginia (ibid., Bryan *et al.* 1994).

According to Barbour and Davis (1969), temperature and relative humidity are important factors in the selection of hibernation sites. During the early fall Indiana bats roost in warm sections of caves and move down a temperature gradient as temperatures decrease. In midwinter Indiana bats tend to roost in portions of the cave where temperatures are cool (37E to 43E F). Relative humidity in Indiana bat hibernacula tends to be high, ranging from 66% to 95% (Barbour and Davis 1969). Prior to entering the hibernacula swarming occurs at the entrances (Cope and Humphrey 1977), or sometimes at other caves located near the hibernacula (LaVal *et al.* 1977, J. MacGregor *et al.* 1999). Swarming usually lasts for several weeks (August - September) and mating occurs toward the end of this period. After mating, females usually enter directly into hibernation, whereas males may remain active through the end of November. Adult females store sperm through the winter thus delaying fertilization until early May. During April and May the majority of the Indiana bat population will leave the cave areas and find suitable summer habitat. Females usually start grouping into larger maternity colonies by mid-May and give birth to a single young between late June and early July (Easterla and Watkins 1969, Humphrey *et al.* 1977).

Summer Habitat

Maternity colonies have been found under sloughing bark of dead and partially dead trees in upland and lowland forest (Cope *et al.* 1974, Humphrey *et al.* 1977, Gardner *et al.* 1991). These colonies are usually located in large-diameter, standing dead trees with direct exposure to sunlight (Callahan *et al.* 1997). A maternity roost may contain more than 100 adult females. During Callahan *et al.*'s (1997) study, he arranged roost trees into two groups depending on the intensity of use and size of the colony that used each tree. Callahan (1993) classified any tree that was used more than once by greater than 30 bats each time as a primary roost tree, and any tree with less than 30 bats or used only once as an alternate roost tree. The primary roost trees had an average diameter at breast height (dbh) of 22.4 inches, while alternate roost trees had an average dbh of 20.9 inches (Callahan *et al.* 1997). For unknown reasons, Indiana bats require many roost trees to fulfill their needs during the summer (Callahan *et al.* 1997). In Michigan, Kurta and Williams (1992) found that Indiana bats used two to four different roost trees during the course of one season. Although Indiana bats have been found roosting in several different species of trees, it appears that Indiana bats choose roost trees based on their structural composition. Therefore, it is difficult to determine if one particular species of tree is more important than others. However, twelve tree species have been listed in the Habitat Suitability Index Model (Romme *et al.* 1995) as primary species (class 1 trees). The trees listed by Romme *et al.* (1995) include silver maple (*Acer saccharinum*), shagbark hickory (*Carya ovata*), shellbark hickory (*C. laciniosa*), bitternut hickory (*C. cordiformis*), green ash (*Fraxinus pennsylvanica*), white ash (*F. americana*), eastern cottonwood (*Populus deltoides*), red oak (*Quercus rubra*), post oak (*Q. stellata*), white oak (*Q. alba*) slippery elm (*Ulmus rubra*), and American elm

(*Ulmus americana*). In addition to these species Romme *et al.* (1995) listed sugar maple (*A. saccharum*), shingle oak (*Q. imbricaria*), and sassafras (*Sassafras albidum*) as class 2 trees. The class 2 trees are those species believed to be less important, but still have the necessary characteristics to be used as roosts. Trees normally used as primary roosts are typically dead and have a dbh greater than 12 inches (Romme *et al.* 1995). However, in some rare cases primary roosts have been found in large hollow live trees. Kurta *et al.* (1993) found a primary roost in a 22 inch dbh hollow sycamore (*Platanus occidentalis*) in Michigan. Roost trees often provide suitable habitat as maternity roost for only a short period of time. However, bats will use them in consecutive years, if they remain standing and have sloughing bark (Gardner *et al.* 1991, Callahan *et al.* 1997).

Food Habits

Historically, the Indiana bat was thought to prey primarily on moths (Lepidoptera), beetles (Coleoptera), true flies (Diptera), and caddisflies (Trichoptera) (Belwood 1979, Brack 1983, Brack and LaVal 1985). During a study by Belwood (1979), the primary insects consumed by females and juveniles in southern Indiana were Lepidoptera (57%), Diptera (18%), and Coleoptera (9%). Belwood=s information was very similar to a three year study conducted by Brack (1983) throughout Indiana. Brack (1983) found that Indiana bats also consumed Lepidoptera (48%), Coleoptera (24%), and Diptera (8.5%). However, he also found Trichoptera (9.8%) to be an important food source. Recent studies by Lee (1993) and Kurta and Whitaker (1998) found the same four insect orders were consumed by Indiana bats in central/northern Indiana and in Michigan. However, these studies showed that Indiana bats preyed much more on caddisflies in central/northern Indiana and in Michigan. The female Indiana bats in central and northern Indiana consumed 40% Lepidoptera, 29% Trichoptera, 13% Coleoptera, and 9% Diptera (Lee 1993). The most recent Indiana bat food habits study was conducted in Michigan at the northern limits of the species range. These bats consumed primarily Trichoptera (55.1%) and Diptera (25.5%) which have aquatic larva (Kurta and Whitaker 1998). These authors hypothesized that Indiana bats in northern portions of their range feed more on aquatic insects than southern populations because they foraged primarily over streams and wetlands.

Indiana bats forage primarily in upland, bottomland, and riparian forests (Cope *et al.* 1974, Humphrey *et al.* 1977, LaVal *et al.*1977, Belwood 1979), but they will also use forest and cropland edges, fallow fields, and areas of impounded water (Gardner *et al.* 1991). It has been documented that Indiana bats may travel up to three miles from their summer roosts to summer foraging areas and will visit these same areas each night. A pregnant female captured near Morehead, Kentucky maintained a very systematic travel pattern to reach an upland wildlife pond and woods that had been shelterwood cut (J. MacGregor, unpublished data). This bat arrived at the pond and adjacent woods within a couple of minutes each night that it was tracked. Reproductively active females traveled a maximum mean distance of 1.5 miles from their roost trees to foraging areas in Illinois (Gardner *et al.* 1991). During a study by Pruitt *et al.* (1995) at the Jefferson Proving Ground (JPG), Jefferson County, Indiana, reproductive female bats were found to travel a mean distance of 1.7 miles from their original capture sites to their roost trees. Also, at JPG, a male traveled 0.4 miles from the capture site to its roost; this distance is less, but similar to the distance of 0.7 miles found by Gardner *et al.* (1991) for males in Illinois.

III. METHODS

Prior to the field survey, a thorough search of existing cave and mine portal information for the project area and adjacent area was conducted. The field survey for hibernacula was done on September 22, 2004. The study area was walked to locate potential hibernacula for the Indiana bat. This included searching for caves and mine portals. If these were present, further evaluation would be provided. Cave-like dwellings (culverts, cisterns, storm sewers) and bridges were also searched for within the project area. These features were evaluated for bat use.

Other Indiana bat habitat characteristics that were rated include summer roosting habitat, food and water availability and quality, and interspersion of habitat components. A bat habitat assessment form was completed during the field survey. Although this form is for all bat species, it was filled out with emphasis on the habitat requirements of the Indiana bat. Notes and photographs of existing land cover were taken. As required by the Endangered Species Act, the best scientific methods were used to evaluate habitat for the species.

IV. RESULTS AND DISCUSSION

The study area is mostly riparian forest and fields in a floodplain terrace of Levisa Fork (see attached photographs). No caves or mine portals were found in the study area. However, an abandoned concrete bridge over Levisa Fork has eroded crevices and interstitial spaces that are suitable for Indiana bats during the summer. In fact, there was a bridge found in Indiana this summer that had Indiana bats using these same features (G. Libby, unpublished data). No hibernacula or winter habitat are present within the study area. Numerous mine portals and a few caves are known within a five-mile radius; however, the Indiana bat has not been documented from this area or Floyd County.

The study area provides medium quality potential summer roosting and foraging habitat for the Indiana bat. It was estimated from transect counts that approximately 5 trees per acre have structural attributes similar to known summer roost trees. These include sycamore, silver maple, box elder, river birch, and red elm snags and cavity trees, as well as live trees of the same species.

If proposed project is constructed during the winter (November 15 through March 31), this project is not likely to affect the Indiana bat. However, if tree removal is proposed outside of this time frame then additional surveys (mist netting and echolocation detection recording and analysis) should be conducted in the study area according to USFWS guidelines (USFWS 1999) to determine whether or not Indiana bats are present.

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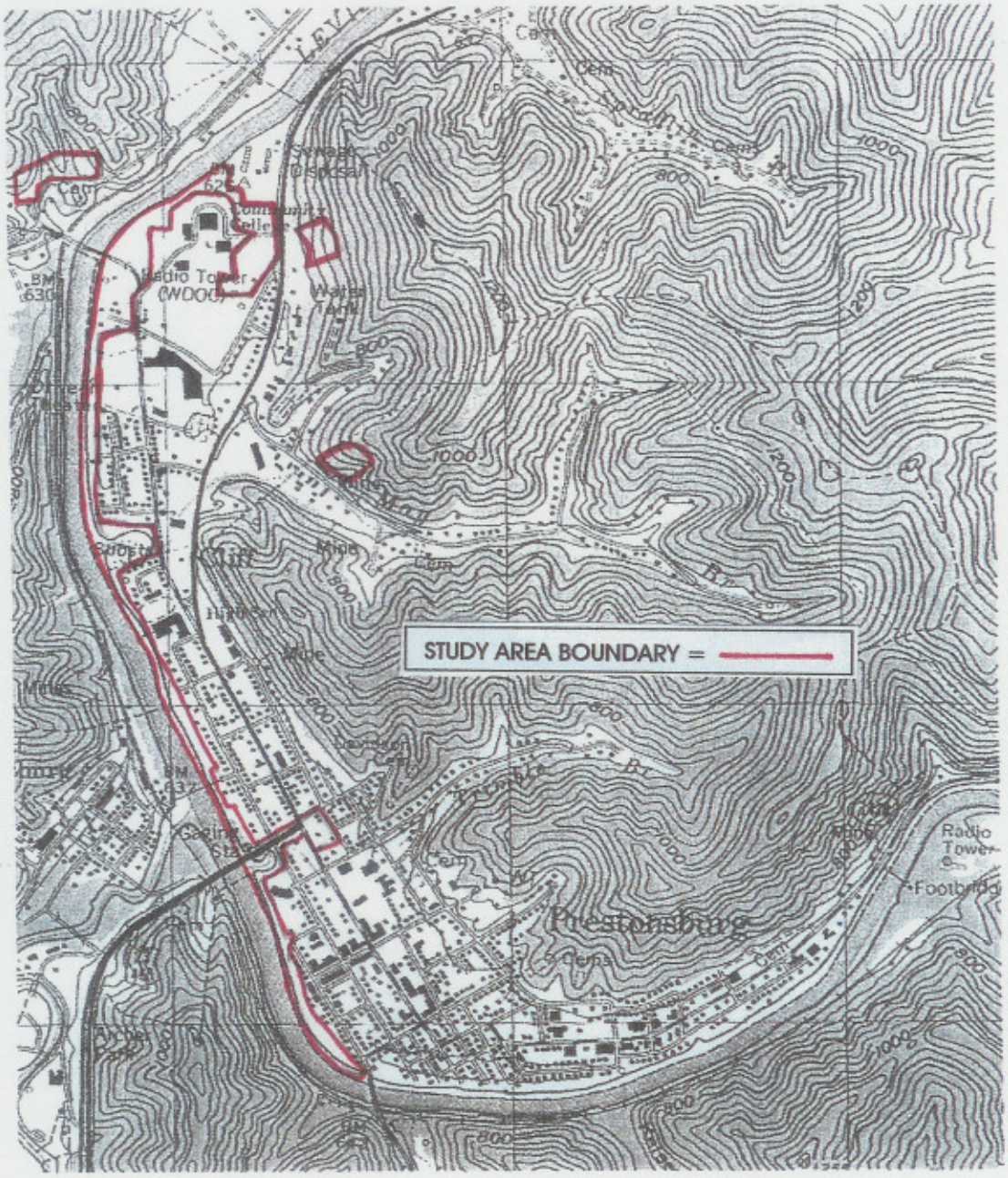

source: USGS 15' Quadrangle
Prestonsburg, KY 1992

N

LOCATION MAP

FIELD SURVEY FOR INDIANA BAT (*Myotis sodalis*) HIBERNACULA FOR PROPOSED FLOOD REDUCTION ACTIVITIES IN FLOYD COUNTY, KENTUCKY

RIPARIAN AREA ALONG LEVISA FORK

RIPARIAN AREA ALONG LEVISA FORK

PHOTOGRAPHS

FIELD SURVEY FOR INDIANA BAT (*Myotis sodalis*) HIBERNACULA FOR PROPOSED FLOOD REDUCTION ACTIVITIES IN FLOYD COUNTY, KENTUCKY

SEPTEMBER 22, 2004

ECO-TECH, INC.

1003 E. Main St.
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PUBLIC ACCESS AREA ALONG LEVISA FORK

HIGHWAY 114 BRIDGE OVER LEVISA FORK

PHOTOGRAPHS

FIELD SURVEY FOR INDIANA BAT (*Myotis sodalis*) HIBERNACULA FOR PROPOSED FLOOD REDUCTION ACTIVITIES IN FLOYD COUNTY, KENTUCKY

SEPTEMBER 22, 2004

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TWO VIEWS OF AN ABANDONED BRIDGE OVER LEVISA FORK, JUST UPSTREAM OF HIGHWAY 114 BRIDGE

PHOTOGRAPHS

FIELD SURVEY FOR INDIANA BAT (*Myotis sodalis*) HIBERNACULA FOR PROPOSED FLOOD REDUCTION ACTIVITIES IN FLOYD COUNTY, KENTUCKY

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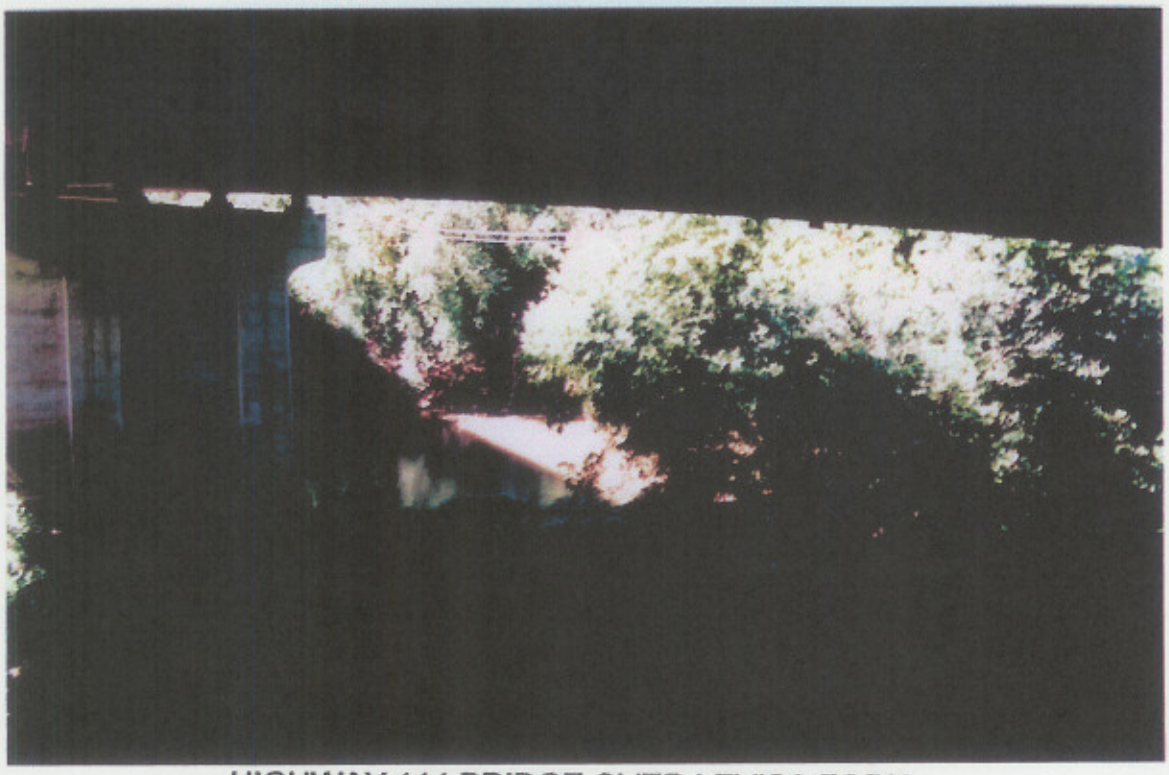
PUBLIC ACCESS AREA ALONG LEVISA FORK



HIGHWAY 114 BRIDGE OVER LEVISA FORK

PHOTOGRAPHS

FIELD SURVEY FOR INDIANA BAT (*Myotis sodalis*) HIBERNACULA FOR PROPOSED FLOOD REDUCTION ACTIVITIES IN FLOYD COUNTY, KENTUCKY

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Bat Habitat Requirements Summary Table.

Prestonsburg Floodwall
Floyd County KY 9/22/04

emphasis on Indiana bat (Myotis sodalis)

Habitat Component	Habitat Requirements
Food - Young	• Milk from mother. Insects usually within two weeks of birth.
Food - Adult	• Night-flying insects such as moths, beetles, fruit flies, mosquitoes, mayflies, caddis flies, midges, grasshoppers, cicadas, and many others. Insect types may vary by bat species. • Fish, frogs, lizards, small rodents, birds, other bats. United States and Canadian bats are primarily insectivorous, but tropical bats have adapted to many other food sources. • Fruit, pollen, and nectar from plants and flowers such as banana, mango, date, fig, peach, cashew, guava, avocado, agave, giant saguaro and organ pipe cacti, and many others. Only a few southwestern species feed on nectar and pollen from cacti and agaves.
Roosts -Hibernacula	• Caves and mines, occasionally buildings. Many species migrate, and a few overwinter in the open, such as in trees. — in region but not within project boundaries.
-Maternity roosts	• Loose tree bark, leaves, tree cavities, caves, mines, bridges, and buildings.
-Bachelor roosts	• Loose tree bark, leaves, tree cavities, caves, mines, bridges, and buildings.
-Night roosts	• Bridges, porches, barns, other buildings, trees, caves, mines, bat houses, and other structures.
-Transient roosts	• May include all of those listed above.
Winter habitat	• Caves, mines, tree branches, cavities and bark; cliff and rock crevices; tangled hedgerow thickets; attics and roofs of barns and other structures that provide an overhang in close proximity to open water; mowed fields; desert landscapes; agricultural crop fields and residential areas lit with street and yard lights. Varies by species. Many bats migrate from their summer range.
Water	• Open bodies of fresh water large enough to enable drinking on the wing without disturbance from cattails, bank side trees, or other vegetation.
Interspersion	• Prefer a complex of open water, mowed fields, woodlots, streams, desert landscapes, agricultural crop fields, residential areas, trees, cliff and rock crevices, tangled hedgerow thickets, caves, mines, attics and roofs of barns and other structures that provide an overhang. Interspersion of habitat components varies tremendously by bat species.
Minimum habitat size	• No reasonable estimate of minimum habitat size exists for bats, but probably varies by species.

Limiting Factors

For planning purposes, use the table below to inventory the site to determine the availability of each of the basic habitat components, based on the above narrative habitat requirement descriptions. Habitat components that are absent or rated low are limiting habitat quality for bats.

	Availability/Quality			
Habitat Component	High	Medium	Low	Absent
Food		✓		
Roosts - hibernacula				✓
- maternity roosts		✓		
- bachelor roosts		✓		
- night roosts		✓		
- transient roosts		✓		
Winter habitat				✓
Water	✓			
Interspersion of habitat components		✓		

Summer (maternity) habitat present, but no winter habitat (potential hibernacula) found.