

From: [Adams, Joshua](#)
To: [Pelren, David](#)
Cc: [Sikula, Nicole R](#); [Gus McLachlan](#); [Benefiel, Jeffrey](#); [Casey, Justin](#); [Haider, Jessica](#); [Fleece, Cody](#)
Subject: [EXTERNAL] Mussel Study Plan for the Ridgeline Pipeline Project
Date: Thursday, September 8, 2022 8:04:16 AM
Attachments: [Ridgeline MusselStudyPlan_090222.pdf](#)

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Dave,

Please find attached the survey plan for the mussel surveys we are planning on initiating this fall.

Josh Adams

Natural Resource Team Lead, Terrestrial Wildlife Technical Lead, Principal

Direct: 502 212-5011

Mobile: 502-718-9512

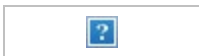
Fax: 502 212-5055

Joshua.Adams@stantec.com

Stantec

9200 Shelbyville Road Suite 800

Louisville KY 40222-5136



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September 2, 2022
David Pelren
Page 1 of 8

Reference: Proposed Study Plan, Mussel Survey for the Proposed East Tennessee Ridgeline Pipeline Project-

September 2, 2022
File: 172677408

Attention: David Pelren
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
446 Neat St.
Cookeville, TN 38501

Dear Mr. Pelren,

Reference: Proposed Study Plan, Mussel Survey for the Proposed East Tennessee Ridgeline Pipeline Project- Trousdale, Smith, Jackson, Putnam, Overton, Fentress, Morgan, and Roane Counties Tennessee

Background

This study is part of a larger effort to assess the potential presence or probable absence of freshwater mussels along the alignment of the proposed Ridgeline Pipeline Project (Attachment A). Stantec previously collected eDNA samples in June of 2022, to assess potential presence of mussels at proposed crossings of small streams. This effort was part of a phased approach where detection of freshwater mussel genetic material would trigger traditional surveys. Results from eDNA sampling are still under review but initial indications suggest that seven of 30 small stream sites should be surveyed using traditional methods (Table 1).

eDNA samples were not collected at the large waterbody sites (i.e., embayments and large rivers) in June, but eDNA data will be collected concurrently with traditional mussel surveys (Table 1). Traditional methods are proposed for these sites because it is assumed freshwater mussels are present. Although the exact position of the proposed pipeline is currently unknown, it is assumed it will be placed within the existing and/or proposed right-of-way (ROW). This study plan describes methods to be used for traditional surveys.

This correspondence was prepared to seek your approval of the methods proposed below. Field studies will be led by James Kiser, Cody Fleece, Triston Mullins, or Don Hubbs. Our Federal Endangered Species Collecting Permit is presented in Attachment B and credential for these individuals are presented in Attachment C.

Technical Approach

The large river and embayment project sites will be surveyed using timed searches and/or transect based field methods. Timed search surveys will be used for small streams. Mussels will be collected by visual or surface searches, including moving cobble and woody debris, hand sweeping away silt, sand, and/or small

Reference: Proposed Study Plan, Mussel Survey for the Proposed East Tennessee Ridgeline Pipeline Project-

detritus, and disturbing/probing the upper five centimeters (two inches) of substrate. If federally protected species are encountered during surveys, USFWS will be contacted for guidance on how to proceed.

Table 1. Sites proposed for mussel surveys.

Site	Pipeline Mile Post	Latitude	Longitude	Drainage	Habitat
5	2.9	36.382598°	-86.208823°	Cumberland River	Embayment
6	3.3	36.380843°	-86.203523°	Cumberland River	Embayment
48	29.7	36.325964°	-85.784254°	Cumberland River	Embayment
52	32.1	36.313377°	-85.745160°	Cumberland River	Large River
188	116.6	35.966868°	-84.467185°	Emory River	Embayment
11	6.8	36.373194°	-86.150556°	Little Goose Cr - Cumberland River	Small streams
11a	6.8	36.373194°	-86.134407°	Big Goose Cr - Cumberland River	Small streams
45	28.0	36.340047°	-85.802222°	Salt Lick Cr - Cumberland River	Small streams
89	55.3	36.215833°	-85.379921°	Spring Cr	Small streams
146	90.7	36.154722°	-84.788889°	White Creek - Emory River	Small streams
165	102.5	36.105167°	-84.613333°	Emory River	Small streams
193	120.0	35.930139°	-84.471944°	Kings Cr - Emory River	Small streams

Embayments

The proposed pipeline crossings currently traverse four lentic areas (embayments) within large reservoirs. These areas are likely depositional in nature, aggradating fine materials (e.g. sand, silt, and detritus), but are still in close proximity to riverine waterbodies (Table 1; Figure 1). Thick, fine-grained sediment deposits typically provide poor habitat for freshwater mussels because they are often unstable and anoxic.

Stantec proposes wandering timed search surveys at equidistant locations along the proposed pipeline crossing. An equal number of sample locations will be placed upstream and downstream of the proposed line. Starting points for searches will be placed within 25 meters of the proposed alignment. Divers will wander randomly searching for mussels and/or good habitat. Two searches will be conducted at each location for a duration of 45 minutes (90 minutes total search time). Search times will be longer at larger sites (Table 2).

Large Rivers

The proposed pipeline crossings currently traverse one riverine area (Table 1. Riverine; Figure 1). It is a perennial waterbody with high potential of native freshwater mussels being present. It will be surveyed

Reference: Proposed Study Plan, Mussel Survey for the Proposed East Tennessee Ridgeline Pipeline Project-

using transect based field methods. Divers will search a one-meter band along transects spanning bank to bank. Transects will be divided into 10-meter segments and searched at a rate of minute per square meter. Two transects will be placed within the ROW, three transects upstream of the ROW, and five transects downstream of the ROW. These transects would be spaced no less than 10m apart and no more than 30m apart. If mussel densities of 0.5/m² or if any live federally protected or proposed to be detected individuals are encountered within a 10m segment of a transect, Stantec would initiate qualitative timed searches within similar habitat for 30 minutes.

Table 2. Embayment search effort.

Site	Pipeline Mile Post (mile)	Approximate Width (m)	Sample Locations (count)	Timed Searches (count)	Search Time (min)
5	2.9	500	12	24	1080
6	3.3	80	4	8	360
48	29.7	110	8	16	720
188	116.6	150	8	16	720

Small Streams

Genetic material for unionid mussels was detected at seven of the 30 proposed pipeline crossings. Small streams with positive eDNA detections for unionids are presented in Table 1. Additional surveys are not proposed for remaining 23 streams where genetic material was not detected. Small streams where mussels are believed present, will be surveyed using timed search field methods. Searches will occur between 50m upstream and 100m downstream of the ROW for a total of 9 search hours within available habitat. Searchers will begin at the downstream end of the site and proceed in an upstream direction while collecting mussels. It is assumed that snorkelling will be the primary search technique, but field personnel may rely on SCUBA if channel depths are greater than 2.5 feet.

Mussels will be identified to species and recorded according to the searcher that found them at each site. All mussels will be returned to the approximate location where found after data collection. Federally listed species will be hand placed in the substrate when ambient river temperatures range between 5 and 10 degrees Celsius (°C). Sampling will only occur when ambient air temperatures are above 0 °C or when nearby USGS Gauges are less than or near the seasonal median. Mussels will be identified to species level and sexed where possible. Individual lengths will be measured, and representative specimens will be photographed as vouchers.

Physical habitat will be visually assessed by divers and recorded for each survey lane. Substrates will be characterized using a modified Wentworth scale (Table 3) and coverage will be estimated to the nearest five percent.

Reference: Proposed Study Plan, Mussel Survey for the Proposed East Tennessee Ridgeline Pipeline Project-

Table 3. Substrate grain size classifications

Category	Size Range
Silt/clay	<1 – 62.5 µm
Sand	62.5 µm – 1 mm
Gravel	2 -64 mm
Cobble	64 – 256 mm
Boulder	>256 mm
Bedrock	Not applicable
Hardpan	Not applicable
Detritus	Not applicable
Wood	Not applicable
Aquatic vegetation	Not applicable

Key:

µm = micrometer

mm = millimeter

Reporting

Upon completion of the field survey, Stantec personnel will prepare a report describing:

- Habitat conditions at the survey sites;
- Methods used to complete the survey;
- Level of effort; and
- Photographs of representative specimens.

The results of the eDNA study will be submitted under separate cover.

Reference: Proposed Study Plan, Mussel Survey for the Proposed East Tennessee Ridgeline Pipeline Project-

Conclusion

Please respond, at the earliest opportunity, with any questions, comments, or concerns you may have regarding the proposed study plan. If you have none, please respond with authorization to proceed with field studies according to the study plan outlined above.

Thank you for your time and attention.

Regards,

Stantec Consulting Services Inc.



Cody Fleece
Principal, Aquatic Ecologist
Phone: 513 842 8238
Cody.Fleece@stantec.com



Josh Adams
Principal
Phone: 502 718 9512
Joshua.Adams@stantec.com

Attachment: A – Project Maps
B – Federal Collecting Permit
C – Resumes for Key Personnel

- c. Gus McLachlan, Enbridge
Triston Mullins, Stantec
James Kiser, Stantec
Justin Casey, Stantec
Jeff Benefiel, Stantec
Jessica Haider, Stantec
Nicole Sikula, USFWS

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September 2, 2022

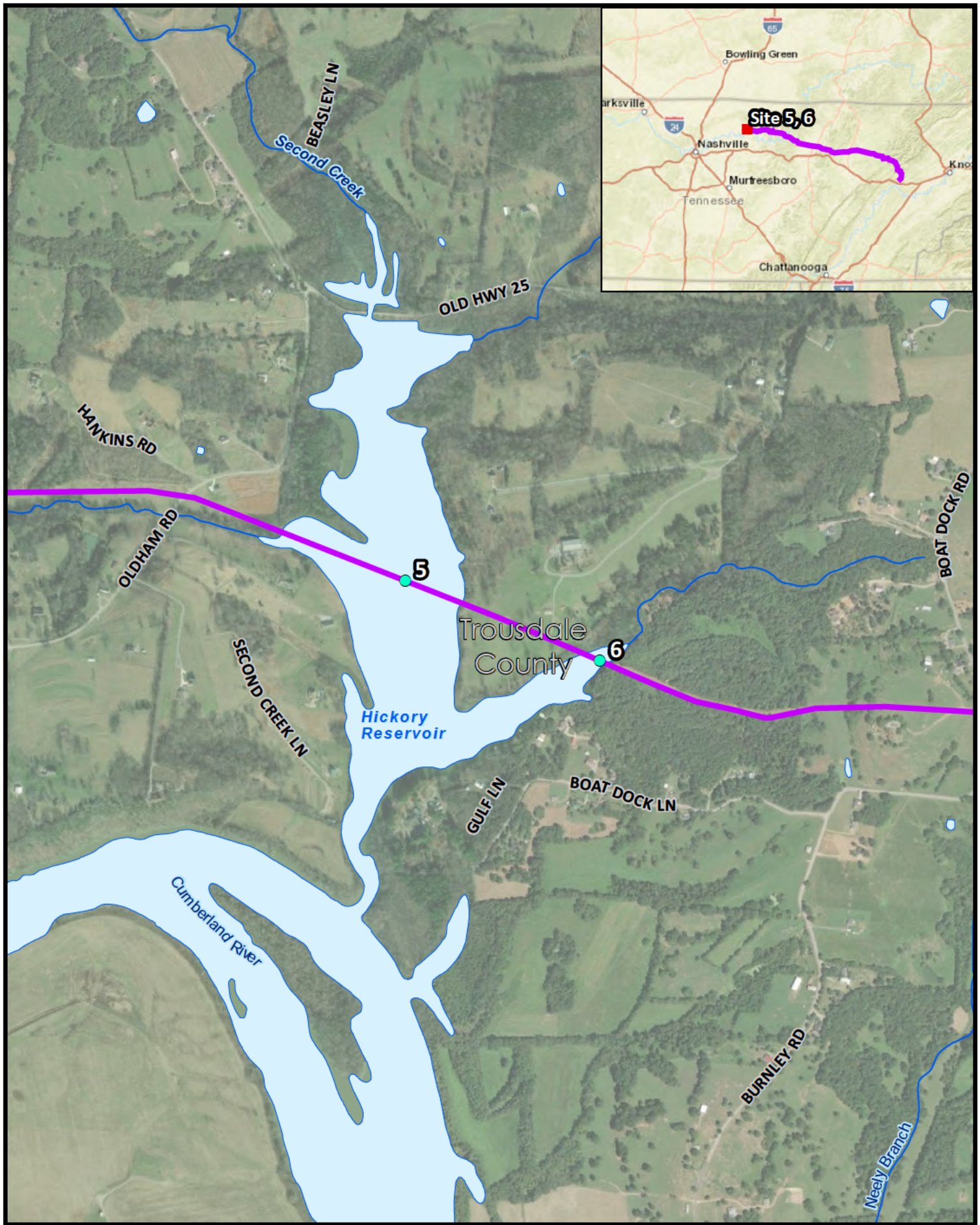
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Reference: Proposed Study Plan, Mussel Survey for the Proposed East Tennessee Ridgeline Pipeline Project-

ATTACHMENT A

Project Area Maps



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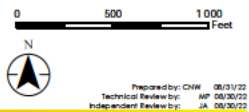
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Proposed Mussel Survey Location

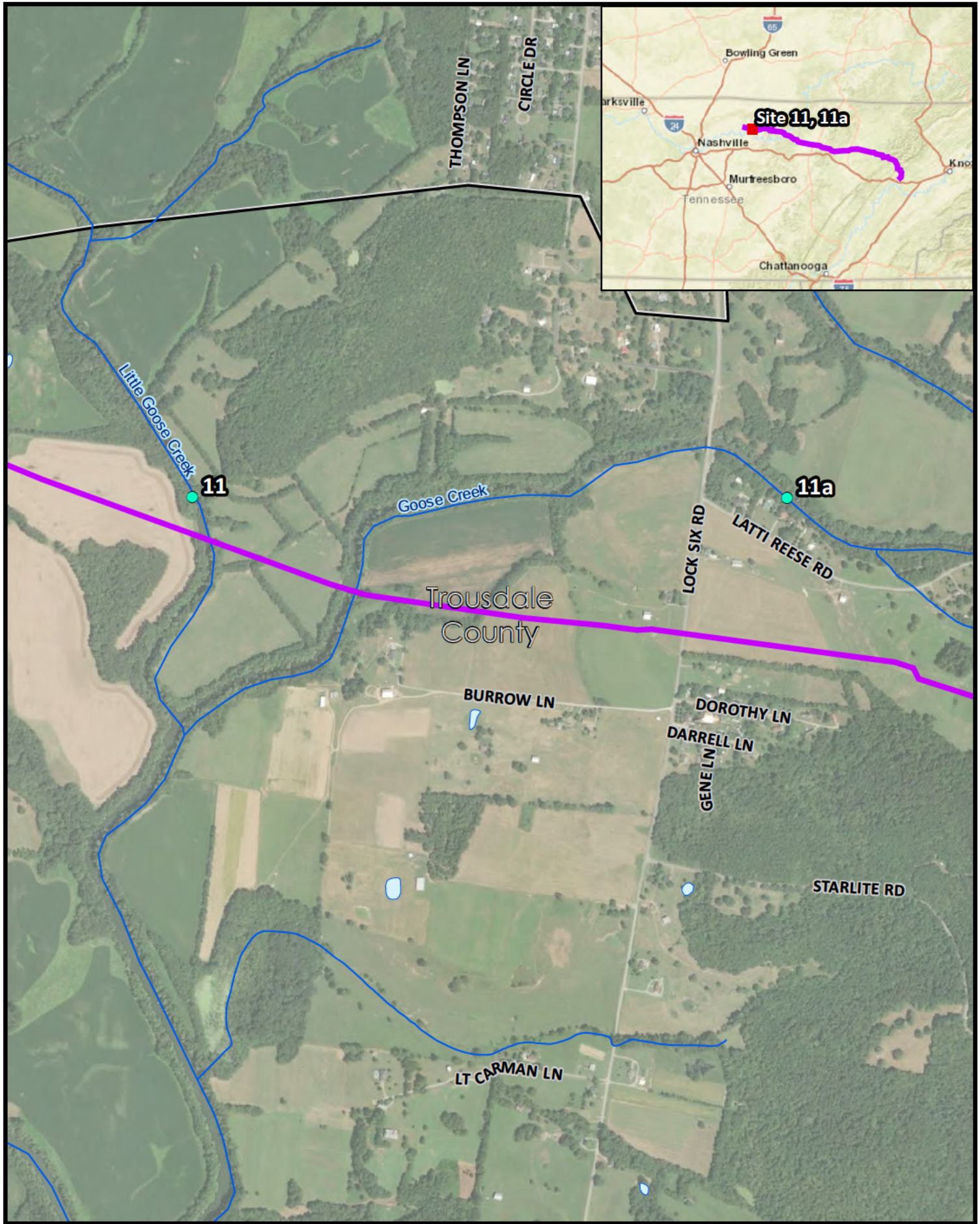
Ridgeline Pipeline Project

August 2022

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Prepared by: CHW 08/31/22
 Technical Review by: JAK 08/30/22
 Independent Review by: JAK 08/30/22



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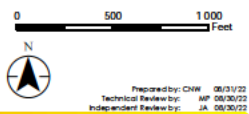
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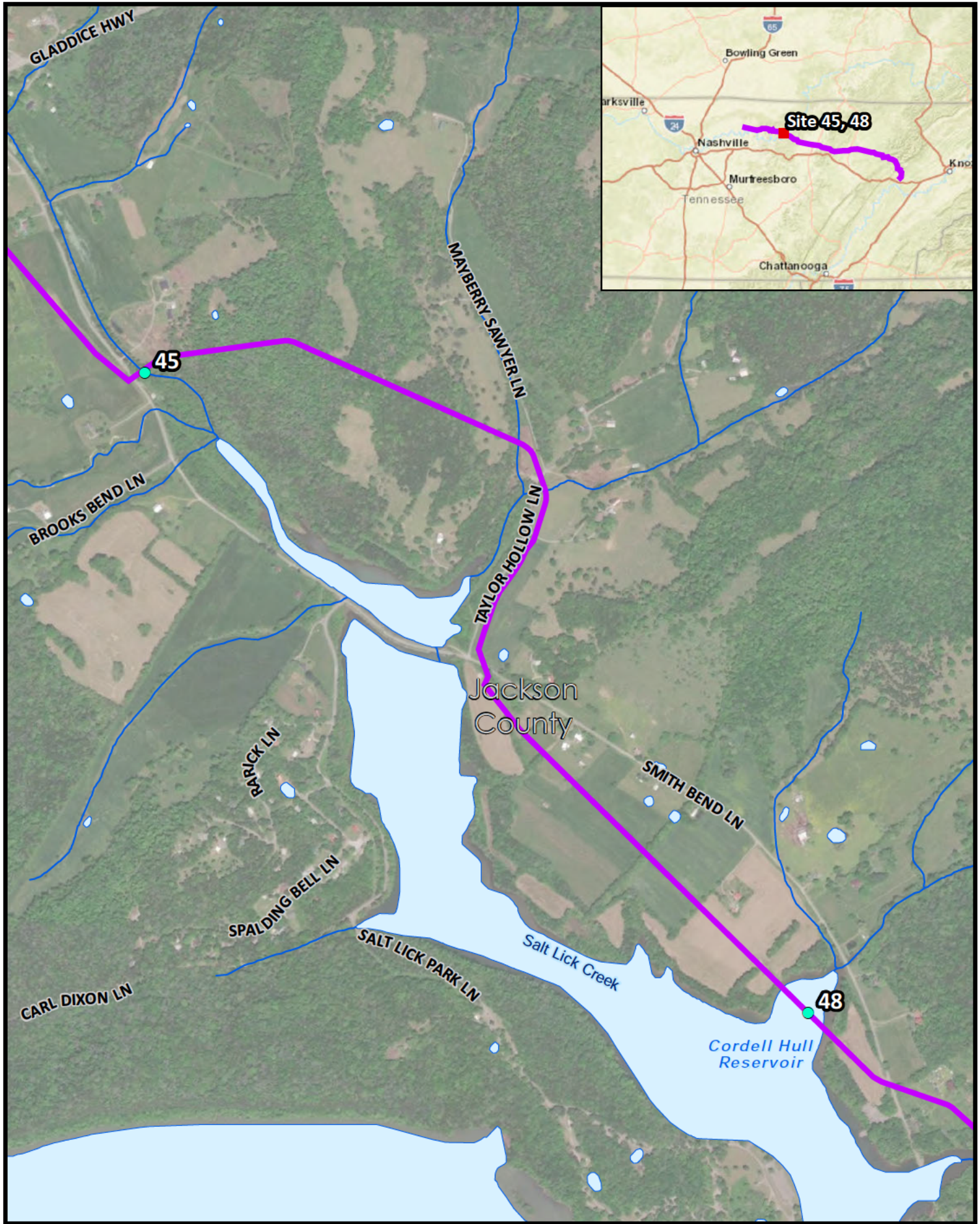
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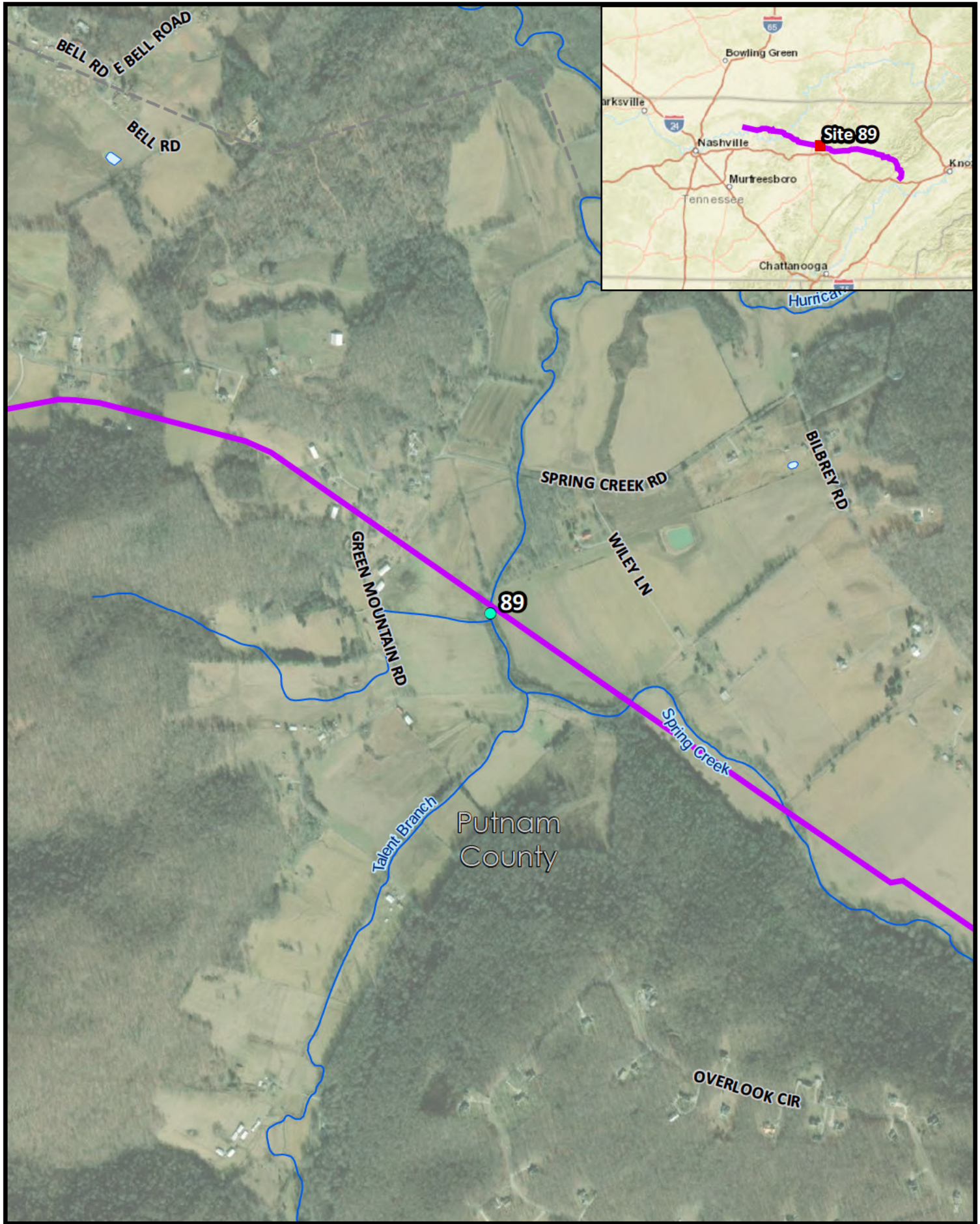
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Prepared by: CHW 08/31/22
 Technical Review by: JAW 09/06/22
 Independent Review by: JAW 09/20/22



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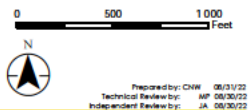
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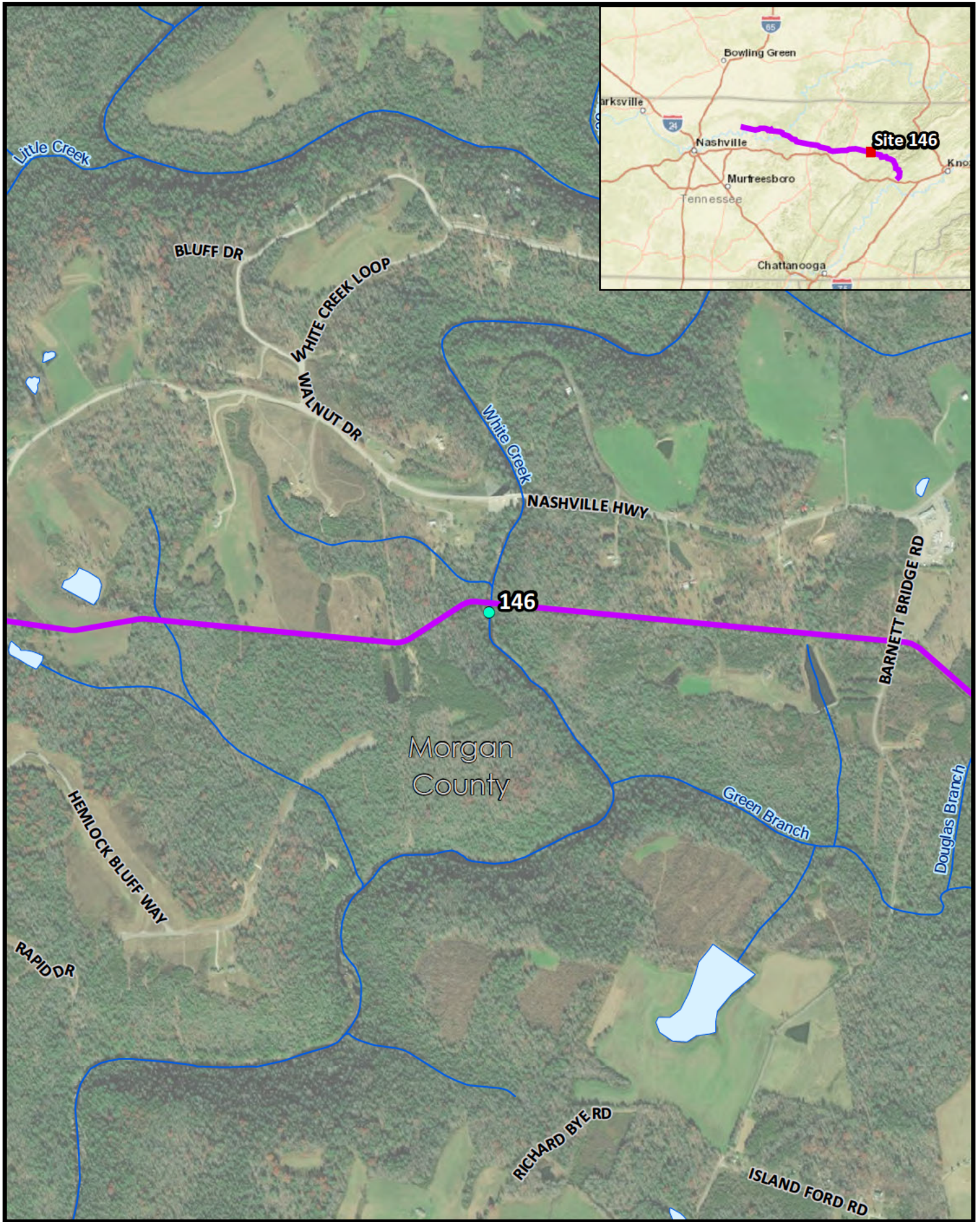
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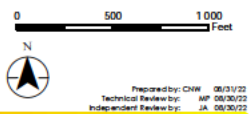
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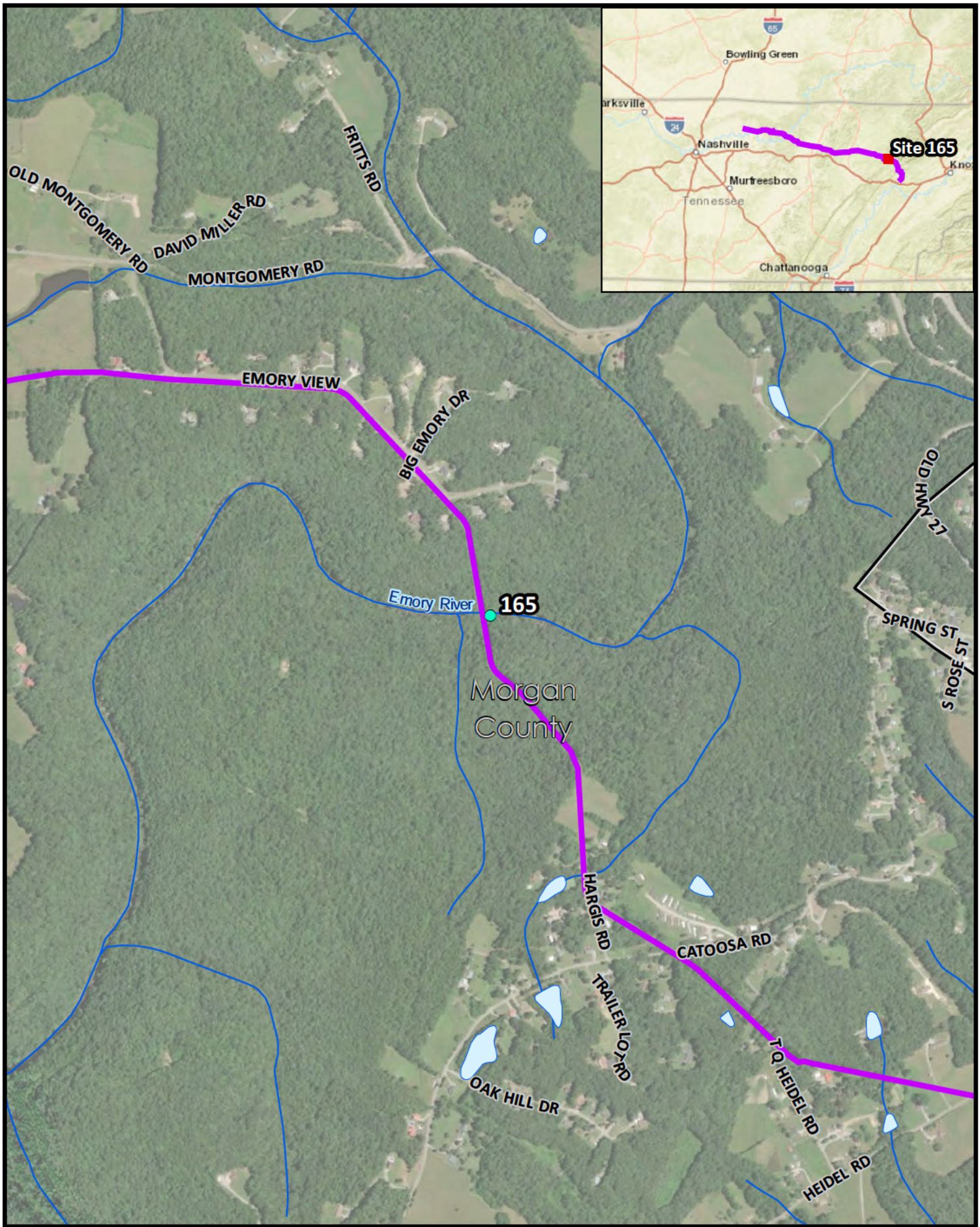
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 Technical Review by: JAK 08/30/22
 Independent Review by: JAK 09/20/22



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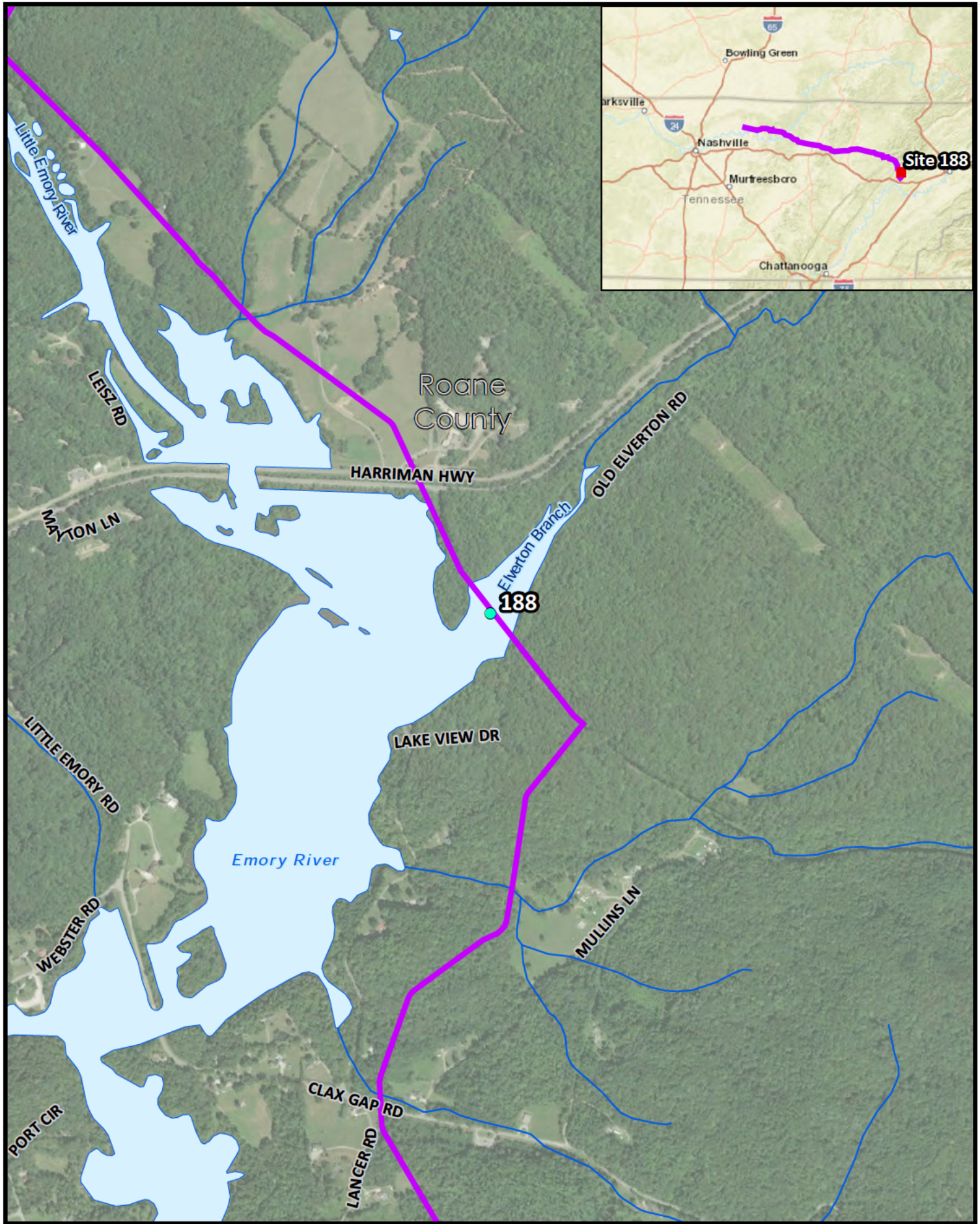
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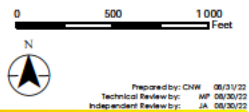
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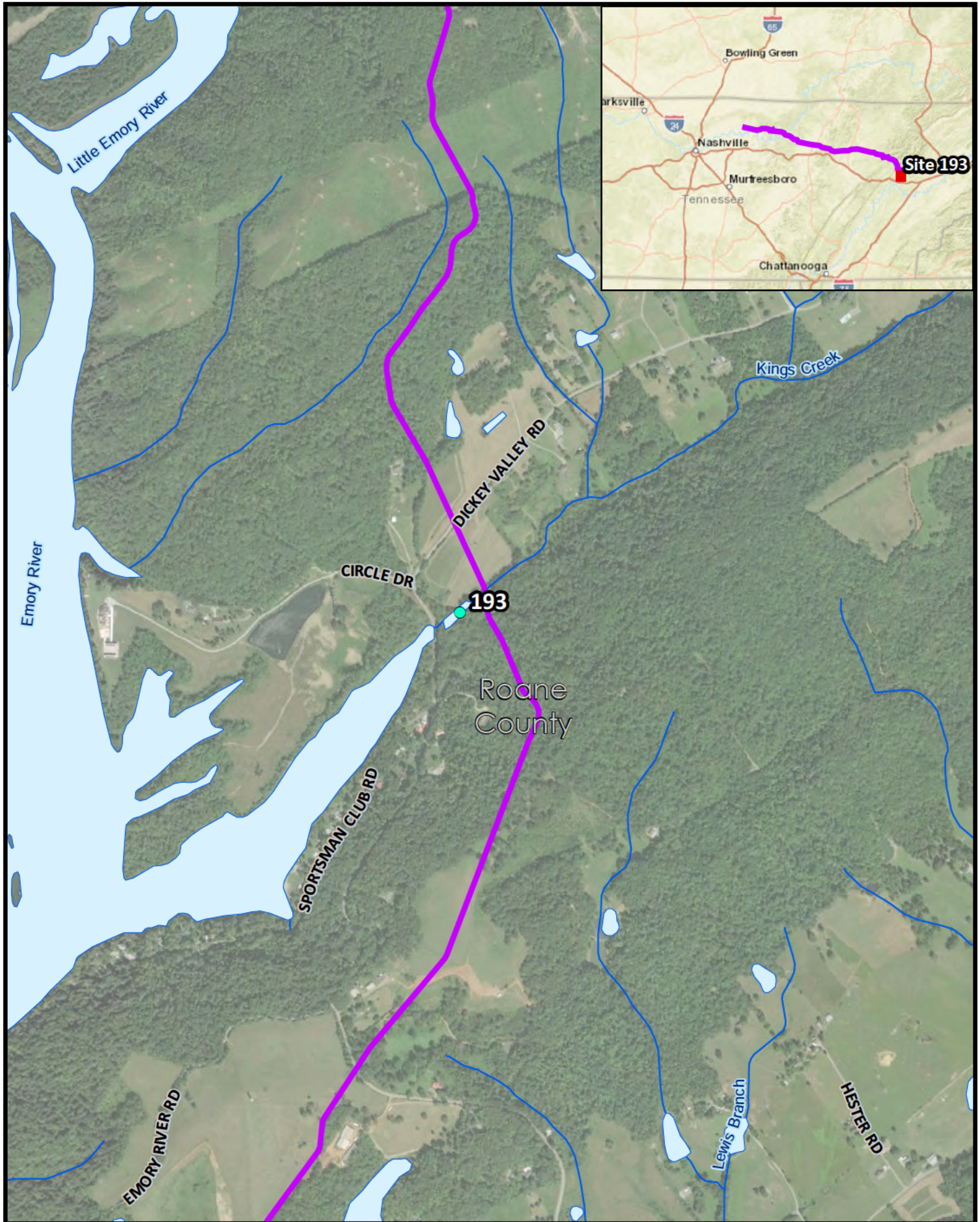
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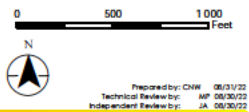
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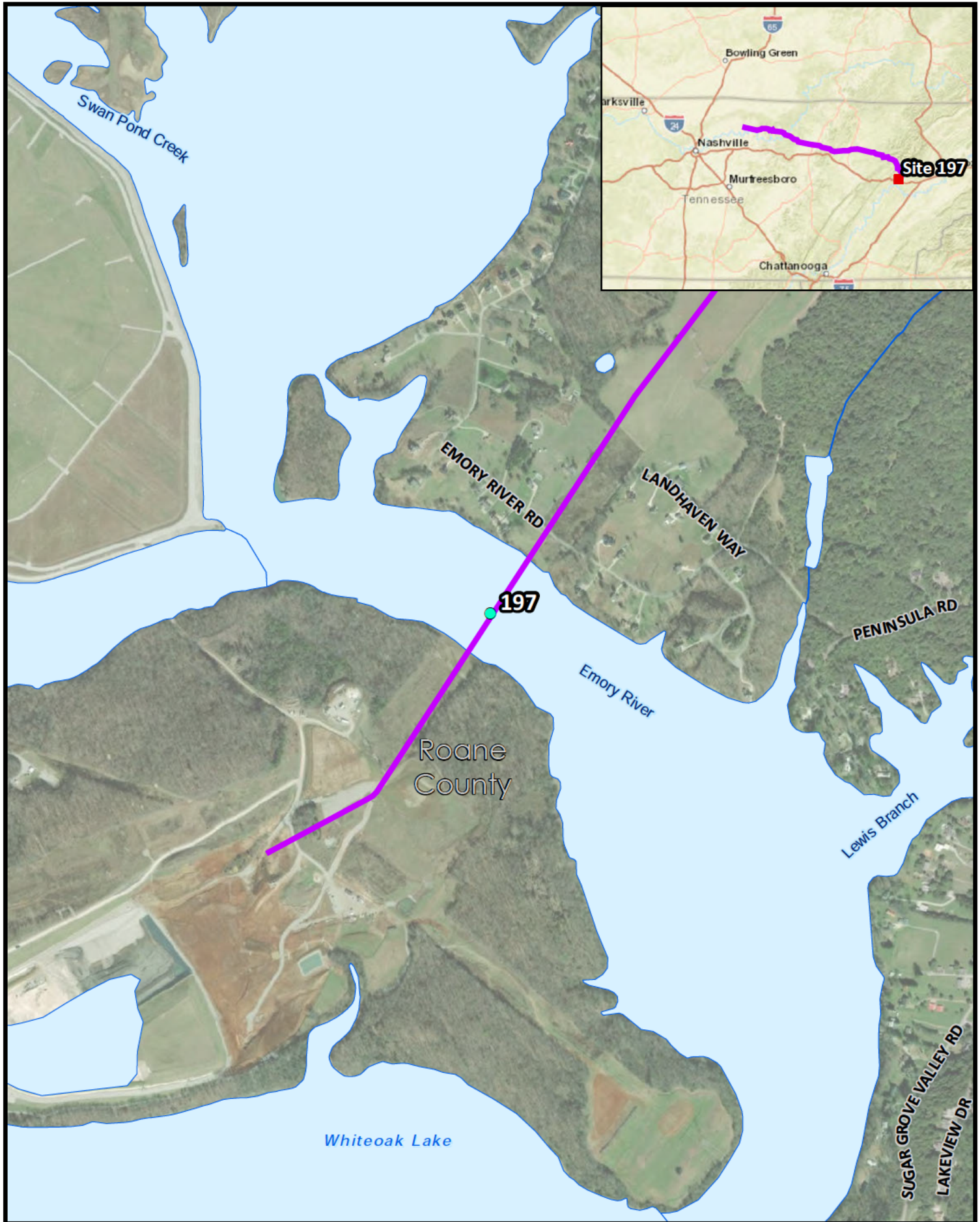
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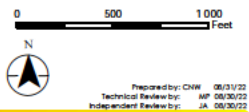
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September 2, 2022

David Pelren

Page 7 of 8

Reference: Proposed Study Plan, Mussel Survey for the Proposed East Tennessee Ridgeline Pipeline Project-

ATTACHMENT B


Federal Collecting Permit

NATIVE ENDANGERED & THREATENED SP. RECOVERY
ENDANGERED & THREATENED WILDLIFE**Permit Number: TE38821A-4**

Effective: 07/02/2019 Expires: 12/31/2021

Issuing Office:

Department of the Interior
U.S. FISH & WILDLIFE SERVICE
Endangered Species Permit Office
5600 American Boulevard, West, Suite 990
Bloomington, MN 55437-1458
permitsR3ES@fws.gov


For
CHIEF - ENDANGERED SPECIES

Permittee:

STANTEC CONSULTING SERVICES
10509 TIMBERWOOD CIRCLE
SUITE 100
LOUISVILLE, KY 40223-2177
U.S.A.

Name and Title of Principal Officer:

GEORGE ATHANASAKES - ECOSYSTEM RESTORATION SERVICES LEADER

Authority: Statutes and Regulations: 16 USC 1539(a), 16 USC 1533(d); 50 CFR 17.22, 50 CFR 17.32, 50 CFR 13.

Location where authorized activity may be conducted:

ON LANDS SPECIFIED WITHIN THE ATTACHED SPECIAL TERMS AND CONDITIONS

Reporting requirements:

ANNUAL REPORT DUE: 01/31

See permit conditions for reporting requirements

Authorizations and Conditions:

- A. General Conditions set out in Subpart B of 50 CFR 13, and specific conditions contained in Federal regulations cited above, are hereby made a part of this permit. All activities authorized herein must be carried out in accord with and for the purposes described in the application submitted. Continued validity, or renewal of this permit is subject to complete and timely compliance with all applicable conditions, including the filing of all required information and reports.
- B. The validity of this permit is also conditioned upon strict observance of all applicable foreign, state, local, tribal, or other federal law. Necessary state and/or local permits where applicable, must also be acquired and observed; this permit is invalid without such permits.
- C. Valid for use by those identified on the List of Authorized Individuals.
- C.1. Authorized Individuals:

Only individuals on the attached List of Authorized Individuals (LAI) are authorized to conduct activities pursuant to this permit. The LAI, printed on U.S. Fish and Wildlife Service (USFWS) letterhead, and signed and dated by the Region 3 permit issuing office or a Region 3 lead species Field Office, may identify special

NATIVE ENDANGERED & THREATENED SP. RECOVERY
ENDANGERED & THREATENED WILDLIFE**Permit Number: TE38821A-4**

Effective: 07/02/2019 Expires: 12/31/2021

Conditions or circumstances under which individuals can conduct authorized activities and it must be retained with these Authorizations and Conditions. Each named individual shall be responsible for compliance with the Authorizations and Conditions of this permit.

Trained assistants not named on the attached LAI may work on permitted activities under the direct and on-site supervision of the individuals named on the LAI. "On-site supervision" is defined as having the Permittee at a distance close enough to enable immediate assistance to a supervised individual, as needed, while the supervised individual conducts an authorized activity. Trained assistants may not work independently at a site.

Permittee shall replace outdated LAIs and attach the subsequent current updated version of the LAI to this recovery permit upon receipt. **This permit will be considered invalid without a current attached LAI.**

- C.2. To request changes to the LAI, the Permittee (Principal Officer for business permits) shall submit written requests to the Service's Midwest Region (Region 3) Permit Coordinator identified in Condition J.1. The request shall be submitted at least 30 days prior to the desired effective date. The Permittee shall submit a \$50.00 processing fee unless fee exempt [see 50 CFR 13.11 (d)], the request should include a desired effective date, shall be signed and dated by the Permittee, and shall include the following information:
- C.2.a. The name of each individual (first name, middle initial, last name) to be appended to the LAI, confirmation that the individual is not permitted under another business or individual Federal recovery permit, and indicate the species they will be working with and the activities they will be conducting;
 - C.2.b. The resume/qualifications of each person, including specific information on previous professional experience working with the species/activity affected by the request. Information should include: the approximate number of hours of focused activity with each species in occupied habitat; approximate numbers of each species the applicant has worked with at each site (i.e., indicate the number specimens at specific sites or specific activities); names, dates, and location of areas surveyed; and experience with similar species;
 - C.2.c. For each individual: the names, titles, organizations, emails, and telephone numbers of a minimum of two references who can verify experience with the species (reference letters are preferred and always appreciated); and
 - C.2.d. The names of any individuals to be deleted from the LAI.

Note: This procedure is **only** for personnel changes to the LAI. For requests to renew/amend this permit, a complete application and appropriate application processing fee must be submitted to the Region 3 Recovery Permits Coordinator. The application Form 3-200-55 may be obtained at www.fws.gov/endangered/permits/how-to-apply.html.

- D. Acceptance of this permit serves as evidence that the Permittee and its authorized agents understand and agree to abide by the terms of this permit and all sections of Title 50 Code of Federal Regulations, Parts 13 and 17, pertinent to issued permits (<https://www.fws.gov/permits/ltr/ltr.html>). Section 11 of the Endangered Species Act of 1973, as amended, provides for civil and criminal penalties for failure to comply with permit conditions.



A request for permit renewal using Application Form 3-200-55 and the \$100 application processing fee must be received **at least 30 days prior to the expiration date** of this permit to continue conducting authorized activities under the expired permit (subject to compliance with reporting requirements), while your application request is being processed. When this requirement is not met, this permit becomes invalid on the expiration date. Unless otherwise instructed within the Authorizations and Conditions, **annual reports are due by January 31** following each year your permit is in effect and shall be submitted to all offices identified in the permit Conditions, as appropriate. The following website link provides the permit application Form 3-200-55 and the mailing address to this office: <http://www.fws.gov/endangered/permits/how-to-apply.html>.

- E. Permittee (as described in condition C. above) is authorized to take Indiana bat (*Myotis sodalis*), gray bat (*M. grisescens*), northern long-eared bat (*M. septentrionalis*), Ozark big-eared bat (*Corynorhinus townsendii ingens*), Virginia big-eared bat (*C. t. virginianus*), listed mussel and fish species identified in Attachment 1, copperbelly water snake (*Nerodia erythrogaster neglecta*), and big sandy crayfish (*Cambarus callianus*) for scientific research aimed at recovery of the species: presence/absence surveys, studies to document habitat use, population monitoring, and evaluate potential impacts as described herein. This permit does not authorize the collection of voucher specimens.
- F. Presence/absence surveys and studies to document habitat use are authorized at the following locations:
- F.1. Locations within Region 3 of the USFWS: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin, upon receipt of written concurrence from Field Supervisor, as outlined in Condition G.
- F.2. Locations within Region 4 of the USFWS: Alabama, Arkansas, Georgia, Louisiana, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee, upon receipt of written concurrence from Field Supervisor, as outlined in Condition G.
- F.3. Locations within Region 5 of the USFWS: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia and West Virginia upon receipt of written concurrence from Field Supervisor, as outlined in Condition G.
- F.4. Locations within Region 6 of the USFWS: Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, and Wyoming, upon receipt of written concurrence from Field Supervisor, as outlined in Condition G.
- F.5. Location within Region 2 of the USFWS: Texas and Oklahoma, upon receipt of written concurrence from Field Supervisor, and upon coordination with Ozark Plateau National Wildlife Refuge prior to 1) surveys of caves known to be used by federally-listed bats, and 2) examinations of caves suspected of containing federally-listed bats species (some presence/absence surveys may require the presence of a U.S. Fish and Wildlife Biologist), as outlined in Condition G.
- G. For all locations specified in Condition F., Permittee shall notify and request site-specific approval from the USFWS Field Supervisor for the state in which activities are proposed to occur at least 15 days prior to conducting any activities. Your notification must be in writing and must indicate:
- G.1. Species for which proposed activities are being conducted.



- G.2. Location of proposed activities, including project site, county, and state.
- G.3. A description of the activities (i.e., surveys, radio-telemetry studies, etc.).
- G.4. Dates when the project is proposed to take place.
- G.5. Evidence that Permittee has received any required contracts to complete the activities.
- G.6. Whether all annual reporting requirements have been fulfilled.
- G.7. You may proceed with activities only upon receipt of written concurrence from the applicable USFWS Field Supervisor. *Your concurrence letter must be carried with this permit to authorize site-specific activities.*
- H. Permittee shall adhere to following conditions involving capture and handling of bats:
- H.1. Activities may be conducted by Stantec Consulting Services personnel as described in Condition C.
- H.2. Bats may be captured with mist nets following the protocol included in the Range-wide Indiana Bat Summer Survey Guidelines. Guidelines are available at: www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html. Note: Permittee must use the most up-to-date version of the Summer Survey Guidelines, available on the USFWS website page, for your summer surveys. The monitoring interval for mist nets is +/- 10 minutes and may not exceed 15 minutes. Captured bats may be held for a maximum of 30 minutes, unless injured. In extenuating circumstances, bats shall be held for no longer than 45 minutes.
- H.3. Bats may be captured with harp traps with written concurrence from the Field Supervisor in the state in which trapping is proposed. Harp traps must be continually monitored. Captured bats may be held for a maximum of 30 minutes, unless injured. In extenuating circumstances, bats shall be held for no longer than 45 minutes.
- At least one Permittee must remain present at each mist-net and harp trap site while it is being operated.**
- H.4. Permittee shall carry out non-intrusive measurements on all captured bats. Data shall be recorded for all bats captured and include, but not be limited to, the data requested in any automated or species specific data sheet provided by the USFWS (e.g., Bat Reporting Spreadsheet). Handling should be limited to the maximum extent practicable and should cease immediately at signs of undue stress (e.g., bat becoming unresponsive, etc.). Bats that appear stressed from handling should be placed in a dark, quiet location away from activity where it can safely fly away after recovery, and should be checked to ensure successful recovery before leaving the study site. Photographs of the identifying characteristics for each individual federally-listed species captured are encouraged. The Permittee may be requested to provide individual photographs after submittal of annual reporting data.
- H.5. Lipped metal bands having a unique identifier may be applied to the forearm of captured bats prior to release. No more than one band per bat may be used. Bands should be applied to the forearm of captured



bats prior to release. Position the band on the wing so that when the bat is hanging upside down, the band numbers are right side up. A single band should be placed on the right forearm of each male and the left forearm of each female bat.

- H.6. Radio transmitters may be applied during spring, summer, and fall roosting and migration periods via nontoxic skin bond adhesive. The total weight of the transmitter may not exceed 5% of the bat's body weight and the total weight of the package (transmitter and adhesive) may not exceed 6% of the bat's body weight. The lightest package (both transmitter and adhesive) capable of accomplishing the required task should be used, especially with pregnant females and newly volant juveniles. Bats carrying transmitters must be monitored daily for at least three days, or until the transmitter falls off, whichever occurs first. ***Although not required as a condition of this permit, in order to gather needed information to promote the conservation of the northern long-eared bat, it is recommended that the permittee radio-track female and juvenile northern long-eared bats captured when conducting mist-netting and radio-tracking of Indiana bats within the white-nose syndrome (WNS) zone of the range of the northern long-eared bat. Specifics on the number of females and juvenile bats to be tracked will be determined in coordination with the appropriate Field Office, as specified in Condition G.***
- H.7. No trapping activities shall occur within 20 meters of a known or potential summer or winter maternity roost site, either natural or artificial roosts, unless Permittee receives prior written approval from the U.S. Fish and Wildlife Service Field Supervisor for the state in which the activities are proposed to occur.
- H.8. Caves, mines, or other suitable hibernation sites may be quietly searched in a manner that minimizes disturbance by utilizing the minimum number of people and time required to complete the survey. Surveys should not be repeated more often than once every other year in any given hibernaculum that is occupied by endangered or threatened bats. Where hibernacula area and safety conditions allow, individuals entering caves are recommended to utilize night vision goggles or red-filtered light and to remain in the cave no more than 90 minutes to complete the work.
- H.9. Equipment used to capture and handle bats shall be cleaned and decontaminated, including personal gear such as boots and gloves, using products cited in decontamination guidelines and in compliance with label directions. The most recent decontamination guidance is found on the web at:
www.whitenosesyndrome.org/topics/decontamination.
- H.10. For the Ozark big-eared bat (*Corynorhinus townsendii ingens*) and Virginia big-eared bat (*C. townsendii virginianus*), the USFWS acknowledges that incidental (unintentional) capture of these co-occurring listed bat species may potentially occur while conducting lawful survey activities directed at authorized bat species. Permittees not authorized to handle Ozark big-eared bats and Virginia big-eared bats shall be observant and cautious to eliminate or minimize "take" of co-occurring listed species to the maximum extent practicable. In the event of incidental (unintentional) capture of Ozark or Virginia big-eared bat, you shall document the capture with a photograph and immediately release at the capture site. Within 48 hours, you must notify the USFWS in the state in which you are working of the incidental capture (see www.fws.gov/midwest/endangered/permits/index.html).
- I. Permittee is authorized to take (only in the context of harass by survey) mussel species identified in Attachment 1 for scientific research aimed at recovery of the species. Permittee shall adhere to the following conditions involving presence/absence surveys for mussel species:



- I.1. Presence/absence studies and surveys to monitor mussel communities shall be conducted by personnel identified in Condition C.
- I.2. Permittee may take (remove from the substrate for identification, data collection and return) mussels by hand via wading, snorkeling, or using divers.
- I.3. Permittee may temporarily hold specimens in mesh bags, either suspended in the water or held in a container containing river water, while awaiting identification and data collection. Specimens may be held for up to 3 hours if they are held in the water in bags that allow free movement of water the mussels were taken from or held in large containers of river water that is replaced every hour [every half-hour when air temperatures are at or above 80° Fahrenheit (F)] with water freshly taken from the water where the mussels were collected. When practicable, specimens held in containers must remain in the shade. Specimens must be returned to the locality from which they were taken. Live specimens that cannot be identified at the site must be photographed for identification purposes.
- I.4. Collection of live mussel specimens must be done only when the air temperature is above 32° F and the water temperature is above 40° F. No collection activities may be conducted when air temperature is above 90° F. Specimens shall be returned to the substrate as follows:
 - I.4.a. For surveys at water temperatures at or above 50° F, mussels may be dropped back into the water after identification.
 - I.4.b. For surveys conducted at water temperatures between 40° and 50° F, mussels must be returned to the substrate, by divers if necessary. Divers must return the specimen to the substrate by hand, placing them on their side and allowing them to burrow on their own. Where the substrate is very compacted cobble, a hole just large enough to receive the animal to a depth of 3/4 its length should be excavated and the mussel placed into it with the siphon (posterior) end up and pointing upstream.
- I.5. All live mussels will be measured (length and height) and, if possible, sexed and aged. No intrusive activities are permitted. Data collected will include descriptions of external morphometry and reproductive status. All specimens of federally listed species - or a representative sample for each species - must be photographed prior to release.
- I.6. No live specimens may be removed from the survey sites, except for specimens encountered in circumstances, which would reasonably be expected to result in stranding due to low or receding water. Such specimens may be moved into deeper water at the survey site, to a suitable location near the survey site, or to an alternative location coordinated with and approved by the appropriate U.S. Fish and Wildlife Field Office in Condition R.
- I.7. The shells of all live specimens collected or captured temporarily must be thoroughly inspected for the presence of zebra mussels (*Dreissena polymorpha*). Unionids with zebra mussels attached must be cleaned by scrubbing prior to returning to the substrate. Document the incidence of zebra mussels and Asiatic clams (*Corbicula fluminea*) at project sites.
- J. Permittee is authorized to take (only in the context of harass by survey) fish species identified in Attachment 1 for



scientific research aimed at recovery of the species. Permittee shall adhere to the following conditions involving presence/absence surveys for fish species:

- J.1. Presence/absence studies and surveys to monitor fish communities shall be conducted by personnel identified in Condition C.
 - J.2. Permittee may hold specimens for a maximum of 15 minutes for photographic documentation and non-intrusive data collection, and release unharmed at the point of capture.
 - J.3. Electrofishing surveys are only authorized by written concurrence of the U.S. Fish and Wildlife Service Field Supervisor for the state in which the activity is proposed.
- K. Permittee shall adhere to the following conditions involving surveys for copperbelly water snake:
- K.1. Activities may be conducted by personnel identified in Condition C., and only by visual searches of habitat to assess habitat quality and to determine presence or absence of copperbelly water snake.
 - K.2. Time searches shall be based on protocol developed and discussed by Bruce Kingsbury (Attachment 2).
 - K.3. Drift fences may also be employed for more quantifiable population estimates.
- L. Upon determination that endangered or threatened species are present at previously undocumented sites, Permittee shall notify the following offices within 48 hours: the U.S. Fish and Wildlife Service Region 3 Office (Condition P.1.), and the USFWS Field Office within the geographic location of study areas (Condition R.).
- M. No injury or mortality is anticipated or allowed as a result of copperbelly water snake surveys. In the event that injury or mortality occurs, all activities must cease. The circumstances of any injury or mortality must be reported in writing within 48 hours to the office listed in Condition P.1., the USFWS Michigan Ecological Services Field Office (Condition R.), and the nearest USFWS Law Enforcement, Special Agent Office (<http://www.fws.gov/offices>). Before you reinitiate studies authorized by this permit, you must receive written authorization from the USFWS Michigan Ecological Services Field Office (Condition R.). Dead or moribund specimens may be retained for further study only with the written permission of the USFWS East Lansing, Michigan Field Office. Any specimens that are not authorized for retention are to be chilled and promptly transferred to the USFWS for potential necropsy and/or contaminants analysis (Condition R.).
- N. Accidental injury and/or mortality of bats, mussels or fish may not exceed two specimens. In the event that any accidental injury or mortality occurs, all activities must cease. The Permittee must immediately report any bat, mussel, or fish mortality or serious injury to the applicable USFWS Field Office in the state in which the incident occurred (contact information provided at: www.fws.gov/midwest/endangered/permits/index.html). Written notification must also be made within 24 hours to the Midwest Regional Permits Coordinator (see Condition P.1.), the Species Recovery Lead (Condition Q., if applicable), and the applicable USFWS Field Office in the state in which the incident occurred (Condition R.). The Permittee's statement must document the cause of the injury or mortality, and identify all remedial measures employed by the Permittee to eliminate future mortality or injury events. Based on consultation between the USFWS offices, decisions will be made regarding remedial measures that will be implemented and whether and/or when any of the authorized activities may continue. The Species Recovery Lead Office will provide a decision within five (5) business days concerning the disposition of

NATIVE ENDANGERED & THREATENED SP. RECOVERY
ENDANGERED & THREATENED WILDLIFE

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any injured or dead specimen. Dead or moribund bats may be retained for further study only with the written permission of the USFWS. Any bats that are not authorized for retention are to be chilled and promptly transferred to the USFWS Species Recovery Lead for potential necropsy and/or contaminants analysis. Permitted activities may resume upon receipt of written approval from the Species Recovery Lead Office.

- O. An annual report of activities conducted under the authority of this permit is due by January 31 each year the permit is in effect. In addition, copies of all reports and publications resulting from data obtained under this permit must be submitted as they become available. Failure to furnish any reports required by this permit is cause for permit revocation and/or denial of future permit applications. At a minimum, your report must include:
- O.1. The date, time, and geographic locations (including datum and projection information), of all specimens encountered as well as all data collected on the individuals (i.e., age, sex, and weight).
 - O.1.a. A completed data collection sheet as found on the Range-wide Indiana Bat Summer Survey Guidelines website page, cited in Condition H.2., and band numbers of all bats banded.
 - O.1.b. Data shall be submitted for all bats captured and include, but not be limited to, the data requested in any automated or species-specific data sheet provided by the USFWS (e.g., the data collection sheets found on the current Rangewide Indiana Bat Summer Survey Guidelines website page cited in Condition H.2., or other species specific data sheets). Photographs of the identifying characteristics for each individual federally-listed species captured are encouraged. The Permittee may be requested to provide individual photographs after submittal of annual reporting data.
 - O.2. A description of locations surveyed for threatened/endangered species where no specimens were encountered.
 - O.3. Location and characteristics of bat roost trees and bat colonies.
 - O.4. Information on any injuries and/or mortalities and disposition of specimens.
 - O.5. Copies of any separate reports and/or publications resulting from work conducted under the authority of this permit.
 - O.6. Copies of all site-specific authorization letters required under Condition G.

If no activities occurred over the course of the year, indication of such shall be submitted as an annual report.

- P. Copies of your reports shall be sent to **all applicable offices** indicated below. Your transmittal letter (or email) must cite your Federal permit number. Electronic copies shall be submitted in MS Word, Portable Document Format, Rich Text Format, or other file format that is compatible with the receiving office (**thumb drives/flash drives cannot be accepted**).
- P.1. Regional Recovery Permit Coordinator
U.S. Fish and Wildlife Service - Midwest Region (Region 3)
Ecological Services - Endangered Species
5600 American Blvd. W., Suite 990



Bloomington, Minnesota 55437-1458
(612/713-5343; fax 612/713-5292)
permitsR3ES@fws.gov

- P.2. Regional Recovery Permit Coordinator
U.S. Fish and Wildlife Service - Southwest Region (Region 2)
Endangered Species Permits Office
P.O. Box 1306
Albuquerque, New Mexico 87103-1306
(505/248-6420; fax 505/248-6788)
permitsR2ES@fws.gov
- P.3. Regional Recovery Permit Coordinator
U.S. Fish and Wildlife Service - Southeast Region (Region 4)
Endangered Species Permits Office
1875 Century Blvd.
Atlanta, Georgia 30345-3301
(404/679-7097; fax 404/679-7081)
permitsR4ES@fws.gov
- P.4. Regional Recovery Permit Coordinator
U.S. Fish and Wildlife Service - Northeast Region (Region 5)
Endangered Species Division
300 Westgate Center Drive
Hadley, Massachusetts 01035-9589
(413/253-8212; fax 413/253-8482)
permitsR5ES@fws.gov
- P.5. Regional Recovery Permit Coordinator
U.S. Fish and Wildlife Service - Mountain-Prairie Region (Region 6)
Endangered Species Permits Office
Denver Federal Center, P.O. Box 25486
Denver, Colorado 80225-0489
(303/236-4224; fax 303/236-0027)
permitsR6ES@fws.gov

Q. Additionally, based on species, reports and publications shall be submitted to the following:

- Q.1. *For studies involving gray bat:*
Shauna Marquardt
U.S. Fish and Wildlife Service
Missouri Field Office
101 Park DeVille Drive, Suite A
Columbia, Missouri 65203-0007
(573/234-2132; fax 573/234-2181)

- Q.2. *For studies involving Indiana bat:*



Lori Pruitt
U.S. Fish and Wildlife Service
Indiana Field Office
620 S. Walker Street
Bloomington, Indiana 47403-2121
(812/334-4261; fax 812/334-4273)

Q.3. *For studies involving northern long-eared bat:*

Jill Utrup
U.S. Fish and Wildlife Service
Minnesota-Wisconsin Field Office
4101 American Blvd. E.
Bloomington, Minnesota 55425-1665
(952/252-0092; fax 952/646-2873)

Q.4. *For studies involving Ozark big-eared bat:*

Richard Stark
U.S. Fish and Wildlife Service
Ozark Plateau National Wildlife Refuge
9014 East 21st Street
Tulsa, Oklahoma 74129
(918/382-4520; fax 918/581-7467)

Q.5. *For studies involving Virginia big-eared bat:*

Barbara Douglas
U.S. Fish and Wildlife Service
Ecological Services Field Office
90 Vance Drive
Elkins, West Virginia 26241
(304/636-6586 x19; fax 304/636-7824)

R. Additionally, based on geographic area, reports and publications shall be submitted to the applicable offices under "For Fish and Wildlife Permit Holders" at: www.fws.gov/midwest/endangered/permits/index.html.

cc: FWS/Regions 2, 4, 5, and 6 (Attn: Recovery Permits Coordinator)
FWS, TE Coordinators for IL, IN, IA, MI, MN, MO, OH, and WI
DNR/DOC, TE Administrator/Coordinators for IL, IN, IA, MI, MN, MO, OH, and WI

END



United States Department of the Interior

FISH AND WILDLIFE SERVICE

5600 American Boulevard West, Suite 990
Bloomington, Minnesota 55437-1458



IN REPLY REFER TO:

FWS/AES-TE

LIST OF AUTHORIZED INDIVIDUALS

TE38821A-4

George Athanasakes (Principal Officer)

July 9, 2019

C.1. Individuals authorized to independently conduct activities under this permit:

- The following individuals are authorized for all activities described for Indiana bat (*Myotis sodalis*), gray bat (*M. grisecens*), northern long-eared bat (*M. septentrionalis*), Ozark big-eared bat (*Corynorhinus townsendii ingens*), and Virginia big-eared bat (*C. t. virginianus*): David Saugey, Joseph Johnson, Lindsay Wight
- The following individuals are authorized for all activities described for gray bat, Indiana bat, and northern long-eared bat only: Wes Cunningham and Lynda Mills
- Cody Fleece is authorized to conduct all activities described for listed mussels and fish species, with the exception of Kentucky arrow darter (*Etheostoma spilotum*).
- Daniel Symonds is authorized to conduct all activities described for listed mussels.
- James Kiser is authorized to conduct all activities described for listed bats, fish, mussels, copperbelly water snake (*Nerodia erythrogaster neglecta*) and big sandy crayfish (*Cambarus callainus*).
- Douglas Stephens is authorized to conduct all activities described for listed bats, fish, and mussels.

Unnamed trained assistants may conduct activities pursuant to this permit only under the direct and on-site supervision of an above-named individual. "On-site supervision" is defined as having the permittee at a distance close enough to enable immediate assistance to a supervised individual, as needed, while the supervised individual conducts an authorized activity. **At least one named permittee must remain present at each mist-net site while it is being operated.**

Acting for George Athanasakes
Chief, Division of Endangered Species

7/9/2019
Date

This List of Authorized Individuals (LAI) is valid only when it is dated on or after the permit issuance date. Federal Permit TE38821A-4 will be considered invalid without this LAI.

Attachment 1: TE38821A-4 (Stantec Consulting Services)
Fish and Freshwater Mussel Species Covered by Permit

Fish Species	
Scientific Name	Common Name
<i>Etheostoma chienense</i>	Relict darter
<i>Etheostoma percnurum</i>	Duskytail darter
<i>Etheostoma spilotum</i>	Kentucky arrow darter
<i>Notropis albizonatus</i>	Palezone shiner
<i>Phoxinus cumberlandensis</i>	Blackside dace
<i>Scaphirhynchus albus</i>	Pallid sturgeon

Freshwater Mussel Species	
Scientific Name	Common Name
<i>Alasmodonta atropurpurea</i>	Cumberland elktoe
<i>Conradilla caelata</i>	Birdwing pearlymussel
<i>Cumberlandia monodonta</i>	Spectaclecase
<i>Cyprogenia stegaria</i>	Fanshell
<i>Dromus dromas</i>	Dromedary parlymussel
<i>Epioblasma brevidens</i>	Cumberland combshell
<i>Epioblasma capsaeformis</i>	Oyster mussel
<i>Epioblasma florentina walkeri</i>	Tan riffleshell
<i>Epioblasma obliquata obliquata</i>	Purple catspaw
<i>Epioblasma torulosa rangiana</i>	Northern riffleshell
<i>Epioblasma triquetra</i>	Snuffbox
<i>Fusconaia cuneolus</i>	Finerayed pigtoe
<i>Fusconaia cor</i>	Shiny pigtoe
<i>Hemistena lata</i>	Cracking pearlymussel
<i>Lampsilis abrupta</i>	Pink mucket
<i>Lampsilis higginsii</i>	Higgins eye
<i>Obovaria retusa</i>	Ring pink
<i>Pegias fibula</i>	Littlewing pearlymussel
<i>Plethobasus cicatricosus</i>	White wartyback pearlymussel
<i>Plethobasus cyphus</i>	Sheepnose
<i>Pleurobema clava</i>	Clubshell
<i>Pleurobema plenum</i>	Rough pigtoe
<i>Pleurobema dolabellodes</i>	Slabside pearlymussel
<i>Potamilus capax</i>	Fat pocketbook
<i>Ptychobranhus subtentum</i>	Fluted kidneyshell
<i>Quadrula cylindrica cylindrica</i>	Rabbitsfoot
<i>Quadrula cylindrica strigillata</i>	Rough rabbitsfoot
<i>Villosa fabalis</i>	Rayed bean
<i>Villosa perpurpurea</i>	Purple bean
<i>Villosa trabilis</i>	Cumberland bean

PROTOCOL FOR COPPERBELLY SURVEYORS

The following guidelines are being distributed to all those working on the surveys for the Copperbelly Water Snake Conservation Agreement, or who are conducting other surveys and wish to follow the same protocol. If there are questions regarding any aspect of this protocol, contact Bruce Kingsbury, Department of Biology, Indiana-Purdue University, Fort Wayne, IN 46805-1499, 219-481-5755 (W), 219-486-6300 (H), (219) 437-6876 (M), kingsbur@ipfw.edu.

Replicate surveys. You have been assigned a set of survey sites, and an approximate order in which to survey them. You must conduct the surveys in the assigned order: other surveyors will be visiting the same sites at other times. Sites that have already been visited will have the general path of the survey determined. However, if you are the first one on the site, you will have the responsibility of defining the path and length of the transect. Check your maps and directions to determine what you need to do. When delineating a transect, keep the following points in mind. The goal for survey duration is two hours, although the survey does not have to be exactly that. Care should be taken to avoid overlapping the same transect line (i.e., going around a wetland and crossing over where you've already been) or flushing snakes, thus risking the potential of counting the same snakes twice. Once a new transect has been delineated, details should immediately be relayed to Bruce Kingsbury for transmittal to other surveyors.

Presence/Absence surveys. P/A surveys are opportunistic in nature, and have no formal structure. Potential areas for these surveys are indicated on some of your maps, but you will very likely see other areas of interest. The main goal of these surveys is to establish if copperbellies or other *Nerodia* (I) are present. We are also particularly curious about other species such as mud snakes (*Farancia*) and cottonmouths (*Agkistrodon*), as these are unusual finds. Scouting out areas and searching under things such as trash or boards can be informative. If you are at a good chunk of habitat and can do a replicate-style survey, use the data form for those surveys. A brief examination of a site does not require strict adherence to filling out all of the details on the data sheet- but if you plan to survey the site for an extended time, the additional information would be useful. If you think that you have found a future replicate survey site, please communicate this right away to Bruce Kingsbury. You should also report opportunistic surveys that produced no copperbellies, as negative information is also useful. Also, please be sensitive to concerns about trespassing.

Surveys will be conducted by traveling the survey path (transect) and counting the snakes seen over a known time and estimated distance. Surveyors should move slowly and cautiously with frequent stops (pauses) of one or more minutes to scan both sides of the transect for snakes. The duration of pauses is left to the discretion of the surveyor, but should be long enough to allow careful examination of the field of view before moving on. An initial suggestion for distance to move between pauses is 10 paces. Transect length will be approximated as accurately as possible using the

corresponding topo map. The time will be recorded at the beginning and end of the transect, as well as each time the habitat type, as defined by the habitat classification below, changes. Habitat classification should default to the more open habitat when a decision must be made between two types. If you are walking along a shrub/scrub vs. palustrine forest boundary, you are surveying shrub/scrub. To minimize the impact of inclement weather, surveys will only be conducted on partly sunny days of at least 70 F, or sunny days between 65-90 F, to maximize chance of seeing the snakes out basking and traveling. Also, as the weather turns hot, observations will be made in early morning and late afternoon to avoid hot temperatures that drive the snakes to cooler microhabitats.

Copperbellies are very mobile and can be found in all sorts of habitat. However, empirical evidence shows that copperbellies prefer 1) the edge habitat between open canopy areas, such as shrub-scrub wetlands, and forest, to bask and rest, and 2) extremely shallow waters (<15 cm (6")), to forage. They do not spend much time in open, deep water (>30 cm), or fast moving water. However, they commonly seen basking on platforms over deep water, and will not hesitate to swim across open water. They are not as easily found in forest, but sometimes can be found at pools of water. Surveyors are most likely to find stationary snakes basking on horizontal surfaces just above the water, such as on nearly sunken logs or branches, or a little higher on living branches of bushes such as buttonbush (*Cephalanthus occidentalis*). Foraging snakes may be seen cruising shorelines. Ripples on the water's surface may also indicate the presence of a foraging or traveling snake, and should be investigated.

Equipment. Surveyors should always bring binoculars and use them. They are vital for examining complex habitats such as brush, and for properly identifying snakes to species. A watch is needed for timing transects. If you are marking a new transect, you will need flagging tape and markers. A compass is also handy, especially for the directionally challenged. A thermometer is needed as well, and we can provide one for you if needed. Surveyors will need to consider footwear. Hip or chest waders may keep you dry, but are tiring to wear for any length of time, and can get hot. Pull-on farm boots work okay unless there is any flooding. Once the water has warmed, I just go ahead and get wet, wearing "Army" boots to protect my feet. Use pencil to keep your notes- pen will smear and run if it gets wet, erasing your data. Ziplock bags are good for keeping things dry.

Data Sheet Explanation

At the top of the data sheet, *Date*, *Site ID Code & Name* (provided for you), *Surveyors*, and *Weather Summary (Beg.)* comments are filled out prior to beginning the survey. *Start* time is entered when the survey actually begins. *Finish* time is entered when the survey is suspended. Times should be recorded in military time (1200 is 12 noon, 1400 is 2PM). *Weather Summary (End)* is for indicating what things are like when you stop.

Initial and final temperatures should be taken in the sun, shade, and water. The sun (in nearest opening in canopy) and shade (under nearest canopy) temperatures should be taken at waist height with no direct light hitting the instrument (use your body or hand to block light from striking the thermometer bulb). Water temperatures should be taken approximately 5 cm below the surface. Keep in mind that a wet bulb will give a cooler temperature than a dry bulb. Substantive changes in the weather should be indicated on data rows between observations.

Transect length is the best estimate of the transect length based on your route and the scale on your map. Length should be recorded in kilometers. *Travel method* would be foot or boat. Additionally, a line is provided to *summarize* your observations: number of each species observed.

Data: The codes for data entries are described in the survey code descriptions provided below. The last column (*Comm*) is for a reference number for additional comments in the space at the bottom of the page. Additional comments could also be made on the back. Surveyor comments will be used to help establish habitat extent and quality throughout the range of the snake, so surveyors are encouraged to make note of their surroundings (including apparent condition of water). You might also comment on directions to the site. Weather comments would include cloud cover, wind, etc. In the field, comments can also be inserted on the data row(s) beneath the relevant observation. If habitat changes during the length of the transect, times and lengths of subtransects should be recorded by habitat. *Time* is when you start a new habitat classification, *elapsed time* is the total time surveying that habitat. *Species* of snake is coded: at least all *Nerodia* should be included. *Age* is the apparent age class of the snake. *Behavior* is the activity of the snake at time of observation.

Three distances are recorded: *Trans* is the distance from the transect line to the snake (perpendicular distance to you). *Shore* is the distance the snake is from shore (distance to shore will be negative for terrestrial observations). A range-finder is useful here, and we can provide you with one if you request it. Since the transect line may be the shore in a shoreline survey, *Trans* and *Shore* may be the same value. *Vertical* is the distance above the substrate. All measurements should be in meters, not yards.

Habitat and *Microhabitat* are coded as indicated in the attached habitat classification (based on a simplification of Cowardin et al.'s wetland classification system). Code should be strictly adhered to, and deviation from the code should be well-documented with comments. *In sun* asks whether or not the snake is in direct sunlight (Y/N).

Final comments: pursuit of individual snakes may not only be illegal for some surveyors, but will also disrupt the continuity of the survey. Snakes should be approached only to the extent that species identification is certain. Lastly, if you have any suggestions for improvement of the survey, feel free to let me know.

SURVEY CODE DESCRIPTIONS

Habitats

This classification was designed to be suitable for studying habitat use by the copperbelly water snake. It is intended to be relatively compatible with the National Wetlands Inventory (NWI) classification developed by Cowardin et al. (1979). Habitat is a large-scale measure: If a habitat area cannot be mapped discretely on a topographic map, it should be incorporated into a neighboring habitat type.

SYSTEM	SUBSYSTEM	CODE	DESCRIPTION
<i>Aquatic Habitats</i>			
Palustrine- shallow (0<2m) water wetlands without extensive open water: vegetated with some trees, shrubs, or emergent vegetation			
	Forested	PF	-floodplain forest, with greater than 30% canopy cover by trees
	Scrub-shrub	PS	-shrub-scrub cover exceeds 30%, but tree cover does not
	Emergent	PE	-emergent vegetation present (cats, etc.) but not enough shrubs to be PS
	Open water	PO	-open water of palustrine system

Note: moist soil units should be commented as such, but would be classified as PE or PO.

Lacustrine- deep water (>2m) wetlands such as large ponds and lakes, lacking emergent vegetation except near shore. The limnetic (deep water) portion of a lacustrine system is termed as LD, while the littoral zone (shoreline zone) will follow the palustrine subsystem, substituting L for P: LF, LS, LE, LO.

Riverine- flowing water all or part of the year. Pooled water in partially dried river is still riverine.			
	Lower perennial	RL	- slow moving stream- muddy or silty bottom, water usually present
	Upper perennial	RU	- faster flowing stream- rocky or cobbly bottom, water usually present
	Intermittent	RI	- only temporarily running

Upland Classification

Just in case you find yourself with dry feet...

Forest-	UF	- greater than 30% canopy cover by trees, elevated above any potential flooding by sloping topography
Scrub-Shrub	US	-not forest, but >30% cover by shrubs such as berry bushes, willows, crab-apples and hawthorns.
Oldfield	OF	-fallow fields well-covered with herbaceous or grassy cover. CRP lands would often be included here.

Agricultural-is highly disturbed, and includes activities such as farming, substantial grazing, and repeatedly mowed areas

Crops	AC	-farm fields, croplands
Grazed	AG	-grazed or mowed areas

Residential	RS	-all space used for living by people
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Microhabitat Classification

Microhabitat classification is somewhat similar to habitat, but on a smaller scale. Its use as a category allows the specific position (substrate) of the animal to vary to some degree from its general surroundings.

Shrub	-up in a bush
Tree	-up in a tree
Grass	-in a patch of grass
Rock	-on a rock or rocks
Log	-on a log
Herbaceous	-in a patch of herbs
Water	-in the water
Barren (soil)	-on bare soil
Island	-on a small hummock
Detritus	-on leafy debris, such as leaves

Behavioral Classification

Basking	-at rest in sunny location
Resting	-resting in non-basking position
Courting	-male pursuing female, female, being pursued by male
Mating	-actually copulating (much less likely than courting)
Foraging	-moving slowly and methodically through shallow water or on shore
Traveling	-moving continuously in linear path, with little investigative behavior along the way
Unknown	-behavior ambiguous or snake disturbed before behavior observed: <i>something that happens all the time!</i>

Miscellaneous

Species- N- copperbelly (*N.e. neglecta*), D- diamondback (*N. rhombifera*), M- midland (*N. sipedon*), Y- yellowbelly water snake (*N. e. flavigaster*), F- mud snake (*Farancia abacura*), A- cottonmouth (*Agkistrodon piscivorus*), U-unknown

Canopy- Tree and shrub canopy cover in the general vicinity of the snake (ca. within 10 m radius) should be characterized as:
 1=sparse: little or no cover,
 2=moderate: forest margin or broken canopy as at treefall or in select cut woods,
 3=complete: complete or nearly complete.

Age- Three categories:
 Y=juvenile: young of the year, retaining juvenile striped color pattern;
 S=subadult: adult coloration, or nearly so, but not yet having attained lg. adult body size;
 A=adult: large-bodied, classic copperbelly coloration.

September 2, 2022

David Pelren

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Reference: Proposed Study Plan, Mussel Survey for the Proposed East Tennessee Ridgeline Pipeline Project-

ATTACHMENT C

Key Personnel

CURRICULUM VITAE

Don W. Hubbs

Mollusk Recovery Coordinator
Tennessee Wildlife Resources Agency
Office: 3905 Hwy 641 South
Post Office Box 70, Camden, TN 38320
(b) (6)

ACADEMIC PREPARATION:

M.S. in Biology, (b) (6), Tennessee Technological University

Concentrations: Fisheries Science, Environmental Science

Thesis: Assessment of Spawning Habitat of Lake Trout (Salvelinus namaycush) and Muskellunge (Esox masquinongy) in Dale Hollow Reservoir

Advisor: Dr. R. Don Estes

Dr. David Stansbery, Ohio State University Museum - Malacology course taught at Tennessee Tech Aqua Field Station July 1987

B.S. in Wildlife Management, (b) (6), Tennessee Technological University

Concentrations: Wildlife and Fisheries Management

Minor: French

RESEARCH SKILLS and CERTIFICATIONS:

- Aquatic habitat survey and evaluation techniques
- Scientific Diver Certified, 2013 Scuba Educators International
- DRAM Certified (Dive Rescue and Accident Management), 2012, Scuba Educators International
- SCUBA Diver Certified, Advanced Open Water, Search and Recovery, 1999, NASE
- SCUBA Diver Certified, Open Water I, 1992, NAUI
- American Heart Association Basic Life Saver, CPR & AED and O2 admin. 1995-2019
- Experienced surveyor of fish populations employing entanglement and electro-fishing gear
- Experienced operator of boats of various types and sizes

- Experienced surveyor of freshwater mussel populations in small streams to large rivers and reservoirs
- Design and implementation of mussel propagation techniques and systems

PROFESSIONAL EXPERIENCE:

Wildlife Biologist 3, 1992- February 2020, Fisheries and Environmental Services Divisions, Tennessee Wildlife Resources Agency Nashville, TN. Freshwater mussel recovery program coordinator responsible for data collection and analysis, report preparation, management recommendations, and strategic planning process of Tennessee's freshwater mussel resources. Coordinated TWRA's annual mussel restoration activities that began in 2004, and in the last 12 years, supervised the stocking of ~60,000 mussels of 35 species including 11 federal endangered mussel species into 11 rivers at 20 different sites. Additional duties include monitoring of mussel populations, research and survey design, proposal development and execution to achieve strategic plan objectives concerning freshwater mussels. Serve as a member and chairman of TWRA's scientific dive team, experienced in underwater diving in rivers and reservoirs where water depths and/or velocities preclude hand collecting. SCUBA and surface supplied air systems are used to perform freshwater mussel surveys and aquatic habitat evaluations in water depths of one to twenty-five meters. A variety of equipment is used to assure safety and efficiency during sampling including: two-way radio communication between diver and support craft, diver tending lines, and sampling transect lines. Participate in various fishery research projects along with other statewide fish research biologists.

Senior Staff Scientist/Geographic Information System Manager, 1988-1992 Young-Morgan & Associates/Woodward & Clyde Consultants, Franklin, TN. Project Manager of endangered freshwater mussel surveys in Tennessee and Virginia associated with the TVA Duck River Columbia Dam project. Additional responsibilities included: completing benthic, mussel and fish population surveys and data analysis from Superfund, RI/FS, CERCLA and monitoring sites in Virginia, Iowa, Indiana, Tennessee, Kentucky, South Carolina, Louisiana and New York. Managed pcARC/INFO geographic information system (GIS) production of digital map databases for habitat modeling, land use analysis, fish movement studies, and contaminant monitoring.

Research Assistant. 1986-1988. Tennessee Technological University Cooperative Fishery Research Unit, Cookeville, TN.

- Developed geographic information system model of fish spawning habitat in Dale Hollow Reservoir
- Assisted fellow students collecting data on stream, river and reservoir fishery evaluation surveys

Fisheries Intern. Tennessee Valley Authority (TVA) Land Between the Lakes Golden Pond, KY. Summer 1985.

- Conducted channel catfish (*Ictalurus punctulatus*) cage culture demonstration project
- Assisted fishery biologists with pond seine surveys, reservoir rotenone surveys
- Assisted graduate student with collection of paddlefish (*Polyodon spatula*) for age and growth analysis

PUBLICATIONS:

Otter RR, McKinney D, Brown B, Lainer S, Monroe W, Hubbs D, Read B.

Bioaccumulation of metals in three freshwater mussel species exposed in situ during and after dredging at a coal ash spill site (Tennessee Valley Authority Kingston Fossil Plant).

Environ Monit. Assess. 2015 Jun; 187(6):334. doi: 10.1007/s10661-015-4578-3. Epub 2015 May 9.

Jones, J., S. Ahlstedt, B. Ostby, B. Beaty, M. Pinder, N. Eckert, R. Butler, D. Hubbs, C. Walker, S. Hanlon, J. Schmerfeld, and R. Neves. 2014. **Clinch River freshwater mussels upstream of Norris Reservoir, Tennessee and Virginia: A quantitative assessment from 2004 to 2009.** Journal of the American Water Resources Association 50(4):820-836

Bettoli, P.W., G.D. Scholten and D. W. Hubbs. 2010. **Anchoring Submersible Ultrasonic Receivers in River Channels with Stable Substrate.** *North American Journal of Fisheries Management* 2010; 30: 989-992 doi: 10.1577/M10-015.1

Jones, J.W., R.J. Neves, S.A. Ahlstedt, D.W. Hubbs, and M. Johnson, H. Dan and B.J.K. Ostby. 2009. **Life History and Demographics of the Endangered Birdwing Pearlymussel (*Lemiox rimosus*) (*Bivalvia: Unionidae*).** *The American Midland Naturalist* 163:335-350.

D.W. Hubbs, D. McKinney, D. Sims, S. Lanier and P. Black. 2006. **Aggregate Extraction Impacts on Unionid Mussel Species Richness and Density.** *Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies* 60:169–173.

Ahlstedt S. A., S. Bakaletz, M. T. Fagg, D.W. Hubbs, M. W. Treece, and R. S. Butler. 2004. **Current status of freshwater mussels (*Bivalvia: Unionidae*) in the Big South Fork National River Recreation Area of the Cumberland River and Recreation Area of the Cumberland River, Tennessee and Kentucky (1999–2002). Evidence of faunal recovery.** 2003–2004, *Walkerana* 14(31): 33–77.

Ahlstedt, S. A., J. R. Powell, R. S. Butler, M. T. Fagg, D.W. Hubbs, S. F. Novak, S. R. Palmer, and P. D. Johnson. 2004. **Historical and current examination of freshwater mussels (Bivalvia: Margaritiferidae, Unionidae) in the Duck River basin Tennessee.** Final Report: Tennessee Wildlife Resources Agency, Nashville, TN. Contract No.: FA-02-14725-00. 213p.

Ahlstedt, S. A., J. R. Powell, D. W. Hubbs, and D. Sims. 2002. **Assessment of freshwater mussels in the Harpeth and East Fork Stones River, Tennessee.** Final Report: Tennessee Wildlife Resources Agency, Nashville TN and U.S. Fish and Wildlife Service, Asheville, NC. 7p.

D. W. Hubbs. 1998. **Augmentation of natural reproduction by freshwater mussels to sustain shell harvests.** Pages 49-51 in Tankersley, R.A., D.I. Warmolts, G.T. Watters, B.J. Armitage, P.D. Johnson, and R.S. Butler (editors). © 2000. Freshwater Mollusk Symposia Proceedings. Ohio Biological Survey, Columbus, Ohio. xxi + 274.

RESEARCH SUBMITTED IN PREPARATION AND RECENT REPORTS:

Inherent variability in the freshwater mussel *Fusconaia ebena*: A reference site meta-analysis

Ryan R. Otter¹, Amber Hills¹, David M Simms², Susan Lainer², Don Hubbs², David McKinney². ¹Department of Biology, Middle Tennessee State University, Murfreesboro TN USA. ²Tennessee Wildlife Resources Agency, Nashville TN USA.

2019 TWRA Annual Mussel Recovery Activity Report for Project 7775. D Hubbs. Tennessee Wildlife Resources Agency, Nashville TN USA.

2019 Clinch River Dive Survey for Federal and State Protected Mussel Species. United States Fish & Wildlife Service Asheville, NC Field Office Grant Award F18AP00734. Tennessee Wildlife Resources Agency, Nashville TN USA.

2018 TWRA Annual Mussel Recovery Activity Report for Project 7775. D Hubbs. Tennessee Wildlife Resources Agency, Nashville TN USA.

2017 TWRA Annual Mussel Recovery Activity Report for Project 7775. D Hubbs. Tennessee Wildlife Resources Agency, Nashville TN USA.

2016 TWRA Annual Mussel Recovery Activity Report for Project 7775. D Hubbs. Tennessee Wildlife Resources Agency, Nashville TN USA.

2015 Duck River Quantitative Mussel Survey. D Hubbs. Tennessee Wildlife Resources Agency, Nashville TN USA.

CURRENT RESEARCH INTERESTS:

Design, setup, and operation of freshwater mussel propagation facilities
Stocking and translocation as conservation techniques for freshwater mussels

Freshwater mussel population survey and monitoring

PROFESSIONAL MEMBERSHIPS:

Mississippi Interstate Cooperative Resource Association

Freshwater Mollusk Conservation Society, founding member (1998)

American Fisheries Society, Tennessee Chapter

Divers Alert Network

PROFESSIONAL SERVICE:

Chair (since 2001) Native Mussel Committee, Mississippi Interstate Cooperative Resource Association

Chair (since 2012) TWRA Scientific Dive Control Board

Chair (since 2011) Tennessee Endangered Mollusk Committee

Past President (2007) Tennessee Chapter American Fisheries Society

James Kiser

Senior Environmental Scientist
32 years of experience · Louisville, Kentucky

James has more than 3 decades of ecological and environmental services experience. He has conducted numerous endangered species surveys and habitat assessments throughout the eastern United States. He understands how the Endangered Species Act (ESA) is implemented and how to streamline the process while maintaining integrity and insuring protection of listed species. He has completed both informal and formal consultation with the US Fish and Wildlife Service on projects involving Indiana bats, gray bats, Virginia big-eared bats, and endangered freshwater mussels. He has published several papers and presented oral papers at scientific meetings on small mammals and bats. James is proficient in the use of various field techniques (e.g., Anabat II echolocation detectors, mist net and harp trap surveys, radio telemetry, hibernacula surveys, bat banding, emergence counts, and habitat analysis) to investigate the presence, distribution, and habitat use of endangered bats. He has also conducted freshwater mussel surveys in both deep water and wadeable aquatic habitats. Since 1990, James has focused much of his time conducting surveys for the federally endangered Indiana bat. These efforts have been extensive, resulting in more than 1,000 nights of mist netting in 16 eastern and midwestern states. Much of this effort was for ESA compliance on development projects. In recent years he has also conducted many freshwater mussel surveys in some of North America's best remaining rivers, including the Green, Licking, Ohio, and Tennessee rivers in Kentucky; Clinch and Powell rivers in Tennessee and Virginia; and Stillwater and Ohio rivers in Ohio.

EDUCATION

MS, Biology, Coursework Completed, Eastern Kentucky University, Richmond, Kentucky, (b)

BS, Biology, Morehead State University, Morehead, Kentucky, (b)

CERTIFICATIONS & TRAINING

West Virginia Approved Mussel Surveyor, West Virginia Department of Natural Resources, Various Locations, 2012

TE38821A-1, Federal Bat & Mussel Permit, United States Fish & Wildlife Service, Kentucky, 2014

PROJECT EXPERIENCE

AQUATIC ECOLOGY

Freshwater Mussel Survey on Green River at Rush Island Watershed and Wildlife Conservation Area | Hart County, Kentucky | Aquatic Biologist

During the autumn of 2015, James conducted a freshwater mussel survey for Kentucky Division of Water along a 1-mile section of the Green River, Hart County, Kentucky. The purpose of this survey was to inventory all species of mussel occurring within this section of river with an emphasis on endangered species. James was responsible for preparing and coordinating a survey plan with state and federal agencies, locating and identifying mussels, and reviewing the final report. He along with fellow biologists found more than 750 mussels in two days of effort, representing 28 species. These mussels included the endangered fanshell (*Cyprogenia stegaria*) and sheepnose (*Plethobasus cyphus*).

Freshwater Mussel Rescue for the West Milton Dam Removal | Stillwater River, Miami County, Ohio | Aquatic Biologist

During the autumn of 2014, James conducted a freshwater mussel rescue on the Stillwater River during the removal of the West Milton Dam, Miami County, Ohio. James was responsible for leading a team, rescuing and identifying stranded freshwater mussels that were left in shallow water, on drying gravel/sand bars and mud flats in the Stillwater River as the dam was being removed. He found 10 of the 15 live federally endangered snuffbox (*Epioblasma triquetra*) mussels, and was responsible for temporarily stopping construction once the number of mussels allowed by the "Incidental Take Statement" outlined in the Biological Opinion was obtained. James helped collect, identify and relocate approximately 3,000 freshwater mussels, representing 15 species during this two week long effort.

Endangered Mussel Survey – Ellick Road Improvement Project | East Fork Little Miami River, Batavia, Ohio | Aquatic Biologist

In preparation for a proposed road improvement and river bank stabilization project on the East Fork Little Miami River in Batavia, Ohio, the USFWS and Ohio Department of Natural Resources requested a freshwater mussel survey to determine the presence/probable absence of the Federal endangered mussel, the rayed bean (*Villosa fabalis*). James implemented the Ohio Mussel Survey Protocols (dated May 2013) and utilized viewing scopes, snorkeling, and SCUBA to successfully complete the survey. Surveying efforts documented approximately 20 live mussels. No protected species were found.

Freshwater Mussel Rescue for the Main Street Dam Removal | Scioto River, Columbus, Ohio | Aquatic Biologist

During the autumn of 2013, James conducted a freshwater mussel rescue on the Scioto River and Olentangy River during the removal of the Main Street Dam, Columbus, Ohio. James was responsible for leading a team, rescuing and identifying stranded freshwater mussels that were left in shallow water, on drying sand bars and mud flats in the Scioto and Olentangy Rivers as the dam was being removed. James helped collect, identify and relocate approximately 8,000+ freshwater mussels during this two week long effort.

Freshwater Mussel Rescue for the 5th Avenue Dam Removal | Olentangy River, Columbus, Ohio | Aquatic Biologist

During the summer of 2012, James conducted a freshwater mussel rescue on the 5th Avenue dam removal, Olentangy River, Columbus, Ohio. James was responsible for rescuing and identifying stranded freshwater mussels that were left in shallow water, on drying sand bars and mud flats in the Olentangy River as the 5th Avenue dam was being removed. James helped collect, identify and relocate approximately 6,000+ freshwater mussels during this week-long effort.

Endangered Mussel Survey – Indian Creek Stream Restoration & Bank Stabilization Project | Butler County, Ohio | Aquatic Biologist

In preparation for a proposed stream restoration & bank stabilization project on Indian Creek, Butler County, Ohio, the USFWS and Ohio Department of Natural Resources requested a freshwater mussel survey to determine the presence/probable absence of the federally endangered mussel, the rayed bean (*Villosa fabalis*). James implemented the West Virginia Mussel Survey Protocol and utilized viewing scopes to successfully complete the survey. Surveying efforts documented no live mussels and found the substrates and streambanks to be very unstable, preventing the colonization of freshwater mussels.

Endangered Mussel Survey – 3rd Street Bridge Project | Great Miami River, Dayton, Ohio | Aquatic Biologist

In preparation for a proposed bridge project on the Great Miami River in Dayton, Ohio, the USFWS and Ohio Department of Natural Resources requested a freshwater mussel survey to determine the presence/probable absence of three federally endangered mussels, the snuffbox (*Epioblasma triquetra*), the clubshell (*Pleurobema clava*) and the rayed bean (*Villosa fabalis*). James implemented the Ohio Mussel Survey Protocols (dated May 2013) and utilized viewing scopes and SCUBA to successfully complete the survey. Surveying efforts documented only one live mussel and identified seven species from relic shells. No protected species were found.

U.S. Route 25 McBean Creek Mussel Survey* | Georgia | 1995

James assisted another biologist with freshwater mussel surveys on McBean, Walnut, and Spirit creeks to determine the presence/probable absence of rare mussels, including the green floater (*Lasmigona subviridis*) and Atlantic pigtoe (*Fusconaia masoni*), so high-way improvements could be completed on U.S. Route 25 between Hephzibah and Waynesboro, Georgia. He used both visual and tactile methods to locate freshwater mussels within the three streams. Mussels were found in all three streams with the greatest diversity (4 species) and greatest abundance (1,188 mussels/5.25 man-hours of effort) documented in McBean Creek.

Industrial Parkway East Fork Little Sandy River Mussel Survey* | Boyd, Carter, and Greenup Counties, Kentucky | 1997

While completing field investigations for preparation of a terrestrial and aquatic ecological impact assessment for the proposed Industrial Parkway from Interstate 64 to U.S. Route 23, James conducted freshwater mussel surveys on East Fork Little Sandy River. Survey efforts documented two extensive mussel beds, each containing fatmucket (*Lampsilis siliquodea*), fragile papershell (*Leptodea fragilis*), mapleleaf (*Quadrula quadrula*), pink heelsplitter (*Potamilus alatus*), Wabash pigtoe (*Fusconaia flava*), plain pocketbook (*Lampsilis cardium*), and pimpleback (*Quadrula pustulosa*).

Jackson County Lake Project Endangered Mussel Survey* | Jackson County, Kentucky | 1998

James along with two other biologists completed field investigations for endangered Cumberlandian mussels along 1.3 miles of Laurel Creek, a tributary to Rockcastle River. He utilized both viewing buckets (scopes) and snorkeling to complete the survey. The survey found more than 100 live mussels, representing eight species. Four live Cumberland bean pearly mussels (*Villosa trabalis*), a federally endangered species, were found in the middle section of proposed impoundment. Additional species located included slippershell mussel (*Alasmidonta viridis*), spike (*Elliptio dilatata*), plain pocketbook (*Lampsilis cardium*), wavyrayed lampmussel (*Lampsilis fasciola*), kidneyshell (*Ptychobranhus fasciolaris*), rainbow (*Villosa iris*), and painted creekshell (*Villosa taeniata*).

Pennington Gap Waterline Extension Mussel Survey* | Powell River,, Virginia | 2004

James was contracted by Gress Engineering to conduct a freshwater mussel habitat assessment and survey on the North Fork Powell River between Reed Creek and Rocklick Branch, near Purcell, Lee County, Virginia. Survey efforts were restricted to 100 meter section of river near the three proposed waterline crossings as directed by Mr. Mike Pinder of Virginia Department Game and Inland Fisheries. James utilized snorkeling and viewing buckets to assess freshwater mussel populations within and adjacent to the proposed crossings. No freshwater mussels (live, fresh dead, or subfossil) were found during this survey. He assisted Gress Engineering with the preparation of the final report, which was submitted to State agencies.

Harold Keene Coal Preparation Plant Clinch River Mussel Survey* | Gardner, Virginia | 2004

James was contracted by Gress Engineering to conduct a freshwater mussel survey on the Clinch River between Swords Creek and Little River to assess the effects of a black-water spill on the local fauna. He followed methodologies suggested by Mr. Brian Watson of Virginia Department Game and Inland Fisheries to survey the freshwater mussel communities. SCUBA and snorkeling efforts found live individuals of six non-listed mussel species and found no evidence that the black-water spill caused a mussel kill below the discharge point. James compared data from this survey to those collected by Steve Ahlstedt in 1984 and found the data to be very similar. He assisted Gress Engineering with the preparation of the final report, which was submitted to State agencies.

Daniel Boone National Forest's Jellico Creek Dispersed Campsites Biological Evaluation Mussel Survey* | Kentucky | 2005

While completing field investigations to prepare a Biological Evaluation so the U.S. Forest Service improved several dispersed campsites along the Jellico River, James located an unknown population of federally endangered mussel, the Cumberland elktoe (*Alasmidonta atropurpurea*), within the river at the project site. Upon inserting stringent sediment and erosion guidelines within the project plans, he was able to obtain a "May Affect – not likely to adversely affect" determination from the U.S. Fish and Wildlife Service for the project.

U.S. Route 60 Tennessee River Bridge Mussel Relocation | McCracken and Livingston Counties, Kentucky | 2006

James reinitiated formal consultation with the U.S. Fish and Wildlife Service to amend the construction activities for the U.S. Route 60 bridge over the Tennessee River. The presence of large concentration of freshwater mussels in this section of river required him to prepare a biological assessment, a mussel relocation/salvage plan, and to implement the recovery phase of the project. Along with a team of Stantec certified divers, James salvaged, identified, and relocated 148 freshwater mussels from a small area along the western shore of the river. He also transported two species back to Kentucky Department of Fish and Wildlife Resources Freshwater Mussel Propagation Center for breeding purposes.

Owensboro River Port Authority's Whaylon D. Coleman Terminal Mussel Survey | Ohio River, Kentucky | 2006-2007

James coordinated an endangered mussel habitat assessment and survey on the Ohio River for a new terminal proposed by Owensboro River Port Authority. Due to poor visibility in the river during October 2006, he laid out transects and directed Stantec's Certified Divers to collect substrate data so potential freshwater mussel habitat could be located within the project area. During July 2007, James returned to the project site with the divers during excellent surveying conditions and found 12 species of native freshwater mussels in low concentrations within potential habitat.

Endangered Mussel Survey - State Route 22 Licking River Bridge* | Falmouth, Kentucky | 2003 | Biologist

James completed an endangered mussel survey on the Licking River, Falmouth, Kentucky, for a new bridge. This survey was initiated by the U.S. Fish and Wildlife Service (USFWS) because this river contains one of the last remaining populations of endangered fanshell mussel. James prepared a mussel survey plan and after obtaining approval from the USFWS completed field surveys along approximately 3,600 feet of river channel. Along with a team of certified divers, James' survey effort was restricted to 36 transects located 100 feet apart and perpendicular to the river channel. The survey found 114 live mussels representing 15 species and documented areas containing unsuitable habitat. An additional 16 species, including the fanshell, was represented by empty shells. Survey results, specifically habitat data, provided Kentucky Transportation Cabinet appropriate information to choose an alternative that would not directly impact rare mussels.

Mussel Relocation - US 60 Tennessee River Bridge | McCracken County, Kentucky | 2006 | Biologist

James reinitiated formal consultation with the U.S. Fish and Wildlife Service to amend the construction activities for the U.S. Route 60 Bridge over the Tennessee River, McCracken and Livingston Counties, Kentucky. The presence of large concentrations (beds) of freshwater mussels in this section of river required James to prepare a biological assessment and mussel relocation/salvage plan, and to implement the recovery phase of the project. Along with a team of Stantec certified divers, James salvaged, identified, and relocated 148 freshwater mussels from the 0.23 acre project area along the western shore of the river.

William Cody Fleece

Senior Associate Malacologist



Mr. Fleece is an aquatic ecologist, restoration specialist, and consultant whose clients include state, federal, and local governments, hydroelectric utilities, watershed planning groups, military installations, and non-governmental organizations. He is Stantec's National Technical Lead for Freshwater Ecosystems, an initiative to improve the quality of services delivered in this discipline. Mr. Fleece is authorized by the Federal government to survey for listed fish and freshwater mussels and has held state-collecting permits in Ohio, Michigan, Kentucky, Tennessee, Wisconsin, Minnesota, Illinois, Texas, West Virginia, Virginia, North Carolina, California, Oregon, Washington, and Alaska. In addition to his work with listed fish and mussels his endangered species work includes formal and informal consultation under Section 7 of the Endangered Species Act for an array of plants, mammals, reptiles, amphibians, mussels, and freshwater, marine, and anadromous fish. Mr. Fleece is also a restoration ecologist with 18 dam removals to his credit and multiple stream restoration projects. Much of his recent work has focused on incorporating the habitat requirements of listed fish and mussels into restoration design. Mr. Fleece has a reputation for executing well designed study plans and delivering scientifically defensible work products. His credibility with those in the regulatory community facilitates quick and efficient resolution of potential conflicts related to threatened and endangered species.

EDUCATION

MS, Environmental Studies, University of Oregon,
Eugene, Oregon, (b)

BS, Political Science, Ball State University, Muncie,
Indiana, (b)

CERTIFICATIONS

Federal Endangered Species Permit TE38821A-4

Authorized Mussel Surveyor (All Groups) Ohio

Authorized Mussel Surveyor (All Groups) West
Virginia

Authorized Mussel Surveyor (All Groups) Minnesota

PROJECT EXPERIENCE

SR-35 Endangered Bat and Mussel Surveys, Green
County, Tennessee

*TDOT was preparing to implement highway improvements to a 3.9 mile section of SR-35. Due to the presence of potential summer Indiana bat (*Myotis sodalis*) habitat on the project site, and potential freshwater mussel habitat in the Nolichucky River, TDOT was requested by USFWS to conduct surveys to determine the presence or probable absence of Indiana bats and listed freshwater mussels within the project area. Mr. Fleece was responsible for planning, executing, and reporting on elements of the project related to freshwater mussels. A total of 70 live freshwater mussels were found within the study area comprising 10 species. However no federally listed mussels were found. *Cyclonaias tuberculata* (n = 17) and *Lampsilis fasciola* (n = 11) were the most numerous species observed. Fresh dead valves were found for two additional species, *Fusconaia subrotunda* and *Pleuroaia barnesiana*, suggesting low-level abundance for these species in the project area. Based on the data collected during Indiana bat and freshwater mussel surveys a May Affect – Not Likely to Adversely Affect determination was received from the USFWS's Tennessee Field Office.*

* denotes projects completed with other firms

William Cody Fleece

Senior Associate Malacologist

Freshwater Mussel Survey, Green River at Rush Island Watershed and Wildlife Conservation Area
The Kentucky Division of Water's Wild Rivers Program contract with Stantec for a mussel survey at the 135-acre Rush Island Watershed and Wildlife Conservation Area. The purpose of this survey was to identify and enumerate any species of freshwater mussels present within this property as part of a biodiversity inventory to determine the ecological value of the area. Mr. Fleece was the Project Manager and Technical Lead for field surveys and reporting.

Wabash River Stream and Floodplain Restoration, Tippecanoe County, Indiana
*Mr. Fleece was the aquatic habitat lead for a 905b feasibility study examining restoration opportunities along the main stem Wabash River and tributaries in Tippecanoe County under contract to the U.S. Army Corps of Engineers, Louisville District. His responsibilities included understanding the distribution and abundance of aquatic species within the project area and developing restoration concepts that could potentially benefit aquatic communities. Potential restoration targets included "Great Rivers" fishes (e.g., shovelnose sturgeon, paddlefish) and special status freshwater mussels (e.g., *Pleurobema clava* (clubshell), *Cyprogenia stegaria* (fanshell), *Plethobasus cyphus* (sheepnose), and rayed bean (*Villosa fabalis*)). Stantec personnel identified over 30 viable bank stabilization, wetland enhancement and instream habitat improvement projects. The total value of this work was estimated at over \$18,000,000.*

Freshwater Mussel Environmental DNA Study, Walhonding River, Warsaw, Ohio.

Mr. Fleece was the project manager and technical lead on a U.S. Fish and Wildlife Service and the Ohio Department of Transportation research grant using environmental DNA (eDNA) to detect rare mussels. The Six Mile Dam pool was lowered in October of 2020 as part of removal of the dam. A freshwater mussel rescue was scheduled to coincide with drawdown of the impoundment. Search efficiency is generally high in this kind of effort and represented a unique opportunity to test the ability of eDNA to detect the presence or probable absence of unionid species in the project area. Prior to removal of the dam, field personnel collected triplicate water samples at 22 stations at 150 meter increments along the length of the impoundment. Water samples were filtered and DNA metabarcoding was used to detect genetic material released from unionid mussels. As part of the drawdown mussel rescue, we collected over 12,000 mussels, representing 24 species, in 362.5 hours of searching. The total included 127 Sheepnose and 632 Rabbitsfoot. Twenty-two of the 25 species collected by traditional methods were also detected using eDNA, including the federally listed species. The study demonstrated that eDNA metabarcoding can be used as an effective tool to assess the presence or probable absence of freshwater unionids in riverine systems.

Claytor Hydroelectric Project FERC No. 739 Mussel Survey, Radford, VA

Stantec Consulting was contracted to conduct water quality and mussel surveys on the New River as a condition of Appalachian Power Company's FERC license for the Claytor Hydroelectric project. This study is part of a Freshwater Mussel Adaptive Management Plan (the Plan) that is designed to determine if flow, temperature, and/or occasionally depressed dissolved oxygen (DO) concentrations are affecting freshwater mussels downstream of Claytor Dam over the term of the new license. This work was part of a ten-year program designed to gain insight into mussel resources in the project area. Water quality is being monitored at 4 sites and mussel populations at 7 sites on a biannual basis for the life of the contract. Mr. Fleece is the project manager and technical lead for all elements of the project. In the most recent phase of the project Stantec personnel have been collecting gravid mussels for use in propagation. Juveniles produced at the hatchery will be placed back into the river in cages as part of in situ studies of growth and survival over time.

* denotes projects completed with other firms

William Cody Fleece

Senior Associate Malacologist

Byllesby-Buck Hydroelectric Project FERC No. 2514-186 Malacological Services, Ivanhoe, VA

Stantec Consulting was contracted to assist American Electrical Power with relicensing of the Byllesby-Buck Hydroelectric Project. Specifically, Stantec prepared freshwater mussel survey study plans and responded to agency comments. Field studies were delayed by COVID-19 and begin in the summer of 2021.

Freshwater Mussel Surveys for the USDA Big Walnut Creek Nutrient Loading Studies

Stantec Consulting was contracted by the USDA to assist with freshwater mussel surveys as part of a long term monitoring program investigating the influences of agricultural practices on water quality in the Big Walnut Creek watershed. Mr. Fleece was the Project Manager and Field Lead for the surveys.

Ohio Brush Creek Mussel Surveys, Cincinnati, Ohio

*Mr. Fleece is collaborating with the Cincinnati Natural History Museum in monitoring long term population changes in the mussel fauna of Ohio Brush Creek in south-central Ohio. In the course of these studies Mr. Fleece assisted with capture, handling, and identification of freshwater mussels. He also assisted with a mark-recapture study intended to characterize mussel movement with the study reaches and examine age and growth relationships for the collected individuals. The Ohio Brush Creek is rich in mussel species and Mr. Fleece has collected state-listed taxa including *Lampsilis ovata*, *Ligumia recta*, *Truncilla donaciformis* as well as State of Ohio species of concern including *Truncilla truncata*, *Alasmodonta marginata*, and *Lasmigona compressa*.*

The Ohio State University Transmission Line Mussel Relocation Project, Columbus, Ohio

The Ohio State University installed a new transmission line across the Olentangy River in Columbus, Ohio. Attempts to use directional drilling for installation of the line proved unsuccessful. Consequently the university was required, as a condition of their 404 permit, to rescue and relocate freshwater mussels present in the project area prior to excavation in the channel. Mussels were initially located using visual search techniques in conjunction with demolition of the 5th Avenue Dam. SCUBA surveys were conducted in habitats too deep to effectively survey using wading techniques.

5th Avenue Dam Mussel Rescue and Relocation, Columbus, Ohio

As a condition of the 404 permit authorizing demolition of the 5th Avenue Dam, the City of Columbus was required to rescue and relocate freshwater mussels in the project area. Potential impacts to mussels could potentially occur as a result of construction activities (e.g., movement of heavy equipment, placement of fill in the channel, etc.) or through stranding as a result of rapid lowering of the dam pool. Mr. Fleece developed rescue and relocation plans in consultation with the Ohio Department of Natural Resources, The Ohio State University, and the City of Columbus. Mr. Fleece also supervised the rescue effort which involved numerous Stantec personnel as well as local volunteers. The dam was demolished in stages over approximately two weeks. The rescue effort consisted of 219 total hours of search effort and a total of 7,513 mussels were relocated to nearby sites.

Englewood Low Dam Removal and Stillwater River Restoration Project, Englewood, Ohio

The Five Rivers MetroParks demolished the Englewood Lowhead Dam in the fall of 2009. Stantec was contracted to monitor water quality and aquatic habitat in the Project Area to determine the response of these indicators to restoration actions. A before-after-control-impact (BACI) experimental design was used for the monitoring program. Water quality, fish communities, and aquatic macroinvertebrate communities were monitored at three sites prior to the removal in 2008 and again after demolition in 2010 and 2011. Vegetation communities were monitored at three plots in 2008, 2009, and 2011. Freshwater mussel assemblages were monitored prior to dam removal in 2007 and again in 2011. Mr. Fleece was the primary investigator and lead author for the post restoration studies. The study found that ecosystems in the project area were recovering from the presence of the dam but had not recovered. Several of the metrics pointed toward substantial progress. For example, the number of intolerant fish species increased in the restored reach over the study duration as did total taxa counts for aquatic macroinvertebrates.

* denotes projects completed with other firms

William Cody Fleece

Senior Associate Malacologist

Six-Mile Dam Removal, Moscow, Ohio (Technical Lead)

Mr. Fleece was the technical lead for regulatory approvals including 404 and 401 permit applications and formal consultation under Section 7 of the Endangered Species Act. He was responsible for preparation of a Biological Assessment, technical support for USFWS in preparation of a Biological Opinion, and rescue and relocation of over 12,000 freshwater mussels. Included in this total were 127 sheepsnose (federal endangered) and 742 rabbitsfoot (federal threatened). Cody was the liaison between the client, the engineering team, and USFWS on conservation measures associated with impoundment drawdown and dam demolition. Demolition of Six Mile Dam began in 2020 and is expected to finish in the spring of 2022.

Ballville Dam Removal Project, Fremont, Ohio (Permitting Task Leader)

Mr. Fleece was the Task Leader for permitting and regulatory compliance for efforts to remove the 407-foot-long, 35-foot-high structure that was originally constructed in 1911. This multi-million-dollar project opened over 22 miles of main stem spawning habitat for the Sandusky River walleye stock. Population size for this stock is currently thought to be limited by spawning habitat availability. His work included informal consultation on impacts to listed species (including freshwater mussels) under the Endangered Species Act, coordination of efforts focused on the Section 106 of the National Historic Preservation Act, Clean Water Act 404 and 401 permitting, consultation with Ohio DNR on the Scenic Rivers Act, and preparation of an Environmental Impact Statement under the National Environmental Policy Act. Ballville Dam was removed from the Sandusky River in the summer of 2018 and lake sturgeon were observed 4 miles upstream of the former dam location in the following spring.

Deer Creek Dam Removal, Williamsport, Ohio

Mr. Fleece was the project manager and technical lead for the pre and post-removal biological surveys. Freshwater mussel surveys were required to determine if Federally listed mussels were present in the project area. Visual and tactile searches were conducted to locate mussels in the construction footprint and in adjacent areas. Total search effort was approximately 12 hours and twenty-three live animals representing nine species were collected. The presence of fresh dead valves suggested that at least twelve species were present somewhere within the project area. No special status mussel species were found. Fish were surveyed using a fourteen-foot aluminum john boat equipped with a Smith-Root GPP 5.0 electrofisher. In total the pre-restoration surveys, 34 species were captured in the project area, 27 from the downstream study reach and 23 from upstream of the dam. Surveyors captured Bluebreast Darter, Banded Darter, River Redhorse, Rosyface Shiner, Silver Shiner, and Stonecat Madtom, all species indicative of exceptional water quality. Data generated in these studies were used to inform the design of post-removal habitat features. Post-restoration fish surveys demonstrated substantial improvement in the project area.

Scioto Greenways/Main Street Dam Removal, Columbus, Ohio

*Approximately 4,455 live mussels comprising 9 species were rescued and relocated as part of this effort. The rescue and relocation involved more than 25 people and 507 search hours over the course of six days. One Ohio State Threatened species, pondhorn (*Unio merus tetralasmus*), and one Ohio State Species of Concern, elktoe (*Alasmidonta marginata*) were observed during the rescue. The dam pool was dominated by facultative and lentic species. The combined total of rescued giant floaters (*Pyganodon grandis*) and mapleleaves (*Quadrula quadrula*) was 3,707 or approximately 83 percent of the live individuals. Species diversity in the Main Street Dam Pool (1.0 – 3.5) was lower than observed in the 5th Avenue Dam Pool (2.2 – 5.2) as was overall richness (9 vs. 16 species). Mussels were relocated in the vicinity of the former 5th Avenue Dam on the Olentangy River, as well as a free-flowing reach downstream of the former dam location.*

* denotes projects completed with other firms

William Cody Fleece

Senior Associate Malacologist

West Milton Dam Removal

*Stantec provided assisted the Village of West Milton with the demolition of West Milton Dam in the fall of 2014. Services rendered to the village included grant writing assistance, engineering design, regulatory compliance, construction oversight, and post-construction monitoring. Mr. Fleece was the project manager and was the technical lead on Clean Water Act 404 permitting, Endangered Species Act consultation, and National Historic Preservation Act consultation. The federally endangered snuffbox mussel (*Epioblamia triquetra*) was collected in pre-project surveys. Mr. Fleece led the formal consultation, including preparation of a Biological Assessment, on behalf of the Village. He also led field surveys that rescued and relocated 14 snuffbox (and ~2,900 other mussels) stranded with the drawdown of the dam pool. Post-project monitoring of the restoration response is ongoing.*

Olentangy River Freshwater Mussel Surveys, Columbus, Ohio

*Columbia Gas of Ohio plans to install a new 20" steel welded, natural gas pipeline below the Olentangy River in one of two locations upstream of Doddridge Dam. Ohio DNR completed a review of the proposed project and requested a survey of freshwater mussels in the vicinity of the pipeline. Mr. Fleece planned, executed, and summarized surveys designed to detect the presence or probable absence of special status species in the project area. SCUBA divers searched substrates along transects in the stream channel. Timed searches and fixed area substrate excavations were conducted in suitable habitats along the channel margins. No Federal or State endangered, threatened, or proposed endangered/threatened mussels were found during the September 19-23, 2011 surveys. A total of 133 live freshwater mussels, comprised of 12 species were found to occur within the Project Area. *Lasmigona complanata* (white heelsplitter), *Amblema plicata* (threeridge), and *Lampsilis radiata luteola* (fat mucket) were the three most numerous species observed (n=55, 41%, n=23, 23%, n=20, 15%, respectively). Two live *P. sintoxia* (Ohio Species of Concern) and one *L. fasciola* (Ohio Species of Concern) was observed during sampling. *Alasmodonta marginata* and *Toxolasma parvus* were not observed as live specimens, but were collected as Fresh Dead shells, suggesting low level abundance in the Project Area. Due to the presumed absence of Federal and State endangered and threatened taxa within the project area, an agency determination of may affect but not likely to adversely affect is anticipated.*

Biological Assessment for Route 609 Bridge, Brunswick County, Virginia

*VDOT is proposing replacement of the existing bridge over the Nottoway River in Brunswick County, Virginia. Mr. Fleece was the technical lead for a Biological Assessment addressing the Atlantic Pigtoe (*Fusconaia masoni*), Yellow Lance (*Elliptio lanceolata*), and the Roanoke Logperch (*Percina rex*). He authored sections of the effects analysis and assisted with agency consultation.*

I-74 Bridge Replacement Biological Opinion, Moline, Illinois

*Mr. Fleece was the project manager, technical expert, and lead author for preparation of a Biological Opinion under the direction of the USFWS. Approximately 2,000,000 freshwater mussels, including 3 federally endangered species were present in the footprint of the existing and proposed Interstate 74 bridge over the Mississippi River. Faced with the prospect of a lengthy Endangered Species Act formal consultation process for sheepsnose (*Plethobasus cyphus*), Higgins' eye pearly mussel (*Lampsilis higginsii*), and spectaclecase (*Cumberlandia monodonta*) and a narrow construction window, the Iowa Department of Transportation (Iowa DOT) contracted with Stantec to provide technical assistance to the U.S. Fish and Wildlife Service Rock Island Field Office (RIFO). Specifically, Stantec was tasked with assisting the RIFO in the preparation of a Biological Opinion. Although Stantec was directly funded by Iowa DOT all documents and work products were prepared under the direct supervision of the RIFO. Elements of the scope of work included preparation of 1) a chronology of the consultation history, 2) a description of the proposed action, 3) the status of listed species found in the action area, 4) an environmental baseline, 5) characterization of the effects of the action, and 6) citations for the literature used in the body of the document. Stantec also assisted with elements of an incidental take statement for the draft and final Biological Opinion.*

I-74 Bridge Replacement Mussel Relocation, Moline, Illinois

*Mr. Fleece assisted the Iowa Department of Transportation (Iowa DOT) with identification, processing, and relocation of thousands of freshwater mussels including sheepsnose (*Plethobasus cyphus*), Higgins' eye pearly mussel (*Lampsilis higginsii*), and spectaclecase (*Cumberlandia monodonta*). Over 125,000 mussels were relocated as part of this effort.*

* denotes projects completed with other firms

William Cody Fleece

Senior Associate Malacologist

I-74 Bridge Demolition Mussel Relocation, Moline, Illinois

Mr. Fleece assisted the Iowa Department of Transportation (Iowa DOT) with relocation of freshwater mussels around the soon to be decommissioned bridge piers for the I-74 bridge over the Mississippi River near Moline, IL. Mr. Fleece was the task lead for the contract. Field crews were on site for 2 months and roughly 40,000 mussels were salvaged and relocated. Mr. Fleece served as scientific diver and also assisted with identification, processing, and tagging of mussels. Listed species collected included sheepnose (*Plethobasus cyphus*), Higgins' eye pearly mussel (*Lampsilis higginsii*), and spectaclecase (*Cumberlandia monodonta*).

Freshwater Mussel Relocation Chatham Bridge Route 3 over the Rappahannock River, Virginia

Stantec was contracted by the Virginia Department of Transportation to relocate freshwater mussels from the construction footprint of the Route 3 bridge in Fredricksburg, Virginia. Field surveys occurred in June and July of 2020 and yielded over 4,200 mussels in 70 hours of searching. The assemblage was dominated by Eastern Elliptio (*Elliptio complanta*) but also included the Alewife floater (*Utterbackia implanata*) (n = 585), Tidewater Mucket (*Leptodea ochracea*) (n = 69), Green Floater (*Lasmigonia subviridis*) (n = 30) and Northern Lance (*Elliptio fisheriana*) (n = 7). Mr. Fleece was the task lead and scientific diver for the project.

US-23/Olentangy River Mussel Relocation, Delaware County, Ohio

Columbia Gas of Ohio (COH) had a leaking pipeline in the Olentangy River and needed to make repairs. Stantec was contracted to prepare study plans, conduct presence/absence surveys, and relocate mussels in the vicinity of the pipeline. During presence/absence surveys total of 36 living freshwater mussels were collected representing 10 different species. One federally threatened species (*Q. cylindrica*) was found along with two sets of sub fossil valves approximately 15 meters downstream of the area of direct impact. This species had not been observed in the Olentangy River since 1962. Ohio species of concern Purple wartyback (*Cyclonaias tuberculata*) and Kidneyshell (*Ptychobranhus fasciolaris*) were present (n=21 and n=1). Mr. Fleece worked with COH and the USFWS on developing measures that enabled the repairs to proceed without formal Section 7 consultation.

Kentor Pipeline Mussel Habitat Assessment, Greene County, Pennsylvania

Chesapeake Midstream proposed to construct a new natural gas pipeline across the South Fork of Tenmile Creek in Greene County, Pennsylvania. The crossing was proposed using traditional trenching methods. The Pennsylvania Fish and Boat Commission expressed concern that the proposed project would adversely affect the state-listed Wabash Pigtoe (*Fusconaia flava*). Mr. Fleece walked approximately 2,300 feet of the channel. He concluded that habitat was suitable for freshwater mussel presence and that the Wabash Pigtoe was likely present in the streams based on observations of spent valves. Chesapeake Midstream altered the proposed project and proposed to use directional drilling to accomplish the stream crossing. Mr. Fleece prepared correspondence with the Pennsylvania Fish and Boat Commission and received a no-effect determination that allowed the project to proceed.

Cincinnati Museum Center Malacology Collection*, Cincinnati, Ohio (Research Associate)

Mr. Fleece is a research associate working to organize and maintain the malacology collection at the Cincinnati Natural History Museum. The collection consists of over 16,400 catalogued lots including specimens collected by Thomas Say and Edward Drinker Cope. Mr. Fleece recently helped to identify and catalogue thousands of valves donated by archaeologist Kent Vickery. He has worked with material for numerous listed or candidate species including *Pleurobema clava*, *Epioblasma torulosa rangiana*, *Epioblasma triquetra*, *Potamilus capax*, *Obovaria retusa*, *Lampsilis abrupta*, *Lampsilis higginsii*, *Cyprogenia stegaria*, *Plethobasus cyphus*, *Plethobasus cooperianus*, and *Villosa fabalis* among others.

Green River Lock and Dam 3, Freshwater Mussel Survey, Rochester, Kentucky

Rochester Dam Regional Water Commission contracted with Stantec Consulting Services Inc. (Stantec) to conduct a freshwater mussel survey on the Green River in Ohio, Muhlenberg, and Butler Counties, Kentucky. The primary objective of this project was to determine the presence or probable absence of and special status mussel species within the project area. The proposed project involved modifications to the Green River Lock and Dam 3 to reduce leakage through the dam structure and help secure the water supply for the surrounding community.

* denotes projects completed with other firms

William Cody Fleece

Senior Associate Malacologist

The mussel survey was conducted between August 27th and August 30th, 2018 by divers using surface supplied air. Total search effort was approximately 12.7 hours and consisted of transect surveys and wandering timed searches. A total of 67 live mussels were collected during the survey effort for a total of 12 species. The most abundant species were M. nervosa (n=14), A. plicata (n=13) and P. alatus (n=13), and C. nodulata (n=11). Also collected during the survey were Q. quadrula (n=6), O.reflexa (n=2), E. lineolata (n=2), A. confragosus (n=2). The following species were represented by single specimens: L. complanata (n=1), L. teres (n=1), P. ohioensis (n=1) and C. pustulosa (n=1). An additional 11 species were observed as spent valves. No live special status mussels were collected during this survey. Mr. Fleece was the task lead and permitted malacologist for this project.

Blanchard River Mussel Relocation, Findlay, Ohio

As part of efforts of flood control efforts the City of Findlay, Ohio and the Maumee Watershed Conservancy District sought to remove four low head dam/riffle structures in the Blanchard River. The 401 Water Quality Certification required a mussel relocation which occurred in two phases 1) mussels were collected and relocated from the instream impact areas (i.e. construction footprints) surrounding the dams and bridge and 2) During deconstruction of the dam/riffle structures, stranded mussels were rescued from exposed substrate as water levels decreased upstream of the dams. All collected mussels were relocated upstream of the project area into areas deemed suitable, with existing mussel communities like those being relocated. The mussel relocation within the construction footprints was performed on July 25 and July 27-31, 2018. Total search effort was approximately 37.8 person hours between the five survey areas. During this effort, 408 mussels were collected and relocated. Mussel rescue and relocation during the four dam/riffle drawdowns were performed between November 12 to 15, 2018. Total search effort was approximately 53.63 hours between the four structures. A total of 729 live mussels comprising nine species were rescued and relocated during the drawdowns. Mr. Fleece was task lead and permitted malacologist during some phases of the project.

Byllesby Dam Mussel Relocation, Ivanhoe, Virginia

The Appalachian Power Company lowered the water surface elevation of the Byllesby Dam impoundment in order to conduct repairs on the Byllesby Dam on the New River in Carroll County, Virginia between April 30 and May 1, 2018. While the rate of drawdown was relatively slow, it was anticipated to exceed the rate at which mussels could move to maintain immersion in the water. Stantec conducted surveys to find freshwater mussels stranded along the margins of the dam pool and relocated them to a site upstream of the project area. Over the two-day search period, only four live mussels were found comprised of two species, L. subviridis (n=1) and C. tuberculata (n=3). These animals were relocated to areas of equal or better habitat upstream of the project area. Mr. Fleece was the Project Manager.

Buck Dam Mussel Relocation, Ivanhoe, Virginia

Between July 10 and July 11, 2018, American Electric Power (AEP) conducted a drawdown at Buck Dam on the New River in Carroll County, Virginia. This was done in order to perform repairs on the dam itself. To complete the repairs the dam pool was lowered approximately nine feet (ft) over a 24-hour period. The rate of pool draw down was anticipated to exceed the rate at which mussel could relocate to maintain immersion in water. Stantec Consulting Services, Inc. (Stantec) was contracted by AEP to relocate freshwater mussels stranded on habitat exposed by the dam pool drawdown to areas outside of the disturbance zone. The search effort focused on potential mussel habitat exposed along channel margins and the island at the upstream end of the dam pool. The mussel relocation was performed on July 11, 2018. The total search effort was 15.5 person-hours covering approximately 2,700 linear meters of streambank. During the effort, two live mussels, both identified as Wavy-Rayed Lampmussel (Lampsilis fasciola) were collected and relocated to an area of suitable habitat outside of the drawdown impact area. Mr. Fleece was the Project Manager and lead malacologist for the project.

* denotes projects completed with other firms

William Cody Fleece

Senior Associate Malacologist

Middle Fork Vermilion Threatened & Endangered Species Consultations, Oakwood, Illinois

*Mr. Fleece managed threatened and endangered species tasks a bank stabilization project adjacent to a decommissioned coal plant in the Middle Fork Vermilion River, Vermilion County, Illinois. Stantec surveyed for mussels on September 16 and 17, 2018 and total search effort was approximately 13.3 person-hours. During this effort 33 live mussels were collected, measured, aged, and sexed. Total live species richness was eight, with an additional 16 species represented by spent shells. Special status species found during the survey include live and shell specimens of *L. fasciola* (Illinois Endangered) and shells of *Epioblasma rangiana* (Northern riffleshell, Illinois and Federal Endangered). Field personnel also collected shells for the following Illinois listed species: *Villosa lienosa* (Little Spectaclecase, n=1), *Alasmidonta viridis* (Slippershell, n=1), *Ptychobranhus fasciolaris* (Kidneyshell, n=1), and *Cyclonaias tuberculata* (Purple Wartyback, n=1). Stantec, during the mussel survey, also observed a live Bluebreast Darter (*Etheostoma camurum*), a state endangered species in Illinois.*

Mr. Fleece also led efforts to assist Dynegy Midwest Generation in obtaining incidental take authorization for both state and federally listed species. Stantec prepared a Conservation Plan and Implementing Agreement covering two mussels and three fish for the State of Illinois. Mr. Fleece also led formal consultation under the federal Endangered Species Act including preparation of a Biological Assessment for three mussels, two bats, and two plants. Construction is anticipated in 2019.

Batavia Dam Removal Mussel Survey, Batavia, Ohio

*Mr. Fleece was Project Manager, permit lead, and permitted malacologist for the Batavia Dam removal project. The Valley View Foundation removed the Batavia Low Head Dam on the East Fork of the Little Miami River near Batavia, Clermont County, OH. The East Fork of the Little Miami River is a Group 2 stream as designated by ODNR. Correspondence with the USFWS indicated the possible presence of 12 special status taxa within the project footprint. Stantec Consulting conducted a freshwater mussel survey over two mobilizations, the first being July 17th-July 19th, 2018 and the second on October 3rd- October 7th, 2018. During this survey a total of 367 living mussels were collected, comprised of 13 species. One live Ohio state Endangered *P. cordatum* was observed within the project area. Four live Ohio Species of Concern were also observed: *L. fasciola*, *P. fasciolaris*, *P. sintoxia* and *T. truncata*. The most abundant species collected were *E. dilatata* (n=107) followed by *P. sintoxia* (n=91) and *F. flava* (n=57).*

Mussel densities varied, especially between upstream and downstream sites. The calculated density from Phase 2 sampling downstream of the dam was 0.2 mussels per m², while upstream of the dam it ranged from 0 to 3 mussels per m². Overall, most species appear to be recruiting with some species not present in high enough numbers to determine successful recruitment. No federally listed species were collected live or as spent shells during this survey.

Belle River Mussel Survey, Calhoun County, MI

*Stream restoration is proposed for a reach of the Belle River in Columbus Township, Michigan. The Belle River is one of a small number of waterbodies in Michigan known or expected to support federally listed species and has been assigned a Group 3 classification by state and federal agencies. Between September 19 and 21, 2018, Stantec Consulting conducted freshwater mussel surveys within the project area to determine the presence or probable absence of special status taxa. During this survey a total of 284 living individuals were collected, comprised of 11 species. The two most abundant species were *Eurynia dilatata* (n=101) and *Villosa iris* (n=84) which is a Michigan Species of Concern. Also, during this survey, a weathered *Epioblasma triquetra* shell, a Federally Endangered species, was collected. One live *Alasmidonta viridis*, which is listed as Threatened in the State of Michigan, was observed.*

Mussel densities were high (>7.6 per m²) in isolated areas within the survey area. Opportunistic species characteristic of impaired systems were rare. Overall species richness (n = 11) was high for a small river with a base flow wetted width of less than 20 meters. Most species appeared to have reproductive success based on the range of size classes observed. Mr. Fleece was task lead and permitted malacologist on this project.

Malacological Services for Potential I-69 Bridge Site Near Henderson, KY and Evansville, IN

Mr. Fleece was the task lead for a study was to assess the presence or probable absence of special status freshwater mussel species within the I-69 Ohio River Crossing (ORX) project corridor, specifically in the area of the three proposed Ohio River bridge alignments. The Western Corridor contains two alignments and is adjacent to the existing U.S. Route 41 (US 41) bridge, while the Central Corridor is approximately 1 mile downriver from the confluence of the Green River, Henderson County, Kentucky.

* denotes projects completed with other firms

William Cody Fleece

Senior Associate Malacologist

*Stantec conducted a freshwater mussel survey from October 9-15, and 27-31, 2018 on the Ohio River between Evansville, IN and Henderson, KY. Divers surveyed one hundred and eight (108) (65ft x 65ft) search cells for a total search time exceeding 47 hours. Depths ranged between 10 and 48 feet and included areas within the federal navigation channel. A total of 452 live mussels were collected, representing 20 species. Several special status species were collected as live animals or as spent shells including 11 live Longsolid (*Fusconaia subrotunda*, Kentucky Special Concern), 1 spent Fat Pocketbook (*Potamilus capax*, Federally Endangered) shell, 2 spent Pyramid Pigtoe (*Pleurobema rubrum*, Kentucky Endangered) shells, and 1 spent Pocketbook (*Lampsilis ovata*, Kentucky Endangered) shell. Mussel habitats along the Central Corridor were considerably more productive, especially those classified as coarse gravel/cobble/hardpan/bedrock by the side-scan sonar acoustic data. Three hundred and ten (310) of the 452 total live mussels were collected in only 15 cells of this substrate type. Divers also assessed the accuracy of side scan sonar classification of submerged substrates in conjunction with the mussel surveys. Data indicate that the acoustic substrate classification system had poor accuracy for silt/clay habitat, but excellent accuracy for the mussel bed habitat (coarse gravel/cobble/ hardpan/bedrock).*

Mr. Fleece was the technical lead for preparation of the freshwater mussel portions of the Biological Assessment and led agency meetings focused on this topic.

Ground-truthing of Side Scan Sonar River Bed Substrate Classification for Potential I-69 Bridge Site Near Henderson, KY and Evansville, IN

This study was conducted to provide needed information on habitat conditions for regulatory processes associated with the proposed Interstate 69 Ohio River Crossing (ORX) near Henderson, Kentucky and Evansville, Indiana area. Acoustic side scan sonar data were collected in November of 2017 for the purpose of mapping substrate types to evaluate the suitability of mussel habitat within the West and Central Corridor impact areas (River Miles 784.1- 787.5). Mr. Fleece led field studies to ground-truth the substrate types related to each acoustic class. Ground-truthing of river substrate took place between December 12-15, 2017 and occurred 100 m upstream and 300 m downstream of the West and Central Corridor impact areas. A chain-rigged Van Veen sediment sampler was used to collect river bed material. The Van Veen was deployed using a davit and motorized winch system mounted to a 24 ft. V-gull Monarch boat. Substrate sampling effort was weighted proportionally to the area of each acoustic class (i.e. stratified random sampling), such that more effort was placed on acoustic classes with larger areas. The field verification effort generally confirmed the desktop classifications, particularly the widespread presence of sand substrates within the survey area. Evidence of freshwater mussels was only detected in acoustic class 7 which apparently consists of cobble over some kind of impermeable layer. Except for unstable sand in the center of the channel, most of these classes appeared capable of supporting freshwater mussels.

William Cody Fleece

Senior Associate Malacologist

North Keowee Street Bridge Replacement Mussel Survey and Relocation

*Mr. Fleece was the Task Manager and lead field biologist for mussel survey and relocation at the Keowee Street Bridge project in Dayton, Ohio. The Ohio Department of Transportation (ODOT) and the Montgomery County Engineer's Office contracted with Stantec for malacological services. The mussel relocation was performed on August 8 – 12, 2017. During the effort, 389 live mussels were collected and relocated upstream. The most abundant live species collected were *Quadrula quadrula* (mapleleaf; n=180) and *Pyganodon grandis* (giant floater; n=119). Other species collected during the mussel relocation included *Lasmigona costata* (fluted shell; n=40), *Lampsilis cardium* (plain pocketbook; n=16), *Lampsilis silquoidea* (fat mucket; n=9), *Alasmidonta marginata* (elktoe; n=9), *Utterbackia imbecillis* (paper pondshell; n=9), *Lasmigona compressa* (creek heelsplitter; n=3), *Strophitus undulatus* (creeper; n=2), *Anodontoides ferussacianus*; n=1), and *Cyclonaias tuberculata* (purple wartyback; n=1). *Alasmidonta marginata* and *Cyclonaias tuberculata* are both Ohio species of concern. Mussels within the project footprint were relocated to nearby areas of equal or better habitat.*

Tait Station Dam Removal Mussel Survey and Relocation

*Mr. Fleece was the Task Manager and lead field biologist for mussel survey and relocation at the Tait Station Dam Removal project in Dayton, Ohio. The Ohio Department of Transportation (ODOT) contracted with Stantec to relocate freshwater mussels from habitat located within the proposed restoration area upstream of the dam to areas outside of the disturbance zone. The mussel relocation was performed on August 29 – 31, 2017. The total search effort was approximately 31 hours and approximately 2,140 m² (23,035 ft²) were searched. During the effort, 51 live mussels were collected and relocated to an area of equal or better habitat approximately 0.8 km (0.5 mi) downstream of the dam. The most abundant live species were *Quadrula quadrula* (mapleleaf; n=20) and *Lampsilis cardium* (plain pocketbook; n=12). Other species collected during the mussel relocation included *Lasmigona costata* (fluted shell; n=8), *Pyganodon grandis* (giant floater; n=5), *Lampsilis silquoidea* (fat mucket; n=1), *Alasmidonta marginata* (elktoe; n=4), *Utterbackia imbecillis* (paper pondshell; n=1). *Alasmidonta marginata* is listed as an Ohio species of Concern. Mussels within the project footprint were relocated to nearby areas of equal or better habitat.*

Charles M. Bolton Water Treatment Plant Great Miami River Bank Stabilization Mussel Survey

*The Greater Cincinnati Water Works proposes to stabilize an area of eroding river bank along approximately 650 meters of the Great Miami River near the Charles M. Bolton Water Treatment Plant in the City of Fairfield, Butler County, Ohio. Mr. Fleece was the technical lead on permitting and supervised work related to preparation of the 404 Department of the Army Permit. The Great Miami at this location was designated as a Group 4 stream by the U.S. Fish and Wildlife Service, due to the potential presence of rayed bean or other federally-listed mussels. Mr. Fleece led field studies to ascertain the presence or probable absence of special status taxa in the project area. The mussel survey was performed on October 4 – 5, 2017. During the effort, 11 live mussels were collected. The most abundant live species collected was *Potamilus alatus* (pink heelsplitter; n=7). Other live species collected during the mussel survey included *Leptodea fragilis* (fragile papershell; n=2) and *Lasmigona complanata* (white heelsplitter; n=2). Despite the sampling effort, no live state or federally-listed species were observed. Based on the data collected during search efforts, the apparent absence of *Villosa fabalis*, a May Affect – Not Likely to Adversely Affect determination is anticipated from the U.S. Fish and Wildlife Service Ohio Field Office.*

Freshwater Mussel Survey in the Wisconsin River as part of the Badger Coulee Transmission Line

Stantec was contracted by American Transmission Company (ATC) to conduct freshwater mussel surveys on the Wisconsin River, Columbia County, Wisconsin as part of the Badger Coulee 345 kV Transmission line Project. Mr. Fleece led field studies and reporting for elements related to freshwater mussels. Over 500 mussels were collected between at four sites with 422 at Site A, 75 at Site B, 11 at Site C and 24 at Site D. Mussel densities were highest at Site A and lower at the remaining locations. Based upon size frequency data some species appear to have successful reproduction at these sites. No federally listed species were observed, but one state threatened species, the buckhorn, was found at Site A as well as the Mucket which is listed as a species of special concern and is fully protected in Wisconsin.

* denotes projects completed with other firms

William Cody Fleece

Senior Associate Malacologist

Freshwater Mussel Salvage and Relocation in the Wisconsin River as part of the Badger Coulee Transmission Line

*As part of the Badger Coulee 345 kV Transmission Line Project (the Project) construction was necessary within the Wisconsin River. Removal of trees along the right of way, temporary barge staging areas, and timber mat bridges had the potential to adversely affect aquatic habitats and aquatic organisms. Prior studies documented the presence of two Federally listed freshwater mussels, Higgins eye pearly mussel (*Lampsilis higginsii*) and sheepnose (*Plethobasus cyphus*) in nearby habitats. The USFWS (2016) issued a Biological Opinion and Incidental Take Statement on July 1, 2016 that required, among other things, salvage and relocation of freshwater mussels at affected areas in the Wisconsin River. Mussels were salvaged from four sites: A, B, C, and D. More than 125 hours of searching occurred during 15 days in the field as part of the salvage effort. This effort collected and relocated over 4,300 freshwater mussels of 22 species, including 5 sheepnose, from within the Wisconsin River Crossing Site (WRCS) footprint to areas of equal or better habitat.*

Freshwater Mussel Survey Spooner – Minong Trego Interchange US Highway 63 – US Highway 53.

The Wisconsin Department of Transportation (WisDOT) proposed to upgrade the crossings to USH 53 and USH 63 intersections in Washburn County, near Trego, Wisconsin. Construction is proposed at Potato Creek and the Namekagon River. Surveys were conducted to determine the presence or probable absence of freshwater mussels near these two crossings. Potato Creek was surveyed by snorkeling and qualitative timed search methods. The Namekagon River was surveyed primarily by SCUBA divers using transects placed at fixed intervals along the channel. A total of 460 mussels, comprised of eleven species, were observed during the survey.

*Most of the mussels (n = 434) were collected in Potato Creek. Twenty-nine round pigtoe (*Pleurobema sintoxia*) and one creek heelsplitter (*Lasmigona compressa*), both Wisconsin species of concern (SC/P), were collected in Potato Creek. Two black sandshell (*Ligumia recta*) and six mucklets (*Actinonaias ligamentina*), also Wisconsin SC/P, were collected in the Namekagon River. Mussels were distributed along the length of both survey sites although densities were far lower in the Namekagon River than in Potato Creek.*

*Approximately 760 live mussels were collected over the course of three days. A total of 28 live species including several protected species such as the elktoe (*Alasmodonta marginata*, n=1), fanshell (*Cyprogenia stegaria*, n= 13), pocketbook (*Lampsilis ovata*, n=20), Sheepnose (*Plethobasus cyphus*, n=2), and pyramid pigtoe (*Pluerobema rubrum*, n=2). The length measurements demonstrate that many of the species collected have had recent reproductive success. The federally listed *C. stegaria*, which was the 10th most abundant species, is apparently recruiting successfully in the study area. Based on these results it is clear that the Rush Island Watershed and Wildlife Conservation Area is a valuable aquatic resource for freshwater mussels.*

Freshwater Mussel Survey for Proposed Outfall, Menominee County, Michigan

*Stantec was contracted by a confidential client to conduct freshwater mussel surveys in Menominee County, Michigan. Permitting associated with the proposed project required construction of an outfall discharge to the Menominee River in Menominee County, Michigan. Mr. Fleece led all phases of the mussel survey from conception to completion. Mussel surveys were conducted at two potential locations to assist with siting decisions. Mussels were collected along fixed linear transects within the potential construction footprint and within buffer areas upstream, downstream, and offshore of the potential direct impact areas. Over 800 live mussels were observed in this study with 521 observed in the vicinity of the 1st potential outfall location and 296 in the second. Overall mussel densities were very high and, based on the size class distributions, several species were reproducing successfully. No Federally listed species were observed but species with special status conferred by the State of Michigan included the hickorynut (*Obovaria olivaria*) (State Endangered), black sandshell (*Ligumia recta*) (State Endangered), and the round pigtoe (*Pleurobema sintoxia*) (Species of Concern). Mr. Fleece was responsible for all aspects of this work including agency coordination, study plan development, field surveys, and reporting.*

Mussel Surveys, Ashland and Iron Counties, Wisconsin

*Mr. Fleece was contracted by a confidential client to ascertain presence or probable absence freshwater mussels in seven creeks within the proposed project boundaries. Only 2 of the 15 study sites were observed to harbor mussels. The cylindrical papershell (*Anodontoides ferussacianus*) was observed at both sites while the creek heelsplitter (*Lasmigona compressa*) was observed at only one location.*

* denotes projects completed with other firms

William Cody Fleece

Senior Associate Malacologist

Endangered Species Surveys, Clermont County, Ohio

*The Clermont County Engineers Office contracted Stantec to conduct endangered species surveys in the vicinity of Ellick Street in the East Fork Little Miami River in Clermont County, Ohio. Two Federally Endangered freshwater mussels historically occurred in the East Fork Little Miami River, rayed bean (*Villosa fabalis*) and snuffbox (*Epioblasma triquetra*) as did Running Buffalo Clover (*Trifolium stoloniferum*) a Federally Endangered plant.*

*Stantec personnel conducted the Phase I survey on October 22 and 23, 2014. Eleven live mussels were observed, including wavy-rayed lampmussel (*Lampsilis fasciola* [Ohio Species of Concern]) and kidneyshell (*Ptychobranchus fasciolaris* [Ohio Species of Concern]). No Federally listed species were observed. Three of the thirty search cells triggered the species requirement for a Phase II survey. No live mussels were found during the Phase II survey quadrat excavations on October 24, 2014. After the Phase II survey was completed, mussels were relocated from the search cells. One live Wabash pigtoe (*Fusconaia flava*) was observed during the relocation effort. A combined total of 10.23 person hours was spent in the search cells for the relocation effort. Mussels were relocated to an area 250 feet (76.2 meters) upstream of the search cells in an area with equal or better habitat.*

*No populations of running buffalo clover were found within the project area. Searches of the project area yielded 127 species of plants, including three species of *Trifolium* clover. The clovers found were suckling clover (*T. dubium*), red clover (*T. pratense*), and white clover (*T. repens*). All three of these clovers are non-native and represent a portion of the non-native plants (17 percent) encountered on the site during October field surveys. Based on the apparent absence of special status species was received from USFW's Ohio Field Office. Mr. Fleece was the project manager and technical director for the project.*

Miller-Coors Great Miami River Mussel Survey

Lateral bank erosion jeopardized the Miller Coors brewery wastewater outfall on the Great Miami River in Butler County, Ohio. Necessary repairs would require the placement of fill in the waters of the U.S. Stantec was contracted to determine if special status freshwater mussels were present within the project footprint. Mr. Fleece was the task manager and technical lead for all elements of this work. Stantec personnel used SCUBA gear to survey in and around the proposed project area. Despite two days of searching for a total of 7.4 hours, no live mussels were observed. The absence of mussels was likely due to the lateral instability of the channel.

Freshwater Mussel Survey for Proposed Park, Lucas County, Ohio

Toledo Metroparks is proposed to excavate a cove along the Maumee River in the vicinity of the Clayton Street Bridge, Lucas County, Ohio for the purpose of allowing small, non-motorized water craft to have direct access to the river. According to the Ohio Mussel Survey Protocol, the Maumee River in Lucas County was a Group 3 stream, suggesting that Federally listed species were not expected in the project area. The objective of this study was to determine the presence or probable absence of special status species at the potential cove site, and if no Federally listed species were observed, relocate all mussels found within the project area.

*Stantec personnel conducted initial surveys at the site on Oct. 2, 2014. A total of 36 live animals and 1 fresh dead valve was observed during the survey. No Federally listed species or state listed species were observed during the initial mussel survey. Since no Federally listed species were present during the survey, Stantec personnel were able to begin the relocation effort on October 4, 2014. A seiche occurred during the relocation effort as a result of strong southwesterly winds. As a result, the river receded approximately 10 meters from the shoreline during the relocation surveys, exposing many small and juvenile mussels. A total of 376 live mussels were collected and relocated during the surveys. No Federally listed species were observed, but two live Ohio Species of Concern were observed during the relocation, one *Alasmidonta marginata* and one *Truncilla truncata*. A combined total of 9.62 hours was spent in the search cells for the relocation effort. Mussels were relocated approximately 100 meters upstream in the Maumee River to an area with equal or better habitat. Mr. Fleece was responsible for all aspects of this work including agency coordination, study plan development, field surveys, and reporting.*

3rd Avenue Bridge, Great Miami Mussel Survey

*The Montgomery County Engineer's office sought to replace or rehabilitate the 3rd Street Bridge over the Great Miami River in Dayton, Ohio. Stantec was contracted to determine the presence or probable absence of special status freshwater mussel taxa within the project footprint. Mr. Fleece was the task manager and technical lead for agency coordination, study plan development, field surveys, and reporting. Nearly 9 hours of search effort yielded only one live mussel, the elktote (*Alasmidonta marginata*) an Ohio Species of Concern.*

* denotes projects completed with other firms

William Cody Fleece

Senior Associate Malacologist

Freshwater Mussel Survey on the St. Croix River, Hudson, Wisconsin (Project Manager)

Mr. Fleece was the project manager and lead biologist for freshwater mussel surveys conducted on the St. Croix River in St. Croix County near Hudson, Wisconsin. These surveys were necessary to complete agency consultation under Section 7 of the Endangered Species Act as part of a proposed dredging project for the St. Croix Yacht Club. The proposed project fell within a National Scenic Riverway and four Federally endangered freshwater mussels, Higgins eye pearl mussel, snuffbox, spectaclecase, and winged mapleleaf, were known to occur close by. Stantec surveyed the area in the fall of 2013 and found 113 live animals comprised of nine species. Overall abundance was strongly skewed toward a single species, with over 84% of the individuals observed identified as the threeidge. No special status Federal species were observed but the flat floater and mapleleaf, both Wisconsin species of concern, were captured. Stantec personnel prepared the summary report for the survey that was subsequently approved by the U.S. Fish and Wildlife Service and the Wisconsin Department of Natural Resources thereby concluding endangered species consultation on the project.

Line 5 Endangered Mussel Survey, St. Clair County, Michigan (Lead Biologist, Task Manager)

*Enbridge Energy Limited Partnership needed to conduct maintenance to the Line 5 pipeline at its intersection with the Pine River in St. Clair County, Michigan. The proposed maintenance included excavation of the pipeline within the stream bed. The Pine River was known for populations of two Federally Endangered mussel species, the snuffbox (*Epioblasma triquetra*) and rayed bean (*Villosa fabalis*). Stantec conducted surveys to determine the presence or probable absence of these species in the Area of Direct Impact and in buffers above and below. A total of 48 live native mussels comprising ten species were observed in the project area. Two live specimens of the State Threatened slippershell (*Alasmidonta viridis*) and the State Species of Concern rainbow (*Villosa iris*) were encountered in the surveyed areas but no Federally listed species were observed.*

After coordination between the construction engineer and the resource agencies, it was determined that mussels would need to be relocated to suitable habitats outside the influence of construction activities. Mr. Fleece and the project team relocated over 130 mussels, comprised of 12 species. Mussels were marked with uniquely numbered tags and moved upstream approximately 500 feet. As part of this effort Stantec personnel encountered two live snuffbox mussels at the relocation site, constituting new locality records for this species. Mr. Fleece coordinated with agency personnel and the construction engineer regarding this discovery and both the relocation effort and project construction were allowed to proceed as

Mussel Survey for Proposed Generating Station, South-Central, Ohio

*A confidential client proposed construction of a pipeline in the Ohio River along the West Virginia/Ohio state line. Mr. Fleece was the technical lead for agency coordination, study design, field surveys, and reporting. Two field crews surveyed 126 transects measuring between 30 and 60 meters in length. This effort yielded 1,397 live mussels comprising 22 species. No Federally listed species were observed but a substantial proportion of the live animals were designated as endangered, threatened, or of concern by the State of Ohio. The most numerous species, three-horned wartyback (*Obliquaria reflexa*), was designated as threatened by the State of Ohio and accounted for 469 individuals or about 34 percent of the live animals observed. The State threatened black sandshell (*Ligumia recta*) was also very numerous and accounted for 10 percent of the live animals captured. Other State listed species included monkeyface (*Quadrula metanerva*), butterfly (*Ellipsaria lineolata*), washboard (*Megalania nervosa*), Ohio pigtoe (*Pleurobema cordatum*), pocketbook (*Lampsillis ovata*), round pigtoe (*Pleurobema sintoxia*), and deertoe (*Truncilla truncata*). Information generated in the study was used to avoid and minimize potential impacts to freshwater mussels. The data informed both project design and site selection.*

* denotes projects completed with other firms

William Cody Fleece

Senior Associate Malacologist

Dominion Monroe County Outlet Project Mussel Habitat Surveys, Monroe County, Ohio

Dominion East Ohio, Inc. (EOG) proposed construction of a new 16" natural gas gathering pipeline, known as the Monroe County Outlet Project, in Monroe County, Ohio, extending approximately 25.1 miles. The Ohio Department of Natural Resources (Ohio DNR) completed a review of the proposed project and requested a survey of freshwater mussels in the vicinity of the pipeline. The request came after survey windows for the mussel surveys had closed so EOG contracted with Stantec to assess habitats in the project area for evidence of mussel presence or absence. Stantec personnel evaluated habitat conditions including water chemistry, channel width and depth, and substrate composition at 11 stream crossings. Surveyors also conducted visually searched the channel for evidence of live animals and/or spent valves. Definitive evidence of freshwater mussel presence was observed at only one of the 11 streams. Five of the streams were deemed unsuitable for mussel presence due insufficient flow, bedrock outcrops, and/or water chemistry. The remaining streams were identified as potentially suitable and detailed surveys were recommended if trenching was proposed for construction.

Possum Hollow Mussel Habitat Assessment, Carbo, Virginia

Stantec was contracted by American Electric Power to conduct a mussel habitat assessment in a headwater tributary called Possum Hollow as one of several supporting studies for a proposed landfill project at the Clinch River Power Plant near Carbo, Virginia. Federally listed mussel species known to occur in the vicinity included Cumberlandian combshell, oyster mussel, purple bean, rough rabbitsfoot, cracking pearly mussel, fine-rayed pigtoe, and shiny pigtoe. Mr. Fleece assisted with field studies, examined the distribution, abundance and habitat utilization of federally listed species in the Clinch River basin and made determinations regarding the potential for project actions to affect these species.

* denotes projects completed with other firms

William Cody Fleece

Senior Associate Malacologist

PUBLICATIONS/PRESENTATIONS

Fleece, W.C., and B. Johnson. 2017. A desktop review of federally listed freshwater mussels, host fish and the potential pathways for impacts from water intakes. Clean Water Act §316(b) Technical Challenges for Ohio/Tennessee River Basin Power Plants and Annual Meeting of the Ohio River Ecological Research Program (ORERP). Oral Presentation. March 14-15, 2017 • American Electric Power Company, 1 Riverside Plaza, Columbus, Ohio.

Fleece, W.C., E.A. Bockstiegel, and J.D. Kiser. In revision. Freshwater mussel distribution and abundance in the pool of a lowhead dam as determined from collection and relocation following pool drawdown associated with dam removal on the Stillwater River, Miami County, Ohio. *Freshwater Mollusk Biology and Conservation*.

Matter, S.F., F.Borrero, and W.C. Fleece. Modeling the Survival and Population Growth of the Freshwater Mussel, *Lampsilis radiata luteola*. *American Midland Naturalist*, 2013.



Triston Mullins M.S.

Malacologist/Fisheries Biologist
9 years of experience · Louisville, Kentucky

Mr. Mullins currently serves as a fisheries biologist specializing in malacology out of Stantec's Louisville, Ky office. He has environmental industry experience as both a chemist and biologist, and he is proficient in the identification of benthic macroinvertebrates to family and genus level and southeastern fish and herptofauna to the species taxonomic level. Mr. Mullins is also recognized as an approved mussel surveyor for state protected species in West Virginia and Ohio and a federally permitted malacologist authorized for the handling of over 30 federally protected mussels within the Ohio and Upper Mississippi River drainages.

Mr. Mullins has regularly drafted study plans for state and federally protection species and led the subsequent presence absence surveys (i.e. crayfish, mussels, fish, and bats), been a field team leader for jurisdictional waters determination surveys, prepared technical reports, and assisted with mitigation site assessment, maintenance, and monitoring (i.e. macroinvertebrate, fish, and flora. His additional duties include leading technical research for novel ecological management methodologies including acoustic bat deterrence, environmental DNA sampling design, and aquatic resource management.

EDUCATION

B.S. Environmental Studies minor Chemistry,
Georgetown College, Georgetown, Kentucky, United States, (b)

M.S. Biology, Eastern Kentucky University,
Richmond, Kentucky, United States, (b)

CERTIFICATIONS & TRAINING

Approved Mussel Surveyor (95% Overall; 100% T&E), Ohio Division of Natural Resources, Columbus, Ohio, United States, 2022

Approved Mussel Surveyor (97% Overall; 100% T&E), West Virginia Division of Natural Resources, Elkins, West Virginia, United States, 2020

Appalachian Crayfishes Identification Workshop; Big Sandy and Guyandotte River Crayfish Survey Protocol, West Liberty University and USFWS, The Breaks Interstate Park, Kentucky and Virginia, United States, 2016

Essential Skills for Next Generation Sequencing and Data Analysis Workshop, University of Kentucky, Lexington, Kentucky, United States, 2015

Waters of the U.S. Wetland Training, Richard Chinn's Wetland Delineation Training Program, Louisville, Kentucky, United States, 2018

MEMBERSHIPS

Member, Freshwater Mollusk Conservation Society

Member, Society for Freshwater Science

Member, Ohio River Valley Mollusk Group

PROJECT EXPERIENCE

AQUATIC ECOLOGY

Brent Spence Mussel Survey | KYTC and ODOT | Cincinnati, OH, USA | Lead Malacologist

The Ohio Department of Transportation (ODOT) and Kentucky Transportation Cabinet (KYTC) jointly funding the design build for rehabilitation improvements and an adjacent bridge at the Brent Spence Bridge carrying I-71 and I-75 across the Ohio River between Cincinnati, OH and Covington, KY. The Brent Spence Bridge is in need of necessary maintenance, and the project addresses the on-going deterioration and extends the life of the bridge. In order to properly assess the mussel fauna assemblages within the proposed ROW of the new bridge, KYTC had HMB contract Stantec to perform surveys on both banks of the river. Triston served as the federally permitted malacologist on site and scientific diver, which included the coordination of activities with state and federal agencies and oversaw the handling of all freshwater mussels found during the surveys.

Mussel Survey Services – Portsmouth Water Treatment Plant (WTP) and Boat Ramp for the City of Portsmouth, Ohio (Owner) | Portsmouth, Ohio | Lead Malacologist

The City of Portsmouth (City) planned to undertake improvements to its Water Treatment Plant and to a boat ramp near Offnere Street along the Ohio River shoreline. Two 36-inch water intake lines will be constructed in the Ohio River to support drinking water needs for the City and surrounding municipalities. In order to assess the presence or likely absence of state and federally protected freshwater mussel species, Stantec was contracted to perform mussel surveys at the respective sites. As lead malacologist on site, Triston coordinated with the relevant state and federal agencies and oversaw the handling and identification of all freshwater mussel found on site.

Claytor Hydroelectric Project FERC No. 739
Freshwater Mussel Adaptive Management Monitoring
| Pulaski County, Virginia | Aquatic Biologist

Stantec Consulting was contracted to conduct water quality and mussel surveys on the New River as a condition of Appalachian Power Company's FERC license for the Claytor Hydroelectric project. This study is part of a Freshwater Mussel Adaptive Management Plan (the Plan) that is designed to determine if flow, temperature, and/or occasionally depressed dissolved oxygen (DO) concentrations are affecting freshwater mussels downstream of Claytor Dam over the term of the new license. Mr. Mullins supported the deployment and continued monitoring of mussel species placed into the Clinch River system. Duties including the handling and care for juvenile mussels, appropriate placement and installation of monitoring silos, and the collection of physiochemical and mussel biometric data.

Bridging Kentucky Program | Kentucky Transportation Cabinet | Kentucky, United States | 2018-Present | Ecologist/Biologist

Triston performed ecological resource surveys, mussel surveys, Section 404/401 permitting and biological assessment preparation for the rehabilitation, repair, or replacement of critical bridge structures associated with the KYTC Bridging Kentucky Program in all 120 KY counties. As a sub-consultant to Stantec, Triston conducted protect species habitat assessments at over 200 bridges and organized over 60 field efforts for the surveying of federally protected fish, mussels, and crayfish. Some surveys had multiple reaches sampled per a survey effort. During each field effort as field team leader, Triston has worked with subject matter experts (federally permitted biologists) so that the team was able to gather the correct data according to each survey protocol and project specific study plans and aided with the identification of common and rare/protected species. For bridge projects needing formal Section 7 consultation, Triston drafted study plans and organized field efforts for species relocation efforts. At the conclusion of each survey, Triston provided the needed materials and technical language in order to complete the associated Biological Assessments.

Kentucky Department of Fish & Wildlife Resources
Fee In-Lieu of Mitigation Program * | Kentucky
Department of Fish and Wildlife Resources |
Kentucky, United States | Ecology Technical Team
Lead at Eco-Tech Consultants

The Kentucky Division of Fish and Wildlife Resources (KDFWR) Wetland and Stream Mitigation "Fee In-Lieu of" (FILO) Program provides a way to fulfill compensatory mitigation requirements associated with the Clean Water Act, Section 404 and 401. The intent of the mitigation is to compensate for the permanent loss of aquatic functions within a defined watershed or regional area. Beginning in 2016, Triston has led and assisted field teams to perform wetland and stream delineations, aquatic surveys for benthic macroinvertebrates and fish, and botanical monitoring that support the design and construction of stream and wetland mitigation sites under the FILO program. Additionally, Triston identified all fish specimens, catalogued photo vouchers of specimens, calculated all stream health metrics, and prepared language for reporting of the interpretation of the biotic integrity and water quality measurements observed.

Mother Ann Lee Hydroelectric Facility FERC Re-Licensing * | Lock 7 Hydro Partners, LLC | High Bridge, Jessamine County, KY, USA | Aquatic Biologist/ Field Lead at Eco-Tech Consultants

Lock 7 Hydropartners required assistance in responding to environmental issues raised during the Federal Energy Regulatory Commission (FERC). Triston prepared an assessment of available habitat for the federally protected sheepsnose mussel (*Plethobasus cyphus*) in the Kentucky River. In order gather data, Triston characterized the river substrate through snorkelling and freediving to the river bottom being supported by a teammate in a watercraft.

Kentucky River Lock and Dam No. 13 Endangered Species Coordination * | Appalachian Hydro Associates | Mercer County, KY, USA | Aquatic Biologist/Field Lead at Eco-Tech Consultants

Appalachian Hydro Associates required Endangered Species Act coordination in order to document environmental activities as directed by U.S. Fish and Wildlife Service (USFWS) and the Federal Energy Regulatory Commission (FERC). Triston prepared an assessment of available habitat for the federally protected snuffbox (*Epioblasma triquetra*), rabbitsfoot (*Quadrula cylindrica cylindrica*), and sheepsnose mussel (*Plethobasus cyphus*) in the Kentucky River. In order gather data, Triston characterized the river substrate through snorkelling and freediving to the river bottom being supported by a teammate on the shoreline.

Mussel Survey for a Proposed Pipeline Replacement across the Great Miami River * | Civil and Environmental, Inc./Duke Energy | Middletown, Butler, OH, USA | Aquatic Biologist at Eco-Tech Consultants

A pipeline crossing was proposed at the Great Miami River and so a mussel survey was contracted with the federally protected rayed bean (*Villosa fabilis*) being listed as extant in the vicinity by the U.S. Fish and Wildlife Service (USFWS). Triston drafted the study plan presented to USFWS and Ohio Division of Natural Resources (ODNR), and he aided the permitted malacologist in organization and implementation of field surveys. Triston prepared and submitted the subsequent survey report. Aquatic

Assessment at Proposed Seven Hills Mine along Pigeon Creek * | Peabody Energy | Warrick County, IN, USA | Aquatic Biologist at Eco-Tech Consultants

As part of the environmental activities required to be performed by United States Army Corps of Engineers (USACE) and the Indiana Department of Environmental Management (IDEM) at the proposed Seven Hills surface mine permit area, an aquatic assessment was contracted mirroring the methodology and assessment performed in 2011. Triston organized and led fish and macroinvertebrate surveys. Post surveys, Triston identified all fish voucher specimens, calculated all stream health metrics, and prepared an assessment report, interpreting the biotic integrity and water quality measurements observed.

2016 Freshwater Mussel Transect Monitoring of the Muskingum River Dresden Plant Intake Facility* | Marine Solutions, Inc./American Electric Power | Dresden, Muskingum County, OH, USA | Aquatic Biologist at Eco-Tech Consultants

To facilitate cooling at the power generation facility an intake is operated from a bank of the Muskingum River, which needs to be dredged periodically in order to remove the sediment obstructing the intake. Annual monitoring and translocation of native mussels was required by U.S. Fish and Wildlife Service (USFWS) and Ohio Division of Natural Resources (ODNR) because the Muskingum River is known to be habitat for the federally protected snuffbox mussel (*Epioblasma triquetra*) and rabbitsfoot (*Quadrula cylindrica cylindrica*). Triston assisted with the field efforts and drafting of the final monitoring report.

SCIENTIFIC RESEARCH

Environmental DNA Collection and Extraction Research* | Eastern Kentucky University | Richmond, KY, USA | Graduate Researcher at Eastern Kentucky University

As a student researcher, Mr. Mullins worked in a lab concentrated on the capture, extraction, sequencing, and bioinformatic analysis of DNA, specifically freshwater invertebrates. He spearheaded the research for comparing and modifying existing eDNA capture and DNA extraction protocols. As part of his thesis project, he designed field protocols and devices for the capture of eDNA. Post field collection, Mr. Mullins used metabarcoding of eDNA consisting of a section of the cytochrome oxidase 1 (COI) gene region (~700 bp). Using a gene library of species previously identified at the site by state agencies, he designed a bioinformatics pipeline for making taxonomic assignments. The result was being able to compare common methodologies for DNA extraction by multivariate statistical analysis.

PUBLICATIONS

Mullins, M.T.. *Sample Collection and DNA Extraction Methods for Environmental DNA Metabarcoding in Headwater Streams*, 2017.

PRESENTATIONS

A River Runs Through It: An Ecological Assessment of Taylor Fork Ecological Area. *Eastern Kentucky University Biological Sciences Department, Spring 2015 Posters*, 2015.