

**Illinois Department of Natural Resources**  
**CONSERVATION PLAN**  
*(Application for an Incidental Take Authorization)*  
Per 520 ILCS 10/5.5 and 17 Ill. Adm. Code 1080

**150-day minimum required for public review, biological and legal analysis, and permitting**

PROJECT APPLICANT: *IROQUOIS COUNTY HIGHWAY DEPARTMENT*

PROJECT NAME: *COUNTY HIGHWAY 4 OVER PIKE CREEK*

COUNTY: *IROQUOIS COUNTY*

AMOUNT OF IMPACT AREA: *95 LINEAR FEET OF PIKE CREEK  
PIKE CREEK IN THE VICINITY OF THE PROPOSED  
BRIDGE REPLACEMENT ON COUNTY HIGHWAY 4.*

The incidental taking of endangered and threatened species shall be authorized by the Illinois Department of Natural Resources (IDNR) only if an applicant submits a conservation plan to the IDNR Incidental Take Coordinator that meets the following criteria:

1. A **description of the impact likely to result** from the proposed taking of the species that would be covered by the authorization, including but not limited to -

A) Identification of the **area to be affected** by the proposed action, include a legal description and a detailed description including street address, map(s), and GIS shapefile. Include an indication of ownership or control of affected property. Attach photos of the project area.

*The project construction area involves the complete replacement of the structure on Iroquois County Highway 4 (E 2850 North Road) over Pike Creek. The structure is located approximately 3.5 miles west-northwest of Martinton in Township 28N, Range 13W, Section 11, of the 2<sup>nd</sup> Principal Meridian. The structure is included on the Gilman Quadrangle Topographic map and may also be located as Latitude 40.92515°N, Longitude 87.79247°W.*

*The closest postal address to the project location is:  
1798 E 2850 North Road, Martinton, IL 60951.*

*Iroquois County has ownership of the roadway right of way through the project location. The existing right of way is 60 feet centered about the centerline of County Highway 4. Land ownership to the north and south of the roadway right of way is under private ownership. Scott and Connie Stirling own the property to the south of the project. Arthur and Sandra Balthazor own the property to the north of the project. Proposed right of way from both of these property owners will be necessary to complete the project.*

*Please see attached location map, topographic map, and project photographs. Electronic GIS shapefiles of the project area will also be submitted.*

B) **Biological data** on the affected species including life history needs and habitat characteristics. Attach all pre-construction biological survey reports.

**State-Listed Mussel Species:** *A mussel survey was conducted in Pike Creek in the vicinity of the proposed structure replacement on July 23-24, 2020. Among the live species collected was one state-endangered species, the Spike (Eurynia dilatata). No live federally-listed species were collected. The state listed mussel species is described below.*

**State-Listed Fish Species:** *A fish survey was conducted in Pike Creek in the vicinity of the proposed structure replacement on July 8, 2020. All taxa encountered were common inhabitants of central Illinois headwater streams. No species collected are listed as threatened or endangered at the federal or state level, nor candidates for listing in Illinois.*

*The Aquatic Survey Report completed by the Illinois Natural History Survey is attached.*

**Spike Mussel (Eurynia dilatata)**

*In the United States, the Spike mussel may be found in the upper midwest region, primarily in the upper watershed reaches of the Missouri, Mississippi, and Ohio River basins. Spike mussels are usually found in small streams to large rivers, but they are also known to inhabit reservoirs and lakes. They are most often found in sand, silt, and gravel substrates in water depths ranging from 2-24 feet. (Parmalee and Bogan 1998). When spike mussels do inhabit lakes or reservoirs, they are normally found within the outlet habitats dominated by swift currents.*

*Mussels are long-lived animals. Members of many species may live for several decades and in some instances, a century or more. Survival rates for populations of Spike mussels, much like other long-lived organisms, are high. Hart et al. (2001) reported that Spike mussels have mean annual survival rates greater than 90 percent. These survival rates were measured in habitats colonized by Zebra mussels (Dreissena polymorpha), and the survival rates in habitats without Zebra mussels would most likely be even higher.*

*Mussels have a complex and distinctive reproductive cycle. Males release sperm into the water, which are drawn in by females through their incurrent siphon. Fertilized eggs are brooded in the female's gills, where they develop into tiny larvae called glochidia. The Spike is a tachytictic breeder, with females brooding their young short-term, from May through August, before they are released as glochidia (Baker 1928). Once the glochidia are expelled from the female's gills, they attach to fish gills or fins by clamping onto them with their valves. The glochidia live as parasites on the host fish until they develop into juvenile mussels, at which point they detach from the fish and fall to the streambed as free-living mussels. Fish hosts for the glochidia of the Spike mussel include the gizzard shad (Dorosoma cepedianum), flathead catfish (Pylodictis olivaris), white crappie (Pomoxis annularis), black crappie (P. nigromaculatus), and yellow perch (Perca flavescens) (Fuller 1974).*

*Degradation of mussel habitat in streams throughout the Spike's known range is a continuing threat. General declines or extirpations in mussel populations are attributed to habitat change and water quality changes that can be linked to pollution from siltation, and urban runoff. (Downing et al. 2010). There are also recent findings indicating glochidia are acutely sensitive to small ammonia spikes (USEPA, 2009) indicating that ammonia runoff from lawns, turf grass, farms, and perhaps wastewater treatment plant overflows during heavy rain events may contribute to a lack of recruitment for larval mussels. The Spike mussel is also being impacted by the infestation of non-native Zebra mussels in the Mississippi River and its tributaries. Zebra mussels can attach themselves in large numbers to the shells of native mussels, eventually causing death by suffocation.*

**C) Description of project activities** that will result in taking of an endangered or threatened species, including practices and equipment to be used, a timeline of proposed activities, and any permitting reviews, such as a USFWS biological opinion or USACE wetland review. Please consider all potential impacts such as noise, vibration, light, predator/prey alterations, habitat alterations, increased traffic, etc.

*The existing structure on Iroquois County Highway 4 over Pike Creek will be completely removed and replaced with a longer and wider structure. The initial construction activities will include removal of the existing bridge deck, supporting piers, and supporting abutments. The existing bridge deck is composed of individual pre-cast concrete deck beams that will be removed individually with a crane. Removal of the deck beams from the center span will be over the channel of Pike Creek and may include minor debris falling into the creek. The existing soils and material around the individual pier columns and the abutments will be excavated such that the pier columns and abutments may be cut off below the finished ground level and removed. Heavy equipment will be used to excavate this material and remove the pier columns and abutments.*

*Construction of the new bridge will begin with placement of a temporary crossing for Pike Creek. These temporary crossings are generally constructed with aggregate materials over temporary metal culvert pipes. The temporary crossing will be necessary to move heavy equipment, materials, and personnel from one side of the creek to the other throughout construction. Please see attached general illustration of a temporary creek crossing.*

*The first item of construction will be cofferdams for the new pier locations. These two cofferdams will be constructed with metal sheet piling driven in a rectangular shape around the pier locations. The soils will be excavated from within the cofferdam and it will be de-watered. The steel piling will be driven in the proper locations and a concrete encasement will be placed around the piling to form a foundation for the pier stem. Once the foundation and concrete pier stem are in place, the metal sheet piling will be removed around the cofferdam. Heavy equipment including a crane, tracked excavators, concrete delivery trucks, and light duty trucks will utilize the temporary crossing as part of the cofferdam and pier stem construction.*

*The construction of the bridge abutments and bridge deck should not have any impact on the channel of Pike Creek; however, once the abutments are complete, and prior to placing the bridge deck, the channel banks will be lined with stone riprap directly under the proposed bridge. The width of this riprap placement will be 40 feet along the length of the creek channel. The stone riprap will be used to prevent erosion and scour around the new bridge piers and under the new bridge along the channel banks.*

*The construction of the temporary creek crossing has the potential to bury and crush mussel species within the footprint of the temporary crossing. The removal of soil materials around the existing piers in order to remove the piers, plus the removal of soil materials within the cofferdams to construct the new piers has the potential to excavate mussel species from the channel bottom. Finally, the placement of stone riprap under the proposed structure along the channel banks has the potential to bury and crush mussel species within the footprint of the proposed right of way for this project.*

*It is anticipated the construction activities for this project will commence as early as June 1, 2021. This date is dependent on the approval of the ITA and relocation of any existing mussels from the construction area. Construction is scheduled to be complete by November 30, 2021.*

*The U.S. Army Corp of Engineers has reviewed the project specifics for this structure replacement to determine compliance with Section 404 of the National Clean Water Act as a*

*Linear Transportation Project. Their review considered cultural, historical, biological, and wetland resources as part of the Nationwide Permit Number 14 issuance. A copy of the Nationwide Permit #14 approval letter is attached.*

D) Explanation of the anticipated **adverse effects on listed species**;

- How will the proposed actions impact each of the species' life cycle stages?

*The Spike is a tachytictic breeder, with females brooding their young short-term, from May through August, which is the height of construction season, before they are released as glochidia (Baker 1928). Once the glochidia are expelled from the female's gills, they attach to fish gills or fins by clamping onto them with their valves. The glochidia live as parasites on the host fish until they develop into juvenile mussels, at which point they detach from the fish and fall to the streambed as free-living mussels. The mussel will then burrow into the soft streambed and remain there unless flooding events scour the streambed and relocate the mussel.*

*If not relocated, mussels would likely be buried or otherwise crushed or killed by construction activities. The potential adverse impacts would result from constructing the temporary creek crossing, cofferdams, removal of the existing bridge piers, construction of the new piers, and placement of the stone riprap erosion protection. There is also a possibility of temporary sedimentation due to the reduced waterway opening width under the temporary creek crossing.*

*It will be especially important to relocate female Spike mussels from the construction footprint as they will be brooding their young during the construction timeframe.*

- Describe potential impacts to individuals and the population. Include information on the species life history strategy (life span, age at first reproduction, fecundity, recruitment, survival) to indicate the most sensitive life history stages.

*The largest potential impact to individual mussels and the population in general will be from crushing during the construction of the temporary creek crossing. If all of the mussels are not relocated from the footprint of the temporary crossing, there is the potential they will be buried under several feet of embankment material used to build the temporary crossing.*

*There is also the possibility of the construction operations increasing the turbidity of the water downstream of the construction process. Construction of the temporary creek crossing, removal of the existing bridge piers, and construction of the proposed bridge piers will all require some amount of activity in the creek channel. These operations will be minimized as much as possible, but are unavoidable for the construction of the proposed bridge.*

- Identify where there is uncertainty, place reasonable bounds around the uncertainty, and describe how the bounds were determined. For example, indicate if it is uncertain how many individuals will be taken, make a reasonable estimate with high and low bounds, and describe how those estimates were made.

*The direct footprint of the proposed construction project includes an area 95 feet long and 50 feet wide. The 95-foot length is along the creek channel from proposed right of way line to proposed right of way line. The 50-foot width is from creek bank to creek*

*bank in between the proposed bridge pier locations. The indirect footprint of the proposed construction project may include the migration of some smaller stone riprap pieces downstream during flooding events, as well as an increased turbidity of the water downstream of the construction project.*

*The mussel survey conducted on July 23-24, 2020 recovered 410 live mussels from a 120-foot length of Pike Creek directly under and adjacent to the structure to be replaced. The 410 live mussels included one (1) live Spike mussel (*Eurynia dilatata*). It is uncertain how many live Spike mussels may be taken as part of this construction project; however, a reasonable estimate would be one (1) to five (5) live Spike mussels.*

2) Measures the applicant will take to **minimize and mitigate** that impact and the **funding** that will be available to undertake those measures, including, but not limited to -

A) Plans to **minimize the area affected** by the proposed action, the estimated **number of individuals** of each endangered or threatened species that will be taken, and the **amount of habitat** affected (please provide an estimate of area by habitat type for each species).

*The construction of a temporary channel crossing is necessary for the movement of heavy equipment from one end of the project to the other. The footprint area of this crossing will be minimized as much as possible, and the duration of the temporary channel crossing will be minimized as much as possible. The stone riprap proposed for erosion protection under the new bridge will be 40 feet in width, which is just slightly wider than the new bridge width. Under normal circumstances, this stone riprap would be placed from proposed right of way line to proposed right of way line, which in this case would be 95 feet. In addition, the stone riprap in the bottom of the channel has been removed from the proposed plans as a means to leave as much natural habitat in place as possible once construction is complete.*

*The mussel survey conducted on July 23-24, 2020 recovered 410 live mussels from a 120-foot length of Pike Creek directly under and adjacent to the structure to be replaced. The 410 live mussels included one (1) live Spike mussel (*Eurynia dilatata*). It is uncertain how many live Spike mussels may be taken as part of this construction project; however, a reasonable estimate would be one (1) to five (5) live Spike mussels.*

*The temporary channel crossing will impact an area of approximately 800 square feet of silty / sandy streambed habitat. This will be a temporary impact as the crossing will be removed as part of the construction process. The stone riprap placed under the proposed structure in the toe or cleat area of the streambed will impact an area of approximately 650 square feet of silty / sandy streambed habitat. This will be a permanent impact as the stone riprap will be left in place.*

B) **Plans for management of the area** affected by the proposed action that will **enable continued use** of the area by endangered or threatened species by maintaining/re-establishing suitable habitat (for example, native species planting, invasive species control, use of other best management practices, restored hydrology, etc.).

*During construction, the adjacent areas of land will contain erosion and sediment control features. The IDOT erosion and sediment control policy will be followed and the project will be in compliance with Section 404 of the Clean Water Act as regulated by the U.S. Army Corp of Engineers, the water quality certification policies of the Illinois EPA, and the requirements of the NPDES construction permit. Other than the pier foundations and the stone riprap for erosion*

*control, all work in the channel is temporary. It is expected, after the in-stream work is completed, the area will be available for recolonization by all species of mussels.*

C) Description of **all measures to be implemented to avoid, minimize, and mitigate** the effects of the proposed action on endangered or threatened species.

- Avoidance measures include working outside the species' habitat.
- Minimization measures include timing work when species is less sensitive, reducing the project footprint, or relocating species out of the impact area.
- Mitigation is additional beneficial actions that will be taken for the species such as needed research, conservation easements, propagation, habitat work, or recovery planning.
- It is the **applicant's responsibility to propose mitigation measures**. IDNR expects applicants to provide species conservation benefits 5.5 times larger than their adverse impact.

*Completely avoiding effects to the Spike mussel and general mussel population in the construction footprint will be next to impossible. A temporary creek crossing will need to be installed for the contractor to mobilize from one side of the creek to the other throughout the construction process. However, as much as possible, the construction of the new bridge piers and foundations will be done outside the limits of the existing creek bottom. Once complete, the new piers will be outside the natural flow line of the creek, which removes this obstacle from the natural creek bottom.*

*The current plan to minimize the effects of the construction project on the Spike mussel is to relocate all mussel species from the project footprint immediately before construction begins. The construction process is currently scheduled to begin as soon as June 1, 2021. The relocation of all live mussels from the project area will take place during April or May 2021 depending on weather and creek conditions.*

*A moving transect method of mussel collection will be utilized during the relocation process. Transects of one meter (3.28 ft) in width will be established perpendicular to the stream flow within the area of direct impact from the project plus a buffer zone. The total area sampled will be 50 meters (150 ft) in length centered upon the midpoint of the bridge. A total of 50 transects will be established and they will be processed from downstream to upstream through the project and buffer areas. The creek bottom will be disturbed to approximately two inches deep to uncover any buried mussels. The temporary holding of mussels will be in containers that allow the mussels to remain moist and uncrowded. All mussel relocation protocols will be followed. IDOT will be responsible to coordinate the mussel relocation.*

*The best relocation area will be determined by the team performing the relocation efforts. The team may use the same one utilized during the initial mussel salvage survey conducted on July 23-24, 2020. This relocation area is approximately 300 yards upstream of the project location. The team may also select a relocation area under the upstream bridge on N 1850 East Road over Pike Creek. This relocation area is approximately 1,950 yards upstream of the project location. Mussels were located here in 2010 during this bridge replacement project. Finally, the team may select a relocation area under the downstream bridge on 1700 East Road over Pike Creek. This relocation*

*area is approximately 2,050 yards downstream of the project location. All of these relocation areas contain similar substrate and habitat as the project location. The relocation areas also contain similar native mussel communities as to what was collected from the project location during the initial mussel salvage survey.*

*An additional effort to minimize the long term effects of the construction project on the Spike mussel and the general mussel population will be to provide a creek bottom with similar suitable habitat as the existing creek bottom conditions. The typical construction practice for erosion control at bridge replacement projects is to place stone riprap through the channel bottom and up the channel banks under the footprint of the newly constructed bridge. On this project, the proposed plans will include a toe or cleat at the bottom of the channel bank to hold the stone riprap in place up the channel bank. The stone riprap through the channel bottom will be eliminated and the channel bottom will be allowed to return to natural conditions once the construction process is complete. Please see the attached illustration of the stone riprap toe.*

*The project cost savings which are realized by removing the stone riprap and filter fabric from the creek bottom will be used as a compensatory payment for the conservation of the Spike mussel. This payment will be made by Iroquois County to the Illinois Wildlife Preservation Fund to be earmarked for the conservation and protection of the Spike mussel. The project cost savings are estimated to be \$5,600.00. The compensatory payment to the Illinois Wildlife Preservation Fund will be in the amount of \$5,600.00.*

D) Plans for **monitoring** the effects of the proposed actions on endangered or threatened species, such as monitoring the species' survival rates, reproductive rates, and habitat before and after construction, include a plan for follow-up **reporting to IDNR**. Monitoring surveys should be targeted at reducing the uncertainty identified in Section 1.d.

*INHS will conduct follow up mussel surveys under the new bridge and at the relocation site at one year and five years after the construction project is complete. The INHS reports will be forwarded to the IDNR and IDOT.*

E) **Adaptive management practices** that will be used to deal with changed or unforeseen circumstances that may affect the endangered or threatened species.

- Adaptive management is a way to make decisions in the face of uncertainty by monitoring the uncertain element over time and adjusting to the new information. Adaptive management requires identifying objectives and uncertainties, thinking through a range of potential outcomes, developing triggers that will lead to different actions being taken, and monitoring to detect those triggers.
- Consider environmental variables such as flooding, drought, and species dynamics as well as other catastrophes. Management practices should include contingencies and specific triggers. Note: Not foreseeing any changes does not qualify as an adaptive management plan.

*Mussel relocation is dependent on the flow and volume of water in the creek at the time of the mussel salvage and relocation operations. If the flow is swift and / or the water levels are high, the relocation effort will not take place and the instream work of the construction project will be delayed. Mussel relocation will occur only when water levels are low and stream current / flow conditions are moderate or low.*

*The mussel relocation area will be carefully screened to assure the habitat is suitable for the transported mussels. Risks of external threats to the relocation area (siltation, chemical spills, etc.) will be evaluated and minimized.*

*The project proposal is to completely remove and replace the existing bridge at this location. There is a very slight chance of complete structure failure during the removal process. The existing structure is composed of pre-cast, pre-stressed concrete deck beams. These beams form the bridge superstructure and driving surface all in one. Each beam is 17 inches thick, by 48 inches wide, by approximately 40 feet long. These beams will be removed one at a time by crane and transported away from the project site. There is a slight possibility one, or multiple, beams could fall into the creek during the removal process. Procedures will be taken to quickly and completely remove the beam(s) from the creek.*

*The existing concrete piers and pier caps will also be completely removed. These cast in place concrete features will likely be pulled and broke over or cut off for removal. The final removal requires each pier pile to be cut off at least one foot below the existing ground line. The concrete and steel rebar debris will be collected and removed from the project site. There is a possibility that during removal the pier piles or pier cap could fall into the creek. Procedures will be taken to quickly and completely remove the materials from the creek.*

*Instructions will be added to the General Notes on the plan sheets to avoid dropping materials into Pike Creek. Instructions will also be added to quickly and completely remove any and all material that does fall into Pike Creek.*

**F) Verification that adequate funding exists** to support and implement all minimization and mitigation activities described in the conservation plan. This may be in the form of bonds, certificates of insurance, escrow accounts, or other financial instruments adequate to carry out all aspects of the conservation plan.

*Iroquois County will enter into a federal aid agreement with the State of Illinois, Department of Transportation, for the construction and observation of this project. Approval of the agreement and expenditure of the federal funding is contingent upon the county, and contractor, following the approved Conservation Plan.*

3) A description of **alternative actions** the applicant considered that would reduce take, and the reasons that each of those alternatives was not selected. A **"no-action" alternative** shall be included in this description of alternatives. Please describe the economic, social, and ecological tradeoffs of each action.

- Consideration of **alternative actions** is an important tool in conservation planning as it allows for thinking of other options and evaluating the potential outcomes in terms of all relevant objectives. However, to be useful it requires creativity in developing alternatives and systematic analysis in evaluating the alternatives.
- In evaluating alternatives, describe the economic, social, and ecological tradeoffs of each.

#### **No Build Alternative**

*The only alternative that would not result in the possibility of taking a state listed species is the "no build" alternative. However, this would result in leaving a structure which is functionally obsolete and structurally deficient in place to the traveling public. The structure is also load posted for legal loads only with a sufficiency rating of 23.3 out of 100. A new structure is needed for the safe passage across Pike Creek for the residents of Iroquois County, as well as to allow heavier permit loads to cross Pike Creek at this location. Leaving the existing structure in place will only result in more deterioration as time passes, and more weight and size restrictions on vehicles allowed to cross the structure. A structure*



posted with weight and size restrictions will have a negative impact on the agricultural community in this area. Forcing detours around this location for farming implements and loaded grain delivery trucks will have a negative impact on the economy in this area.

### **Three Span Structure Utilizing Existing Piers**

*This alternative would reconstruct the bridge superstructure (beams and deck surface) as well as the bridge abutments, but leave the existing piers and pier caps in place. This alternative eliminates the removal process of the existing piers from the creek channel and the construction of new pier foundations (with cofferdams) in the creek channel. However, this alternative does not eliminate the need for a temporary creek crossing during the construction activities. Also, utilizing this alternative will not alleviate the load posting requirement for the new structure as the existing piers are undersized for current design standards. In addition, utilizing 60 year old piers with new abutments and a new superstructure results in an incompatible structure that will ultimately fail as the piers fail and long before the new superstructure fails. This would not be a prudent use of public tax funding. As with the no build alternative, a structure posted with weight and size restrictions will have a negative impact on the agricultural community in this area. Forcing detours around this location for farming implements and loaded grain delivery trucks will have a negative impact on the economy in this area.*

### **Three Span Structure With Piers Out of the Creek Channel**

*This alternative would completely reconstruct the bridge over Pike Creek at this location. This alternative includes removing the existing piers from the creek channel and constructing new bridge piers outside the limits of the existing normal water flow line. This alternative also requires the need for a temporary creek crossing during the construction activities. In an effort to minimize long term effects to the creek channel and the habitat of the Spike mussel, the riprap erosion protection will be excluded from the bottom of the creek channel. Riprap erosion protection will be placed on the creek banks under the new bridge and a toe or cleat will be used at the base of the creek bank to hold the riprap and creek bank in place. Utilizing this construction technique will provide for a natural silty / sandy bottom to the creek channel for the mussel population. This alternative is the only one that can be built economically and minimizes the impacts to the creek and mussels. This alternative also eliminates the load posting for the structure over Pike Creek, which will allow free flow of goods and services over Pike Creek and additional economic opportunities for the surrounding area of Iroquois County.*

*The three span structure with piers out of the creek channel was chosen for construction at this location.*

4) Data and information to indicate that the proposed taking **will not reduce the likelihood of the survival** of the endangered or threatened species in the wild within the State of Illinois, the biotic community of which the species is a part, or the habitat essential to the species existence in Illinois.

*Suitable habitat exists both upstream and downstream of the proposed bridge construction site in Pike Creek. This is evident as the relocation site for the mussel salvage conducted by INHS on July 23-24, 2020 was only 300 yards upstream of the proposed construction site. Due to the small area affected by construction of the new bridge and the relocation of the mussels from areas to be affected by construction activities, it is expected the Spike mussel will continue to exist in this reach of Pike Creek.*

*It should also be noted there are multiple other populations of the Spike mussel located in Illinois that will not be affected by this project. Therefore, this project should not affect the survivability of the species in the wild in Illinois.*

5) An **implementing agreement**, which shall include, but not be limited to (on a separate piece of paper containing signatures):

A) Names and signatures of all participants in the execution of the conservation plan;

B) The obligations and responsibilities of each of the identified participants with schedules and deadlines for completion of activities included in the conservation plan and a schedule for preparation of progress reports to be provided to the IDNR;

C) Certification that each participant in the execution of the conservation plan has the legal authority to carry out their respective obligations and responsibilities under the conservation plan;

D) Assurance of compliance with all other federal, State and local regulations pertinent to the proposed action and to execution of the conservation plan;

E) **Copies of any final federal authorizations for a taking already issued to the applicant**, if any.

*Please see the attached Implementing Agreement.*

**PLEASE SUBMIT TO: Incidental Take Authorization Coordinator, Illinois Department of Natural Resources, Division of Natural Heritage, One Natural Resources Way, Springfield, IL, 62702 OR [DNR.ITAcordinator@illinois.gov](mailto:DNR.ITAcordinator@illinois.gov)**

July 2016

Implementing Agreement  
For  
Incidental Take Authorization

Iroquois County  
County Highway 4 over Pike Creek

The Iroquois County Highway Department will be responsible for the activities related to the County Highway 4 over Pike Creek bridge replacement project. Iroquois County, in conjunction with the Illinois Department of Transportation, will oversee the activities of the contractor. Construction is scheduled to begin as early as June 1, 2021. This date is dependent on the approval of the ITA and relocation of any existing mussels from the construction area. Construction is scheduled to be complete by November 30, 2021. Once the construction project is complete, a report will be submitted to the IDNR summarizing all activities that occurred prior to the commencement of monitoring activities.

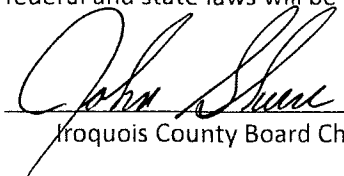
As part of the project implementation, Iroquois County pledges to contribute \$5,600.00 to the Illinois Wildlife Preservation Fund to be earmarked for the conservation and protection of the Spike mussel (*Eurynia dilatata*).

Coordination of this project has taken place with the following agencies:

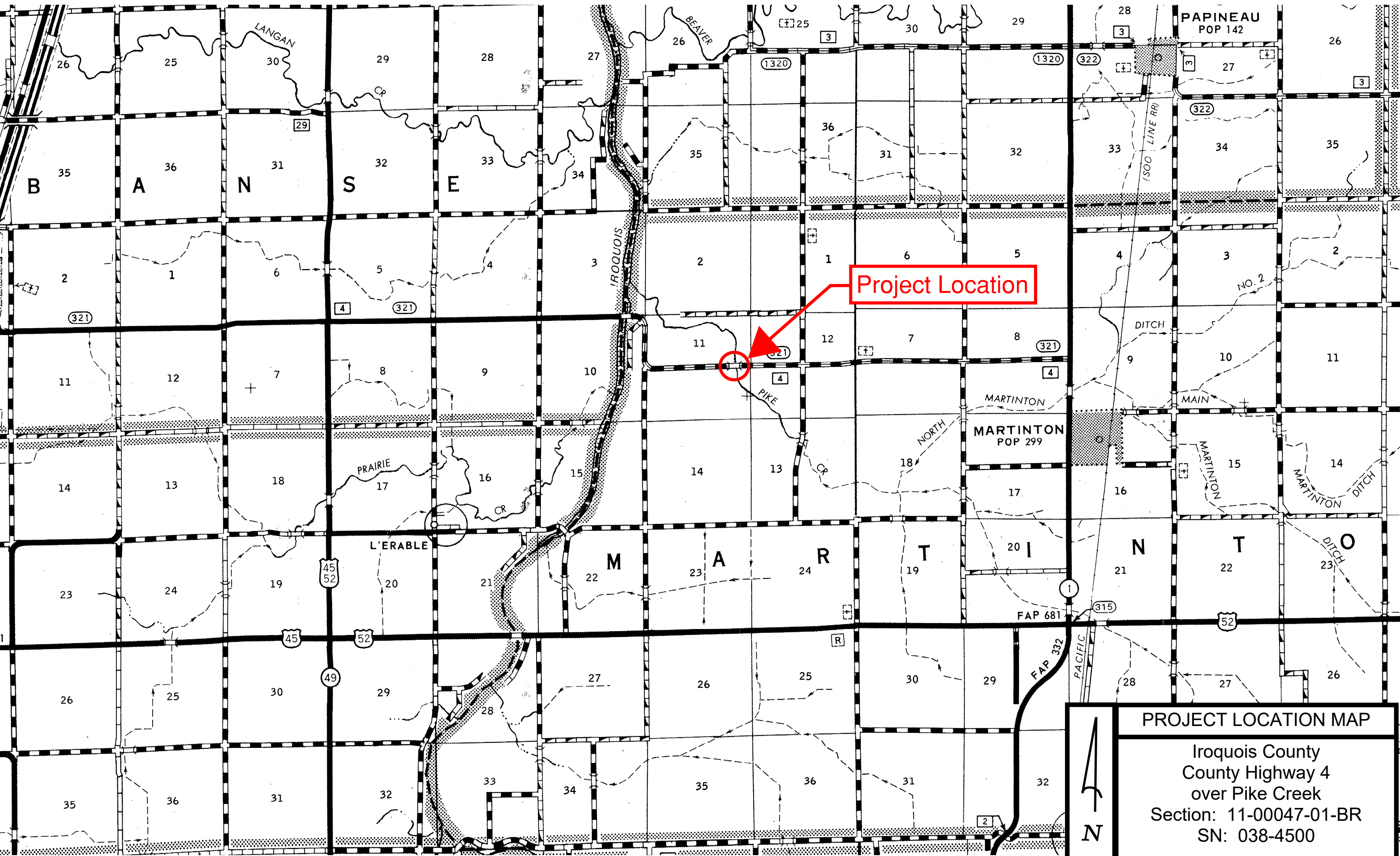
1. U.S. Army Corp of Engineers
2. U.S. Fish & Wildlife Service
3. Illinois Environmental Protection Agency
4. Illinois Department of Natural Resources
5. Illinois Historic Preservation Agency
6. Illinois Department of Transportation

The U.S. Army Corp of Engineers has issued a Nationwide Permit #14 for Linear Transportation Projects under Section 404 of the National Clean Water Act for the proposed project. A copy of the Nationwide Permit #14 approval letter is attached.

Iroquois County certifies it has the authority to complete the construction project and to address the items proposed in the Conservation Plan in the event state listed threatened, or endangered, species are encountered during construction. Iroquois County, in conjunction with the Illinois Department of Transportation, will be in responsible charge of the construction project and will assure all applicable federal and state laws will be adhered to during the completion of the project.

  
Iroquois County Board Chairman

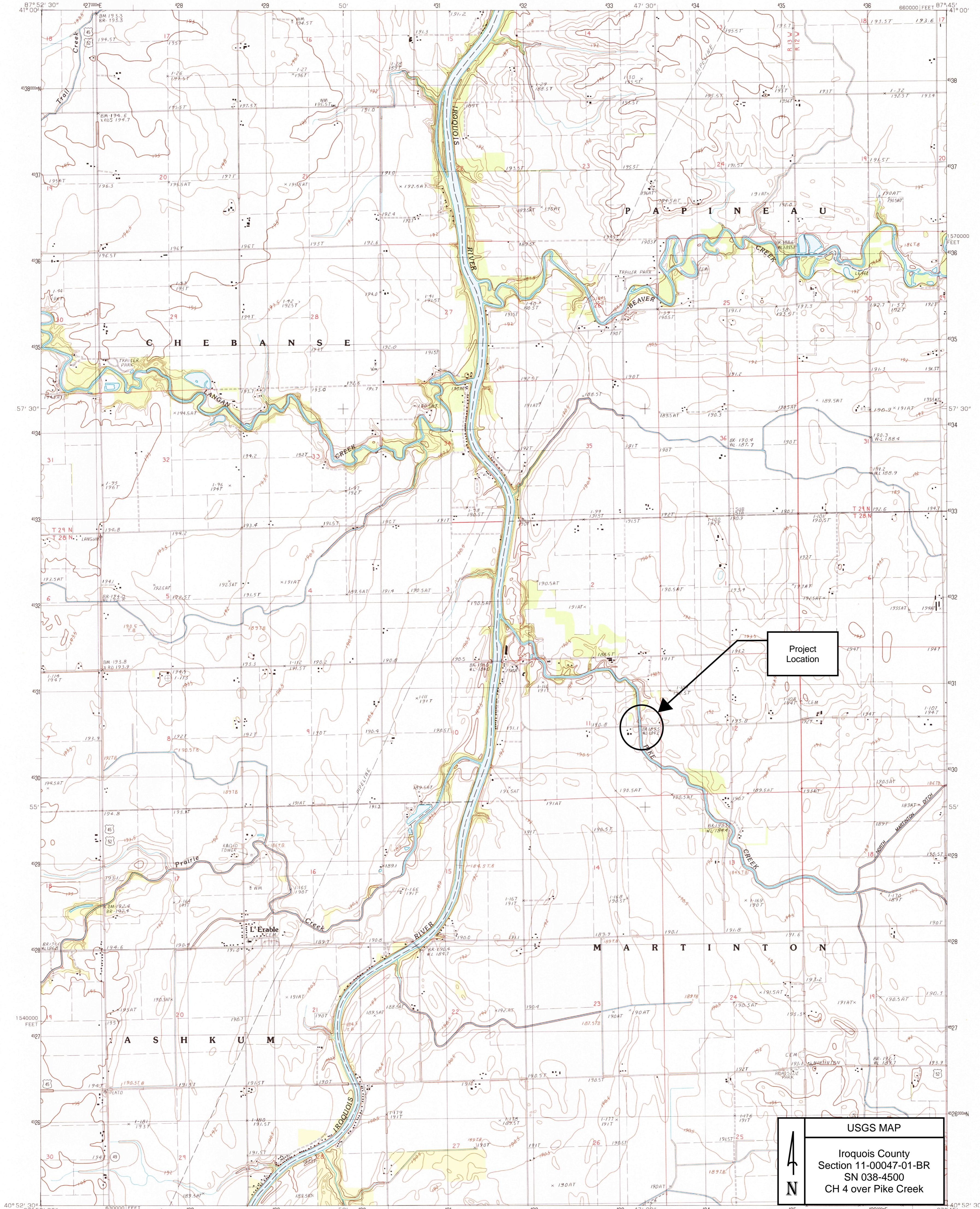
  
Date



Project Location

**PROJECT LOCATION MAP**

Iroquois County  
 County Highway 4  
 over Pike Creek  
 Section: 11-00047-01-BR  
 SN: 038-4500



Project Location

USGS MAP  
Iroquois County  
Section 11-00047-01-BR  
SN 038-4500  
CH 4 over Pike Creek

CONTOURS AND ELEVATIONS IN METERS  
ROAD LEGEND  
Improved Road  
Unimproved Road  
Trail  
Interstate Route U.S. Route State Route  
L'ERABLE, ILLINOIS  
PROVISIONAL EDITION 1986  
40087-117-TM-024

PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY  
CONTROL BY THE UNITED STATES GEOLOGICAL SURVEY  
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN  
FIELD CHECKED . . . . . 1985 . . . . . MAP EDITED . . . . . 1986  
PROJECTION . . . . . UNIVERSAL TRANSVERSE MERCATOR  
GRID . . . . . 1000-METER UNIVERSAL TRANSVERSE MERCATOR  
10000-FOOT STATE GRID TICS . . . . . ILLINOIS, EAST ZONE  
UTM GRID DECLINATION . . . . . 0°32' WEST  
1986 MAGNETIC NORTH DECLINATION . . . . . 0°00'  
GEOIDAL DATUM . . . . . NATIONAL GEOIDIC VERTICAL DATUM OF 1929  
HORIZONTAL DATUM . . . . . 1927 NORTH AMERICAN DATUM  
To place on the predicted North American Datum of 1983,  
move the projection lines as shown by dashed corner ticks  
(1 meter north and 4 meters east)  
There may be private inholdings within the boundaries of any  
Federal and State Reservations shown on this map  
No distinction made between houses, barns, and other buildings

PROVISIONAL MAP  
Produced from original  
manuscript drawings. Informa-  
tion shown as of date of  
photography. 1

SCALE 1:24 000  
1 000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000  
KILOMETERS  
METERS  
MILES  
CONTOUR INTERVAL 15 METERS  
CONTROL AND FIELD ESTABLISHED ELEVATIONS SHOWN TO THE NEAREST 0.1 METER  
OTHER ELEVATIONS SHOWN TO THE NEAREST AS METER  
To convert meters to feet multiply by 32808  
To convert feet to meters multiply by .3048  
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS  
FOR SALE BY U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092  
AND ILLINOIS GEOLOGICAL SURVEY, CHAMPAIGN, ILLINOIS 61820

QUADRANGLE LOCATION

1	2	3	West Kankakee
4	5	6	St. Anne
7	8	9	Clifton
10	11	12	Beaverville
13	14	15	Gilman
16	17	18	Crescent City
19	20	21	Waukena

ADJOINING 7.5' QUADRANGLE NAMES

USGS MAP HISTORICAL MAP  
SEP 24 1986  
REC'D FILE COPY



LOOKING EAST THROUGH PROJECT AREA



LOOKING WEST THROUGH PROJECT AREA



UPSTREAM VIEW – LOOKING SOUTH



DOWNSTREAM VIEW – LOOKING NORTH



UPSTREAM OPENING – LOOKING NORTHEAST



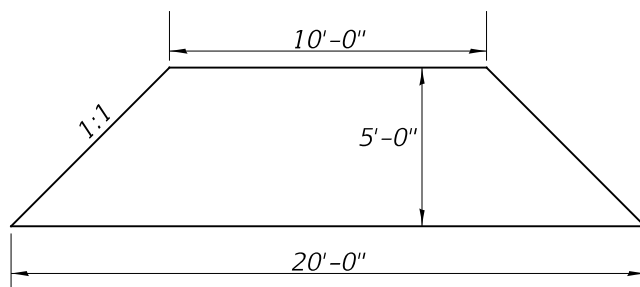
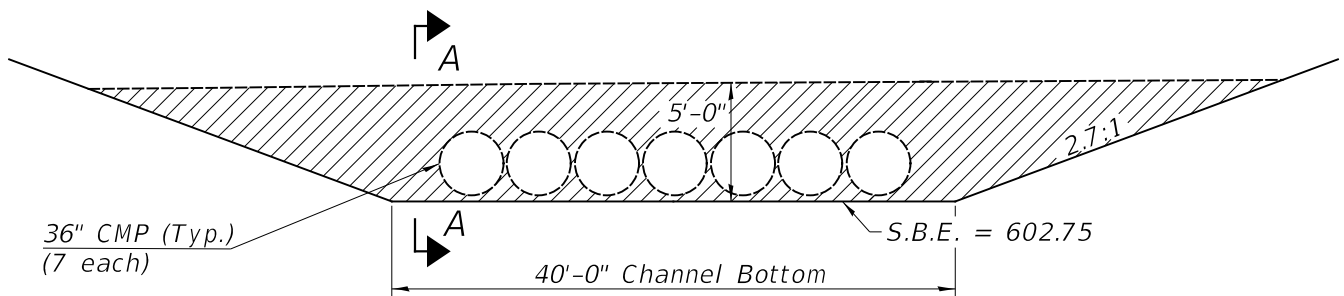
DOWNSTREAM OPENING – LOOKING SOUTHWEST



VIEW BETWEEN PIERS – LOOKING EAST



VIEW BETWEEN PIERS – LOOKING WEST



SECTION A-A

IROQUOIS COUNTY  
SEC. 11-00047-01-BR

TYPICALLY TEMPORARY  
CROSSING TO BE USED  
ONLY DURING CONSTRUCTION





REPLY TO  
ATTENTION OF

DEPARTMENT OF THE ARMY  
CORPS OF ENGINEERS, ROCK ISLAND DISTRICT  
PO BOX 2004 CLOCK TOWER BUILDING  
ROCK ISLAND, ILLINOIS 61204-2004

October 15, 2020

Operations Division

SUBJECT: CEMVR-OD-P-2020-1456

Joel Moore  
Iroquois County Highway Department  
1747 North State Route 1  
Watseka, Illinois 60970

Dear Mr. Moore:

Our office has reviewed the application received October 14, 2020, concerning the proposed bridge placement over Pike Creek, located in Section 11, Township 28 North, Range 13 West, Iroquois County, Illinois.

The project is covered under Nationwide Permit No. 14, as published in the enclosed Fact Sheet No. 8 (IL), provided you meet the permit conditions for the nationwide permits, which are included in the Fact Sheet. The Corps has also made a determination of no effect on federally threatened and endangered species or critical habitat. The Illinois Environmental Protection Agency (IEPA) has also issued Section 401 Water Quality Certification with conditions for this nationwide permit. Please note these additional conditions included in the Fact Sheet. The decision regarding this action is based on information found in the administrative record, which documents the District's decision-making process, the basis for the decision, and the final decision.

This verification is valid until March 18, 2022, unless the nationwide permit is modified, reissued, or revoked. It is your responsibility to remain informed of changes to the nationwide permit program. We will issue a public notice announcing any changes if and when they occur. Furthermore, if you commence or are under contract to commence this activity before the date the nationwide permit is modified or revoked, you will have twelve months from that date to complete your activity under the present terms and conditions of this nationwide permit. If the project plans change, you should contact our office for another determination.

This authorization does not eliminate the requirement that you must still acquire other applicable Federal, state, and local permits. If you have not already coordinated your project with the Illinois Department of Natural Resources – Offices of Water Resources, please contact them at 217/782-3863 to determine if a floodplain development permit is required for your project.

You may contact the IEPA Facility Evaluation Unit at 217/782-3362 to determine whether additional authorizations are required from the IEPA. Please send any electronic correspondence to [Epa.401.docs@illinois.gov](mailto:Epa.401.docs@illinois.gov).

You are required to complete and return the enclosed "Completed Work Certification" form upon completion of your project in accordance with General Condition No. 30 of the nationwide permits.

Should you have any questions, please contact our Regulatory Branch by letter, or telephone Ms. Samantha Chavez at 309/794-5104.

Sincerely,



Digitally signed by  
POPKIN.TREVOR.EUGENE.136707  
3493  
Date: 2020.10.16 14:39:30 -05'00'

Trevor Popkin  
Chief, Illinois/Missouri Permit Section  
Regulatory Branch

Copy Furnished:

(w/o enclosures)

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## COMPLETED WORK CERTIFICATION

Permit Number: CEMVR-OD-P-2020-1456

Name of Permittee: Iroquois County

County/State: Iroquois / Illinois

Date of Issuance: October 15, 2020

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

U.S. Army Engineer District, Rock Island  
ATTN: Regulatory Branch  
Clock Tower Building  
Post Office Box 2004  
Rock Island, Illinois 61204-2004

Please note that your permitted activity is subject to a compliance inspection by a U.S. Army Corps of Engineers representative. If you fail to comply with this permit, you are subject to permit suspension, modification, or revocation.

I hereby certify that the work authorized by the above reference permit has been completed in accordance with the terms and conditions of the said permit, and required mitigation was completed in accordance with the permit conditions.

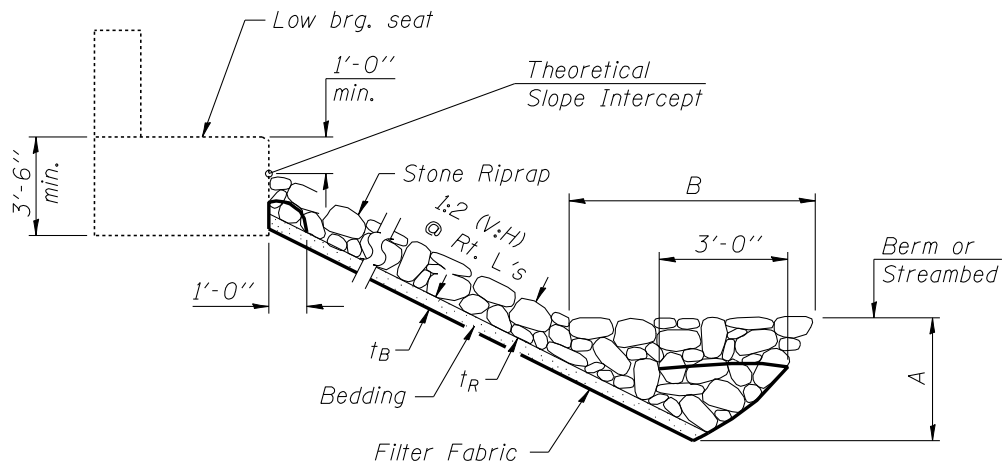
\_\_\_\_\_  
Signature of Permittee

\_\_\_\_\_  
Date

SC

Riprap Class	$t_R$	$t_B$	A	B
A4	16"	6"	4'	8'
A5	22"*	8"	5'	10'
A6	26"*	10"	6'	12'
A7	30"*	12"	7'	14'

\* Check abutment depth and increase as necessary to match depth of riprap and bedding



TOE STONE RIPRAP TREATMENT  
STREAM CROSSINGS

Figure 2.3.6.3.3-2

**Freshwater Mussel Salvage in Pike Creek  
(Iroquois River Basin) at the Iroquois County Highway 4  
(FAS 321) Bridge in Iroquois County, Illinois**

IDOT Sequence Number 22770



Prepared by:  
Alison P. Stodola

**INHS/IDOT Statewide Biological Survey & Assessment Program**  
2020:35

31 July 2020



## PROJECT SUMMARY

This report is submitted in response to a request from IDOT to INHS for freshwater mussel salvage in Pike Creek (Iroquois River drainage) at the Iroquois County Highway 4 (FAS 321) bridge (IDOT Sequence No. 22770) in Iroquois County, Illinois. The mussel salvage was completed by INHS personnel on 23-24 July 2020.

During this salvage, freshwater mussels were collected by completing 37 multiple-pass 3.28 ft-wide transects over a 120-ft-long stretch of the stream directly under the Iroquois County Highway 4 (FAS 321) bridge. Ten species of mussels were collected and relocated from the salvage area, including one Spike *Eurynia dilatata* – Illinois endangered.



Approved By: Kevin S. Cummings, Further Studies Aquatics  
Group Coordinator-Malacologist

Surveys Conducted By: Alison P. Stodola, Assistant Aquatic Field Biologist  
Rachel M. Vinsel, Senior Scientific Specialist  
Kathryn E. Conatser, Hourly Assistant  
Thomas A. Dodson, Hourly Assistant

Report Edited By: Mark J. Wetzel

GIS Layers: Janet L. Jarvis, GIS and Remote Sensing Specialist

University of Illinois  
Prairie Research Institute  
Illinois Natural History Survey  
Statewide Biological Survey and Assessment Program  
1816 South Oak Street  
Champaign, Illinois 61820

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**Cover Photo:** Pike Creek at the Iroquois County Highway 4 (FAS 321) bridge, Iroquois County, Illinois (Latitude 40.92515°N, Longitude 87.79247°W). Photo is taken from the east bank, facing downstream (northwest), on 24 July 2020. Photo by A.P. Stodola, INHS.

## INTRODUCTION

This report is submitted in response to a request on 14 November 2019 by Vincent Hamer of the Illinois Department of Transportation (IDOT) to Rachel Vinsel of the Illinois Natural History Survey (INHS) for a freshwater mussel salvage in Pike Creek at the Iroquois County Highway 4 (FAS 321; CR 2850N; Section 11-00047-01-BR; Structure No. 038-4500) bridge in Iroquois County, Illinois [IDOT Sequence No. 22770, INHS Project No. FS-1405]. This reach of Pike Creek is listed as a Category VI site on the Illinois Natural Areas Inventory (INAI) by the Illinois Department of Natural Resources (IDNR) Division of Natural Heritage due to an unusual concentration of Flora and Fauna, which in this case is an unusual concentration of freshwater mussels (IDNR 2013; INAI 2018). The Iroquois County highway department proposes removal and replacement of the Iroquois County Highway 4 (FAS 321) bridge over Pike Creek with minor approach roadway work to tie the new structure into the existing roadway. The replacement structure will be a three-span structure on the existing horizontal alignment.

In this report, we summarize the results of the freshwater mussel salvage conducted in Pike Creek at the Iroquois County Highway 4 (FAS 321) bridge by INHS personnel on 23-24 July 2020.

## PROJECT AREA

The Iroquois County Highway 4 project (FAS 321; Section 11-00047-01-BR; Structure No. 038-4500) is located on the Gilman Quadrangle Topographic map and occurs approximately 3.5 miles west-northwest of Martinton in Iroquois County, Illinois - in Township 28N, Range 13W, Section 11 (2<sup>nd</sup> Prime Meridian) at Latitude 40.92515°N, Longitude 87.79247°W (**Figure 1**). Iroquois County Highway 4 is also referenced as County Road 2850N.

**Appendix 1** references an Arc-GIS shapefile with sampling point information for the stream crossing discussed in this report.

## HABITAT CHARACTERIZATION

During our site visit on 23-24 July 2020, Pike Creek at the Iroquois County Highway 4 (FAS 321) bridge was approximately 33 feet wide and 1 ft deep (ranged from 0.25 to 2 ft deep), with a flow of 1 ft/second. The entire salvage area was wadable. Substrate in the salvage area was primarily sand (75%), but rip-rap (1%), cobble (2%), gravel (2%), silt (10%), clay (5%), and detritus (5%) were also present. Habitat throughout the salvage area was a run of shallow flowing water. This section of Pike Creek has been channelized (**Figure 2, top image**), which has compromised the habitat in areas both upstream and downstream of the salvage area under the Iroquois County Highway 4 (FAS 321) bridge. Habitats immediately upstream (south) and downstream (north) of the salvage area transitioned to a deeper, U-shaped channel with unconsolidated sand/silt substrates and fine detritus over hard-pan clay. Several large drain tile outputs were observed upstream of the salvage area, and these outputs created scour pools that were filled with fine sediments (i.e., sand, silt, and detritus) during our site visit on 23-24 July 2020. Habitat upstream (south) of the salvage area eventually transitioned to a shallow riffle/run with consolidated sand/silt/clay substrates, approximately 300 yards upstream (south) of the salvage area (**Figure 1**). We determined this area to be suitable for relocation due to habitat and substrates similar to those in the salvage area (**Figure 2, bottom image**).



## BACKGROUND

Pike Creek is a tributary the Iroquois River in east-central Illinois. Pike Creek rises near Donovan in Iroquois County, Illinois, and flows ENE for approximately 15 miles before it joins the Iroquois River. The confluence of Pike Creek with the Iroquois River is less than 2 miles downstream of the salvage site at the Iroquois County Highway 4 (FAS 321) bridge. Pike Creek has been ditched and channelized throughout its entire drainage and tile drainage for rowcrop agriculture production is abundant. Surrounding land use in the area is rowcrop agriculture, and riparian areas consist of a thin strip of grasses or herbaceous growth throughout the length of Pike Creek.

Freshwater mussels have been surveyed previously in Pike Creek at the Iroquois County Road North 1850E crossing (INHS Mollusk Collections Data 2020), which is located one mile upstream (southeast) of the Iroquois County Highway 4 (FAS 321) bridge (**Table 1**). Twelve species were previously recorded from Pike Creek in Iroquois County, and this section of Pike Creek is listed on the INAI list for freshwater mussels under Category VI for having 10 or more live species present, or being rated as “unique or highly valued” according to the Freshwater Mussel Community Index (IDNR 2013). The County Road 1850E crossing of Pike Creek in Iroquois County was classified as “unique” during a mussel survey in 2010 by INHS (Bales et al. 2013), and Black Sandshell *Ligumia recta* was recorded alive during that survey (**Table 1**). Black Sandshell was removed from the Illinois Endangered Species list in 2020 (Illinois Endangered Species Protection Act [IESPA] 2020). While no listed species have been recorded in this stretch of Pike Creek, Spike *Eurynia dilatata* (Illinois Endangered) and Purple Wartyback *Cyclonaias tuberculata* (Illinois Threatened) have been recorded from the Iroquois River at the Iroquois County Highway 4 bridge crossing, which is located approximately ¼ mile upstream (south) of the confluence of Pike Creek and the Iroquois River (IESPA 2020; INHS Mollusk Collections Data 2020). All other species collected from Pike Creek or the Iroquois River in the vicinity of Pike Creek are common inhabitants of central Illinois streams (Cummings and Mayer 1992; Cummings and Mayer 1997; Tiemann et al. 2007).

Spike are found in medium to large rivers in gravel or mixed sand and gravel; they generally prefer riverine conditions with stronger flow (Cummings and Mayer 1992). Spike are found throughout the Midwest but are becoming increasingly sporadic and isolated, particularly in Illinois (Douglass and Stodola 2014).

Purple Wartyback are found in medium to large rivers in gravel or mixed sand and gravel; they generally prefer riverine conditions with stronger flow (Cummings and Mayer 1992).

## METHODS

A salvage for freshwater mussels was conducted in Pike Creek at the Iroquois County Highway 4 (FAS 321) bridge on 23-24 July 2020 by INHS personnel A.P. Stodola, R.M. Vinsel, K.E. Conatser, and T.A. Dodson.

Mussels were collected using a moving transect method to ensure that most animals are collected and relocated. Transects that were 3.28 feet (1 m) wide and ran perpendicular to stream flow were established within the area of direct impact. The area of direct impact

consisted of a 120 ft (40 yards) long stream reach that was centered upon the midpoint of the bridge. During this salvage, 37 transects were established, and transects were sampled from downstream-most to upstream-most transect. Mussels were sampled within each transect using tactile search methods. Substrates were disturbed to a depth of approximately 1.5 inches (4 cm) to uncover buried mussels and transects were searched at a rate that did not exceed 20 seconds/ft<sup>2</sup> (1 min/m<sup>2</sup>). Each transect was resampled until the subsequent pass no longer yielded ≥10% of the total individuals collected in that transect. All mussels collected were processed separately for each pass within each transect and were identified to species and measured. Mussels were held in mesh bags in the stream except during processing.

Due to the time-intensive sampling effort required to complete the moving transect method, this salvage occurred over a period of two days. On day 1 (July 23), 22 transects were sampled and a relocation area was established approximately 300 yards upstream of the Iroquois County Highway 4 (FAS 321) bridge. The relocation area was selected based on the presence of similar substrate and habitat as the salvage area, as well as a native mussel community similar to what was collected on July 23. The relocation area was qualitatively surveyed for mussels for 0.5 person hours. All mussels collected on July 23 were relocated after processing.

On day 2 (July 24), 15 transects were sampled and one live state endangered Spike was collected during sampling in transect 8 (Appendix 2). This Spike and a subset of non-listed mussels (n=9) were affixed with a unique numbered tag and a passive integrated transponder (PIT) tag to facilitate detection during follow-up monitoring events. The remaining mussels collected on 24 July were affixed with a batch mark (glitter tag, in this instance) following measurement and were released in the relocation area established on 23 July. Additionally, 10 mussels from the relocation area were measured, affixed with a unique numbered tag and a PIT tag, and placed back in the relocation area (**Appendix 2**).

Nomenclature used for freshwater mussels discussed in this report follows Williams et al. (2017). Voucher material of mollusks collected were deposited in the Illinois Natural History Mollusk Collection and cataloged as INHS 90991-91000.

## RESULTS AND DISCUSSION

On 23-24 July 2020, 410 live mussels representing 10 live species were collected by INHS personnel from Pike Creek in the salvage area at the Iroquois County Highway 4 (FAS 321) bridge (**Table 1; Figure 2; Appendix 2**). One Spike, Illinois endangered, was collected from the salvage area (IESPA 2020). Three additional species were collected as shell material from the salvage survey area, which brings the salvage area species total to 13 species.

Nine species were collected alive from the relocation area during the 0.5-person hour sample, which included two species not collected alive in the salvage area. The site total (including both the salvage and relocation area) was 12 live species and 13 total species. Spike is Illinois endangered, but all other mussels collected during the present survey are common inhabitants of central Illinois streams (Cummings and Mayer 1992; Cummings and Mayer 1997; Tiemann et al. 2007).

Thirty-seven transects (each 3.28 feet wide) were sampled, and widths ranged from 23.6 to 43.6 feet (**Appendix 3**). The total length of transects sampled was 1245 feet, which calculates to an area of 4083.9 ft<sup>2</sup>. Density of freshwater mussels was 0.1 mussels/ft<sup>2</sup>, or roughly 1 mussel for every 10 ft<sup>2</sup>.

## ACKNOWLEDGMENTS

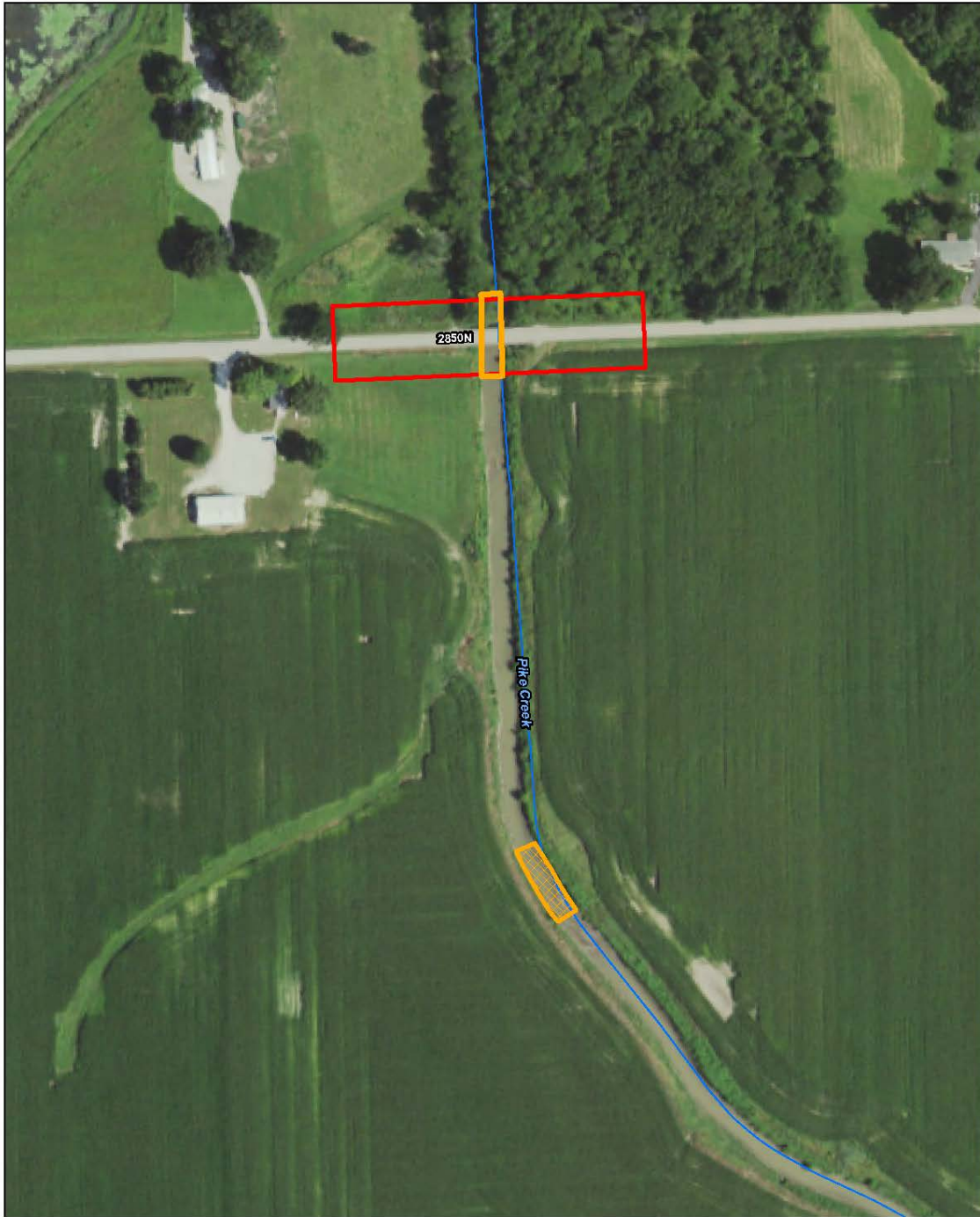
INHS employees Rachel M. Vinsel, Kathryn E. Conatser, and Thomas A. Dodson assisted with field work. Janet L. Jarvis (INHS) prepared the map in **Figure 1** and the associated shape file referenced in **Appendix 1**, and Mark J. Wetzel edited early drafts of the report.

## LITERATURE CITED

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- Tiemann, J.S., K.S. Cummings, and C.A. Mayer. 2007. Updates to the distributional checklist and status of Illinois freshwater mussels (Mollusca: Unionidae). Transactions of the Illinois State Academy of Science 100: 107-123.

**Table 1.** Freshwater mussel collections from Pike Creek in Iroquois County, Illinois. Mussels collected by INHS personnel on 23-24 July 2020 at the Iroquois County Highway 4 (FAS 321) bridge (IDOT Sequence No. 22770; Section 11-00047-01-BR; Structure No. 038-4500) project area are bounded by a black border. Data from the INHS Mollusk Collection Data (2020), accessed 28 July. Number = live individuals. SE=Illinois Endangered.

		23-24 July 2020			2000	2010
		area of direct impact (ADI)	relocation area	ADI & relocation area	County Road 1850E	
<i>Amblema plicata</i>	Threeridge	99	10	109	relict	24
<i>Cyclonaias pustulosa</i>	Pimpleback	98	10	108		28
<i>Euryntia dilatata</i> - SE	Spike	1		1		
<i>Fusconaia flava</i>	Wabash Pigtoe	173	10	183		26
<i>Lampsilis cardium</i>	Plain Pocketbook	dead	2	2	relict	1
<i>Lampsilis siliquoidea</i>	Fatmucket	7	5	12	6	21
<i>Ligumia recta</i>	Black Sandshell					1
<i>Megaloniais nervosa</i>	Washboard	1		1		
<i>Pleurobema sintoxia</i>	Round Pigtoe	6	1	7		
<i>Quadrula quadrula</i>	Mapleleaf	18	5	23	1	14
<i>Toxolasma parvum</i>	Lilliput	6	5	11		6
<i>Anodontoides ferussacianus</i>	Cylindrical Papershell	1		1	dead	5
<i>Lasmigona complanata</i>	White Heelsplitter	dead	2	2	1	14
<i>Lasmigona compressa</i>	Creek Heelsplitter					2
<i>Pyganodon grandis</i>	Giant Floater	dead	dead	dead	1	35
<i>Strophitus undulatus</i>	Creepers				relict	
<b>Total Individuals</b>		<b>410</b>	<b>50</b>	<b>460</b>	<b>9</b>	<b>177</b>
<b>Total Live</b>		<b>10</b>	<b>9</b>	<b>12</b>	<b>4</b>	<b>12</b>
<b>Total Species</b>		<b>13</b>	<b>10</b>	<b>13</b>	<b>8</b>	<b>12</b>



Mussel survey location on Pike Creek near CR 2850 North (Sequence no. 22770) Iroquois County, Illinois.



**Figure 1.** Pike Creek project (IDOT Sequence No. 22770) at the Iroquois County Highway 4 (FAS 321) bridge (Section 11-00047-01-BR; Structure No. 038-4500) project site in Iroquois County, Illinois, where a freshwater mussel salvage was conducted by INHS personnel on 23-24 July 2020.



**Figure 2.** Pike Creek from the Iroquois County Highway 4 (FAS 321) bridge, Iroquois County, Illinois, facing upstream (south) – demonstrating channelized nature of the stream (top) and transition to riffle (bottom), where relocation area was established on 24 July 2020. Photos by A.P. Stodola, INHS.



**Figure 3.** Representatives of species collected in Pike Creek at the Iroquois County Highway 4 (FAS 321) bridge, Iroquois County, Illinois, on 23-24 July 2020 by INHS personnel. From L to R, starting at top left: Threeridge, Washboard, White Heelsplitter, Pimpleback, Mapleleaf, Fatmucket, Plain Pocketbook, Spike (beak inset), Wabash Pigtoe, Round Pigtoe, Cylindrical Papershell (top) and Lilliput (bottom). Photos by R.M. Vinsel and A.P. Stodola, INHS.

## Appendix 1

**Appendix 1:** The appendix references an ArcGIS shapefile < 22770\_Mussel\_Survey\_GIS.zip > with sampling point information for the stream crossing of Pike Creek at the Iroquois County Highway 4 (FAS 321) bridge (IDOT Sequence No. 22770; Bridge Section 11-00047-01-BR; Structure No. 038-4500), Iroquois County, Illinois (Latitude 40.92515°N, Longitude 87.79247°W) , where a freshwater mussel salvage was conducted by INHS personnel on 23-24 July 2020.

The ArcGIS shapefile and this report were both submitted to IDOT via the IDOT Site Assessment Tracking System extranet website (Frostycap) on 31 July 2020.



## Appendix 2

**Appendix 2:** Raw mussel data associated with freshwater mussels collected in Pike Creek at the Iroquois County Highway 4 (FAS 321) bridge, Iroquois County, Illinois, on 23-24 July 2020 by INHS personnel. Data collected during transects, plus the mussels tagged in the relocation area: mm=total length in mm of mussel; GRC=external growth ring count; Sex=Sex of mussel (if determinable); Ltag=tag on left valve; Rtag= tag on right valve.

Transect	Pass	Species	mm	GRC	Sex	Ltag	Rtag
36	1	<i>Lampsilis siliquoidea</i>	38	5	M		
35	1	<i>Amblyma plicata</i>	66	6			
35	1	<i>Cyclonaias pustulosa</i>	56	7			
35	1	<i>Quadrula quadrula</i>	39	4			
35	1	<i>Toxolasma parvum</i>	29	3			
34	1	<i>Cyclonaias pustulosa</i>	38	4			
34	1	<i>Cyclonaias pustulosa</i>	45	5			
34	1	<i>Cyclonaias pustulosa</i>	46	5			
34	1	<i>Cyclonaias pustulosa</i>	54	7			
34	1	<i>Pleurobema sintoxia</i>	35	5			
33	1	<i>Amblyma plicata</i>	58	5			
33	1	<i>Amblyma plicata</i>	83	5			
33	1	<i>Amblyma plicata</i>	110	6			
32	1	<i>Fusconaia flava</i>	68	7			
31	1	<i>Cyclonaias pustulosa</i>	35	5			
31	1	<i>Cyclonaias pustulosa</i>	44	4			
31	1	<i>Cyclonaias pustulosa</i>	56	7			
31	1	<i>Cyclonaias pustulosa</i>	59	16			
31	1	<i>Fusconaia flava</i>	43	5			
31	1	<i>Fusconaia flava</i>	47	5			
31	1	<i>Fusconaia flava</i>	49	5			
31	1	<i>Pleurobema sintoxia</i>	43	5			
30	1	<i>Cyclonaias pustulosa</i>	58	8			
29	1	<i>Amblyma plicata</i>	48	6			
29	1	<i>Cyclonaias pustulosa</i>	37	4			
29	1	<i>Fusconaia flava</i>	25	4			
29	1	<i>Fusconaia flava</i>	40	5			
29	1	<i>Fusconaia flava</i>	44	5			
29	1	<i>Fusconaia flava</i>	50	5			
29	1	<i>Quadrula quadrula</i>	35	5			
28	1	<i>Cyclonaias pustulosa</i>	53	11			
28	1	<i>Fusconaia flava</i>	35	5			
28	2	<i>Cyclonaias pustulosa</i>	32	7			
28	2	<i>Fusconaia flava</i>	37	6			
27	1	<i>Cyclonaias pustulosa</i>	29	4			
27	1	<i>Cyclonaias pustulosa</i>	36	5			
27	1	<i>Cyclonaias pustulosa</i>	40	6			
27	1	<i>Cyclonaias pustulosa</i>	42	6			
27	1	<i>Fusconaia flava</i>	29	4			

27	1	<i>Fusconaia flava</i>	61	6			
26	1	<i>Cyclonaias pustulosa</i>	29	5			
26	1	<i>Cyclonaias pustulosa</i>	32	5			
26	1	<i>Cyclonaias pustulosa</i>	35	5			
26	1	<i>Cyclonaias pustulosa</i>	37	6			
26	1	<i>Cyclonaias pustulosa</i>	41	6			
26	1	<i>Fusconaia flava</i>	14	3			
26	1	<i>Fusconaia flava</i>	45	5			
26	1	<i>Fusconaia flava</i>	48	4			
26	1	<i>Fusconaia flava</i>	50	5			
26	1	<i>Quadrula quadrula</i>	43	5			
26	1	<i>Toxolasma parvum</i>	24	4			
26	2	<i>Cyclonaias pustulosa</i>	45	6			
26	2	<i>Cyclonaias pustulosa</i>	65	11			
26	2	<i>Quadrula quadrula</i>	37	5			
25	1	<i>Amblyma plicata</i>	67	6			
25	1	<i>Cyclonaias pustulosa</i>	41	5			
25	1	<i>Cyclonaias pustulosa</i>	52	9			
25	1	<i>Fusconaia flava</i>	35	6			
24	1	<i>Cyclonaias pustulosa</i>	30	5			
24	1	<i>Fusconaia flava</i>	37	5			
24	1	<i>Fusconaia flava</i>	42	7			
24	2	<i>Cyclonaias pustulosa</i>	56	10			
24	2	<i>Pleurobema sintoxia</i>	54	7			
23	1	<i>Cyclonaias pustulosa</i>	61	11			
22	1	<i>Cyclonaias pustulosa</i>	34	6			
22	1	<i>Cyclonaias pustulosa</i>	35	7			
22	1	<i>Cyclonaias pustulosa</i>	37	6			
22	1	<i>Fusconaia flava</i>	33	4			
22	1	<i>Fusconaia flava</i>	38	5			
21	1	<i>Cyclonaias pustulosa</i>	22	3			
21	1	<i>Cyclonaias pustulosa</i>	29	4			
21	1	<i>Cyclonaias pustulosa</i>	36	5			
21	1	<i>Cyclonaias pustulosa</i>	38	6			
21	1	<i>Fusconaia flava</i>	35	4			
21	1	<i>Fusconaia flava</i>	48	5			
21	2	<i>Fusconaia flava</i>	35	5			
21	2	<i>Fusconaia flava</i>	47	4			
20	1	<i>Cyclonaias pustulosa</i>	34	6			
20	1	<i>Cyclonaias pustulosa</i>	46	7			
20	1	<i>Fusconaia flava</i>	27	4			
20	1	<i>Fusconaia flava</i>	43	5			
20	1	<i>Fusconaia flava</i>	43	4			
20	1	<i>Fusconaia flava</i>	45	4			
20	1	<i>Fusconaia flava</i>	45	4			
20	1	<i>Fusconaia flava</i>	69	7			

20	2	<i>Fusconaia flava</i>	43	4		
19	1	<i>Amblyma plicata</i>	28	3		
19	1	<i>Amblyma plicata</i>	70	5		
19	1	<i>Cyclonaias pustulosa</i>	36	4		
19	1	<i>Cyclonaias pustulosa</i>	47	4		
19	1	<i>Cyclonaias pustulosa</i>	48	5		
19	1	<i>Cyclonaias pustulosa</i>	90	6		
19	1	<i>Fusconaia flava</i>	38	4		
19	1	<i>Fusconaia flava</i>	39	4		
19	1	<i>Fusconaia flava</i>	46	4		
19	1	<i>Fusconaia flava</i>	46	4		
19	1	<i>Fusconaia flava</i>	47	4		
19	1	<i>Fusconaia flava</i>	48	4		
19	1	<i>Fusconaia flava</i>	49	5		
18	1	<i>Amblyma plicata</i>	50	7		
18	1	<i>Amblyma plicata</i>	60	8		
18	1	<i>Amblyma plicata</i>	60	7		
18	1	<i>Amblyma plicata</i>	68	7		
18	1	<i>Amblyma plicata</i>	74	8		
18	1	<i>Amblyma plicata</i>	75	8		
18	1	<i>Amblyma plicata</i>	81	8		
18	1	<i>Cyclonaias pustulosa</i>	39	5		
18	1	<i>Cyclonaias pustulosa</i>	42	4		
18	1	<i>Cyclonaias pustulosa</i>	45	5		
18	1	<i>Cyclonaias pustulosa</i>	48	5		
18	1	<i>Cyclonaias pustulosa</i>	48	5		
18	1	<i>Fusconaia flava</i>	39	5		
18	1	<i>Fusconaia flava</i>	40	5		
18	1	<i>Fusconaia flava</i>	45	5		
18	1	<i>Fusconaia flava</i>	45	5		
18	1	<i>Fusconaia flava</i>	45	5		
18	1	<i>Fusconaia flava</i>	46	5		
18	1	<i>Fusconaia flava</i>	47	5		
18	1	<i>Fusconaia flava</i>	53	6		
18	1	<i>Fusconaia flava</i>	62	11		
18	1	<i>Fusconaia flava</i>	68	7		
18	1	<i>Fusconaia flava</i>	71	8		
18	1	<i>Quadrula quadrula</i>	33	4		
17	1	<i>Amblyma plicata</i>	45	7		
17	1	<i>Amblyma plicata</i>	52	5		
17	1	<i>Amblyma plicata</i>	55	5		
17	1	<i>Amblyma plicata</i>	57	7		
17	1	<i>Amblyma plicata</i>	63	6		
17	1	<i>Amblyma plicata</i>	67	5		
17	1	<i>Amblyma plicata</i>	69	6		
17	1	<i>Amblyma plicata</i>	69	7		

17	1	<i>Amblema plicata</i>	69	6			
17	1	<i>Amblema plicata</i>	70	8			
17	1	<i>Amblema plicata</i>	72	7			
17	1	<i>Amblema plicata</i>	72	7			
17	1	<i>Amblema plicata</i>	73	7			
17	1	<i>Amblema plicata</i>	74	7			
17	1	<i>Amblema plicata</i>	75	7			
17	1	<i>Amblema plicata</i>	75	6			
17	1	<i>Amblema plicata</i>	79	8			
17	1	<i>Amblema plicata</i>	82	7			
17	1	<i>Cyclonaias pustulosa</i>	41	6			
17	1	<i>Cyclonaias pustulosa</i>	66	10			
17	1	<i>Fusconaia flava</i>	32	4			
17	1	<i>Fusconaia flava</i>	38	5			
17	1	<i>Fusconaia flava</i>	41	5			
17	1	<i>Fusconaia flava</i>	42	4			
17	1	<i>Fusconaia flava</i>	42	5			
17	1	<i>Fusconaia flava</i>	44	4			
17	1	<i>Fusconaia flava</i>	48	4			
17	1	<i>Fusconaia flava</i>	50	6			
17	1	<i>Quadrula quadrula</i>	36	5			
17	1	<i>Quadrula quadrula</i>	39	5			
17	1	<i>Quadrula quadrula</i>	46	5			
17	2	<i>Amblema plicata</i>	60	5			
16	1	<i>Amblema plicata</i>	72	7			
16	1	<i>Amblema plicata</i>	96	10			
16	1	<i>Fusconaia flava</i>	35	7			
16	1	<i>Fusconaia flava</i>	40	5			
16	1	<i>Fusconaia flava</i>	40	6			
16	1	<i>Fusconaia flava</i>	41	6			
16	1	<i>Fusconaia flava</i>	42	6			
16	1	<i>Fusconaia flava</i>	46	8			
16	1	<i>Fusconaia flava</i>	55	10			
16	1	<i>Megalonaias nervosa</i>	135	28			
16	2	<i>Amblema plicata</i>	50	6			
15	1	<i>Amblema plicata</i>	65	8			
15	1	<i>Amblema plicata</i>	66	7			
15	1	<i>Amblema plicata</i>	68	6			
15	1	<i>Amblema plicata</i>	69	9			
15	1	<i>Amblema plicata</i>	69	8			
15	1	<i>Amblema plicata</i>	70	9			
15	1	<i>Amblema plicata</i>	70	8			
15	1	<i>Amblema plicata</i>	71	11			
15	1	<i>Amblema plicata</i>	77	8			
15	1	<i>Amblema plicata</i>	85	8			
15	1	<i>Amblema plicata</i>	86	9			

15	1	<i>Anodontoides ferussacianus</i>	46	6		
15	1	<i>Cyclonaias pustulosa</i>	32	6		
15	1	<i>Cyclonaias pustulosa</i>	42	6		
15	1	<i>Cyclonaias pustulosa</i>	44	6		
15	1	<i>Cyclonaias pustulosa</i>	46	7		
15	1	<i>Cyclonaias pustulosa</i>	47	7		
15	1	<i>Cyclonaias pustulosa</i>	60	8		
15	1	<i>Fusconaia flava</i>	36	5		
15	1	<i>Fusconaia flava</i>	38	5		
15	1	<i>Fusconaia flava</i>	40	7		
15	1	<i>Fusconaia flava</i>	44	6		
15	1	<i>Fusconaia flava</i>	44	6		
15	1	<i>Fusconaia flava</i>	45	7		
15	1	<i>Fusconaia flava</i>	46	6		
15	1	<i>Fusconaia flava</i>	49	7		
15	1	<i>Fusconaia flava</i>	49	6		
15	1	<i>Fusconaia flava</i>	49	6		
15	1	<i>Fusconaia flava</i>	52	7		
15	1	<i>Fusconaia flava</i>	52	7		
15	1	<i>Fusconaia flava</i>	58	8		
15	1	<i>Lampsilis siliquoidea</i>	43	5		
15	1	<i>Quadrula quadrula</i>	35	4		
15	1	<i>Quadrula quadrula</i>	45	7		
15	2	<i>Amblyma plicata</i>	70	8		
15	2	<i>Amblyma plicata</i>	76	9		
15	2	<i>Fusconaia flava</i>	45	5		
14	1	<i>Amblyma plicata</i>	39	5		glitter
14	1	<i>Amblyma plicata</i>	68	7		glitter
14	1	<i>Amblyma plicata</i>	79	8		glitter
14	1	<i>Cyclonaias pustulosa</i>	36	6		glitter
14	1	<i>Cyclonaias pustulosa</i>	43	5		glitter
14	1	<i>Cyclonaias pustulosa</i>	43	5		glitter
14	1	<i>Cyclonaias pustulosa</i>	58	10		glitter
14	1	<i>Cyclonaias pustulosa</i>	59	8		glitter
14	1	<i>Cyclonaias pustulosa</i>	64	17		glitter
14	1	<i>Fusconaia flava</i>	42	5		glitter
14	1	<i>Fusconaia flava</i>	45	5		glitter
14	1	<i>Fusconaia flava</i>	52	7		glitter
14	1	<i>Fusconaia flava</i>	58	8		glitter
13	1	<i>Amblyma plicata</i>	65	5		glitter
13	1	<i>Amblyma plicata</i>	72	5		glitter
13	1	<i>Amblyma plicata</i>	75	5		glitter
13	1	<i>Cyclonaias pustulosa</i>	57	6		glitter
13	1	<i>Fusconaia flava</i>	34	4		glitter
13	1	<i>Fusconaia flava</i>	48	4		glitter

13	1	<i>Fusconaia flava</i>	65	6		glitter	
13	1	<i>Lampsilis siliquoidea</i>	47	4	M	glitter	
13	1	<i>Lampsilis siliquoidea</i>	49	4	M	glitter	
12	1	<i>Amblyma plicata</i>	45	9		glitter	
12	1	<i>Amblyma plicata</i>	74	9		glitter	
12	1	<i>Amblyma plicata</i>	75	10		glitter	
12	1	<i>Cyclonaias pustulosa</i>	28	5		glitter	
12	1	<i>Cyclonaias pustulosa</i>	32	9		glitter	
12	1	<i>Cyclonaias pustulosa</i>	36	6		glitter	
12	1	<i>Cyclonaias pustulosa</i>	54	9		glitter	
12	1	<i>Fusconaia flava</i>	39	6		glitter	
12	1	<i>Fusconaia flava</i>	48	6		glitter	
12	1	<i>Fusconaia flava</i>	57	11		glitter	
12	1	<i>Fusconaia flava</i>	57	10		glitter	
12	1	<i>Pleurobema sintoxia</i>	50	7		glitter	
12	1	<i>Toxolasma parvum</i>	30	6		glitter	
12	2	<i>Quadrula quadrula</i>	42	6		glitter	
11	1	<i>Amblyma plicata</i>	58	6		glitter	
11	1	<i>Amblyma plicata</i>	88	6		glitter	
11	1	<i>Cyclonaias pustulosa</i>	34	5		glitter	
11	1	<i>Cyclonaias pustulosa</i>	35	5		glitter	
11	1	<i>Cyclonaias pustulosa</i>	46	6		glitter	
11	1	<i>Cyclonaias pustulosa</i>	56	7		glitter	
11	1	<i>Cyclonaias pustulosa</i>	56	6		glitter	
11	1	<i>Fusconaia flava</i>	29	4		glitter	
11	1	<i>Fusconaia flava</i>	35	4		glitter	
11	1	<i>Fusconaia flava</i>	45	4		glitter	
11	2	<i>Cyclonaias pustulosa</i>	64	7		glitter	
11	2	<i>Fusconaia flava</i>	36	5		glitter	
11	2	<i>Fusconaia flava</i>	72	5		glitter	
11	3	<i>Amblyma plicata</i>	55	5		glitter	
11	3	<i>Lampsilis siliquoidea</i>	45	5		glitter	
10	1	<i>Amblyma plicata</i>	38	6		glitter	
10	1	<i>Amblyma plicata</i>	55	5		glitter	
10	1	<i>Amblyma plicata</i>	65	6		glitter	
10	1	<i>Amblyma plicata</i>	67	6		glitter	
10	1	<i>Amblyma plicata</i>	75	7		glitter	
10	1	<i>Cyclonaias pustulosa</i>	46	4		glitter	
10	1	<i>Cyclonaias pustulosa</i>	46	6		glitter	
10	1	<i>Cyclonaias pustulosa</i>	54	6		glitter	
10	1	<i>Fusconaia flava</i>	35	4		glitter	
10	1	<i>Fusconaia flava</i>	37	4		glitter	
10	1	<i>Fusconaia flava</i>	40	4		glitter	
10	1	<i>Fusconaia flava</i>	42	4		glitter	
10	1	<i>Fusconaia flava</i>	44	4		glitter	
10	1	<i>Fusconaia flava</i>	45	5		glitter	

10	1	<i>Fusconaia flava</i>	45	5		glitter	
10	1	<i>Fusconaia flava</i>	47	5		glitter	
10	1	<i>Fusconaia flava</i>	48	4		glitter	
10	1	<i>Fusconaia flava</i>	67	6		glitter	
10	1	<i>Quadrula quadrula</i>	37	4		glitter	
9	1	<i>Amblyma plicata</i>	63	5		glitter	
9	1	<i>Amblyma plicata</i>	98	13		glitter	
9	1	<i>Cyclonaias pustulosa</i>	32	5		glitter	
9	1	<i>Cyclonaias pustulosa</i>	67	8		glitter	
9	1	<i>Fusconaia flava</i>	36	4		glitter	
9	1	<i>Fusconaia flava</i>	40	5		glitter	
9	1	<i>Fusconaia flava</i>	41	4		glitter	
9	1	<i>Fusconaia flava</i>	43	4		glitter	
9	1	<i>Fusconaia flava</i>	47	6		glitter	
9	1	<i>Fusconaia flava</i>	48	5		glitter	
9	1	<i>Fusconaia flava</i>	48	5		glitter	
9	1	<i>Fusconaia flava</i>	52	7		glitter	
8	1	<i>Amblyma plicata</i>	60	9		glitter	
8	1	<i>Amblyma plicata</i>	63	6		glitter	
8	1	<i>Amblyma plicata</i>	64	7		glitter	
8	1	<i>Amblyma plicata</i>	70	6		glitter	
8	1	<i>Amblyma plicata</i>	70	5		glitter	
8	1	<i>Amblyma plicata</i>	72	6		glitter	
8	1	<i>Amblyma plicata</i>	75	7		glitter	
8	1	<i>Amblyma plicata</i>	76	8		glitter	
8	1	<i>Amblyma plicata</i>	81	7		glitter	
8	1	<i>Cyclonaias pustulosa</i>	42	7		glitter	
8	1	<i>Euryntia dilatata</i>	64	5		3DD.003BFA0168	362
8	1	<i>Fusconaia flava</i>	31	4		glitter	
8	1	<i>Fusconaia flava</i>	36	4		glitter	
8	1	<i>Fusconaia flava</i>	39	5		glitter	
8	1	<i>Fusconaia flava</i>	45	5		glitter	
8	1	<i>Fusconaia flava</i>	47	6		glitter	
8	1	<i>Fusconaia flava</i>	49	5		glitter	
8	1	<i>Fusconaia flava</i>	55	7		glitter	
8	1	<i>Fusconaia flava</i>	64	8		glitter	
8	1	<i>Fusconaia flava</i>	68	7		glitter	
8	1	<i>Quadrula quadrula</i>	42	6		glitter	
8	1	<i>Quadrula quadrula</i>	46	6		glitter	
8	1	<i>Toxolasma parvum</i>	27	5		glitter	
7	1	<i>Amblyma plicata</i>	75	8		glitter	
7	1	<i>Cyclonaias pustulosa</i>	69	12		glitter	
7	1	<i>Fusconaia flava</i>	41	4		glitter	
7	1	<i>Fusconaia flava</i>	42	5		glitter	
7	1	<i>Fusconaia flava</i>	42	5		glitter	
7	1	<i>Fusconaia flava</i>	45	5		glitter	

7	1	<i>Fusconaia flava</i>	45	5		glitter	
7	1	<i>Fusconaia flava</i>	50	6		glitter	
7	1	<i>Fusconaia flava</i>	50	6		glitter	
7	1	<i>Fusconaia flava</i>	51	6		glitter	
7	1	<i>Fusconaia flava</i>	52	6		glitter	
7	1	<i>Fusconaia flava</i>	55	7		glitter	
7	1	<i>Quadrula quadrula</i>	39	6		glitter	
7	2	<i>Cyclonaias pustulosa</i>	33	4		glitter	
7	2	<i>Cyclonaias pustulosa</i>	54	9		glitter	
7	2	<i>Fusconaia flava</i>	46	6		glitter	
7	2	<i>Fusconaia flava</i>	51	5		glitter	
6	1	<i>Amblyma plicata</i>	69	5		glitter	
6	1	<i>Fusconaia flava</i>	32	4		glitter	
6	1	<i>Fusconaia flava</i>	40	5		glitter	
6	1	<i>Fusconaia flava</i>	44	4		glitter	
6	1	<i>Fusconaia flava</i>	47	5		glitter	
6	1	<i>Fusconaia flava</i>	65	5		3DD.003BFA024C	356
6	1	<i>Fusconaia flava</i>	65	6		glitter	
6	1	<i>Fusconaia flava</i>	68	7		glitter	
6	1	<i>Lampsilis siliquoidea</i>	41	5	M	3DD.003BFA0298	357
6	1	<i>Quadrula quadrula</i>	49	4		3DD.003BFA0126	358
5	1	<i>Cyclonaias pustulosa</i>	35	5		glitter	
5	1	<i>Cyclonaias pustulosa</i>	41	5		glitter	
5	1	<i>Cyclonaias pustulosa</i>	60	8		glitter	
5	1	<i>Fusconaia flava</i>	39	5		glitter	
5	1	<i>Fusconaia flava</i>	41	5		glitter	
5	1	<i>Fusconaia flava</i>	42	6		glitter	
5	1	<i>Fusconaia flava</i>	43	5		glitter	
5	1	<i>Fusconaia flava</i>	50	6		glitter	
5	1	<i>Fusconaia flava</i>	59	9		glitter	
5	1	<i>Lampsilis siliquoidea</i>	46	4		vouchered	
5	1	<i>Quadrula quadrula</i>	39	7		glitter	
4	1	<i>Amblyma plicata</i>	63	5		glitter	
4	1	<i>Amblyma plicata</i>	64	5		glitter	
4	1	<i>Amblyma plicata</i>	65	6		glitter	
4	1	<i>Amblyma plicata</i>	66	6		glitter	
4	1	<i>Amblyma plicata</i>	71	8		3DD.003BFA014C	364
4	1	<i>Amblyma plicata</i>	71	6		glitter	
4	1	<i>Cyclonaias pustulosa</i>	41	10		glitter	
4	1	<i>Cyclonaias pustulosa</i>	46	6		3DD.003BFA0132	363
4	1	<i>Fusconaia flava</i>	31	4		glitter	
4	1	<i>Fusconaia flava</i>	41	5		glitter	
4	1	<i>Fusconaia flava</i>	42	5		glitter	
4	1	<i>Fusconaia flava</i>	44	5		glitter	
4	1	<i>Fusconaia flava</i>	45	6		glitter	
3	1	<i>Amblyma plicata</i>	65	7		glitter	



3	1	<i>Amblema plicata</i>	75	8		glitter	
3	1	<i>Fusconaia flava</i>	42	6		glitter	
3	1	<i>Fusconaia flava</i>	48	7		glitter	
3	1	<i>Fusconaia flava</i>	50	7		glitter	
3	1	<i>Fusconaia flava</i>	54	7		glitter	
3	1	<i>Fusconaia flava</i>	62	9		glitter	
3	1	<i>Toxolasma parvum</i>	26	5		glitter	
2	1	<i>Amblema plicata</i>	71	8		3DD.003BFA0273	361
2	1	<i>Cyclonaias pustulosa</i>	38	7		glitter	
2	1	<i>Cyclonaias pustulosa</i>	44	8		3DD.003BFA0157	359
2	1	<i>Fusconaia flava</i>	41	5		glitter	
2	1	<i>Fusconaia flava</i>	47	5		3DD.003BFA014A	360
2	1	<i>Toxolasma parvum</i>	30	5		glitter	
1	1	<i>Amblema plicata</i>	57	6		glitter	
1	1	<i>Amblema plicata</i>	61	7		glitter	
1	1	<i>Amblema plicata</i>	70	7		glitter	
1	1	<i>Amblema plicata</i>	72	7		glitter	
1	1	<i>Amblema plicata</i>	77	6		glitter	
1	1	<i>Amblema plicata</i>	78	6		glitter	
1	1	<i>Cyclonaias pustulosa</i>	38	5		glitter	
1	1	<i>Cyclonaias pustulosa</i>	41	5		glitter	
1	1	<i>Cyclonaias pustulosa</i>	42	5		glitter	
1	1	<i>Fusconaia flava</i>	42	4		glitter	
1	1	<i>Fusconaia flava</i>	44	4		glitter	
1	1	<i>Fusconaia flava</i>	47	5		glitter	
1	1	<i>Fusconaia flava</i>	50	5		glitter	
1	1	<i>Fusconaia flava</i>	60	6		glitter	
1	1	<i>Quadrula quadrula</i>	39	5		glitter	
1	2	<i>Fusconaia flava</i>	53	4		glitter	
0	1	<i>Amblema plicata</i>	56	6		glitter	
0	1	<i>Amblema plicata</i>	66	6		glitter	
0	1	<i>Amblema plicata</i>	68	7		glitter	
0	1	<i>Amblema plicata</i>	76	9		glitter	
0	1	<i>Cyclonaias pustulosa</i>	41	5		glitter	
0	1	<i>Cyclonaias pustulosa</i>	41	7		glitter	
0	1	<i>Cyclonaias pustulosa</i>	46	8		glitter	
0	1	<i>Cyclonaias pustulosa</i>	49	8		glitter	
0	1	<i>Cyclonaias pustulosa</i>	54	7		glitter	
0	1	<i>Cyclonaias pustulosa</i>	56	7		glitter	
0	1	<i>Cyclonaias pustulosa</i>	60	8		glitter	
0	1	<i>Fusconaia flava</i>	38	5		glitter	
0	1	<i>Fusconaia flava</i>	41	6		glitter	
0	1	<i>Fusconaia flava</i>	42	5		glitter	
0	1	<i>Fusconaia flava</i>	45	5		glitter	
0	1	<i>Fusconaia flava</i>	45	5		glitter	
0	1	<i>Fusconaia flava</i>	66	8		glitter	

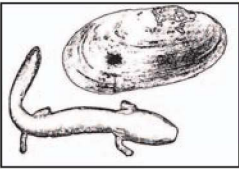
0	1	<i>Pleurobema sintoxia</i>	44	6		glitter	
0	1	<i>Pleurobema sintoxia</i>	55	7		3DD.003BFA02A5	355
0	2	<i>Fusconaia flava</i>	41	4		glitter	
0	2	<i>Fusconaia flava</i>	45	6		glitter	
relocation area		<i>Amblema plicata</i>	75	9		3DD.003BFA028E	347
relocation area		<i>Amblema plicata</i>	78	11		3DD.003BFA0248	349
relocation area		<i>Cyclonaias pustulosa</i>	60	11		3DD.003BFA027D	345
relocation area		<i>Cyclonaias pustulosa</i>	58	9		3DD.003BFA0269	348
relocation area		<i>Fusconaia flava</i>	40	6		3DD.003BFA027A	350
relocation area		<i>Fusconaia flava</i>	38	6		3DD.003BFA011F	351
relocation area		<i>Fusconaia flava</i>	60	8		3DD.003BFA02A2	352
relocation area		<i>Fusconaia flava</i>	45	6		3DD.003BFA025C	353
relocation area		<i>Fusconaia flava</i>	46	8		3DD.003BFA0274	354
relocation area		<i>Pleurobema sintoxia</i>	49	7		3DD.003BFA012A	346

### Appendix 3

**Appendix 3:** Raw habitat data associated with freshwater mussels collected in Pike Creek at the Iroquois County Highway 4 (FAS 321) bridge, Iroquois County, Illinois, on 23-24 July 2020 by INHS personnel. Transects are ordered from downstream-most (36) to upstream-most (0).

Data collected during transects: substrate percentages (rip-rap, cobble, gravel, sand, silt, clay, detritus), and transect width (ft).

Transect	Width (ft)	Rip-Rap	Cobble	Gravel	Sand	Silt	Clay	Detritus
36	24.6				95	5		
35	23.6				90	5	5	
34	25.3				90		5	5
33	23.6				90	10		
32	24.6				95		5	
31	25.3				90		5	5
30	26.2				75		25	
29	27.2				90	5	5	
28	29.5				80	15	5	
27	31.5			5	70	20	5	
26	32.1			5	70	15	5	5
25	31.8				70	20	5	5
24	39.0				50	10	20	20
23	38.0				70	10	10	10
22	40.3				65	10	5	20
21	42.6				10	70		20
20	43.6				60	20		20
19	43.3				40	30		30
18	39.4				50	10	35	5
17	40.3				50	40	10	
16	39.0				70	15	15	
15	38.4				60	40		
14	36.1				70	10	10	10
13	36.1		5		75	10		10
12	35.1		5		75	10	10	
11	34.8	2			80	5	3	
10	32.8		5		90		5	
9	33.8	5			80	5	5	5
8	33.8				90	5	5	
7	32.8				70	15	15	
6	32.8				90		10	
5	33.1				85	5	10	
4	34.1				85	5	10	
3	35.1				85	5	5	5
2	35.1				90		10	
1	35.1				90	5	5	
0	35.1				90	5	5	



**Spike**      *Elliptio dilatata*  
**Subfamily Ambleminae**

external views

State Listed as Threatened: IL

**ID. Aids:**

**External Surface** – A thin but strong, moderately compressed, elongated shell. The posterior margin is usually rounded, but rarely is it truncated. The ventral margin is usually straight or slightly convex, but can become slightly concave in older shells. Very low profile beaks have sculpture of several heavy, rough loops when the sculpture is not eroded away.

**Internal Surface** – Nacre usually light to dark purple, occasionally white, and glossy. Teeth are well developed.

**Distinguishing Features:**

**Similar Species** – Black sandshell.

**Compared To** – The spike is more compressed laterally and is not as elongated as the black sandshell. The posterior pointed end of the spike is below the longitudinal midline of the shell, while it is above the midline in the black sandshell.

**Beak Sculpture** – Three or four heavy, raised, mildly double-looped bars; often eroded in adults. Beaks are even with, or protrude very slightly above, the hinge line.

**Beak Cavity** – Shallow.

**Color** – Smooth and greenish brown, sometimes with indistinct green rays in young shells. Older shells usually rayless and darker ruddy brown to black with a slightly rough periostracum.

**Nacre** – Usually varying shades of purple, but occasionally white or pink, and rarely light orange.

**Teeth/Hinge** – Pseudocardinal teeth are prominent and grooved. There are two in the left valve, and one in the right. Lateral teeth are moderately short, about half of the shell length, straight and roughened. There are two in left valve, and one in the right.

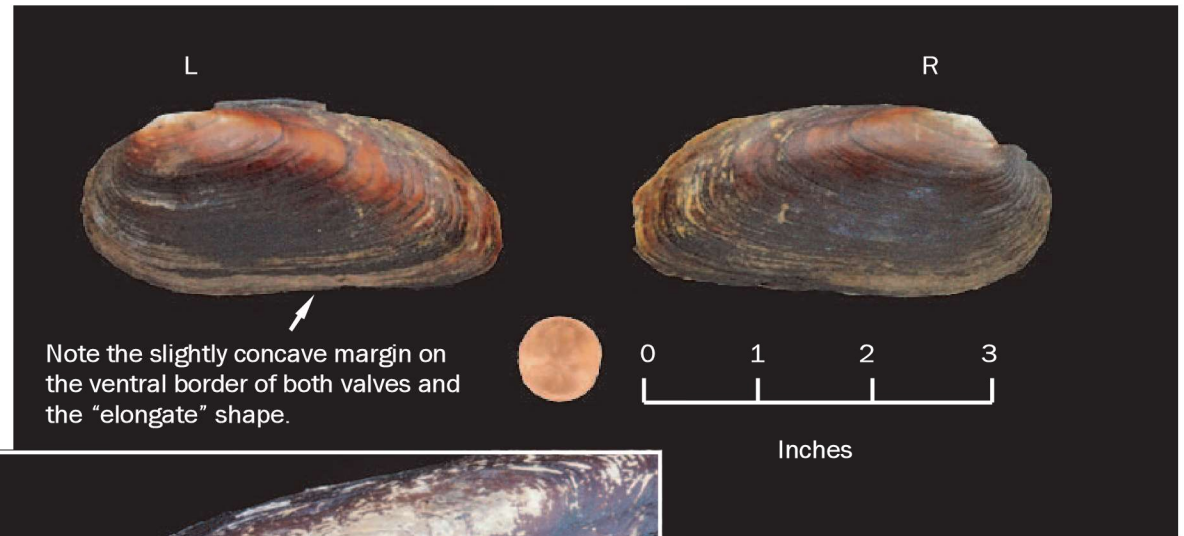
**Size/Thickness** – To 5.5 inches. A 5.5 inch (139mm) long shell measured 2.0mm thick at the center of the valve.

**Environmental Profile:**

**Habitat** – In small streams to large rivers and occasionally in lakes; in silt, sand and gravel.

**Hosts** – Gizzard shad, white crappie, black crappie, flathead catfish.

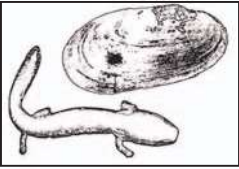
**Distribution /Status** – Threatened in IL. Formerly widespread and abundant but declining and imperiled in much of its range. Vulnerable in IN, WI, and under review in MI.



The periostracum on the umbo has been worn away but the beak sculpture is still distinct. Three to four heavy loops are characteristic.



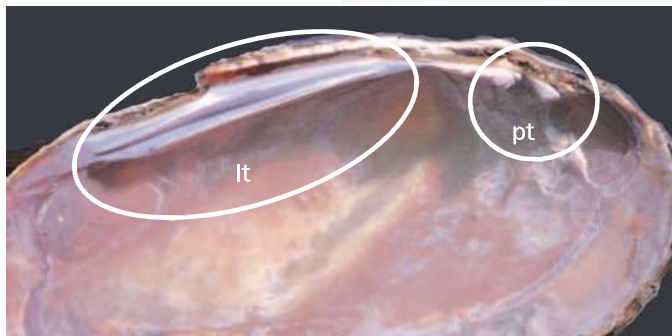
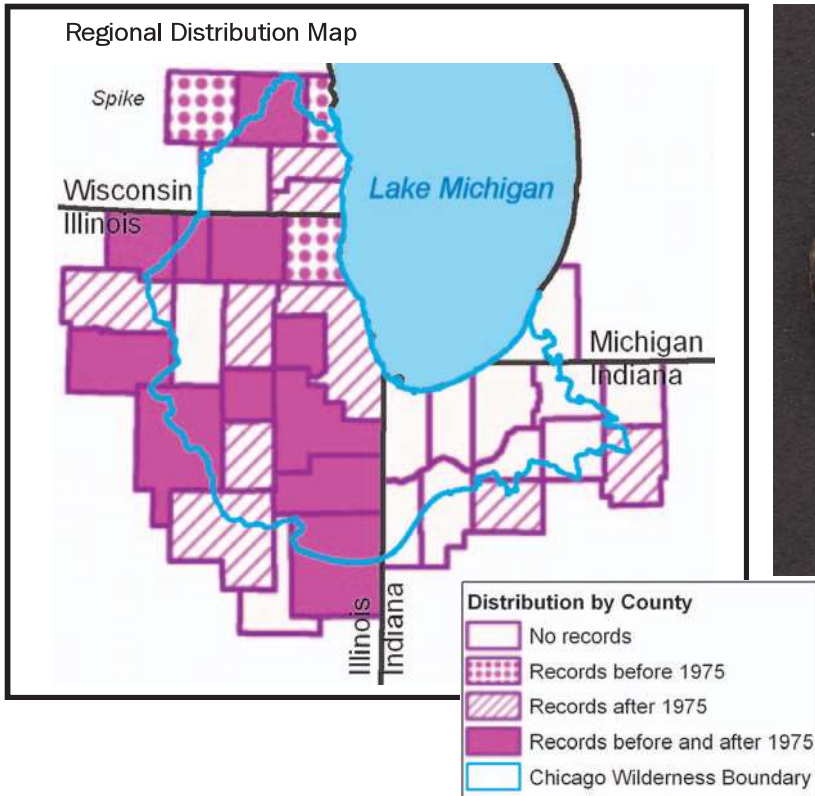
Another view of the umbo showing that it is even with the hinge line. Contrast this with other species like the Wabash pigtoe that have umbos that are elevated above the hinge line.



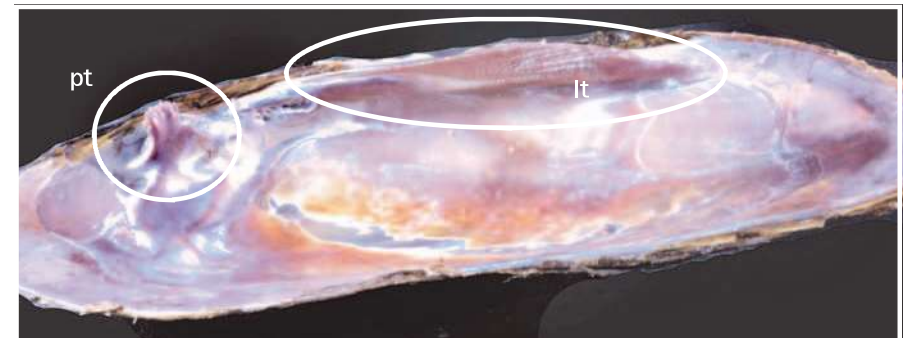
Spike *Elliptio dilatata*  
Subfamily Ambleminae

internal views

State Listed as Threatened: IL



Both valves show intense nacre color. The left valve has two pseudocardinal teeth (pt) and two lateral teeth (lt).



A recurved, single pseudocardinal tooth (pt) in the right valve. The single lateral tooth (lt) is straight and striated along its long axis. The nacre of some species of freshwater mussels, including the spike, can be intensely colored.