<u>IDOT Conservation Plan</u> for the State-threatened Butterfly mussel (*Ellipsaria lineolata*) and Black sandshell (*Ligumia recta*), the State-endangered Ebonyshell mussel (*Fusconaia ebena*), and the State and Federally-endangered Higgins eye mussel (*Lampsilis higginsii*), Spectaclecase mussel (*Cumberlandia monodonta*), and Sheepnose mussel (*Plethobasus cyphyus*) Inhabiting the Mississippi River's Sylvan Slough in the vicinity of the proposed Pedestrian Bridge Replacement Project in Moline, IL in Rock Island County

1. Description of the impact likely to result from the proposed taking

A. Legal description of the project area

The general area of the pedestrian bridge replacement project is located approximately 600' north of the intersection at 1st Avenue and 2nd Street starting at the Great River Trail traversing north to Sylvan Island in Moline, Illinois. Specifically, the area of impact shall occur in the vicinity (general footprint area) of the existing pedestrian bridge within the Sylvan Slough of the Mississippi River.

The legal location of the bridge replacement area (i.e. the subject mussel bed) is taken from the Davenport East, IA, US Geological Survey 7.5-minute topographic quadrangle map (1991, NAD 1983) (attached as Exhibit 1, Site Location Map). It is anticipated that the entire area of the project has potential in which mussels could be located within the Sylvan Slough.

The bridge replacement is located at the 4th Principal Meridian, Township 18 North, Range 1 West, and northeast ¼ of Section 31 in Rock Island County.

B. Biological Data

Sylvan Slough

The project crosses the Mississippi River-Moline Natural Area (The Natural Area) which covers 2,297 acres of the Mississippi River on the Illinois side of the river. This Natural Area contains specific suitable habitat for threatened or endangered species. Portions of what is now the Mississippi River-Moline Natural Area have been designated as a mussel refuge since 1988, i.e. Sylvan Slough, a lateral channel of the Mississippi River which covers a width of approximately 200 feet. The project traverses between the Great River Trail on the Illinois side of the slough and Sylvan Island. The significant features of the Natural Area are its mussel beds which contain federal and state listed species of mussels and wintering habitat for the federally protected bald eagle.

The Sylvan Slough is a part of this Natural Area and the slough is located between the Rock Island Arsenal Island and the cities of Rock Island and Moline. Approximately 4,800 feet of the upstream portion of the Sylvan Slough has been designated as an Essential Habitat Area for the Higgins eye pearly mussel (federally listed) by the Higgins eye pearly mussel recovery plan. The existing pedestrian bridge (and proposed replacement bridge area) is located approximately 2,500' downstream from this designated area.

A May 2015 limited presence/absence brail survey for mussels within the Sylvan Slough at the pedestrian bridge project area identified one state-threatened species of mussels out of the eleven species collected. The state listed species was Butterfly mussel (*Ellipsaria lineolata*). It is noted that two previous mussel surveys were conducted upstream and in the general area of the project area. The first mussel survey was performed in 2014 (attached) for the Interstate 74 (I-74) construction project from approximately 600 meters upstream to 300 meters downstream of the I-74 bridge, which included an area of the Sylvan Slough (located approximately 5,500' upstream of the project area). Multiple mussel species were observed during the survey, of which, three federally endangered listed mussel species (Higgins eye, Spectacle case, and Sheepnose) and two state threatened listed mussel species (Butterfly and Black sandshell) were also identified. The second mussel survey was conducted in May 2015 for the MetroLINK Ferryboat Terminal (MetroLINK) construction project located approximately at the Mississippi River Mile 487.7 (approximately two miles upstream of the project area) (ITA Conservation Plan, Fresh Water Mussel Survey attached). Twelve species of mussels were collected during this survey, which included the two state-threatened species identified as the Butterfly and Black sandshell mussels. Due to the close proximity of the I-74 and MetroLINK projects relative to the project area, and the fact that a state-threatened listed species was present during the brail survey within the project area, it is reasonable to believe that there is the potential for all of the above-mentioned mussel species to be present in the project area.

In light of the concern for federal and state listed species to be present within the project area, a more in-depth mussel survey was conducted within the project area in August 2015. A total of twenty mussel species were collected during this survey. Though it was anticipated that the Higgins eye, Spectacle case, and Sheepnose mussel species were to be present, neither these two nor any other federally endangered listed mussel species were identified in the project area during the August 2015 survey. However, two state listed species were identified and these listed mussel species are briefly described in the following paragraphs.

Butterfly mussel (*Ellipsaria lineolata*)

The State threatened Butterfly mussel is known to occur within the project area and at River Mile 487.7 (Duyvejonck et al 2015) and from approximately River Mile 486, downstream under the existing I-74 bridge, to the Sylvan Slough (Ecological Specialists, Inc. *et al*).

The freshwater drum (*Aplodinotus grunniens*) is a known host of glochidia of the Butterfly mussel. The Butterfly mussel prefers a substrate of gravel or sand.

Black Sandshell mussel (*Ligumia recta*)

The State threatened Black Sandshell mussel is also known to occur within the project area and in the same areas as described above for the Butterfly mussel.

The American eel and bluegill are likely host species for the Black Sandshell. The Black Sandshell prefers a substrate of gravel or firm sand.

As stated previously, the 2014 mussel survey for the Interstate (I-74) bridge project identified three Federal and one State endangered listed mussel species that were not observed in the mussel survey for the Sylvan Slough bridge replacement project area. These listed mussel species are briefly described below.

Higgins eye mussel (*Lampsilis higginsii*)

The State and Federally endangered Higgins eye mussel has the potential to be found during mussel relocation within the project area due to the projects close proximity to the I-74 bridge project area where the Higgins eye mussel species were identified in the 2014 mussel survey.

The sauger (*Sander Canadensis*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Perca flavescens*), black crappie (*Pomoxis nigromaculatus*), and green sunfish (*Lepomis cyannellus*) are possible hosts of glochidia of the Higgins eye mussel. The Higgins eye mussel prefers stable substrate areas of mixed sand and gravel.

Spectaclecase mussel (*Cumberlandia monodonta*)

The State and Federally endangered Spectaclecase mussel has the potential to be found during mussel relocation within the project area due to the projects close proximity to the I-74 bridge project area where the Spectaclecase mussel species were identified in the 2014 mussel survey.

Though there are no known glochidia host fish, Spectaclecase mussel glochidia have been found in one instance on bigeye chub *(Hybopsis amblops)* and pealip redhorse *(Moxostoma pisolabrum)*. The Spectaclecase mussel prefers substrate of boulders in patches of sand, cobble, or gravel in areas of reduced current.

Sheepnose mussel (*Plethobasus cyphyus*)

The State and Federally endangered Sheepnose mussel has the potential to be found during mussel relocation within the project area due to the projects close proximity to the I-74 bridge project area where the Sheepnose mussel species were identified in the 2014 mussel survey.

The sauger (*Sander Canadensis*) is the only known host of glochidia of the Sheepnose mussel; although lab experiments have been successful with the flathead minnow (*Pimephales promelas*), central stoneroller (*Campostoma anomalum*), and brook stickleback (*Culaea inconstans*) as glochidia host fish. The Sheepnose mussel prefers substrate of gravel or gravel mixed with sand, although has also been found in areas of mud, cobble, and boulders.

Ebonyshell mussel (*Fusconaia ebena*)

The State endangered Ebonyshell mussel has the potential to be found during mussel relocation within the project area due to the projects close proximity to the I-74 bridge project area where the Ebonyshell mussel species were identified in the 2014 mussel survey.

The skipjack herring (*Alosa chrysochloris*) is the primary host of glochidia of the Ebonyshell mussel; although there is literature supporting that the largemouth bass (*Micropterus salmoides*), black crappie (*Pomoxis nigromaculatus*), and white crappie (*Pomoxis annularis*) are possible hosts of glochidia of the Ebonyshell mussel. The Ebonyshell mussel prefers substrate of stable sand or gravel.

C. Habitat and description of activities that will result in take.

A concentration of mussels on substrates of sand and gravel is known to occur within the Sylvan Slough area. Habitat for the State and Federal listed mussels is present in the Sylvan Slough and in the vicinity of the pedestrian bridge. During low river conditions the current is relatively swift within the narrow slough.

At this time, it is unknown as to what contractor will be awarded the project, and subsequently, which method they would choose to complete the necessary work (contractor means and methods). Methods that have been presented and discussed to date that would ultimately result in take would include the following:

1) Construct a temporary rock causeway.
2) Construct a floating barge causeway in the effort to strategically dismantle the bridge potentially using spuds to hold the barges in place. Each spud consists of a heavy duty pipe that is driven into the channel bottom deep enough to keep the barge stable. A hollow pipe is placed over the driven piece of pipe that will then be connected to the barge. This allows for the barge to fluctuate up and down adjusting for water elevation changes, while keeping the barge in place. The bridge superstructure shall be cut and the sections shall be placed on to the barges. It is noted that due to either the poor condition of the bridge and/or potential safety concerns, it is reasonable to believe some sections may fall into the waterway or method be abandoned all together. It is noted that if any debris should fall into the waterway, it shall be removed from the river via crane.

Prior to the demolition of the existing bridge and subsequent construction of the new pedestrian bridge, a temporary rock causeway landing will be constructed for river and land access for materials and equipment. The causeway landing within the Sylvan Slough (at the base within the waterway) would have an impact area of approximate 1,500 SF, which will be one of the potential impacts to mussel habitat. It is anticipated that this causeway will be constructed no matter which of the following methods of bridge superstructure removal will be performed.

The asphalt bridge deck will be hand cut and removed to prevent debris from entering the river. Following the bridge deck removal, a floating causeway method will be used that will extend from the landing to the opposite Slough bank. Two methods of securing the barges could be used; either cable anchoring to the shoreline and/or piers, or using spuds. If spuds are used, it is anticipated that seven barges shall be needed, each requiring 4 spuds to hold the barges in place (if bedrock isn't too shallow). A spud generally occupies 1 SF, so there is an estimated area of 28 SF of potential impact. Once secure, cutting the superstructure in sections and lowering the bridge pieces by use of a crane on to the barges may be performed.

If during the dismantling method bridge superstructure sections drop directly into the waterway, it will be assumed that an approximate total impact area (most conservative area or worst case scenario) of 5,250 SF shall occur.

The existing pedestrian bridge to be removed is approximately 201 feet in length from the north to the south abutments; 175 feet of that length has the potential for mussel habitat impact. The demolition of the bridge will be performed by dismantling the bridge in sections and lowering each portion of the bridge onto barges. Due to the age and poor condition of the existing pedestrian bridge, it is reasonable to believe that portions of the bridge may break into pieces and potentially drop into the slough while performing the dismantling method. Lowering the bridge sections onto barges may be abandoned if safety concerns arise, in which case dropping these sections in the slough could be necessary. Any portion of the bridge that would drop into the waterway will be removed. It is noted that the existing bridge piers will remain in place and are not proposed for removal. An anticipated impact width within the slough for dropping the sections is 15 feet per side of the centerline of bridge or 30 feet total width. With the length of bridge to be removed (over the waterway) at 175 feet, the maximum potential impact to mussel habitat is approximately 5,250 SF, if dropping of the bridge occurs within the slough. The total square footage also takes into of the area of impact from the use of spuds.

In conclusion, the total impact area of the proposed activities is 6,778 square feet; 1,500, 28, and 5250 square feet, respectively, from the proposed temporary rock causeway landing, spud placement for the floating causeway, and potential extended footprint drop area of the existing bridge (reference Attached Exhibit 2, Impact Area Map).

D. Explanation of the anticipated adverse effects on the listed species.

If not relocated, mussels would likely be buried or otherwise crushed or killed by construction activities. The potential adverse impacts would result from rock placement to construct the temporary causeway landing and the potential for portions of the bridge that may get dropped into the slough. The construction of the new pedestrian bridge will require the use of barges, temporary rock causeway, and floating causeway. The removal of the existing bridge will be accomplished through dismantling the superstructure and lowering it onto barges, and/or maybe dropping into the slough. This will be at the Contractor's option and dependent on safety during removal operations.

2. Measures the applicant will take to minimize and mitigate that impact

A. Plans to minimize the area affected by the proposed action, the number of individuals of an endangered or threatened species that will be taken, and the amount of habitat affected.

The area of the in-stream work has been minimized to reduce the impact to the mussel habitat. Utilizing a floating causeway rather than a temporary structure significantly reduces impacts. In addition, the proposed rock causeway landing shall be field adjusted as possible to utilize as much of the existing rock/shale stone shelf/bedding located along the waterline and near shore rather than placing rock on the mussel habitat. Lastly, a significant reduction in mussel habitat impacts could be achieved by potential use of barges to lower the dismantled bridge portions onto, rather than dropping into the waterway.

As stated previously, the total impact area of the entire proposed project activities is 6,778 square feet; 1,500, 28, and 5,250 square feet, respectively, from the proposed rock causeway landing, floating causeway spud placement, and potential extended footprint drop area of the existing bridge.

The 2015 INHS mussel survey found 2 butterfly mussels while the 2015 ESI mussel survey found 18 butterfly and 19 black sandshell mussels. According to page seven of the ESI mussel report, they estimate a population size of 689 butterfly and 725 black sandshell mussels in the project area. They represent 3.8% and 4.0% respectively of all unionids collected. Estimated take for this project will be 5% of the population, which are 69 butterfly mussels and 73 black sandshell mussels.

B. Plans for management of the area affected by the proposed action that will allow continued use of the area by the species.

During construction, adjacent land areas will contain erosion and sediment control features. The Department's erosion and sediment control policy will be followed and will be in compliance with the U.S. Army Corps of Engineers Section 404 permit, the water quality certification policies of Illinois EPA, and the requirements within the NPDES construction permit. Following bridge removal, the rock causeway shall be removed by excavating the rocks out of the waterway by the use of an excavator. The excavator shall be situated on the side slope of the waterway. Rocks shall be removed out of the main channel area first, and then excavation shall continue working back toward the side slope. Rock shall be placed on the side slopes to assist in slope stabilization. The channel bottom/slope banks shall be constructed to similar conditions as prior to construction activities. It is expected, that after the in-stream work has been completed, the area will be available for re-colonization by all species of mussels.

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

To minimize and mitigate the effects of the project on the observed State endangered Butterfly mussels and the Black Sandshell mussels, along with the potential impact of other known State and Federal endangered mussel species (Ebonyshell mussels, Higgins eye mussels, Spectaclecase mussels, and Sheepnose mussels) in the area, if found, it is planned to relocate all individuals of these species from the rock causeway, spud placement areas, and extended footprint dropping area of the bridge (1,500 SF, 28 SF and 5,250 SF, respectively).

The relocation area will be to an area with suitable stable substrates, similar unionid assemblages, and low to no zebra mussel infestations. The relocation area or areas will be determined before the mussels are moved through consultation with the IDNR. These areas could include the Sylvan Slough, other localities within the Mississippi River, or areas within the Rock River. The temporary holding of mussels will be in containers that allow the animals to remain moist and un-crowded. All mussel relocation protocols will be followed. The relocation is anticipated to occur between May 1 and mid-October of 2016 (or between this timeframe on any given year if not relocated in 2016) and will be done as to avoid extreme temperatures.

Prior to construction all contractors and construction personnel will receive training regarding legal and ecological aspects of all suspected State of Illinois listed mussel species.

D. Plans for monitoring the effects of the measures implemented.

The Illinois Natural History Survey (INHS) will conduct mussel surveys two and four years following construction and removal of the rock causeway. The purpose of the monitoring effort is to determine if the mussels have re-colonized the area. It is anticipated that the habitat at the construction site will have recovered and that the host fishes have re-colonized the area. Based on the results of the monitoring survey, the need for further monitoring will be assessed.

Monitoring of the mussel relocation site(s) will occur two and four years post-construction. The purpose of the monitoring effort is to determine the survival of the relocated mussel species.

E. Adaptive management practices that will be used to deal with changed or unforeseen circumstances that affect the effectiveness of measures instituted to minimize or mitigate the effects of the proposed action on endangered or threatened species.

If conditions become unsafe for bridge removal by placement of portions of the bridge pieces onto a barge, bridge portions shall be dismantled and dropped into the waterway. All bridge portions shall be removed from the water. The potential impact area has been extended out fifteen feet on each side of the existing bridge footprint to account for this potential change in project scope.

Mussel relocation is dependent on the flow and volume of water in the river at that time. If the flow is swift and/or the water levels are high the relocation(s) will not take place. Mussel

relocation will occur only when water levels are low and current conditions are moderate or low.

Potential mussel relocation beds will be carefully screened to assure that habitat is suitable for translocated mussels and that risks of external threats to the relocation beds (siltation, chemical spills) are minimized. The relocation will be done according to accepted standards to minimize mussel mortality.

F. Verification that funding to support mitigation activities will be available for the life of conservation plan.

Illinois Department of Transportation has a contractual obligation with the INHS. The INHS will be in charge of the mussel relocation and monitoring surveys.

3. Alternative actions that would not result in the take

The only alternative that would not result in the take of listed freshwater mussels is the "no action" alternative, which means that the bridge would not be replaced. The bridge is structurally deficient and currently closed for use not allowing any access to the Sylvan Island Park. Initially, the scope of work discussed in order to replace the pedestrian bridge was to construct a temporary rock causeway across the entire slough with flow tubes to allow water to pass. This would allow for heavy machinery to traverse back and forth along the span of the bridge. However, due to the large area of disturbance to the river bottom (and potential mussel habitat), it was proposed that a floating causeway should be used for a majority of the span. This method would significantly reduce impacts to potential mussel habitat. In addition, in order to further reduce habitat impact, it was determined that removal of the bridge piers wasn't necessary, so they will remain in place.

4. Data and information to assure that the proposed taking will not reduce the likelihood of the survival of the species.

The biogeographic range of the Butterfly mussel includes Pools 10, 11, 12, 15, and 19 of the Mississippi River and lower reaches of tributaries flowing into these pools.

The biogeographic range of the Black Sandshell mussel includes the Mississippi River in Rock Island County, Illinois. It is widely distributed, but uncommon in much of the Midwest.

The biogeographic range of the Ebonyshell mussel includes the Mississippi, Illinois, Ohio, Wabash, and Little Wabash Rivers in Illinois.

The biogeographic range of the Higgins eye mussel includes the Mississippi and Rock Rivers in Illinois.

The biogeographic range of the Spectaclecase mussel includes the Mississippi River in Hancock, Henderson, Madison, Mercer, and Rock Island Counties, Illinois.

The biogeographic range of the Sheepnose mussel includes the Mississippi, Rock, Ohio, Wabash, Kaskaskia, and Kankakee Rivers in Illinois.

Suitable habitat exists both upstream and downstream of the pedestrian bridge site. Due to the relatively small proposed area affected by demolition and subsequent construction of the new pedestrian bridge, and the relocation of the mussels from areas to be affected by construction activities, it is expected that Butterfly Mussel and any other likely mussel species will continue to exist in this reach of the Sylvan Slough. It is not likely that this project will reduce the survival or recovery of the species in the wild in Illinois.

5. Attachments

A. Exhibit 1, Site Location Map
B. Exhibit 2, Impact Area Map
C. Project Area Photo Log
D. Ecological Specialists, Inc.; Mussel Survey (2014) – I-74 Bridge Project
E. Illinois Natural History Survey; Mussel Survey (2015) – Pedestrian Bridge in Sylvan Slough Project
F. Ecological Specialists, Inc.; Mussel Survey (2015) – Pedestrian Bridge in Sylvan Slough Project
G. U.S. Fish & Wildlife Service; Freshwater Mussel Survey (2015) – Channel Cat Taxi Project
H. United States Army Corps of Engineers 404 Permit
I. Illinois DNR Office of Water Resources Permit

LITERATURE CITED

Ecological Specialists, Inc. 2014. Unionid Survey for Replacement of the Interstate 74 Bridge over the Mississippi River, Illinois - Iowa

Illinois Natural History Survey. 2015. Freshwater Mussel (Mollusca: Unionoida) Survey at the Pedestrian Bridge in Sylvan Slough in Moline, Rock Island County, Illinois

Ecological Specialists, Inc. 2015. Unionid Survey for Replacement of a Pedestrian Bridge over Sylvan Slough, Mississippi River Pool 15 Report

U.S. Fish & Wildlife Service 2015. Freshwater Mussel Survey, Channel Cat Taxi – Moline, Illinois

IMPLEMENTING AGREEMENT
For
Conservation Plan
For the Illinois Threatened Butterfly Mussel (*Ellipsaria lineolata*) and Black Sandshell Mussel (*Ligumia recta*), Illinois Endangered Ebonyshell (*Fusconaia ebena*), and Federally and Illinois Endangered Higgins Eye (*Lampsilis higginsii*), Spectaclecase (*Cumberlandia monodonta*), and Sheepnose Mussels (*Plethobasus cyphyus*) for the Sylvan Slough Pedestrian Bridge Replacement in Moline, Rock Island County, Illinois

The Illinois Department of Natural Resources (IDNR) is responsible for the review of this Conservation Plan and for subsequent issuance of the Incidental Take Authorization.

The Illinois Department of Transportation is responsible for all biological clearance coordination and recommendations related to the project. IDOT is also responsible for securing authorization for the incidental take; securing all permits, Section 404 and Office of Water Resources; inspection of the work and contractor compliance with the contract documents.

The activities in the conservation plan will be implemented before construction begins (i.e., relocating mussels from the project area) and after construction is completed (i.e., monitoring mussel relocation site and construction site). Construction is estimated to begin in 2016 and be completed in approximately one year. Progress reports will be provided to IDNR within 90 days of each relocation or monitoring event.

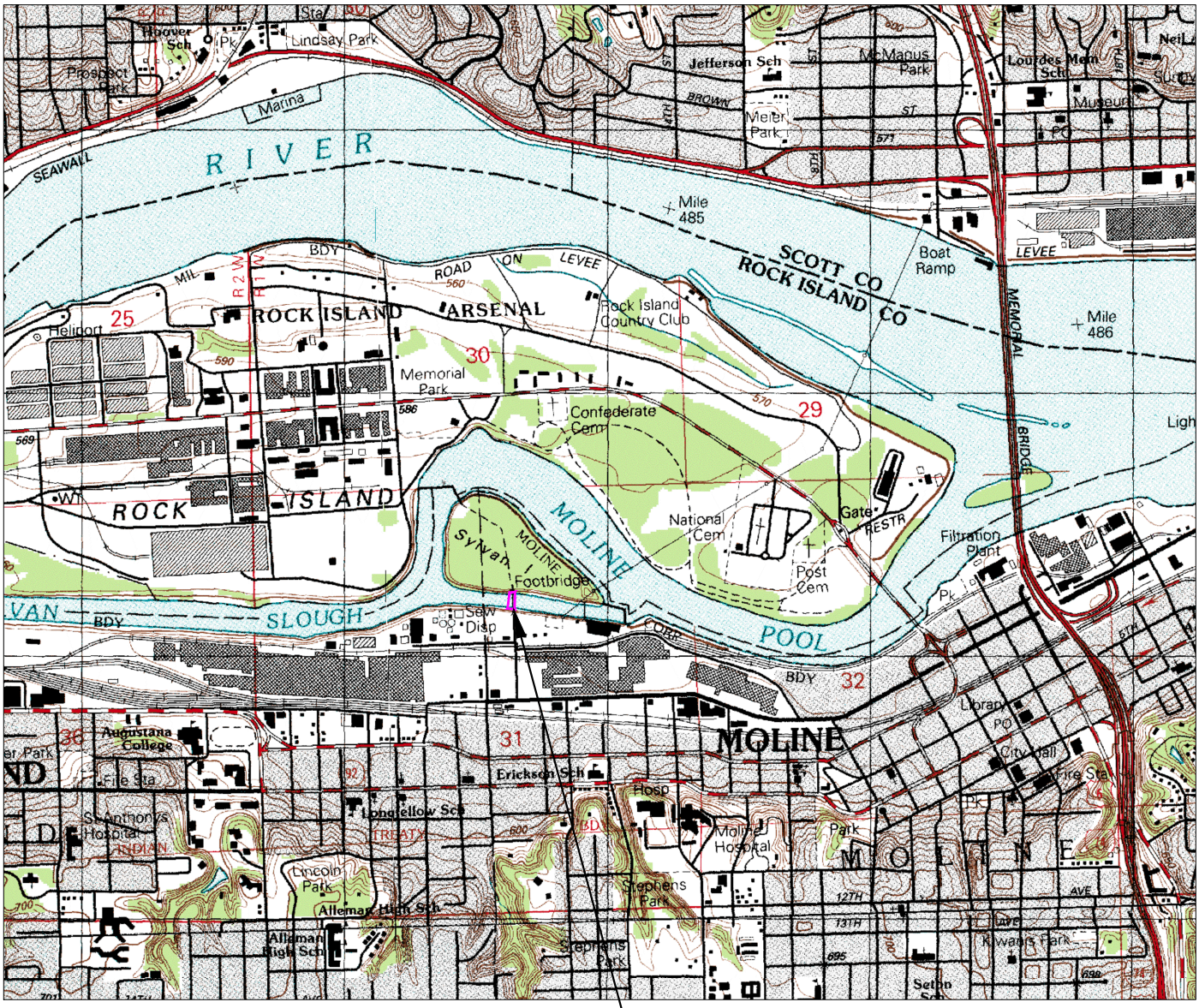
IDOT is authorized by the Illinois Highway Code to carry out its duties of providing safe and efficient highways for Illinois citizens.

The Illinois Department of Transportation exclusively abides by the National Environmental Policy Act and all associated federal and state environmental laws in carrying out their mission of performing the most environmentally sensitive methods of transportation planning and engineering. The Higgins eye, sheepnose, and spectaclecase mussels are listed as endangered in Illinois and federally. They are thus covered by the Illinois Endangered Species Act of 1972. Also compliance under the federal Endangered Species Act of 1973 is required. The butterfly and black sandshell mussel are listed as threatened and the ebonyshell is listed as endangered in Illinois. They are covered by the Illinois Endangered Species Act of 1972 only. Therefore, compliance under the federal Endangered Species Act of 1973 is not required for the butterfly, black sandshell, and ebonyshell mussels. No known local regulations are pertinent to this conservation plan.

7-20-16

Kevin Marchek
Region Two Engineer
Illinois Department of Transportation

Date



Site Location

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MILES

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FEET

CONTOUR INTERVAL 10 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

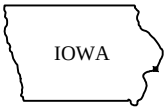
MN GN 1° 18 MILS 1°37' 29 MILS

UTM GRID AND 1991 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

DAVENPORT EAST, IOWA-ILL

1991

DMA 7867 II SE-SERIES V876



QUADRANGLE LOCATION

Sheet 1 of 1	Exhibit 1	Date: 6/2015	Checked By: N/A	Drawn By: MWH	Field Book No: N/A

File Name: Site Location Map.dwg
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Missman Project No: A14Y010

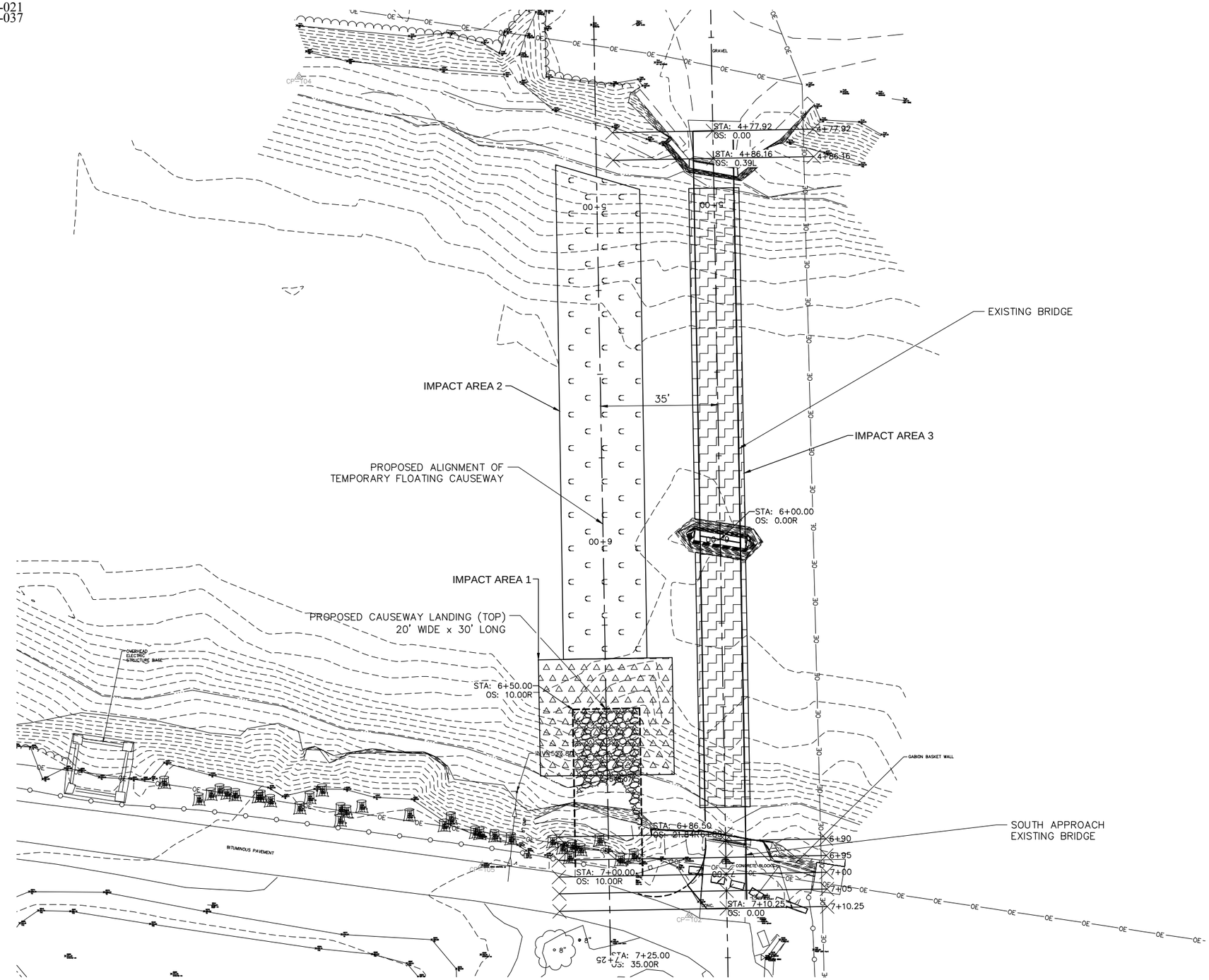
Sylvan Slough Pedestrian Bridge Replacement Project
North of 2nd Street Over Sylvan Slough, Moline, IL

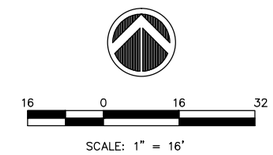
Site Location Map

Missman, Inc.
Professional Engineers & Land Surveyors
Rock Island, IL (309) 788-7644 · Bettendorf, IA (563) 344-0260 · Rockford, IL (815) 965-6400 · Sycamore, IL (815) 895-3825
www.missman.com

REVISIONS

No.	DESCRIPTION	DATE





IMPACT AREA 1:
FOOTPRINT OF ROCK CAUSEWAY LANDING

IMPACT AREA 2:
FOOTPRINT OF TEMP. FLOATING CAUSEWAY

IMPACT AREA 3:
FOOTPRINT OF DEMOLITION AREA FOR
EXISTING BRIDGE

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FILE NAME =	USER NAME =	DESIGNED —	REVISED —	Missman, Inc. Professional Engineers & Land Surveyors	SYLVAN ISLAND PEDESTRIAN BRIDGE	F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS / SHEET NO.
		DRAWN —	REVISED —	Rock Island, IL (309) 788-7644 • Bettendorf, IA (563) 344-0260 • Rockford, IL (815) 965-6400 • Sycamore, IL (815) 895-3825	EXISTING SITE PLAN - POTENTIAL IMPACT AREAS				
	PLOT SCALE =	CHECKED —	REVISED —	www.missman.com				CONTRACT NO.	
	PLOT DATE =	DATE —	REVISED —		SHEET NO. OF SHEETS	FED. ROAD DIST. NO. _	ILLINOIS	FED. AID PROJECT	

PHOTO LOG

DATE: 10/20/14 TAKEN BY: MAM	SITE NAME: Proposed Sylvan Island Pedestrian Bridge Replacement Project; Moline, IL
COMMENTS: A general view of the southern end of the Sylvan Island bridge and approach to be removed and replaced in the same location. PHOTO #: 01	

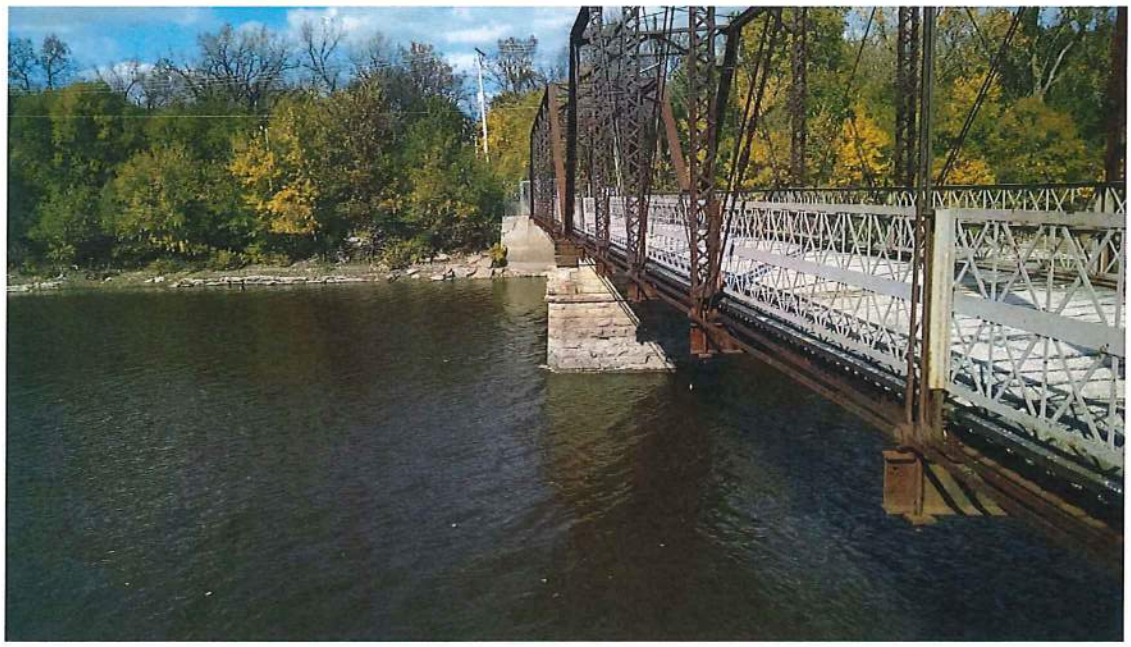
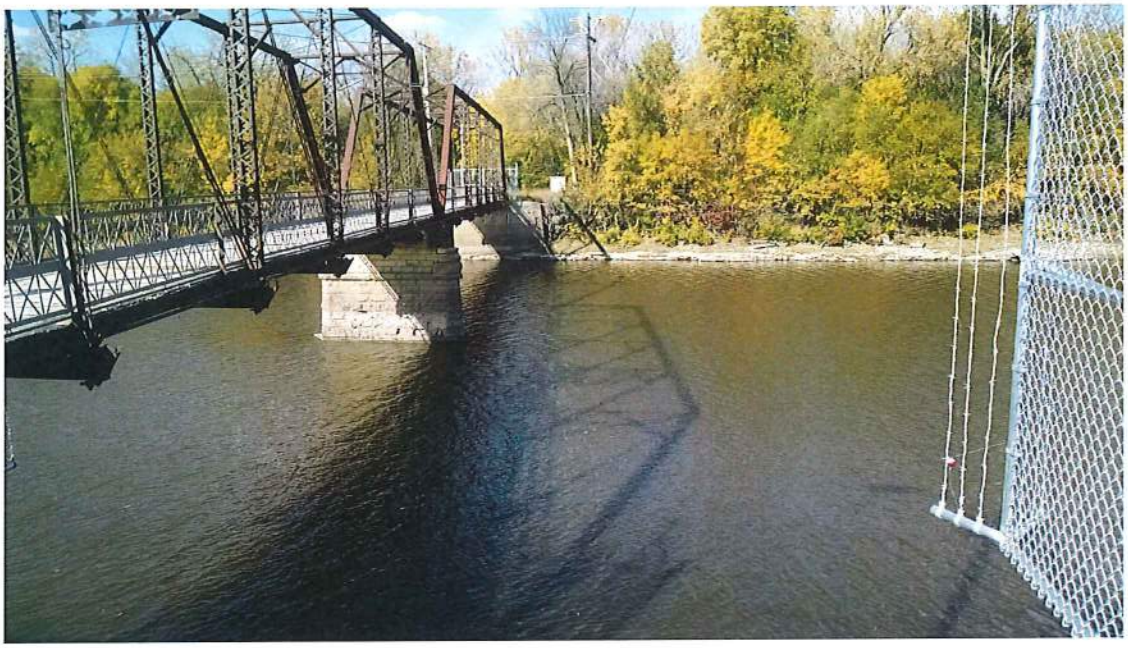
DATE: 10/20/14 TAKEN BY: MAM	SITE NAME: Proposed Sylvan Island Pedestrian Bridge Replacement Project; Moline, IL
COMMENTS: Another general view of the Sylvan Island bridge & the central & north structural piers that will not be removed during demolition. The photo also depicts the downstream bank area of the project. No disturbance of the bank or trees is proposed. PHOTO #: 02	

PHOTO LOG

DATE: 10/20/14 TAKEN BY: MAM	SITE NAME: Proposed Sylvan Island Pedestrian Bridge Replacement Project; Moline, IL
COMMENTS: A view of the upstream bank area on the northern end of the bridge for the project. Again, no disturbance of the bank or trees is proposed. PHOTO #: 03	

DATE: 10/20/14 TAKEN BY: MAM	SITE NAME: Proposed Sylvan Island Pedestrian Bridge Replacement Project; Moline, IL
COMMENTS: A general view of the structural support to remain and the current condition of the upstream southern slope bank of the bridge structure. PHOTO #: 04	

PHOTO LOG

DATE: 10/20/14 TAKEN BY: MAM	SITE NAME: Proposed Sylvan Island Pedestrian Bridge Replacement Project; Moline, IL
COMMENTS: A general view of the southern slope bank downstream of the bridge structure. Trees have been cut for preparation construction access to the working rock platform. The bank will be brought back to existing conditions following bridge construction.	
PHOTO #: 05	

Final Report:
Unionid Survey for Replacement of the Interstate 74 Bridge over the Mississippi River, Illinois - Iowa

Prepared for:

Stantec Consulting Services, Inc.
Independence, IA

Prepared by:

Ecological Specialists, Inc.
O'Fallon, Missouri

December 2014

(ESI Project No. 14-021)

14-021 December 2014

Acknowledgements

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1.0 Introduction

Stantec Consulting Services, Inc. is assisting the Iowa Department of Transportation with replacing the Interstate 74 bridge over the Mississippi River. The existing bridge is located in Pool 15 near river mile 486, and connects the cities of Bettendorf, Iowa (Scott County) and Moline, Illinois (Rock Island County). The project will involve removal of the existing bridge and construction of a new bridge just upstream (Figure 1-1). The proposed new bridge design consists of 14 concrete piers supporting the deck. Impacts to the riverbed will be greatest in the vicinity of the proposed piers. Demolition of the existing bridge may also impact the riverbed. Construction equipment will likely be staged along the banks, causing additional in-stream disturbance.

Pool 15 is known to harbor a species rich unionid community. Forty (40) unionid species have been reported from Pool 15, 30 of which have been collected within the past 30 years (Table 1-1). Sixteen of the 40 species are presently listed in Illinois and/or Iowa as threatened or endangered (T&E), including the federally endangered *Cumberlandia monodonta*, *Plethobasus cyphyus*, and *Lampsilis higginsii* (all considered "rare" in Pool 15). However, 7 of the state listed species and the federally endangered *Epioblasma triquetra* have not been observed in Pool 15 in the past 30 years. The bridge project area overlaps the Sylvan Slough *L. higginsii* Essential Habitat Area (EHA) on the Illinois bank (see Figure 1-1). EHAs are areas considered capable of supporting reproducing populations of *L. higginsii*, and are defined as areas where "*L. higginsii* constitute at least 0.25% of the mussel community and the mussel habitat appears to be stable and supports a dense and diverse mussel community" (USFWS, 2004).

Replacement of the I-74 bridge may directly affect unionids and their habitat in the project area. Unionids may be crushed beneath the concrete during construction of the new piers, or may be harmed by dewatering if coffer dams are used to construct the piers. Staging of construction barges in the shallow water near the banks may disturb the substrate and unionids therein. Removal of the existing bridge may potentially impact unionids as well. Because unionids, including federally endangered species, are known to occur in the project area, a mussel survey was conducted at the bridge crossing. The objective of this survey was to determine unionid distribution, species composition, and density with respect to the bridge replacement project.

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2.0 Methods

To assess unionid distribution and density with respect to both the existing bridge and new bridge, the mussel survey area at the I-74 bridge crossing extended from approximately 600 m upstream to 300 m downstream of the existing bridge. The survey area was divided into 4 sections based on physical features (Figure 2-1). A combination of quantitative and qualitative sampling was used to meet the survey objectives. Quantitative samples (0.25 m^2 quadrats) were used to determine mussel distribution and density within the areas described above. The number of quadrats in each section was determined based on the area of the section (Table 2-1). A three random start design (Strayer and Smith, 2003) was used; this method allowed for calculation of a confidence interval for density and population estimates, and provided information on mussel distribution. Sample points were generated using Geospatial Modelling Environment for GIS (Beyer, 2012). A small number of points were moved in the field to avoid banks and the parallel dike on the Illinois bank. Points were moved to the closest wetted location. Each sample location was recorded with GPS. For each sample, the diver excavated all substrate within a 0.25m^2 quadrat into an attached mesh bag (6 mm mesh). Substrate was sieved through 12 and 6 mm sieves and all unionids retrieved from the sample. All collected unionids were identified to species, measured (length in mm), and aged (external annuli count). Zebra mussel infestation was also recorded (number of zebra mussels attached to each unionid, and % shell coverage). At least one individual of each species was photographed, and at least one dead shell of each species was retained (if available) as a voucher. Unionids were released near their original collection location; endangered species were marked with a Dremel tool and hand placed in the substrate. At each quadrat location, the diver also visually estimated substrate composition (Wentworth scale), and depth was recorded with a depth pole in areas <2 m and a pneumofathometer in areas >2 m deep.

Qualitative sampling (timed searches) was used to delineate unionid concentrations, detect endangered species within unionid concentrations, and investigate areas of direct impact (e.g. bridge piers). Qualitative sampling consisted of a diver collecting as many unionids (concentrating on rare species) within a 5-minute interval as possible. Samples were retrieved after 5 minutes, and all unionids were identified and counted as ≤5 years old or > 5 years old. The start point of each sample was recorded with GPS and is depicted on figures. The area searched per sample varied with the substrate and unionid abundance, but samples around existing piers generally covered the entire pier perimeters. A minimum of 1 hour of qualitative sampling (12 timed searches) and up to 2 hours (24 samples) was conducted in each of the 4 survey areas. Timed searches were concentrated in areas that will be directly impacted by the project, particularly the existing bridge piers and proposed locations of new bridge piers, to determine the probability of endangered species being present in these areas. Timed searches were conducted until at least 6 searches were conducted with no new species present. Additional timed searches were conducted as needed to delineate mussel concentrations. Timed searches were also conducted around the existing and proposed bridge piers in the main navigation channel to determine if unionids occurred around these structures. One search at an existing pier in the navigation sample was recorded as a single 10-min search rather than 2 5-min searches; thus, only 12 GPS points were recorded, but total search time was 65 min (see Table 2-1).

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3.0 Results

The mussel survey at the I-74 bridge was conducted August 4-9 and September 19-25, 2014. Flow ranged from 47,300 cubic feet per second (cfs) to 105,000 cfs during sampling, and stage ranged from 5.8 ft to 10.7 ft (Rock Island gage).

3.1 Area A

Area A encompassed the upstream end of Sylvan Slough and the *L. higginsii* EHA (see Figure 2-1). Depth was relatively shallow, ranging from 0.13 to 3.35 m; most of the area was < 3 m deep (Figure 3-1). Substrate near the banks was generally a mix of clay, silt, and sand, while sand and zebra mussel shells were the predominant substrate components mid-channel (Figure 3-2, Figure 3-3).

Area A supports a dense and species rich unionid community. A total of 1127 unionids of 25 species were collected in quantitative and qualitative samples combined (Table 3-1). In quantitative samples, unionids were generally scarce along the banks, but were present in moderate to high densities throughout the rest of the area (Figure 3-4). Qualitative sampling suggested that unionids were fairly abundant at all of the existing and proposed bridge piers as well (Figure 3-5). As in quantitative samples, abundance was lower at the 2 existing piers on either bank, and higher at the pier in the center channel. However, unionids were more abundant at the proposed bridge pier closest to the Illinois bank.

Unionid density in Area A was 24.9 ± 4.1 unionids/m^2, and catch per unit effort (CPUE) was 275.4 unionids/hour (see Table 3-1). *Quadrula pustulosa* (29.6%) was the most common species collected overall, followed by *Obliquaria reflexa* (18.8%) and *Amblema plicata* (15.3%). The remaining 22 species each comprised <10% of the total catch. Three additional species were collected as weathered dead or subfossil shells (see Table 3-1). Recruitment was observed for nearly all species; juveniles of 23 species were collected in Area A, and 42.8% of unionids collected in quantitative samples were ≤5 years old. Recent mortality was somewhat high (26.4% fresh dead shells), though nearly half of the fresh dead shells were juvenile *Utterbackia imbecillis*.

Eighteen (18) individuals of federally endangered species were collected: 3 *L. higginsii*, 1 *P. cyphyus*, and 14 *C. monodonta*. The *L. higginsii* and *P. cyphyus* were collected in quantitative samples in the riverward half of the area (see Figure 3-4). All of the *C. monodonta* were collected at the existing bridge pier in the center of the slough (see Figure 3-5). The Illinois threatened species *Ellipsaria lineolata* and *Ligumia recta* were also both collected in Area A. *Ellipsaria lineolata* was present in low numbers, while *L. recta* was fairly common, particularly in qualitative samples.

3.2 Area B

Area B extended from the small island at the head of Sylvan Slough riverward to the navigation channel (see Figure 2-1). A parallel dike transected the area just outside the navigation channel. Habitat characteristics were variable throughout Area B. Silt and clay were the primary substrate constituents near the small island, and depth was generally <2 m (see Figure 3-1; Figure 3-6). Riverward of the island, depth increased and substrate transitioned to a mixture of sand and zebra mussel shells. A patch of bedrock was present at the downstream end of the area inside the dike. Substrate along

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the dike remained primarily sand and shell, but depth decreased, and most of the top of the dike was exposed. Substrate was more heterogeneous at the existing bridge piers, and many of the pier samples contained some boulder, cobble, and/or gravel (Figure 3-7).

A total of 1135 unionids of 22 species were collected in all samples combined (Table 3-2). Unionids were most abundant in a strip between the small island and the parallel dike, and were also fairly dense at the head of the island (Figure 3-8). Only a few unionids were in shallow water (≤0.5 m) along the small island and near the dike. In qualitative searches, unionids were present at most of the existing and proposed bridge piers (Figure 3-9). Most of the existing piers harbored only scattered unionids, but abundance was somewhat higher at the large pier riverward of the dike. Abundance at the proposed piers was highest closest to the Illinois bank, and decreased with distance riverward (see Figure 3-9).

Unionid density in Area B was 10.1 ± 3.6 unionids/m^2, and CPUE was 336.0 unionids/hour. Species composition was similar to Area A, with *Q. pustulosa* (32.7%), *A. plicata* (22.8%), and *O. reflexa* (16.5%) being the most common species (see Table 3-2). The remaining 19 species each comprised <10% of the total, and of these, only *L. recta* (7.6%) comprised >5%. An additional 6 species were collected as dead shell material only. Two of these species, *Quadrula nodulata* and *U. imbecillis,* were found live in Area A, and thus may occur in Area B in low numbers as well. Recruitment was apparent for 14 of the 22 species collected, and 19.7% of unionids collected in quantitative samples were ≤5 years old. Mortality was relatively low (13.3% fresh dead shells).

The federally listed species *C. monodonta* and *L. higginsii* were both collected in Area B (2 individuals each) (see Table 3-2). One *L. higginsii* was collected in a quantitative sample just downstream of the existing bridge (see Figure 3-8). The other *L. higginsii* and 1 *C. monodonta* were collected in qualitative searches near the upstream end of the small island, while the second *C. monodonta* was collected at the existing center bridge pier inside the dike (see Figure 3-9). Illinois threatened species *E. lineolata* and *L. recta* were both collected live in Area B. While *E. lineolata* was present only in low numbers, *L. recta* was the fourth most abundant species collected.

3.3 Area C

Area C was upstream of Areas A and B, and extended from the Illinois bank riverward to the navigation channel. The parallel dike in Area B continued upstream through the riverward portion of Area C (see Figure 2-1). Depth ranged from 0.61 m near the bank to 6.10 m in the upstream riverward corner. Depth was generally shallower along the bank, adjacent to the dike, and along the downstream edge of the area, and deeper in the center of the area and riverward of the dike (see Figure 3-1). Substrate was variable in the shoreward half of the area. Sand, silt, clay, and zebra mussel shells were common constituents, with smaller amounts of bedrock, boulder, cobble, and gravel also present in some samples (Figure 3-10, Figure 3-11). Substrate in the riverward half of the area was primarily composed of sand and zebra mussel shells.

Unionid abundance and species richness was lower than in Areas A and B. A total of 444 unionids of 20 species were

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collected (Table 3-3). The majority of unionids were collected in the downstream shoreward corner, where density was still relatively high (Figure 3-12). However, only scattered unionids were collected throughout the rest of the area, and most quantitative samples in the riverward half of Area C did not contain any unionids. Unionids were collected in qualitative searches at all but the farthest riverward proposed piers, though abundance was generally low (Figure 3-13).

Density in Area C was relatively low at 5.2 ± 1.5 unionids/m^2, and CPUE was 101.6 unionids/hour (see Table 3-3). As in the previous 2 areas, *Q. pustulosa* (34.9%), *O. reflexa* (23.9%), and *A. plicata* (16.4%) together comprised 75% of all unionids collected. The remaining 17 species each comprised <5% of the total. One additional species, *Fusconaia ebena*, was collected as a weathered dead shell. Recruitment was observed for 17 of the 20 species, and juveniles (≤5 years old) comprised nearly 50% of all unionids collected in quantitative samples. Observed mortality was low (3.9% fresh dead shells).

Two *L. higginsii* were collected in qualitative searches. One was collected at the proposed bridge pier closest to the bank, while the other was collected farther upstream (see Figure 3-13). The Illinois threatened species *E. lineolata* and *L. recta* were collected in Area C. Both species were present in relatively low numbers, although *L. recta* was still the fourth most abundant species (along with *M. nervosa*, 2.9% each).

3.4 Area D

Area D was located on the Iowa bank, and extended from the bank riverward to the navigation channel (see Figure 2-1). Depth ranged from 0.15 m near the bank to 5.18 m riverward; most of the area was >3 m deep (see Figure 3-1). Substrate at most sampling locations was primarily bedrock, with small amounts of other material (sand, silt, shell) on top (Figure 3-14, Figure 3-15). Sand, silt, and clay were more abundant near the bank in the downstream half of the area, while boulder/rip-rap was present along the bank under the existing bridge. A patch of more heterogeneous substrate (sand/silt/clay with some cobble and gravel) occurred near the upstream end of the area (see Figure 3-14).

A total of 383 unionids of 22 species were collected in Area D (Table 3-4). Abundance was highest in the upstream shoreward half of the area, where substrate was more heterogeneous and contained less bedrock (Figure 3-16, Figure 3-17). Very few unionids were collected in the downstream or riverward portions. A few unionids were collected at each of the existing and proposed bridge piers as well, though abundance at these locations was low (see Figure 3-17).

Density in Area D was 2.6 ± 1.0 unionids/m^2, and CPUE was 200.8 unionids/hour (see Table 3-3). Species composition was fairly similar to the other survey areas. *Obliquaria reflexa* (22.5%) was the most common species, followed by *Q. pustulosa* (19.3%) and *A. plicata* (16.7%). *Megalonaias nervosa* was also common, comprising 10.4% of unionids collected; the remaining species each comprised <10% of the total. Recruitment was apparent for 11 of the 22 species, and 31.1% of unionids collected in quantitative samples were ≤5 years old. Recent mortality was low (3.6% fresh dead shells; see Table 3-4).

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One *L. higginsii* and 1 *C. monodonta* were collected in Area D. The *L. higginsii* was collected in a quantitative sample near the downstream riverward end of the area (see Figure 3-16). The *C. monodonta* was found at the existing bridge pier closest to the bank (see Figure 3-17). The Iowa threatened species *Ellipsaria lineolata* was also collected, and comprised 5.5% of the total.

3.5 Navigation Channel

Qualitative sampling was conducted at each of the existing and proposed bridge piers in the navigation channel. Depth ranged from 3.05 m to 5.18 m. Substrate at the existing piers was primarily sand and bedrock (Figure 3-18). Trash and debris covered the substrate around the upstream pier on the Illinois side of the main span. Sand and zebra mussel shells were the primary components of the proposed piers in the main channel (see Figure 3-18).

A total of 37 unionids of 8 species were collected in the navigation channel (Table 3-5). Scattered unionids were collected at each of the proposed piers and 2 of the 3 existing bridge piers (Figure 3-19). As in the other survey areas, the catch was dominated by *Q. pustulosa* (35.1%), *A. plicata* (21.6%), and *O. reflexa* (13.5%). Illinois threatened *L. recta* was also fairly common. Despite the low unionid abundance, 1 *L. higginsii* was collected at the existing pier on the Iowa side of the main span (see Figure 3-19). No juveniles or fresh dead shells were collected (see Table 3-5).

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4.0 Discussion

The purpose of this survey was to determine the distribution, species composition, and density of unionids with respect to the I-74 bridge replacement project. A total of 3126 unionids of 25 species were collected in the study area. Overall density was highest in Area A (24.9 ± 4.1 unionids/m^2), and lowest in Area D (2.6 ± 1.0 unionids/m^2). Unionids were abundant throughout most of Area A, but were concentrated in smaller aggregations in the other 3 areas (Figure 4-1, Figure 4-2). These aggregations generally corresponded to areas of more heterogeneous substrate; unionids were scarce or absent where substrate was bedrock or sand and shell. Unionids were also present in varying numbers at many of the existing and proposed bridge piers.

A Mussel Community Assessment Tool (MCAT) is currently being developed for the Upper Mississippi River (Dunn et al., 2012). The purpose of this tool is to develop and test a series of metrics that will aid in assessing unionid community health in the Upper Mississippi River. These metrics were calculated for each of the 4 survey areas (Table 4-1). The communities in all 4 areas scored “Fair” or “Good” on the majority of the metrics, particularly those assessing conservation status and taxonomic composition. Scores were generally lower for species and tribe evenness, likely due to the fact that all 4 areas were dominated (55-75%) by the same 3 common species (*Q. pustulosa*, *O. reflexa*, and *A. plicata*). Scores were more variable for metrics assessing population processes. Area A had the highest mortality, but also had fairly high recruitment. Area B had lower mortality, but also had the lowest recruitment. Areas C and D were similar in their low mortality and relatively high recruitment (see Table 4-1). Although scores for the MCAT metrics varied somewhat among the 4 survey areas, all of the areas appear to support fairly healthy unionid communities of varying size and density.

Metrics were calculated for each area individually, but it is likely that the unionid communities in Areas A, B, and C are all part of the same mussel bed. Area A encompassed the upstream end of the Sylvan Slough *L. higginsii* EHA, which was previously known to support a dense, species rich mussel bed. The current study indicates that this bed still persists in the designated EHA, and appears to extend outside of the present EHA boundary. Unionid abundance in quantitative samples suggests that the bed occupies most of Area A, extends upstream a short distance into Area C, and wraps around the head of the small island to continue downstream in a strip through the center of Area B (see Figure 4-1).

Both state and federally listed unionid species were collected in all 4 survey areas. *Ellipsaria lineolata*, listed as threatened in both Illinois and Iowa, was collected in all of the survey areas. This species comprised ≤2% of the catch on the Illinois bank (Areas A, B, and C), and 5.5% in Area D. *Ligumia recta*, listed as threatened in Illinois, was relatively common; this species was the fourth most abundant species collected in Areas A, B, and C. The federally endangered *L. higginsii* was collected in all 4 survey areas, though it comprised <1% of the total catch in each area. One *L. higginsii* was also collected at an existing bridge pier in the navigation channel. *Cumberlandia monodonta* was collected in Areas A, B, and D; the majority of these individuals were collected around existing bridge piers. One *P. cyphyus* was also collected in Area A.

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The results of this study indicate that a healthy, good-quality unionid bed occurs on the Illinois bank within and upstream of Sylvan Slough. A smaller, less dense unionid concentration is also present on the Iowa bank between the existing bridge and the Isle of Capri casino (see Figure 4-1, Figure 4-2). State and federally listed unionid species were found within these concentrations, as well as at bridge piers outside of these areas. This suggests that both construction of the new bridge and removal of the existing bridge have the potential to impact numerous unionids, including endangered species. We therefore recommend that these unionid communities be considered when planning bridge construction and removal methods. Potential mitigation measures for construction might include relocating unionids from the proposed bridge pier locations, particularly those piers closest to the Illinois bank where unionids were most abundant. Limiting staging of equipment to areas where unionids were less dense could also be considered. Impacts to most unionids could be greatly reduced by staging upstream of the new bridge alignment on the Illinois bank, and/or downstream of the existing bridge on the Iowa bank. Methods for removing the existing bridge that limit in-stream disturbance would help mitigate impacts to unionids beneath the bridge. In addition, leaving some of the existing bridge piers in place, particularly those where unionids were most abundant, would ensure that this habitat remains available for unionids after the bridge project is complete. This may be especially important for *C. monodonta*, which was almost exclusively collected adjacent to the existing bridge piers. Considering these various mitigation measures in the bridge replacement project should help minimize impacts to unionids in the area.

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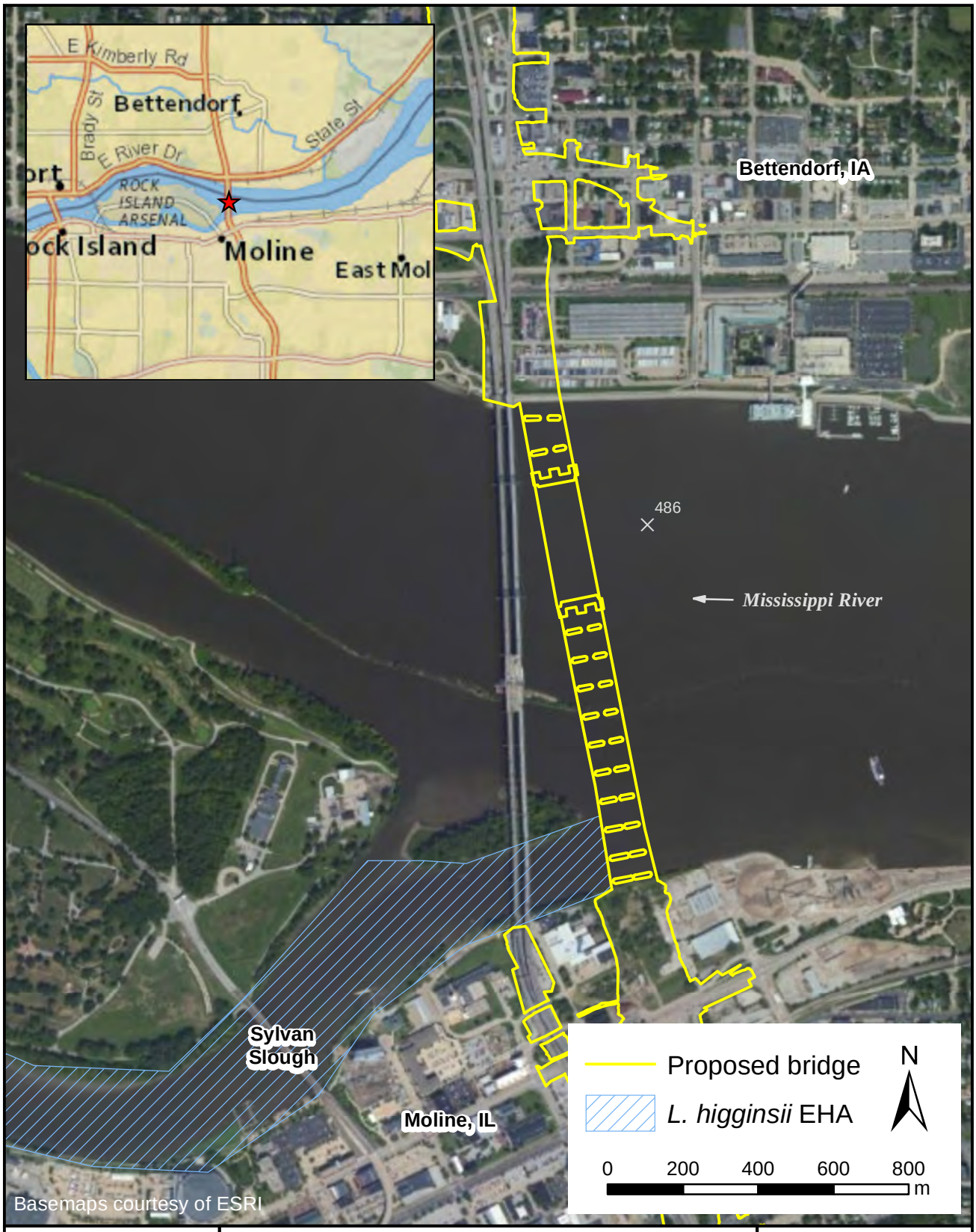

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Figure 1-1. Existing and proposed I-74 bridge alignments and *Lampsilis higginsii* Essential Habitat Area, Mississippi River Pool 15.

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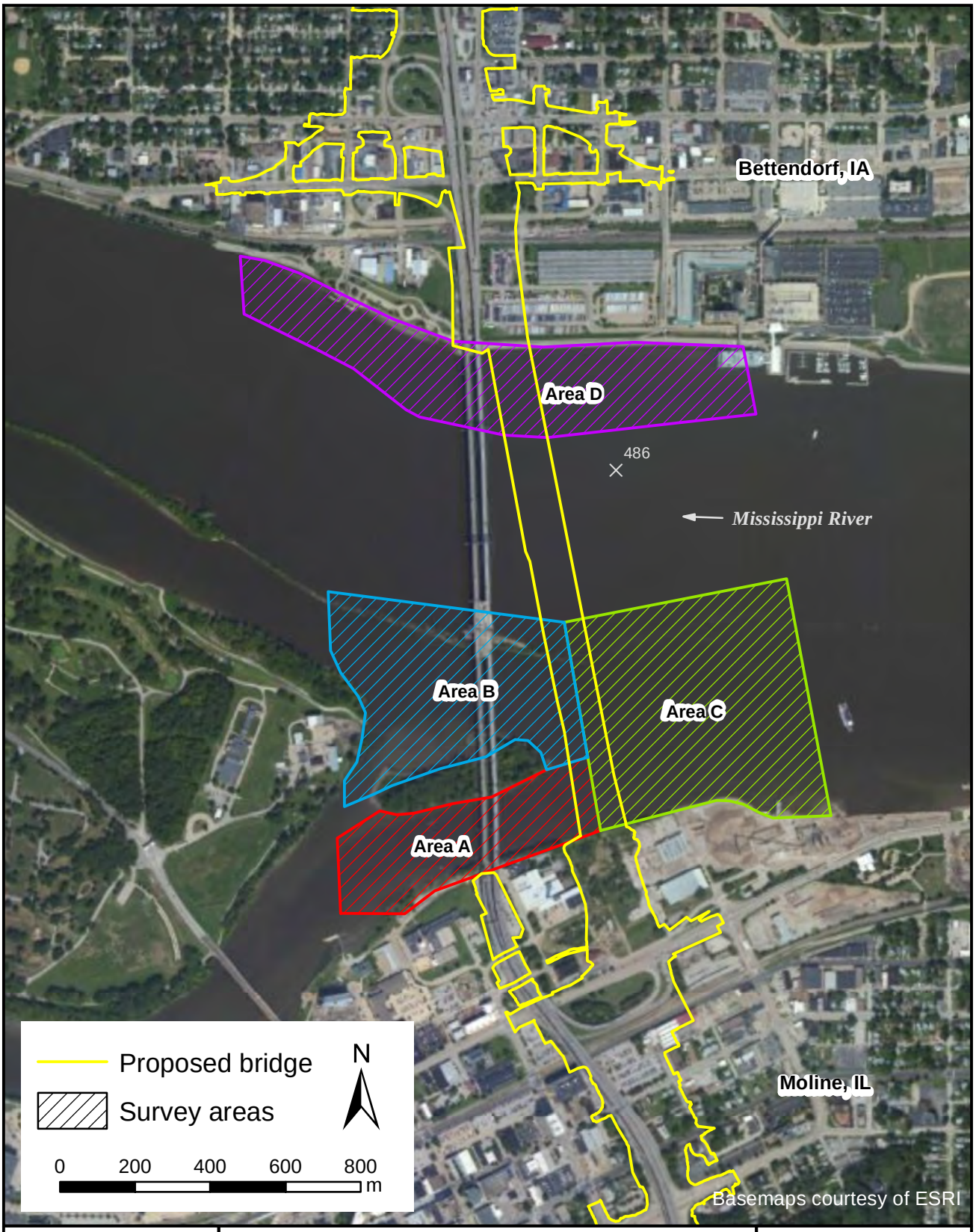

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Figure 2-1. Mussel survey areas for the I-74 bridge replacement project, August-September 2014.

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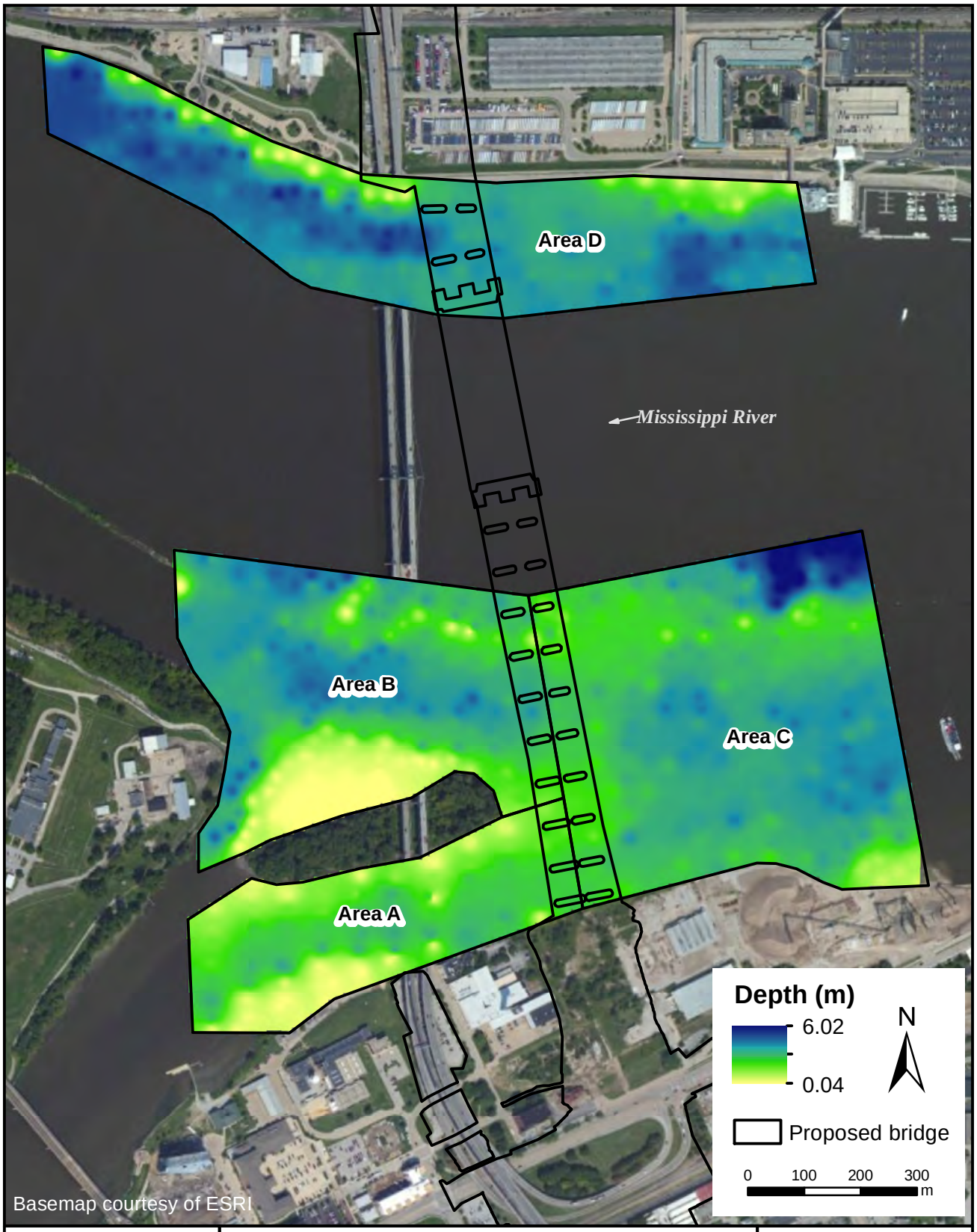

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Figure 3-1. Depth in quantitative samples at the I-74 bridge site, August-September 2014.

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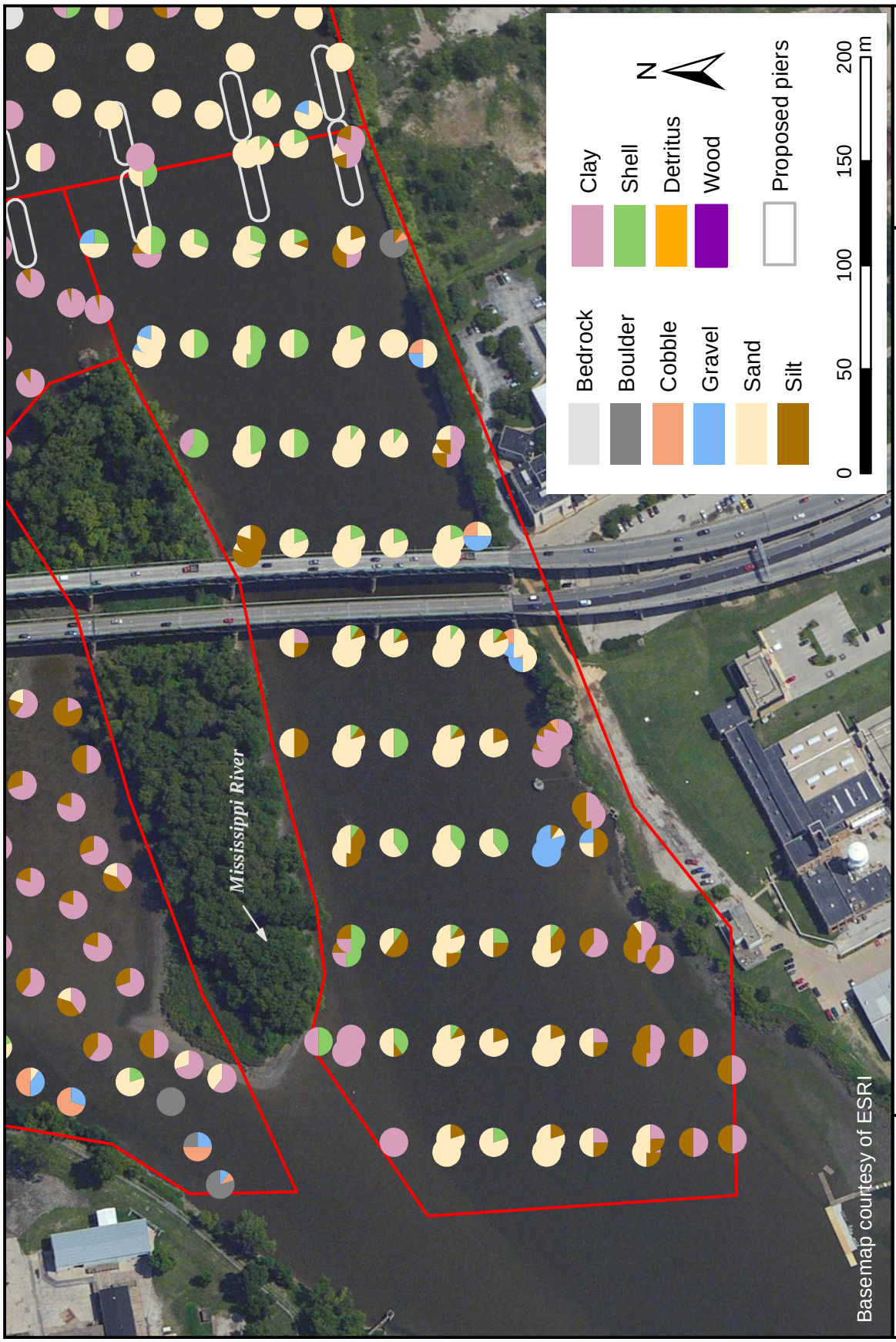

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Figure 3-2. Substrate composition in Area A quantitative samples, August-September 2014.

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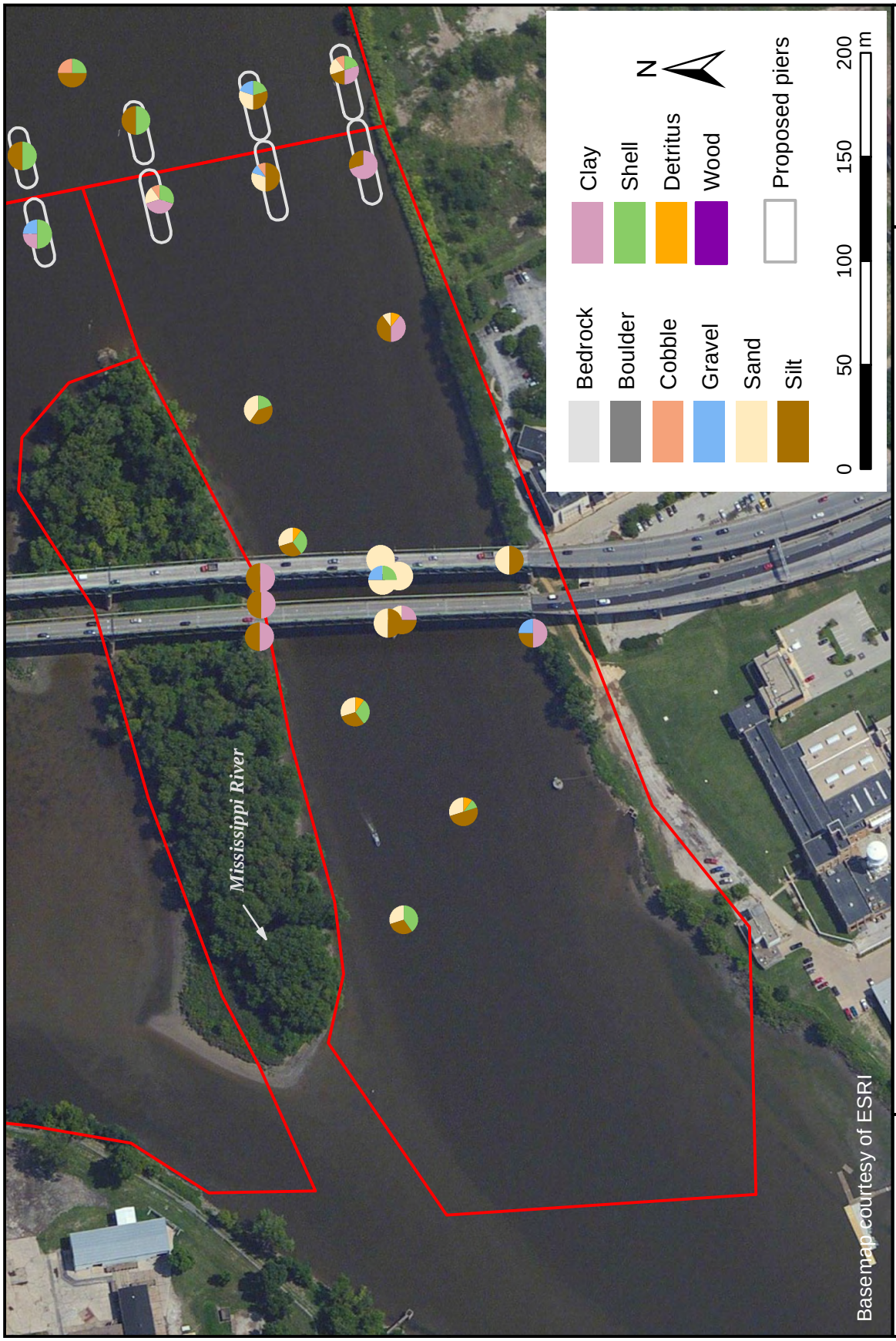

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Figure 3-3. Substrate composition in Area A qualitative samples, August-September 2014.

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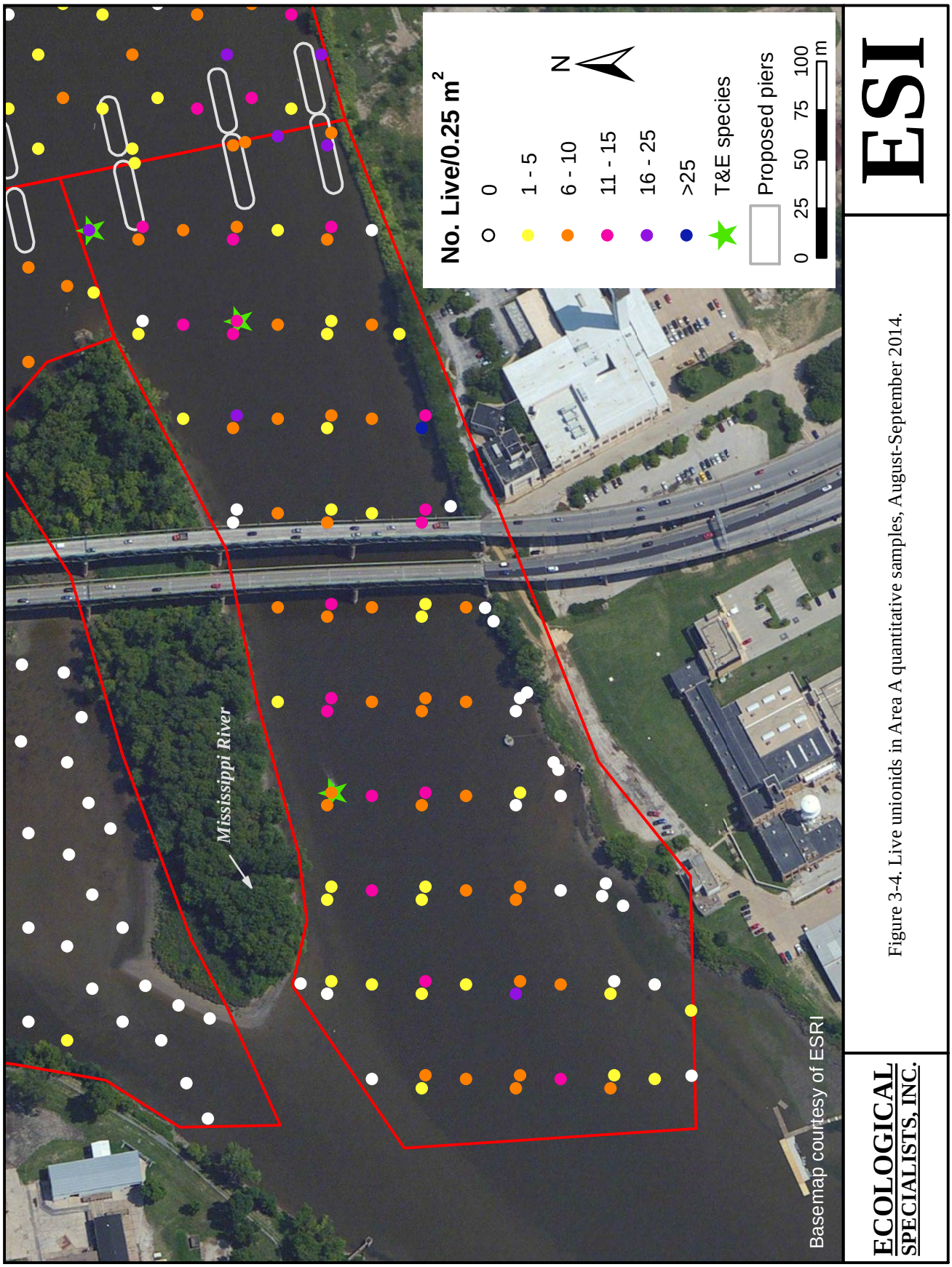

Figure 3-4. Live unionids in Area A quantitative samples, August-September 2014.

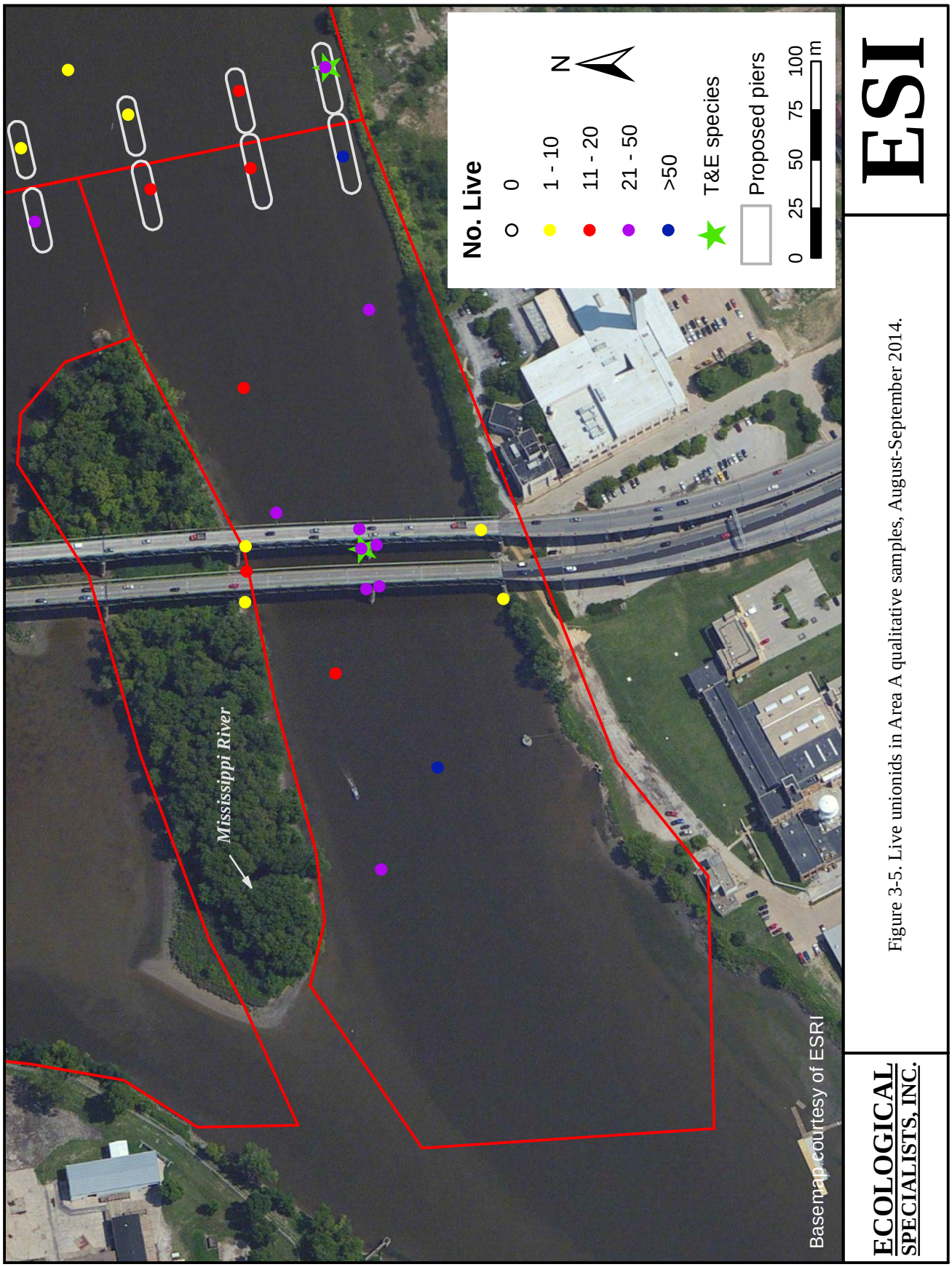

Figure 3-5. Live unionids in Area A qualitative samples, August-September 2014.

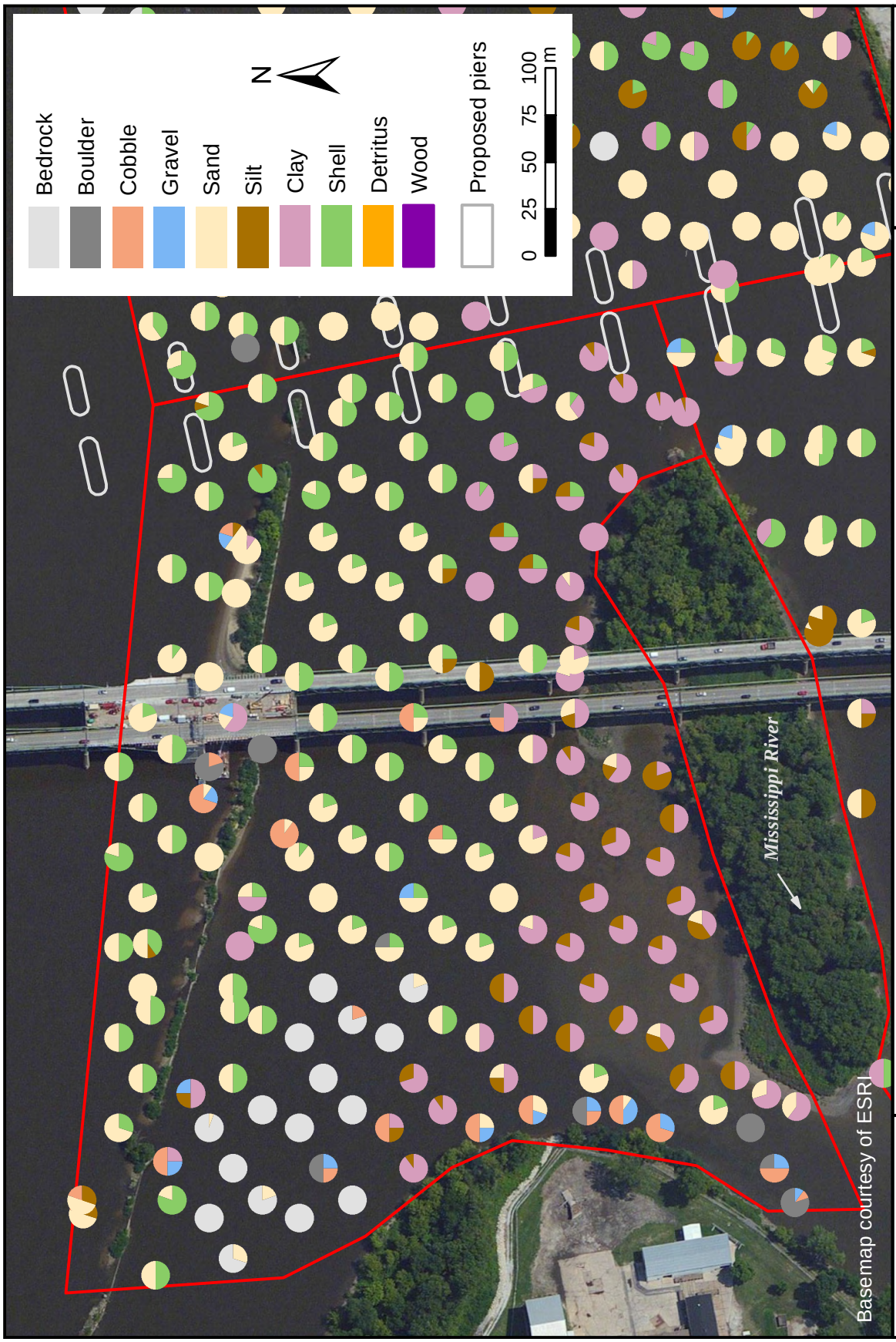

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Figure 3-6. Substrate composition in Area B quantitative samples, August-September 2014.

ESI

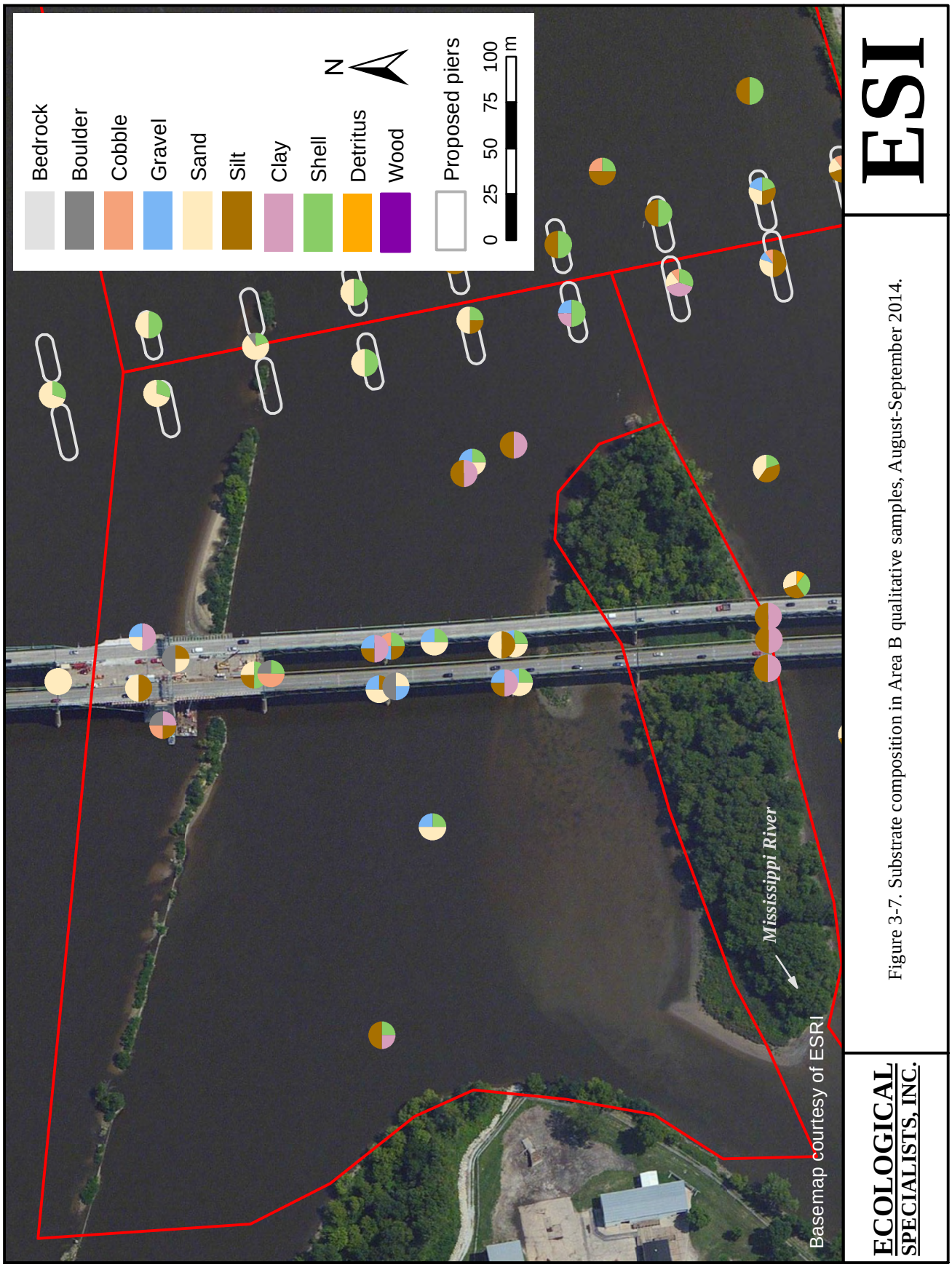

Figure 3-7. Substrate composition in Area B qualitative samples, August-September 2014.

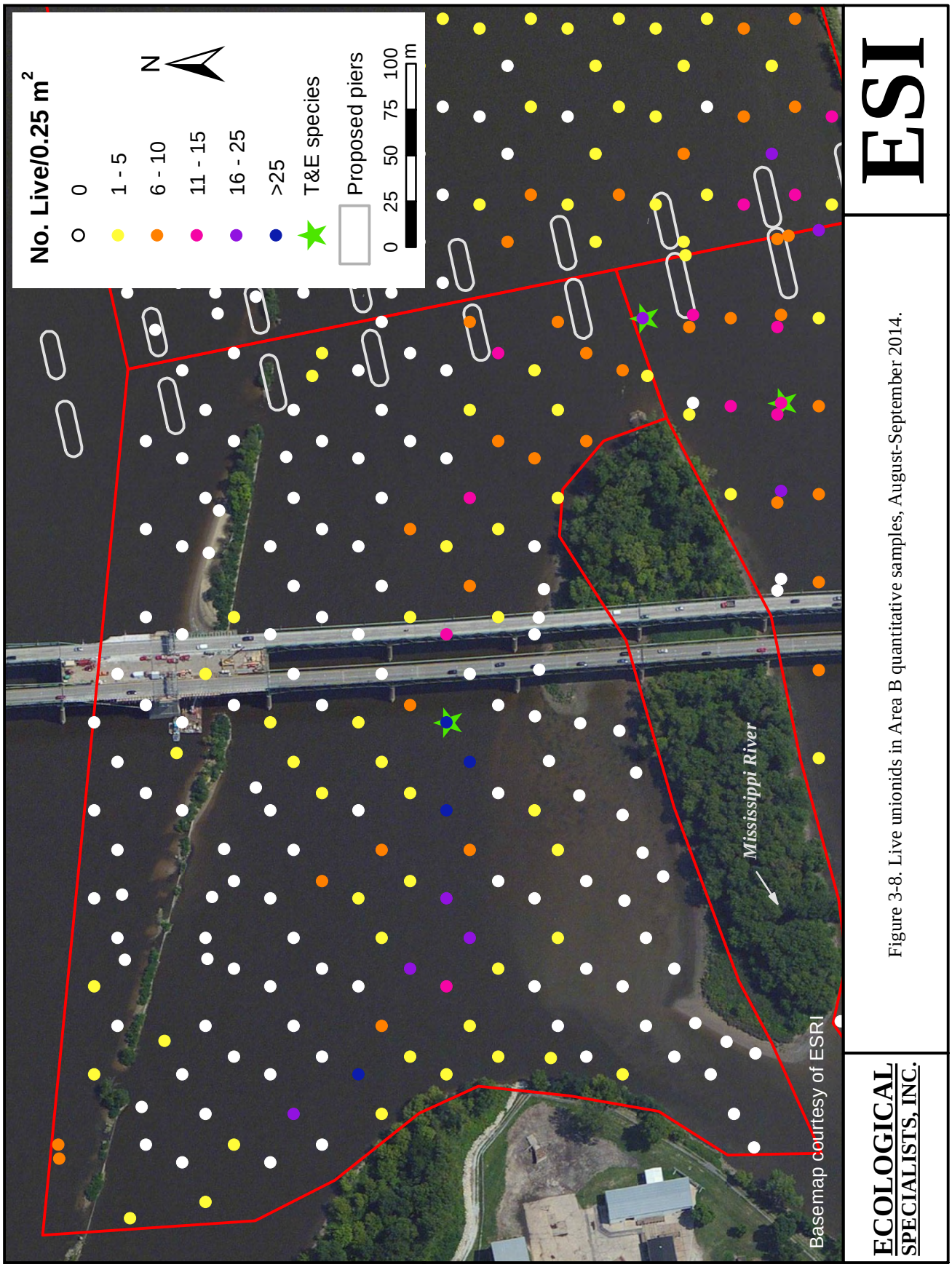

Figure 3-8. Live unionids in Area B quantitative samples, August-September 2014.

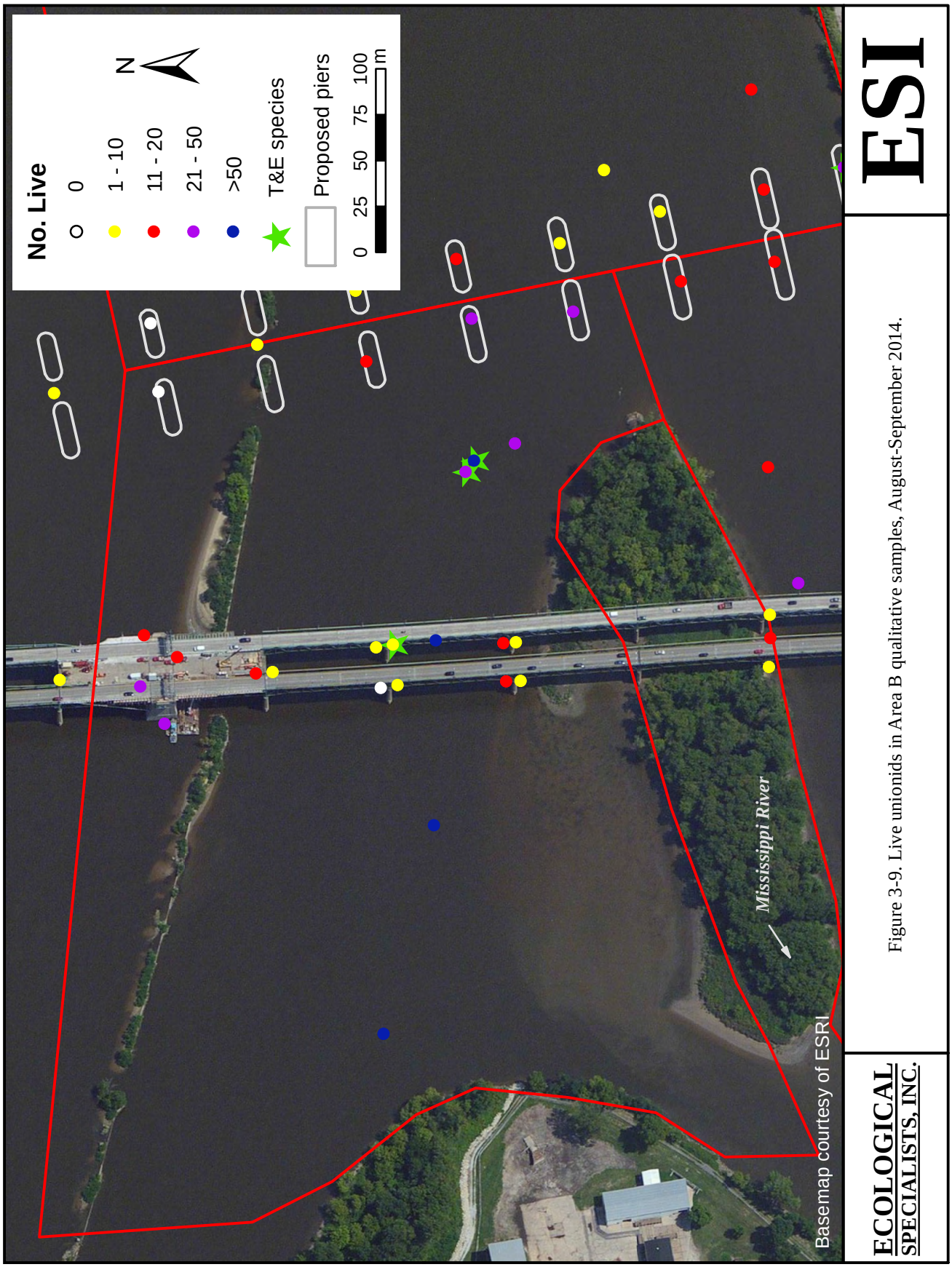

Figure 3-9. Live unionids in Area B qualitative samples, August-September 2014.

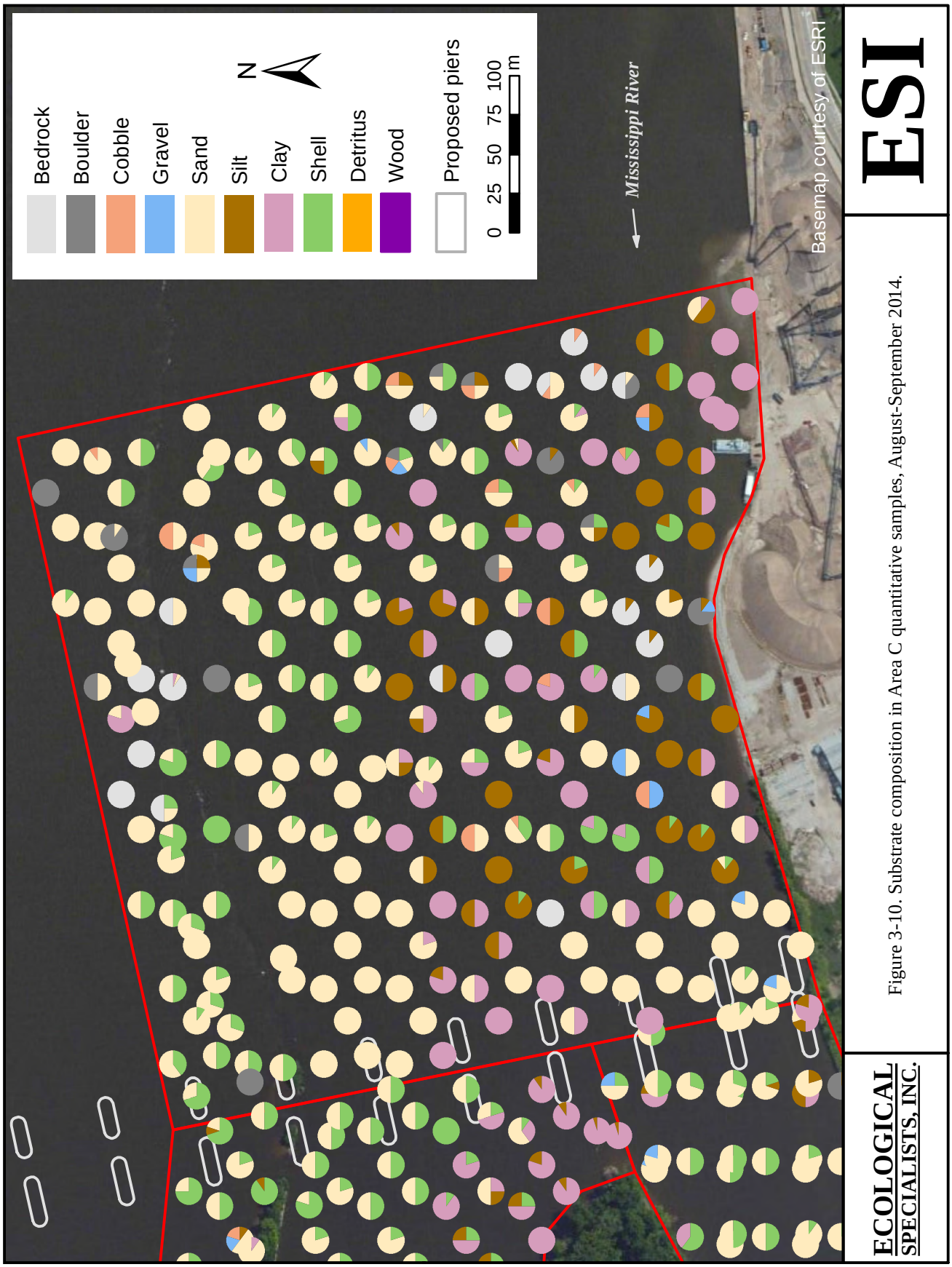

Figure 3-10. Substrate composition in Area C quantitative samples, August-September 2014.

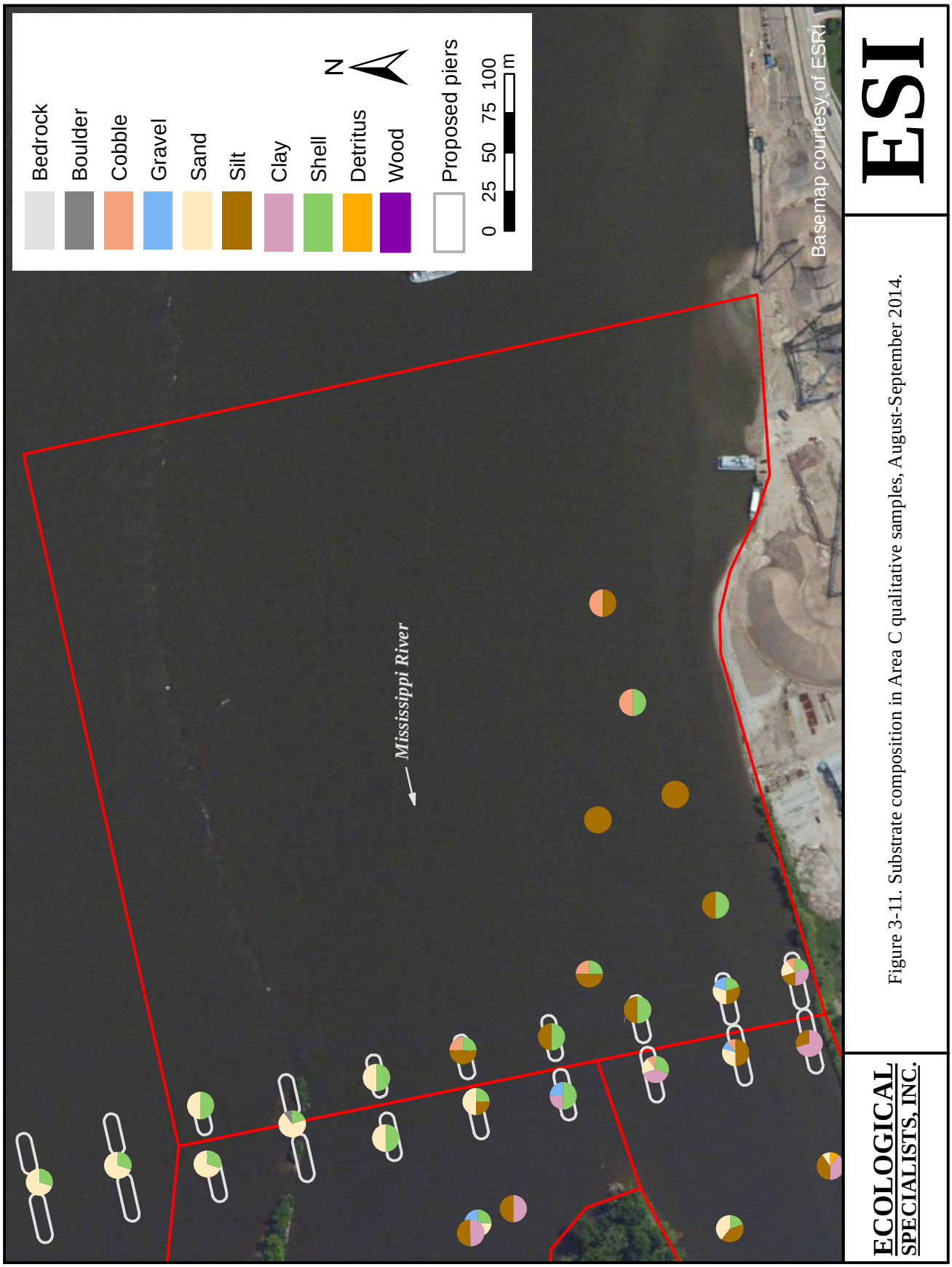

Figure 3-11. Substrate composition in Area C qualitative samples, August-September 2014.

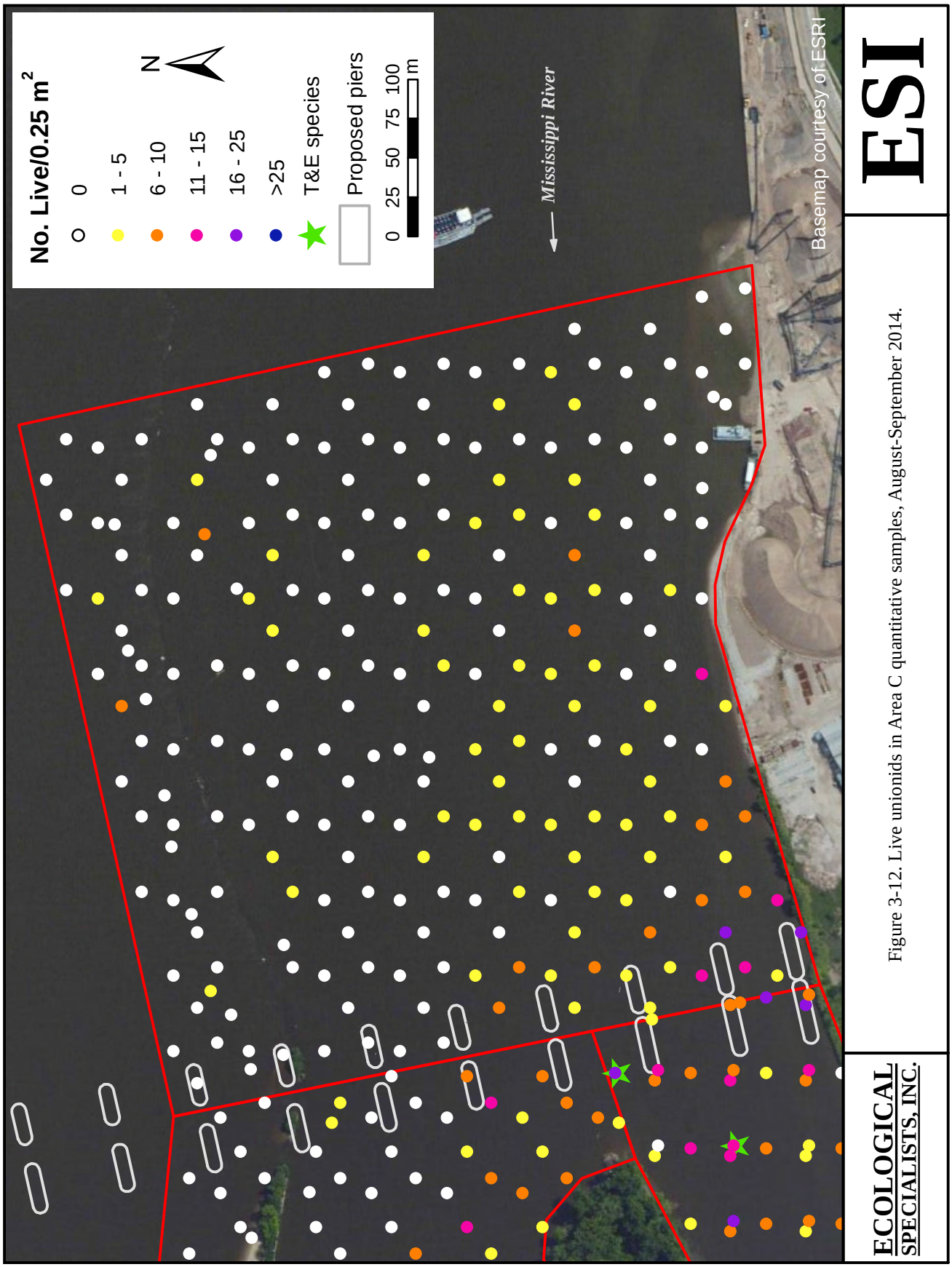

Figure 3-12. Live unionids in Area C quantitative samples, August-September 2014.

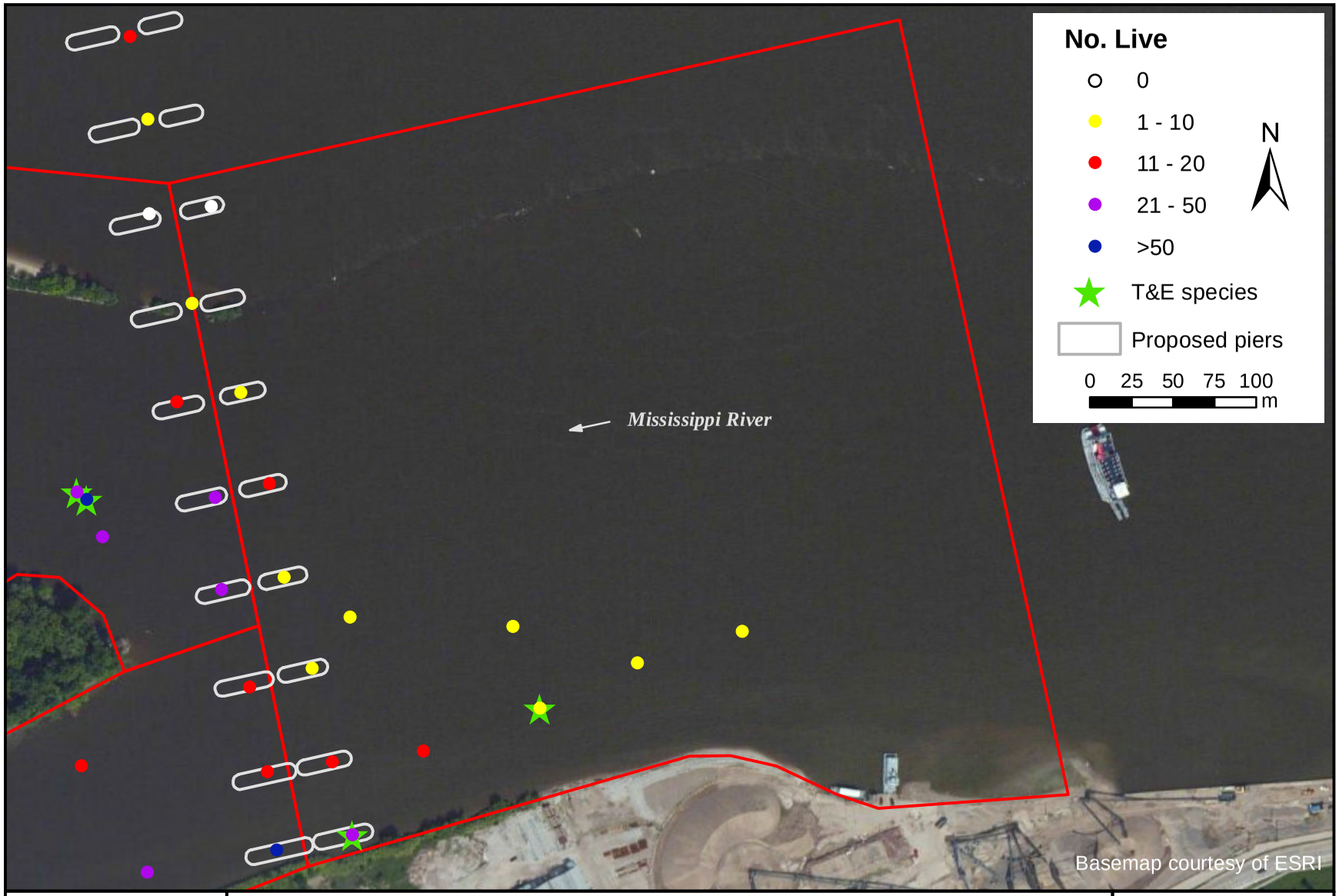

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Figure 3-13. Live unionids in Area C qualitative samples, August-September 2014.

ESI

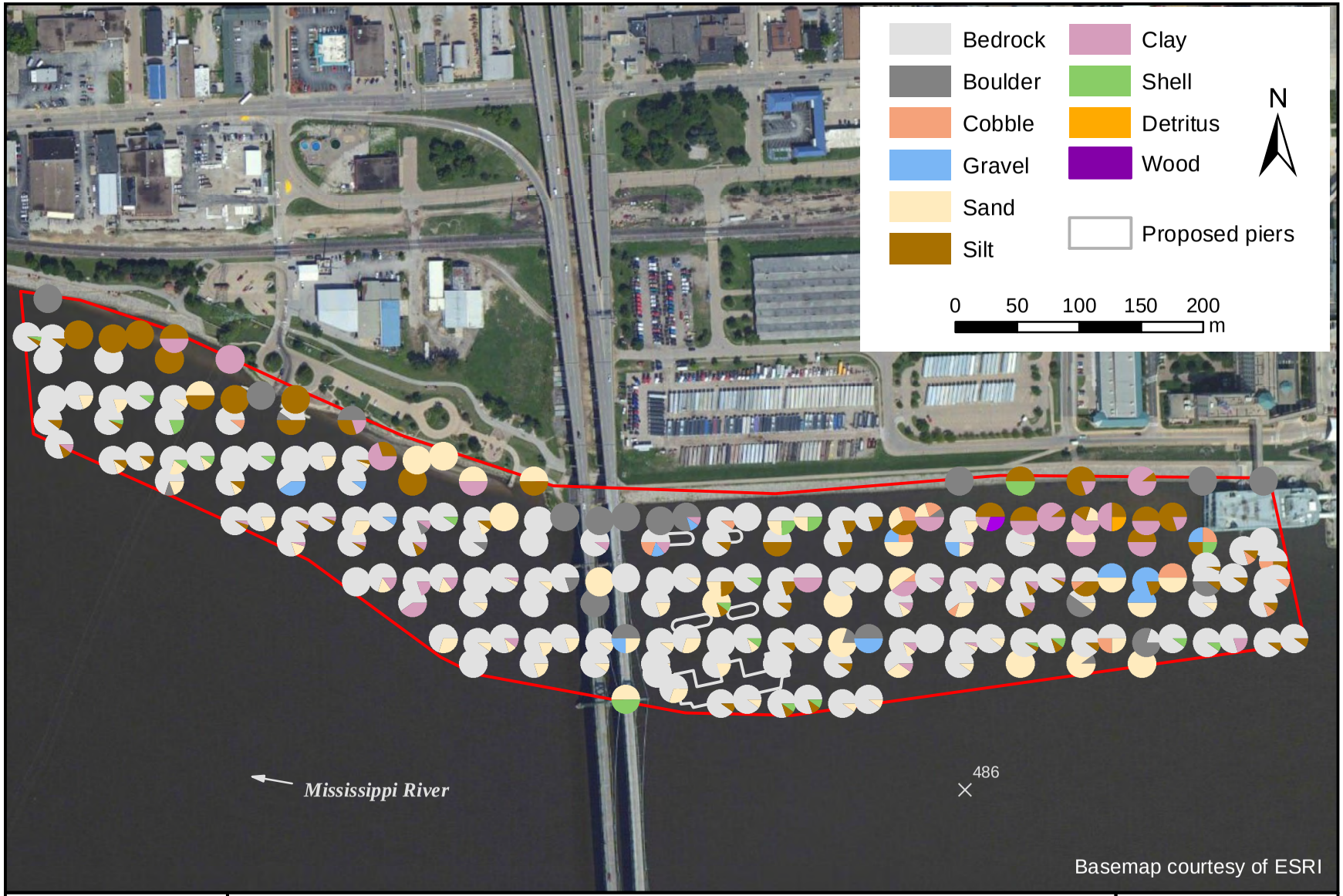

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Figure 3-14. Substrate composition in Area D quantitative samples, August-September 2014.

ESI

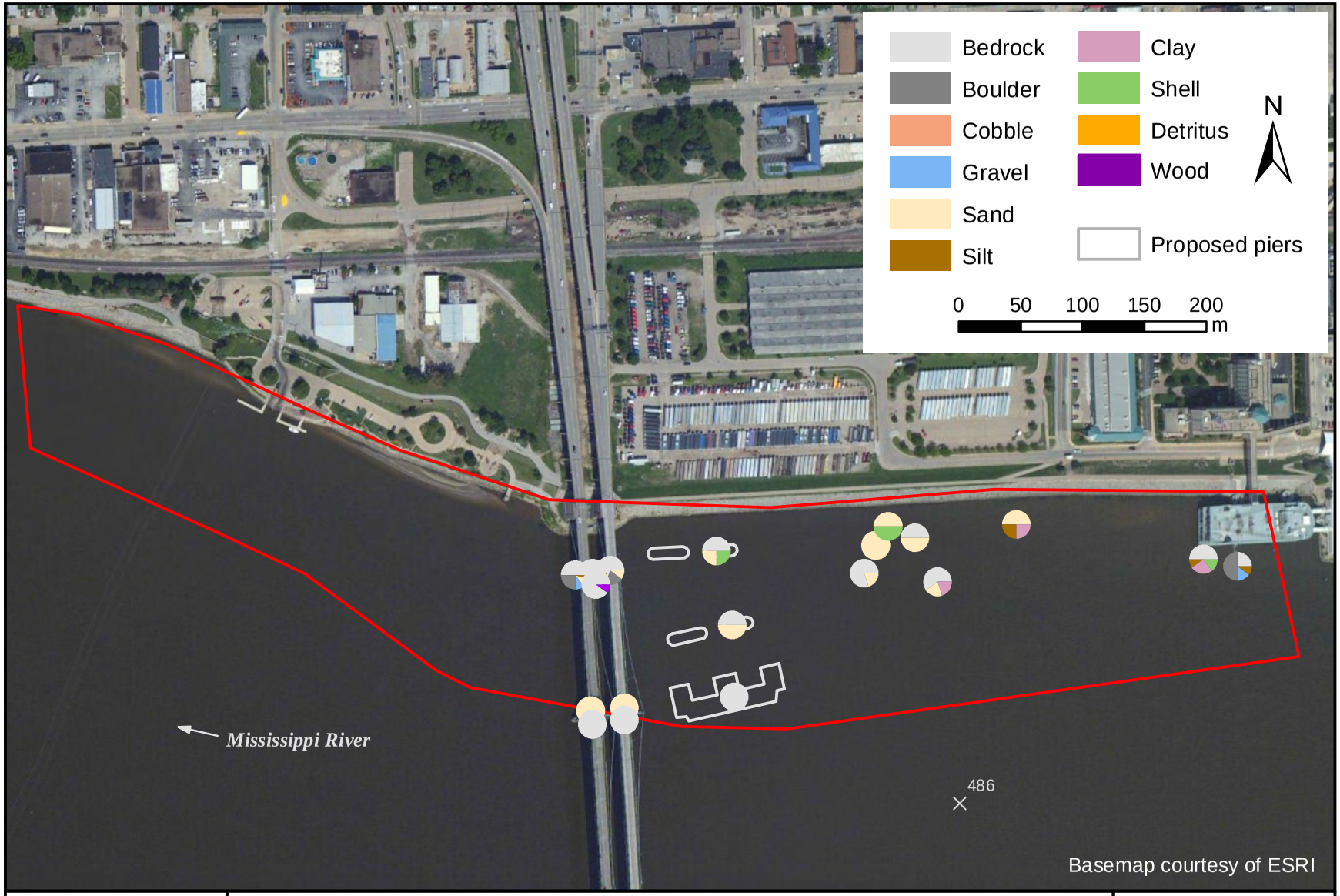

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Figure 3-15. Substrate composition in Area D qualitative samples, August-September 2014.

ESI

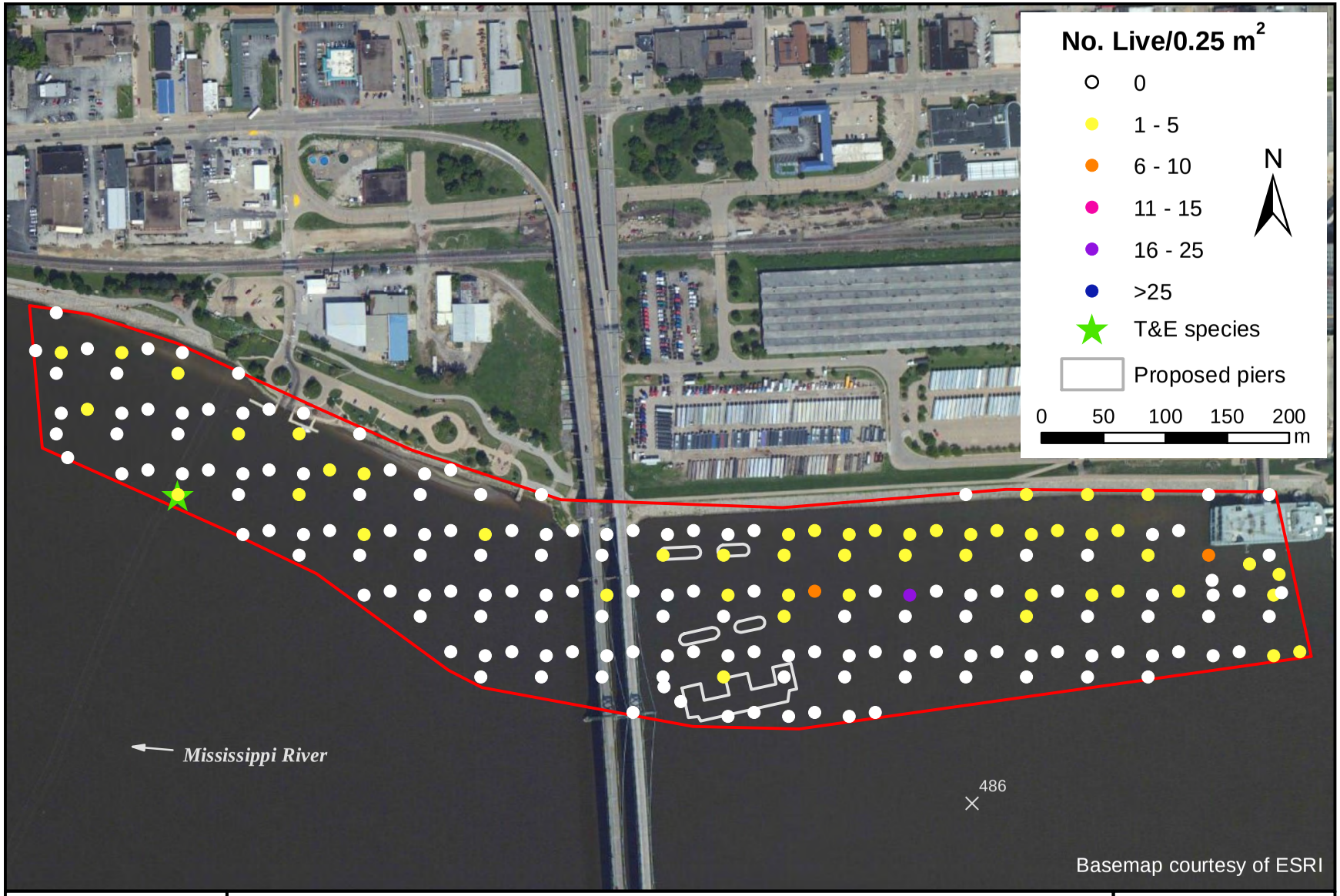

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Figure 3-16. Live unionids in Area D quantitative samples, August-September 2014.

ESI

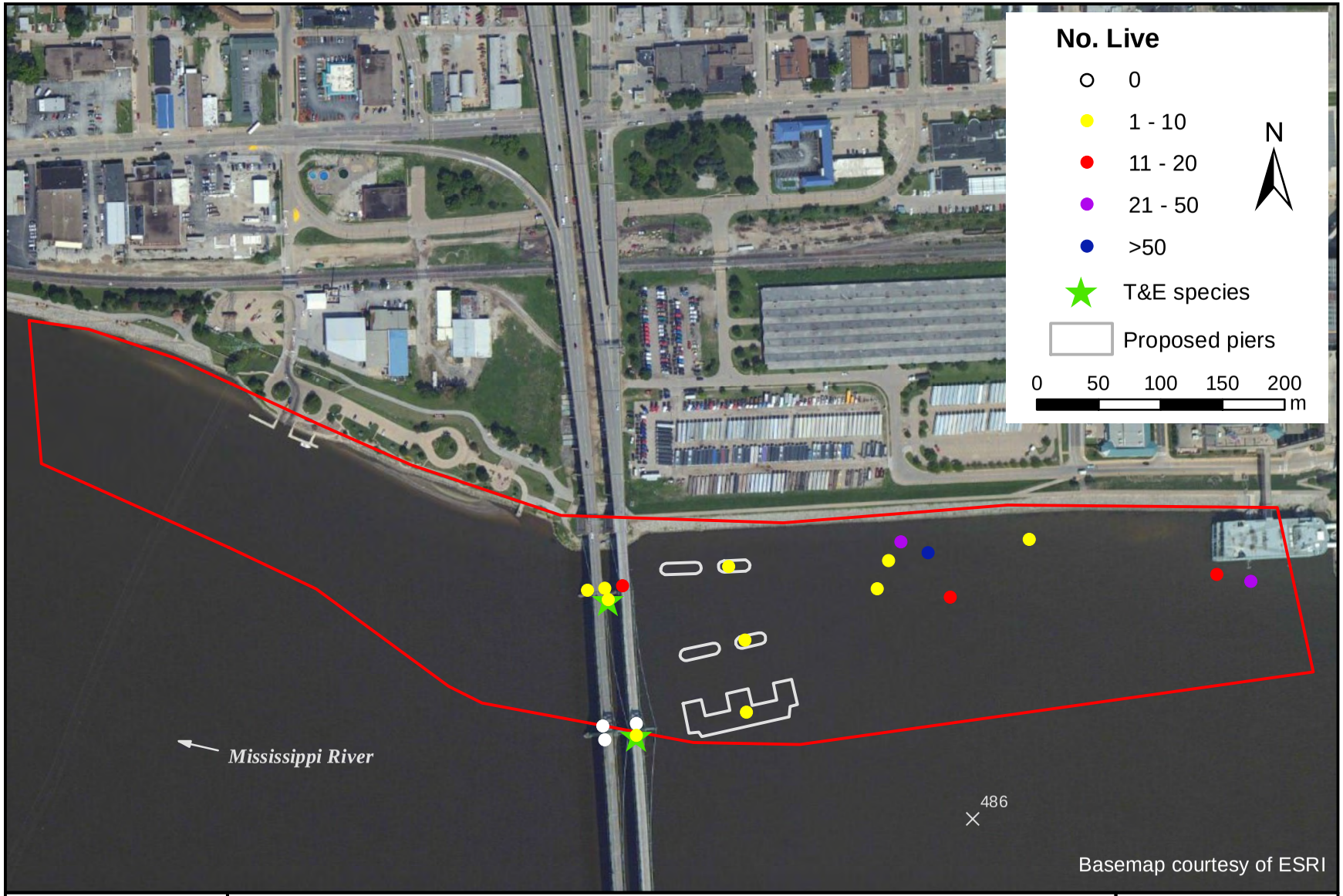

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Figure 3-17. Live unionids in Area D qualitative samples, August-September 2014.

ESI

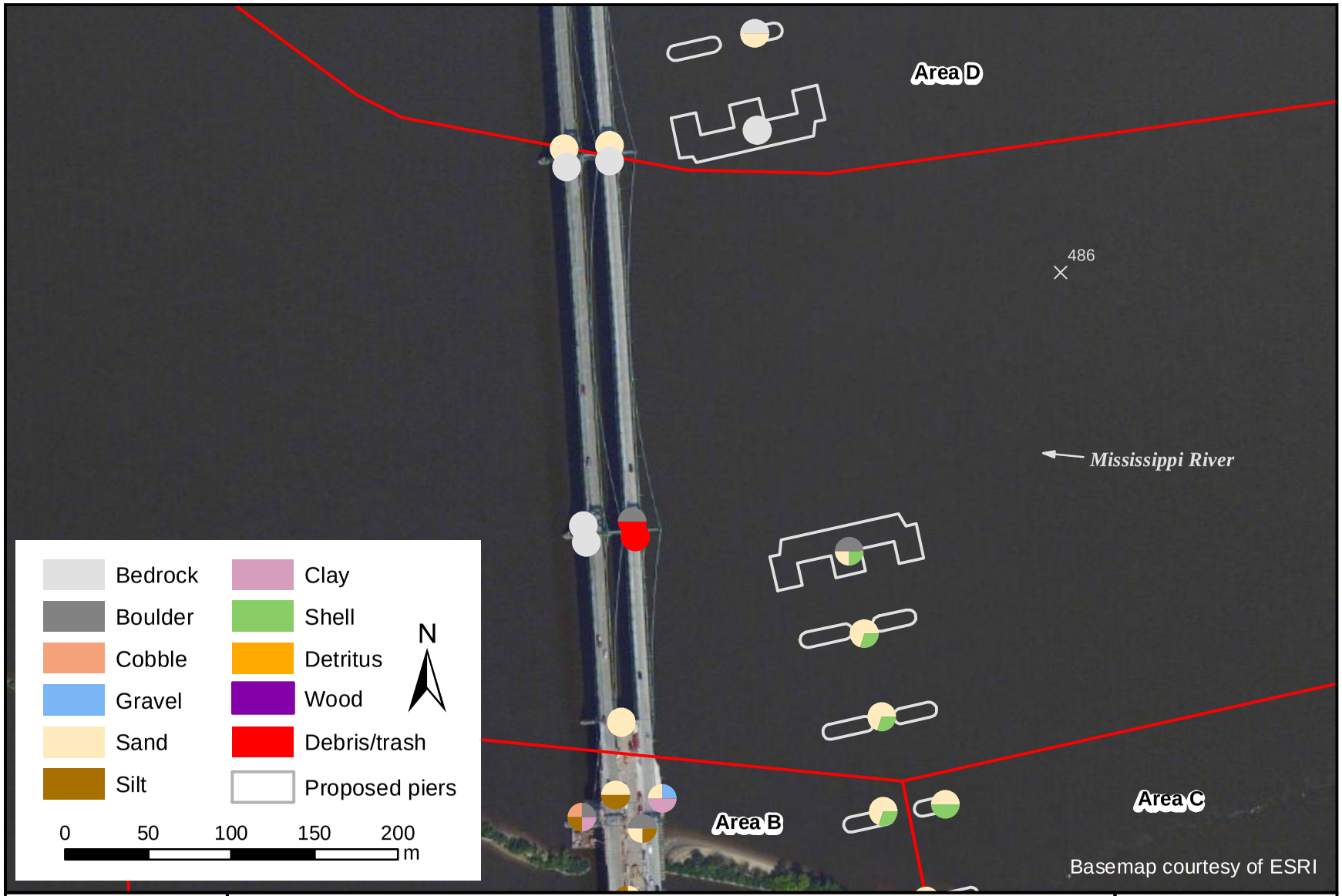

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Figure 3-18. Substrate composition in navigation channel qualitative samples, August-September 2014.

ESI

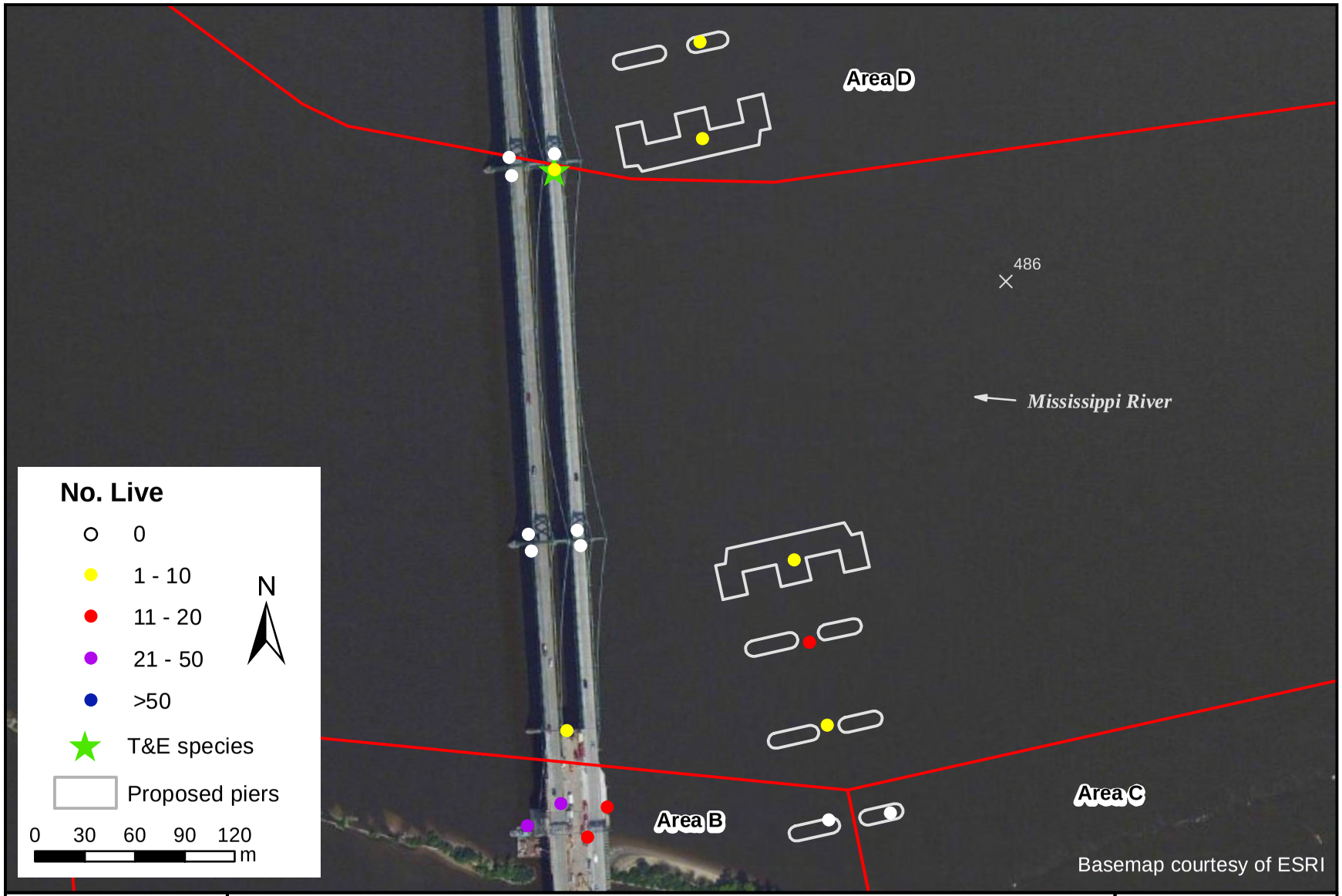

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Figure 3-19. Live unionids in navigation channel qualitative samples, August-September 2014.

ESI

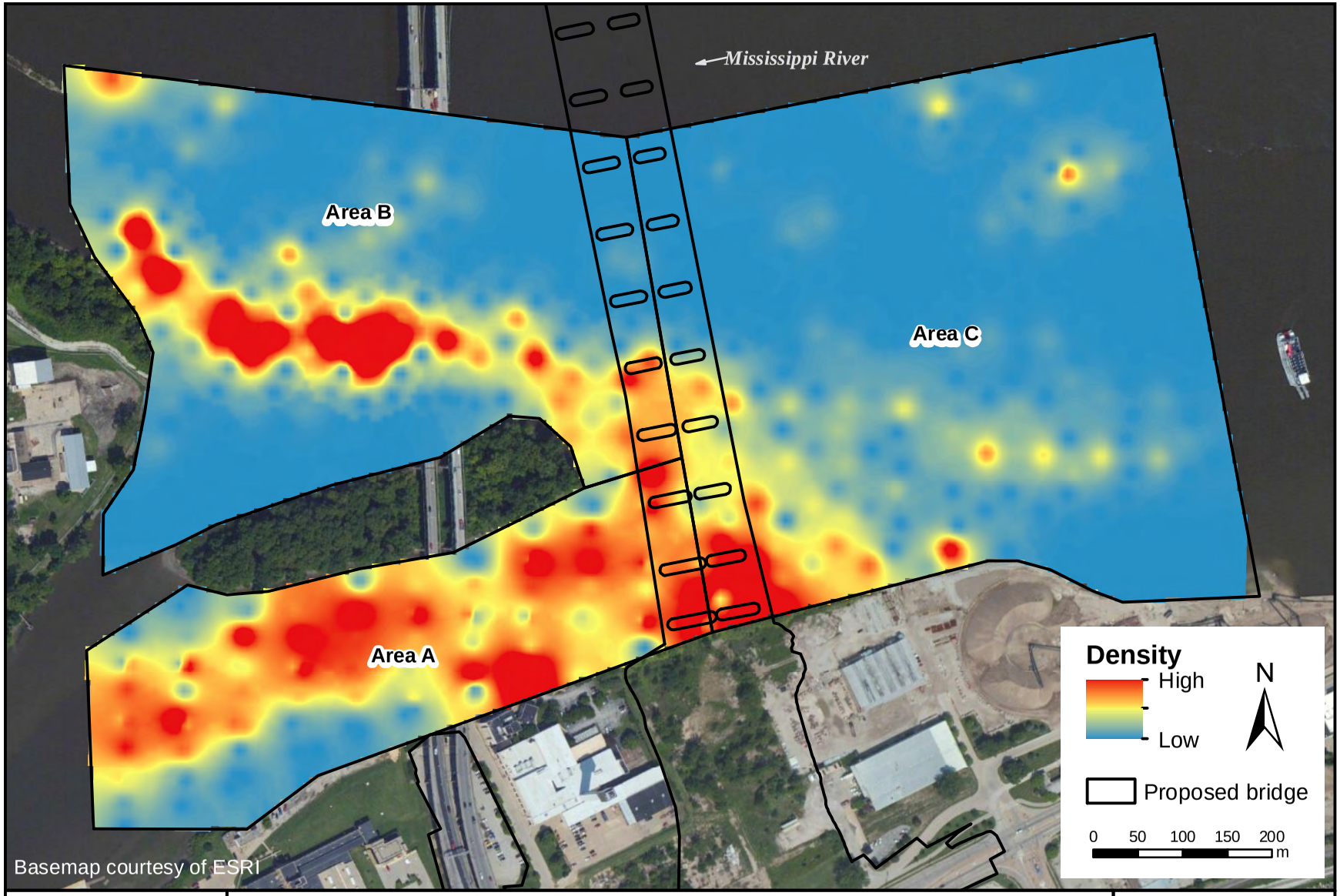

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Figure 4-1. Unionid density with respect to the existing and proposed I-74 bridge alignments, Illinois bank, August-September 2014.

ESI

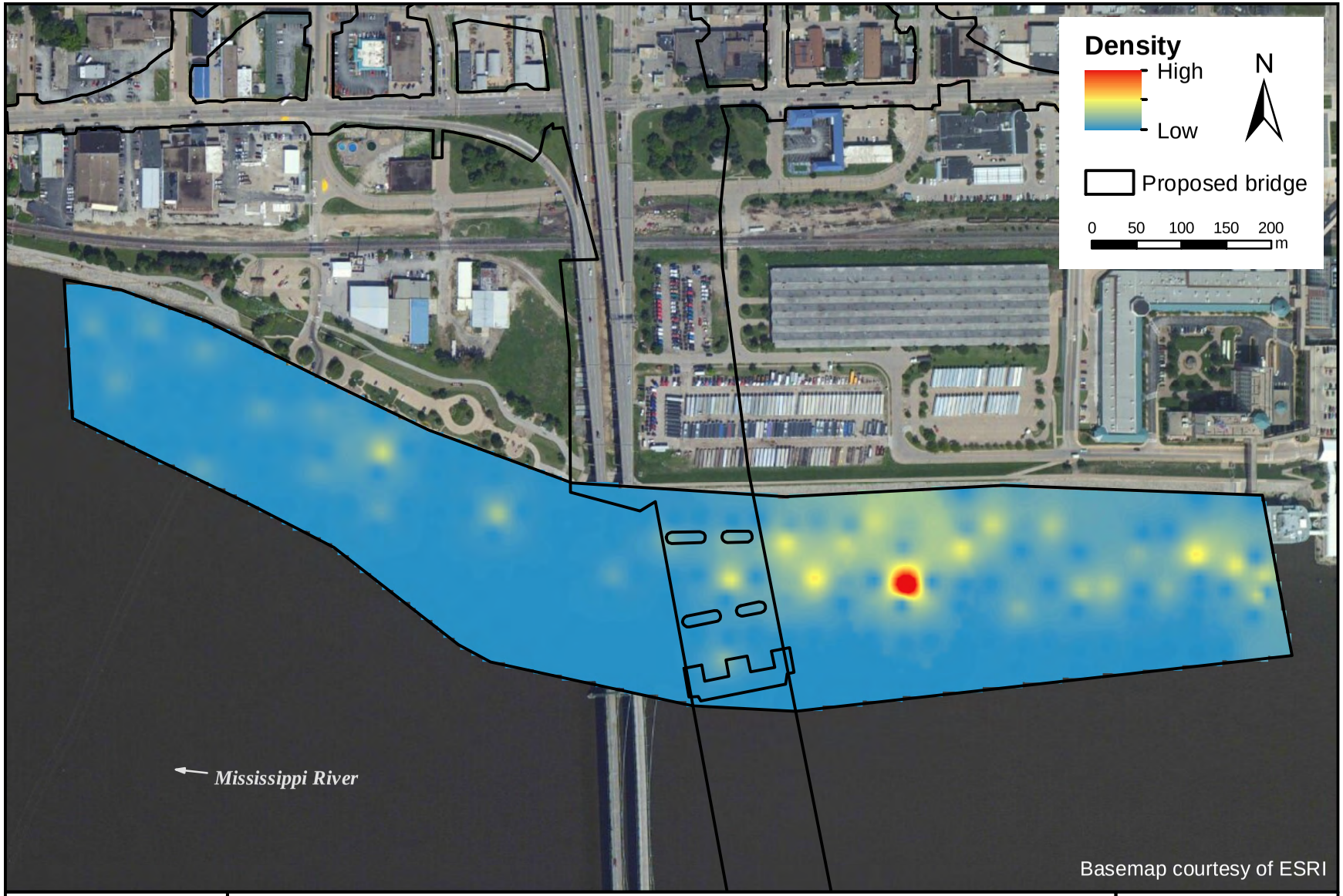

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Figure 4-2. Unionid density with respect to the existing and proposed I-74 bridge alignments, Iowa bank, August-September 2014.

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Table 1-1. Unionid species reported from Mississippi River Pool 15.

Species	Common name	Status [1]	Pool 15 [2]
Cumberlandinae			
Cumberlandia monodonta	spectaclecase	FE, ILE, IAE	R
Amblemini			
Amblema plicata	threeridge		A
Pleurobemini			
Elliptio crassidens	elephant ear	ILT	H
Elliptio dilatata	spike	ILT	H
Fusconaia ebena	ebonyshell	ILT	H
Fusconaia flava	Wabash pigtoe		R
Plethobasus cyphyus	sheepnose	FE, ILE, IAE	R
Pleurobema sintoxia	round pigtoe	IAE	R
Quadrulini			
Cyclonaias tuberculata	purple wartyback	ILT, IAT	H
Megalonaias nervosa	washboard		A
Quadrula metanevra	monkeyface		C
Quadrula nodulata	wartyback		R
Quadrula pustulosa	pimpleback		A
Quadrula quadrula	mapleleaf		C
Tritogonia verrucosa	pistolgrip	IAE	H
Anodontini			
Anodonta suborbiculata	flat floater		R
Arcidens confragosus	rock pocketbook		R
Lasmigona complanata	white heelsplitter		R
Lasmigona compressa	creek heelsplitter	IAT	H
Lasmigona costata	fluted shell		H
Pyganodon grandis	giant floater		R
Strophitus undulatus	creeper	IAT	R
Utterbackia imbecillis	paper pondshell		R
Lampsilini			
Actinonaias ligamentina	mucket		R
Ellipsaria lineolata	butterfly	ILT, IAT	A
Epioblasma triquetra	snuffbox	FE, ILE	H
Lampsilis cardium	plain pocketbook		C
Lampsilis higginsii	Higgins eye	FE, ILE, IAE	R
Lampsilis siliquoidea	fatmucket		H
Lampsilis teres	yellow sandshell	IAE	R
Leptodea fragilis	fragile papershell		C
Ligumia recta	black sandshell	ILT	R
Obliquaria reflexa	threehorn wartyback		A
Obovaria olivaria	hickorynut		R
Potamilus alatus	pink heelsplitter		R
Potamilus ohiensis	pink papershell		R
Toxolasma parvus	lilliput		R
Truncilla donaciformis	fawnsfoot		C
Truncilla truncata	deertoe		A
Venustaconcha ellipsiformis	ellipse	IAT	H
Live species			30
Historic			10
Total species			40

[1] FE = federally endangered, ILE = Illinois endangered, ILT = Illinois threatened, IAE = Iowa endangered, IAT = Iowa threatened. USFWS (2014), ILDNR (2011), IADNR (2009).

[2] H = Records of occurrence but no live collections have been documented since approximately 1980; R = Rare, does not usually appear in sample collections, populations are small either naturally or have declined and may or may not be near extirpation; C = Commonly taken in most samples, can make up a large portion of some samples; A = Abundantly taken in most samples. Kelner (2011).

Table 2-1. Summary of sampling effort at the I-74 bridge, August-September 2014.

Survey Area	Description	Approx. Area (m^2)	No. Quadrats	Qualitative Search Time (min)
Area A	EHA	84,000	111	95
Area B	Riverward of EHA	145,000	183	120
Area C	Up of EHA	195,000	243	75
Area D	Iowa bank	159,000	201	75
Navigation Channel	Existing/proposed piers in navigation channel	-	-	65

Table 3-1. Unionids collected in Area A, August-September 2014.

	Quantitative				Qualitative					
Species	No. Live	%	No. FD	No. ≤5y	No. Live	%	No. FD	No. ≤5y	Total	%
Cumberlandinae										
Cumberlandia monodonta	-	-	(WD)	-	14	3.2	10	-	14	1.2
Subtotal	-	-	*(WD)*	-	*14*	*3.2*	*10*	-	*14*	*1.2*
Amblemini										
Amblema plicata	106	15.3	10	34	66	15.1	1	6	172	15.3
Subtotal	*106*	*15.3*	*10*	*34*	*66*	*15.1*	*1*	*6*	*172*	*15.3*
Pleurobemini										
Fusconaia flava	13	1.9	-	5	3	0.7	1	-	16	1.4
Plethobasus cyphyus	1	0.1	-	-	-	-	(WD)	-	1	0.1
Subtotal	*14*	*2.0*	-	*5*	*3*	*0.7*	*1*	-	*17*	*1.5*
Quadrulini										
Megalonaias nervosa	11	1.6	6	2	10	2.3	1	-	21	1.9
Quadrula metanevra	24	3.5	2	2	11	2.5	-	-	35	3.1
Quadrula nodulata	1	0.1	-	1	-	-	-	-	1	0.1
Quadrula pustulosa	227	32.9	54	80	107	24.5	-	11	334	29.6
Quadrula quadrula	11	1.6	1	6	10	2.3	-	2	21	1.9
Tritogonia verrucosa	-	-	(SF)	-	-	-	-	-	(SF)	-
Subtotal	*274*	*39.7*	*63*	*91*	*138*	*31.7*	*1*	*13*	*412*	*36.6*
Anodontini										
Arcidens confragosus	1	0.1	-	1	2	0.5	-	1	3	0.3
Lasmigona complanata	2	0.3	-	1	3	0.7	-	-	5	0.4
Pyganodon grandis	1	0.1	1	1	-	-	-	-	1	0.1
Strophitus undulatus	-	-	(WD)	-	-	-	-	-	(WD)	-
Utterbackia imbecillis	7	1.0	107	7	-	-	-	-	7	0.6
Subtotal	*11*	*1.6*	*108*	*10*	*5*	*1.1*	-	*1*	*16*	*1.4*
Lampsilini										
Ellipsaria lineolata	8	1.2	2	4	1	0.2	-	-	9	0.8
Lampsilis cardium	24	3.5	-	6	54	12.4	2	4	78	6.9
Lampsilis higginsii	3	0.4	-	1	-	-	-	-	3	0.3
Lampsilis teres teres	-	-	(WD)	-	-	-	-	-	(WD)	-
Leptodea fragilis	31	4.5	21	30	9	2.1	-	4	40	3.5
Ligumia recta	29	4.2	-	3	81	18.6	-	4	110	9.8
Obliquaria reflexa	155	22.4	13	81	57	13.1	11	15	212	18.8
Obovaria olivaria	7	1.0	-	2	2	0.5	-	-	9	0.8
Potamilus alatus	4	0.6	1	4	4	0.9	-	-	8	0.7
Potamilus ohiensis	2	0.3	-	2	-	-	-	-	2	0.2
Toxolasma parvus	3	0.4	-	3	1	0.2	-	1	4	0.4
Truncilla donaciformis	14	2.0	29	14	1	0.2	2	1	15	1.3
Truncilla truncata	6	0.9	1	6	-	-	-	-	6	0.5
Subtotal	*286*	*41.4*	*67*	*156*	*210*	*48.2*	*15*	*29*	*496*	*44.0*
Total	691	100.0	248	296	436	100.0	28	49	1127	100.0
Live species	24				18				25	
Total species	28				19				28	
% FD			26.4							
% ≤5y				42.8						
Effort (min)					95					
CPUE (no./hour)					275.4					
Density (mean ± 2SE)	24.9 ± 4.1									

FD = fresh dead shell, WD = weathered dead shell, SF = subfossil shell

Table 3-2. Unionids collected in Area B, August-September 2014.

Species	Quantitative				Qualitative				Total	%
	No. Live	%	No. FD	No. ≤5y	No. Live	%	No. FD	No. ≤5y		
Cumberlandinae										
Cumberlandia monodonta	-	-	-	-	2	0.3	1	-	2	0.2
Subtotal	-	-	-	-	*2*	*0.3*	*1*	-	*2*	*0.2*
Amblemini										
Amblema plicata	83	17.9	2	7	176	26.2	-	8	259	22.8
Subtotal	*83*	*17.9*	*2*	*7*	*176*	*26.2*	-	*8*	*259*	*22.8*
Pleurobemini										
Cyclonaias tuberculata	-	-	(SF)	-	-	-	(WD)	-	(WD)	-
Fusconaia ebena	-	-	(WD)	-	-	-	-	-	(WD)	-
Fusconaia flava	6	1.3	-	-	11	1.6	-	-	17	1.5
Pleurobema sintoxia	1	0.2	-	-	-	-	-	-	1	0.1
Subtotal	*7*	*1.5*	-	-	*11*	*1.6*	-	-	*18*	*1.6*
Quadrulini										
Megalonaias nervosa	11	2.4	1	2	10	1.5	-	1	21	1.9
Quadrula metanevra	2	0.4	-	-	6	0.9	-	-	8	0.7
Quadrula nodulata	-	-	(WD)	-	-	-	-	-	(WD)	-
Quadrula pustulosa	164	35.4	16	15	207	30.8	-	3	371	32.7
Quadrula quadrula	11	2.4	-	3	39	5.8	-	3	50	4.4
Tritogonia verrucosa	-	-	-	-	-	-	(WD)	-	(WD)	-
Subtotal	*188*	*40.6*	*17*	*20*	*262*	*39.0*	-	*7*	*450*	*39.6*
Anodontini										
Arcidens confragosus	2	0.4	-	-	-	-	-	-	2	0.2
Lasmigona complanata	2	0.4	-	1	3	0.4	-	-	5	0.4
Pyganodon grandis	-	-	-	-	1	0.1	-	-	1	0.1
Utterbackia imbecillis	-	-	35	-	-	-	(WD)	-	(FD)	-
Subtotal	*4*	*0.9*	*35*	*1*	*4*	*0.6*	-	-	*8*	*0.7*
Lampsilini										
Actinonaias ligamentina	-	-	(WD)	-	-	-	-	-	(WD)	-
Ellipsaria lineolata	6	1.3	1	4	3	0.4	-	-	9	0.8
Lampsilis cardium	17	3.7	-	7	33	4.9	-	1	50	4.4
Lampsilis higginsii	1	0.2	-	-	1	0.1	-	-	2	0.2
Leptodea fragilis	9	1.9	4	8	14	2.1	1	10	23	2.0
Ligumia recta	32	6.9	-	5	54	8.0	-	1	86	7.6
Obliquaria reflexa	95	20.5	4	27	92	13.7	-	8	187	16.5
Obovaria olivaria	12	2.6	-	3	7	1.0	-	1	19	1.7
Potamilus alatus	-	-	-	-	12	1.8	-	3	12	1.1
Potamilus ohiensis	-	-	-	-	1	0.1	-	-	1	0.1
Truncilla donaciformis	4	0.9	7	4	-	-	-	-	4	0.4
Truncilla truncata	5	1.1	1	5	-	-	-	-	5	0.4
Subtotal	*181*	*39.1*	*17*	*63*	*217*	*32.3*	*1*	*24*	*398*	*35.1*
Total	463	100.0	71	91	672	100.0	2	39	1135	100.0
Live species	18				18				22	
Total species	23				21				28	
% FD			13.3							
% ≤5y				19.7						
Effort (min)					120					
CPUE (no./hour)					336.0					
Density (mean ± 2SE)	10.1 ± 3.6									

FD = fresh dead shell, WD = weathered dead shell, SF = subfossil shell

Table 3-3. Unionids collected in Area C, August-September 2014.

Species	Quantitative				Qualitative				Total	%
	No. Live	%	No. FD	No. ≤5y	No. Live	%	No. FD	No. ≤5y		
Amblemini										
Amblema plicata	48	15.1	-	10	25	19.7	-	3	73	16.4
Subtotal	*48*	*15.1*	-	*10*	*25*	*19.7*	-	*3*	*73*	*16.4*
Pleurobemini										
Fusconaia ebena	-	-	-	-	-	-	(WD)	-	(WD)	-
Fusconaia flava	9	2.8	-	3	2	1.6	-	1	11	2.5
Subtotal	*9*	*2.8*	-	*3*	*2*	*1.6*	-	*1*	*11*	*2.5*
Quadrulini										
Megalonaias nervosa	6	1.9	-	3	7	5.5	-	1	13	2.9
Quadrula metanevra	1	0.3	-	1	2	1.6	-	-	3	0.7
Quadrula nodulata	1	0.3	1	-	-	-	-	-	1	0.2
Quadrula pustulosa	113	35.6	1	41	42	33.1	-	5	155	34.9
Quadrula quadrula	5	1.6	-	2	7	5.5	-	1	12	2.7
Subtotal	*126*	*39.7*	*2*	*47*	*58*	*45.7*	-	*7*	*184*	*41.4*
Anodontini										
Arcidens confragosus	2	0.6	-	1	-	-	-	-	2	0.5
Lasmigona complanata	2	0.6	-	2	1	0.8	-	-	3	0.7
Subtotal	*4*	*1.3*	-	*3*	*1*	*0.8*	-	-	*5*	*1.1*
Lampsilini										
Ellipsaria lineolata	6	1.9	-	4	3	2.4	-	-	9	2.0
Lampsilis cardium	9	2.8	-	3	2	1.6	-	-	11	2.5
Lampsilis higginsii	-	-	(WD)	-	2	1.6	-	-	2	0.5
Leptodea fragilis	9	2.8	2	9	-	-	-	-	9	2.0
Ligumia recta	7	2.2	-	1	6	4.7	-	-	13	2.9
Obliquaria reflexa	82	25.9	3	66	24	18.9	-	5	106	23.9
Obovaria olivaria	4	1.3	-	-	2	1.6	-	-	6	1.4
Potamilus alatus	3	0.9	1	2	1	0.8	-	-	4	0.9
Potamilus ohiensis	1	0.3	-	1	-	-	-	-	1	0.2
Truncilla donaciformis	5	1.6	4	5	1	0.8	-	1	6	1.4
Truncilla truncata	4	1.3	1	4	-	-	-	-	4	0.9
Subtotal	*130*	*41.0*	*11*	*95*	*41*	*32.3*	-	*6*	*171*	*38.5*
Total	317	100.0	13	158	127	100.0	-	17	444	100.0
Live species	19				15				20	
Total species	20				16				21	
% FD			3.9							
% ≤5y				49.8						
Effort (min)					75					
CPUE (no./hour)					101.6					
Density (mean ± 2SE)	5.2 ± 1.5									

FD = fresh dead shell, WD = weathered dead shell

Table 3-4. Unionids collected in Area D, August-September 2014.

Species	Quantitative				Qualitative				Total	%
	No. Live	%	No. FD	No. ≤5y	No. Live	%	No. FD	No. ≤5y		
Cumberlandinae										
Cumberlandia monodonta	-	-	(WD)	-	1	0.4	-	-	1	0.3
Subtotal	-	-	*(WD)*	-	*1*	*0.4*	-	-	*1*	*0.3*
Amblemini										
Amblema plicata	23	17.4	-	6	41	16.3	-	-	64	16.7
Subtotal	*23*	*17.4*	-	*6*	*41*	*16.3*	-	-	*64*	*16.7*
Pleurobemini										
Fusconaia flava	-	-	-	-	1	0.4	-	-	1	0.3
Subtotal	-	-	-	-	*1*	*0.4*	-	-	*1*	*0.3*
Quadrulini										
Megalonaias nervosa	7	5.3	-	-	33	13.1	-	-	40	10.4
Quadrula metanevra	1	0.8	-	-	1	0.4	-	-	2	0.5
Quadrula nodulata	1	0.8	-	1	1	0.4	-	1	2	0.5
Quadrula pustulosa	33	25.0	2	6	41	16.3	1	-	74	19.3
Quadrula quadrula	8	6.1	1	3	28	11.2	-	2	36	9.4
Subtotal	*50*	*37.9*	*3*	*10*	*104*	*41.4*	*1*	*3*	*154*	*40.2*
Anodontini										
Arcidens confragosus	-	-	-	-	4	1.6	-	-	4	1.0
Lasmigona complanata	-	-	-	-	6	2.4	-	-	6	1.6
Pyganodon grandis	-	-	-	-	1	0.4	-	-	1	0.3
Utterbackia imbecillis	2	1.5	-	2	-	-	-	-	2	0.5
Subtotal	*2*	*1.5*	-	*2*	*11*	*4.4*	-	-	*13*	*3.4*
Lampsilini										
Ellipsaria lineolata	7	5.3	-	-	14	5.6	-	-	21	5.5
Lampsilis cardium	2	1.5	-	1	4	1.6	-	-	6	1.6
Lampsilis higginsii	1	0.8	-	-	-	-	-	-	1	0.3
Leptodea fragilis	3	2.3	-	3	3	1.2	1	-	6	1.6
Ligumia recta	3	2.3	-	-	6	2.4	-	-	9	2.3
Obliquaria reflexa	30	22.7	2	10	56	22.3	1	1	86	22.5
Obovaria olivaria	1	0.8	-	-	4	1.6	-	-	5	1.3
Potamilus alatus	2	1.5	-	1	4	1.6	-	-	6	1.6
Truncilla donaciformis	7	5.3	-	7	-	-	-	-	7	1.8
Truncilla truncata	1	0.8	-	1	2	0.8	-	-	3	0.8
Subtotal	*57*	*43.2*	*2*	*23*	*93*	*37.1*	*2*	*1*	*150*	*39.2*
Total	132	100.0	5	41	251	100.0	3	4	383	100.0
Live species	17				19				22	
Total species	18				19				22	
% FD			3.6							
% ≤5y				31.1						
Effort (min)					75					
CPUE (no./hour)					200.8					
Density (mean ± 2SE)	2.6 ± 1.0									

FD = fresh dead shell, WD = weathered dead shell

Table 3-5. Unionids collected in the navigation channel, August-September 2014.

Species		No. Live	%	No. FD	No. ≤5y
Amblemini					
Amblema plicata		8	21.6	-	-
	Subtotal	*8*	*21.6*	-	-
Quadrulini					
Quadrula pustulosa		13	35.1	-	-
	Subtotal	*13*	*35.1*	-	-
Lampsilini					
Lampsilis cardium		2	5.4	-	-
Lampsilis higginsii		1	2.7	-	-
Ligumia recta		4	10.8	-	-
Obliquaria reflexa		5	13.5	-	-
Obovaria olivaria		3	8.1	-	-
Potamilus alatus		1	2.7	-	-
	Subtotal	*16*	*43.2*	-	-
Total		37	100.0	-	-
Live species		8			
Total species		8			
Effort (min)		65			
CPUE (no./hour)		34.2			

FD = fresh dead shell

Table 4-1. MCAT metrics in the I-74 bridge survey areas, August-September 2014. [1]

Metric	Area A	Score	Area B	Score	Area C	Score	Area D	Score
Conservation status/sensitivity								
% listed species	5.9	Good	8.4	Good	4.1	Fair	6.1	Good
% tolerant species	39.4	Good	40.8	Fair	42.6	Fair	46.2	Fair
Taxonomic composition								
% Lampsilini	41.4	Good	39.1	Good	41.0	Good	43.2	Good
Population processes								
% fresh dead	26.4	Poor	13.3	Fair	3.9	Good	3.6	Good
% juveniles	42.8	Fair	19.7	Poor	49.8	Good	31.1	Fair
% ≥15 years old	1.6	Fair	1.1	Fair	1.3	Fair	6.8	Fair
Abundance								
Abundance at 75th quartile (no./m^2)	40	Good	8	Fair	4	Poor	4	Poor
Diversity								
Species evenness	0.67	Poor	0.68	Poor	0.66	Poor	0.77	Fair
Tribe evenness	0.72	Poor	0.71	Poor	0.73	Fair	0.79	Fair
ES_100	15	Fair	13	Fair	14	Fair	15	Fair

[1] Dunn et al., 2012

ILLINOIS NATURAL HISTORY SURVEY
PRAIRIE RESEARCH INSTITUTE

AQUATIC SURVEY REPORT

Freshwater Mussel (Mollusca: Unionoida) Survey at the Pedestrian Bridge in Sylvan Slough in Moline, Rock Island County, Illinois

(IDOT Sequence No.: 19030; Section No.: 15-000264-00-BR)

Prepared by:
Jeremy S. Tiemann
Kevin S. Cummings

INHS/IDOT Statewide Biological Survey & Assessment Program
Program Report 2015 (20)

8 June 2015

Project Summary

This report is submitted in response to a request from IDOT for INHS personnel to conduct a survey for freshwater mussels (Mollusca: Unionoida) in the Mississippi River in the immediate vicinity of a pedestrian bridge (IDOT Sequence No.: 19030; Section No.: 15-000264-00-BR) over Sylvan Slough to Sylvan Island in Moline, Rock Island County, Illinois. The survey was conducted on 27 May 2015. Eleven species of mussels were collected live, including the state-threatened Butterfly (*Ellipsaria lineolata*). Results from this survey suggest the habitat around the pedestrian bridge is suitable for freshwater mussels. Although not collected during our limited brail survey, we feel there is a high likelihood that other listed species are extant in the area – in particular, the Higgins' Eye (*Lampsilis higginsii*), Black Sandshell (*Ligumia recta*), and Sheepnose (*Plethobasus cyphyus*) – all of which have been collected alive in Sylvan Slough within the last decade.

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Cover photo: Pedestrian bridge over Sylvan Slough to Sylvan Island, Moline, Rock Island County, Illinois, where a freshwater mussel survey was conducted by INHS personnel J.S. Tiemann, K.S. Cummings, and J.L. Sherwood on 27 May 2015. Photograph is facing upstream (K.S. Cummings photo).

INTRODUCTION

This report is submitted in response to a request made Susan Hargrove (Illinois Department of Transportation, Springfield – IDOT) to Wendy Schelsky (Illinois Natural History Survey, Champaign – INHS) dated 9 April 2015 for a survey for freshwater mussels (Mollusca: Unionoida) in Sylvan Slough to a pedestrian bridge (Sequence No.: 19030; Section No.: 15-000264-00-BR) to Sylvan Island in Moline, Rock Island County, Illinois. IDOT proposes the removal and replacement of the existing dilapidated and unsafe pedestrian bridge and bike path. Construction of a temporary rock causeway within the waterway and a temporary floating causeway are needed. The purpose of this survey was to assess the river for the presence of any state or federally listed freshwater mussel species.

Nomenclature used for mussels discussed in this report follows Graf and Cummings (2007) with slight modification. The current status of threatened and endangered species of mussels discussed in this report is taken from Illinois Endangered Species Protection Board [IESPB] (2015).

PROJECT LOCATION

Sampling for freshwater mussels was conducted in Sylvan Slough, which is a secondary channel to the Mississippi River that flows around the Illinois side of Arsenal Island in Moline, Rock Island County, Illinois. Freshwater mussels were collected in Sylvan Slough from 100 yards upstream of the pedestrian bridge to 120 yards downstream of the bridge (**Figure 1**). A mid-point for that area is used for the following locality information as a reference point for the project --- latitude 41.51101°N, longitude 90.53600°W; Second Principal Meridian: Township 18N, Range 1W, section 31. **Appendix 1** references a shapefile with sampling point information for the Mississippi River project site, as discussed in this report.

HABITAT CHARACTERIZATION

The reach of Sylvan Slough at the pedestrian bridge to Sylvan Island is approximately 65 yards wide and depths ranged from 0.1 to ~13 feet. The streambed was mapped using a Humminbird 999CI HD Side Imaging sonar (Eufaula, AL), and the substrate at the project sites appeared uniform. Based upon brail hauls, the substrate was predominantly silted sand with a layer of leaf matter covering the surface; some woody debris and areas of rip-rap were present. The banks were lined with a small strip of trees, except for the right descending bank upstream of bridge, which was rip-rap (**cover photo**; **Figure 2**).

BACKGROUND

Historically, 50 species of freshwater mussels occurred in the upper Mississippi River (upstream from its confluence with the Ohio River), but only 35 species have been found post-1970 (Tiemann et al. 2007). Factors responsible for these declines include impoundments, chemical pollution, siltation, and loss of fish hosts (Cummings and Mayer 1997).

A literature review and a search of the INHS Mollusk Collection's database, which includes the Ohio State University Museum of Biological Diversity – Mollusc Division (OSUM), was conducted for historical and recent records of freshwater mussels in the Mississippi River, and specifically, records of species collected from Sylvan Slough in the vicinity of the pedestrian bridge to Sylvan Island in Moline, Rock Island County, Illinois. At least 15 surveys have been conducted in Sylvan Slough in Pool 16, resulting in a total of 34 species, of which 22 have been collected as live or fresh-dead since 2000 **(Table 1**). Of particular importance to this current study, based upon historical and recent records, is the possibility that the federally-endangered Spectaclecase, *Margaritifera monodonta* (**Figure 3**), the state-threatened Butterfly, *Ellipsaria lineolata* (**Figure 4**), the federally-endangered Higgins' Eye, *Lampsilis higginsii* (**Figure 5**), the state-threatened Black Sandshell, *Ligumia recta* (**Figure 6**), or the federally-endangered Sheepnose, *Plethobasus cyphyus* (**Figure 7**) are present in Sylvan Slough in the vicinity of the pedestrian bridge to Sylvan Island.

The federally-endangered Spectaclecase was historically widely distributed in Illinois in large rivers with swiftly flowing water, among boulders in patches of sand, cobble, or gravel in areas where current is reduced (Cummings and Mayer 1992). However, it is now sporadic and very rare in only the Mississippi Rivers (Cummings and Mayer 1997; **Figure 3**). The Spectaclecase has been collected from two sites within Sylvan Slough (data from INHS Mollusk Collection Champaign):

1) SW shore Arsenal Island; latitude 41.51378°N, longitude 90.57215°W – collected as fresh-dead in 1977 (OSUM 39943), 1978 (OSUM 42629), and 1987 (INHS 49323).
2) E Arsenal Island; latitude 41.51301°N, longitude 90.51593°W – collected in 1978 (OSUM 42483 – shell status unknown).

The state-threatened Butterfly was historically widely distributed in large streams in gravel or firm sand (Cummings and Mayer 1992). However, it has disappeared from many areas where it formerly occurred and now uncommon in much of the Midwest. Within Illinois, the Butterfly is found sporadically in the Mississippi River upstream of its confluence with the Missouri River, and in the Ohio River (Cummings and Mayer 1997; Tiemann et al. 2007; **Figure 4**). The Butterfly has been collected from three sites within Sylvan Slough (data from INHS Mollusk Collection, Champaign):

1) SW shore Arsenal Island; latitude 41.51378°N, longitude 90.57215°W – collected alive in 1979 (INHS 9372).
2) E Arsenal Island; latitude 41.51301°N, longitude 90.51593°W – collected alive in 1990 (INHS 10213; N = 5), 1993 (N = 16), and 2011 (N = 1), as fresh-dead in 2005 (INHS 30860), and collected in 1978 (OSUM 42769) but the shell status is unknown.
3) 0.4 mi NW Moline, downstream Rodman Ave. bridge; latitude 41.51081°N, longitude 90.51942°W – collected as relict in 2011 (INHS 41578).

Within Illinois, the federally-endangered Higgins' Eye was historically distributed in the Illinois and Mississippi river and some of their larger tributaries in gravel or sand (Cummings and Mayer 1992). However, it is now sporadic in the Mississippi River and is extirpated from all of the other Illinois drainages where it was historically found (Cummings and Mayer 1997; **Figure 5**). The Higgins' Eye has been collected from two sites within Sylvan Slough (data from INHS Mollusk Collection Champaign):

1) SW shore Arsenal Island; latitude 41.51378°N, longitude 90.57215°W – collected as fresh-dead in 1977 (OSUM 39947), 1986 (INHS 3068), and 1987 (INHS 3007).
2) E Arsenal Island; latitude 41.51301°N, longitude 90.51593°W – collected alive in 2005 (N = 1).

The state-threatened Black Sandshell was historically widely distributed in medium to large rivers in riffles or raceways in gravel or firm sand (Cummings and Mayer 1992). However, it is now uncommon in much of the upper Midwest. Within Illinois, the Black Sandshell is found sporadically in the northern half of the state as well as in the Ohio River (Cummings and Mayer 1997; Tiemann et al. 2007; **Figure 6**). The Black Sandshell has been collected from two sites within Sylvan Slough (data from INHS Mollusk Collection Champaign):

1) E Arsenal Island; latitude 41.51301°N, longitude 90.51593°W – collected alive in 1990 (INHS 10215; N = 1), 1993 (N = 2), 2005 (N = 5), and 2011 (N = 7), and collected in 1978 (OSUM 42776) but the shell status is unknown.
2) 0.4 mi NW Moline, downstream Rodman Ave. bridge; latitude 41.51081°N, longitude 90.51942°W – collected alive in 2011 (INHS 41581; N = 2).

The federally-endangered Sheepnose was historically widely distributed in Illinois in medium to large rivers in gravel or mixed sand and gravel (Cummings and Mayer 1992). However, it is now restricted to the lower Rock, lower Kankakee and Mississippi rivers (Cummings and Mayer 1997; **Figure 7**). The Sheepnose has been collected from one site within Sylvan Slough (data from INHS Mollusk Collection Champaign):

1) E Arsenal Island; latitude 41.51301°N, longitude 90.51593°W – collected alive in 1990 (INHS 10221; N = 1) and 2005 (N = 4), as relict in 2011 (INHS 41576), and collected in 1978 (OSUM 42766) but the shell status is unknown.

METHODS

A 220-yard stretch of Sylvan Slough at the pedestrian bridge to Sylvan Island (**Figures 1, 2**) was sampled for mussels by INHS personnel J.S. Tiemann, K.S. Cummings, and J.L. Sherwood on 27 May 2015. Sampling was conducted by brailing four 100-yard sections upstream of the bridge and four 120-yard sections downstream for a total of 8 runs. When brailing, a surveyor deploys a tethered 6-foot bar with a series of non-barbed hooks into the water from the front of the boat and pulls the bar a given distance downstream. If a hook goes over an actively siphoning mussel, the mussel will clamp onto the hook. When the tethered bar is retrieved from the water and brought to the boat, the unharmed mussels are removed from the hooks for processing and identification.

Additionally, both banks and dried areas were also visually searched for the presence of shells. All live mussels were identified, counted, and released, whereas dead shell was vouchered and deposited into the INHS Mollusk Collection, Champaign (**Table 1**).

RESULTS & DISCUSSION

During this present survey of Sylvan Slough at the pedestrian bridge to Sylvan Island, 11 species of freshwater mussels were found and all were represented by live specimens (**Table 1**). Results from this survey suggest the habitat around the pedestrian bridge is suitable for freshwater mussels. Included in our collection were two live Butterfly mussel specimens, one collected upstream and one downstream from the bridge. No other species listed at the state or federal level were collected or observed. Although not collected during our limited brail survey, we feel there is a high likelihood that other listed species could be in the area – in particular, Higgins' Eye, Black Sandshell and Sheepnose all have been collected alive in Sylvan Slough within the last decade. Given its affinity for rocky crevices, Spectaclecase is difficult to collect while brailing. Some rocky crevices (e.g., rip-rap) was present in the area, and given the fact that it was collected near the I-74 bridge (Heidi Dunn and Emily Grossman, Ecological Specialists, Inc., O'Fallon, MO, personal communication), we cannot rule out that Spectaclecase is absent in the pedestrian bridge project corridor.

ACKNOWLEDGMENTS

INHS GIS and Remote Sensing Specialist J.L. Jarvis assisted in preparing the map in **Figure 1** and the associated shapefile referenced in **Appendix 1**. INHS Field Biologist J.L. Sherwood assisted in collecting. M.J. Wetzel (retired INHS) edited early drafts of this report.

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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. List of freshwater mussels (Mollusca: Unionoida) recorded from Sylvan Slough (Mississippi River Drainage) and those collected at the pedestrian bridge to Sylvan Island, Moline, Rock Island County, Illinois, by INHS personnel on 27 May 2015. Species in **BOLD** indicate species extant in Sylvan Slough and are those species collected as live or fresh-dead since 2000 (data from INHS Mollusk Collection Champaign). Data from these surveys include the number of individuals found alive. Special designation includes those species listed as either federally-endangered [(FE)] or state-threatened in Illinois [(ST)].

	Scientific name	Common name	Ped. bridge (2015)
Margaritiferidae	*Margaritifera monodonta* [FE]	Spectaclecase	
Unionidae	*Actinonaias ligamentina*	Mucket	
	Alasmidonta marginata	Elktoe	
	Amblema plicata	**Threeridge**	21
	Amphinaias (Quadrula) nodulata	Wartyback	
	Amphinaias (Quadrula) pustulosa	**Pimpleback**	4
	Arcidens confragosus	**Rock Pocketbook**	
	Cyclonaias tuberculata [ST]	Purple Wartyback	
	Ellipsaria lineolata [ST]	**Butterfly**	2
	Fusconaia ebena [ST]	Ebony Shell	
	Fusconaia flava	**Wabash Pigtoe**	1
	Lampsilis cardium	**Plain Pockebook**	2
	Lampsilis higginsii [FE]	**Higgins' Eye**	
	Lampsilis teres	Yellow Sandshell	
	Lasmigona complanata	White Heelsplitter	
	Leptodea fragilis	**Fragile Papershell**	34
	Ligumia recta [ST]	**Black Sandshell**	
	Megalonaias nervosa	**Washboard**	
	Obliquaria reflexa	**Threehorn Wartyback**	15
	Obovaria olivaria	**Hickorynut**	2
	Plethobasus cyphyus [FE]	**Sheepnose**	
	Pleurobema sintoxia	Round Pigtoe	
	Potamilus alatus	**Pink Heelsplitter**	15
	Potamilus ohiensis	**Pink Papershell**	1
	Pyganodon grandis	**Giant Floater**	

	Quadrula quadrula	**Mapleleaf**	
	Strophitus undulatus	Creeper	
	Theliderma (Quadrula) metanevra	**Monkeyface**	
	Toxolasma parvum	**Lilliput**	
	Tritogonia verrucosa	Pistolgrip	
	Truncilla donaciformis	**Fawnsfoot**	22
	Truncilla truncata	**Deertoe**	
	Utterbackia imbecillis	**Paper Pondshell**	
	Utterbackia suborbiculata	Flat Floater	
Species extant (live + fresh-dead)			11
Species total			11
No. individuals			109

Figure 1. Aerial image of the pedestrian bridge over Sylvan Slough to Sylvan Island, Moline, Rock Island County, Illinois, where a freshwater mussel survey was conducted by INHS personnel J.S. Tiemann, K.S. Cummings, and J.L. Sherwood on 27 May 2015. Area in orange indicates the stretch of Sylvan Slough in which the mussel survey was conducted. Map created by J.L. Jarvis (INHS).

Figure 2. Brail bar near the pedestrian bridge over Sylvan Slough to Sylvan Island, Moline, Rock Island County, Illinois, where a freshwater mussel survey was conducted by INHS personnel J.S. Tiemann, K.S. Cummings, and J.L. Sherwood on 27 May 2015. Photograph is facing upstream (K.S. Cummings photo).

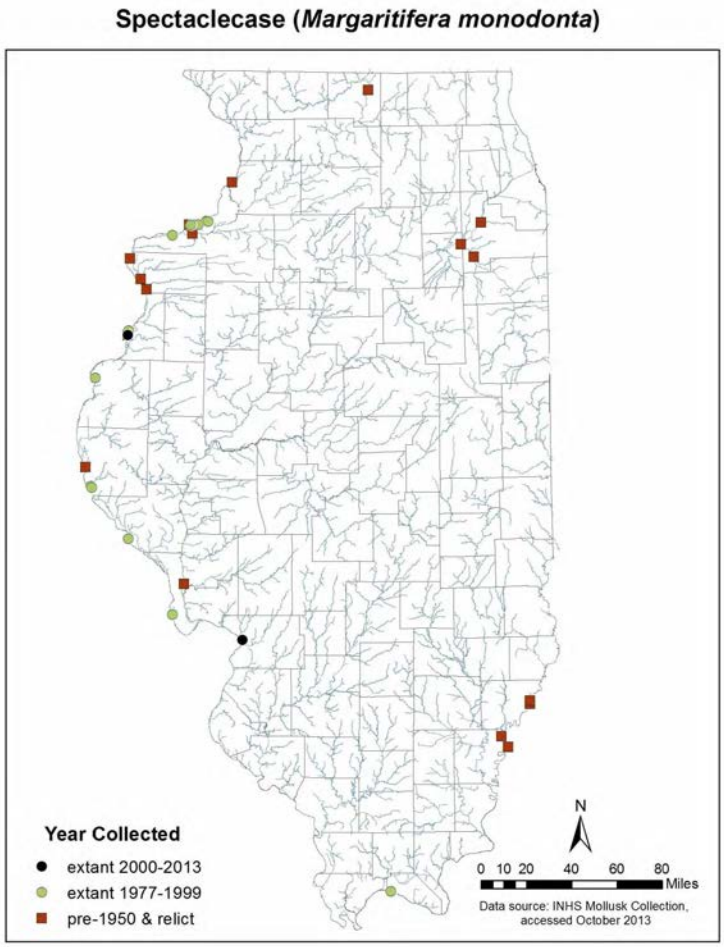
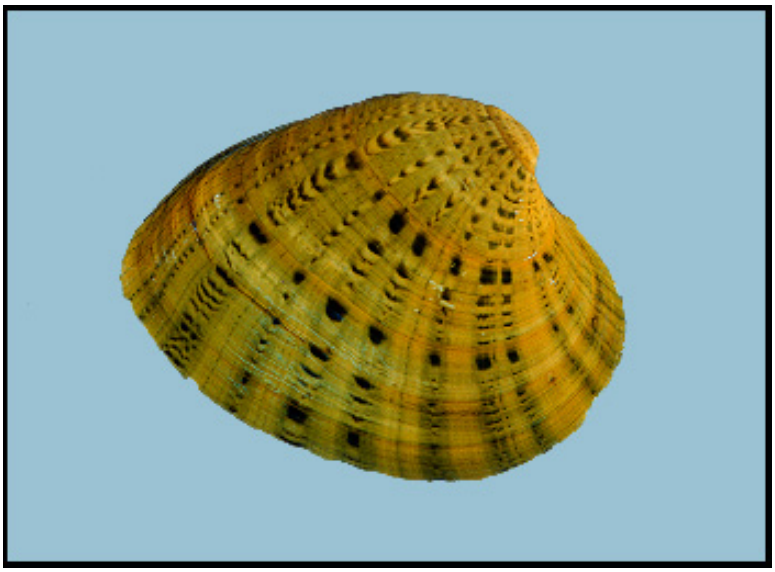


Figure 3. The federally-endangered Spectaclecase (*Margaritifera monodonta*) and its distribution in Illinois (K.S. Cummings photo; map from Stodola et al. 2014).



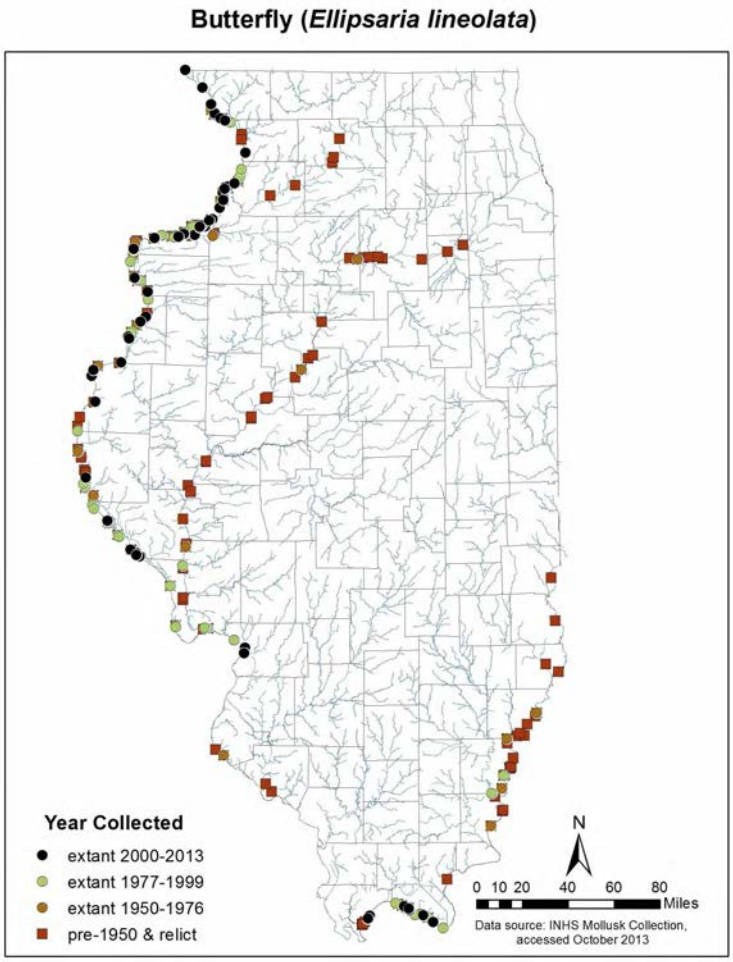


Figure 4. The state-threatened Butterfly (*Ellipsaria lineolata*) and its distribution in Illinois (K.S. Cummings photo; map from Stodola et al. 2014).

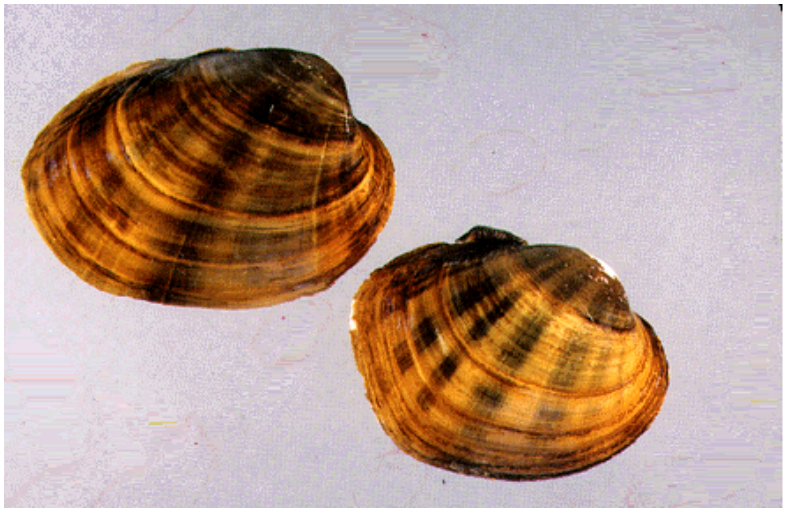


Figure 5. The federally-endangered Higgins' Eye (*Lampsilis higginsii*) and its distribution in Illinois (K.S. Cummings photo; map from Stodola et al. 2014).

Figure 6. The state-threatened Black Sandshell (*Ligumia recta*) and its distribution in Illinois (K.S. Cummings photo; map from Stodola et al. 2014).

Sheepnose (*Plethobasus cyphyus*)

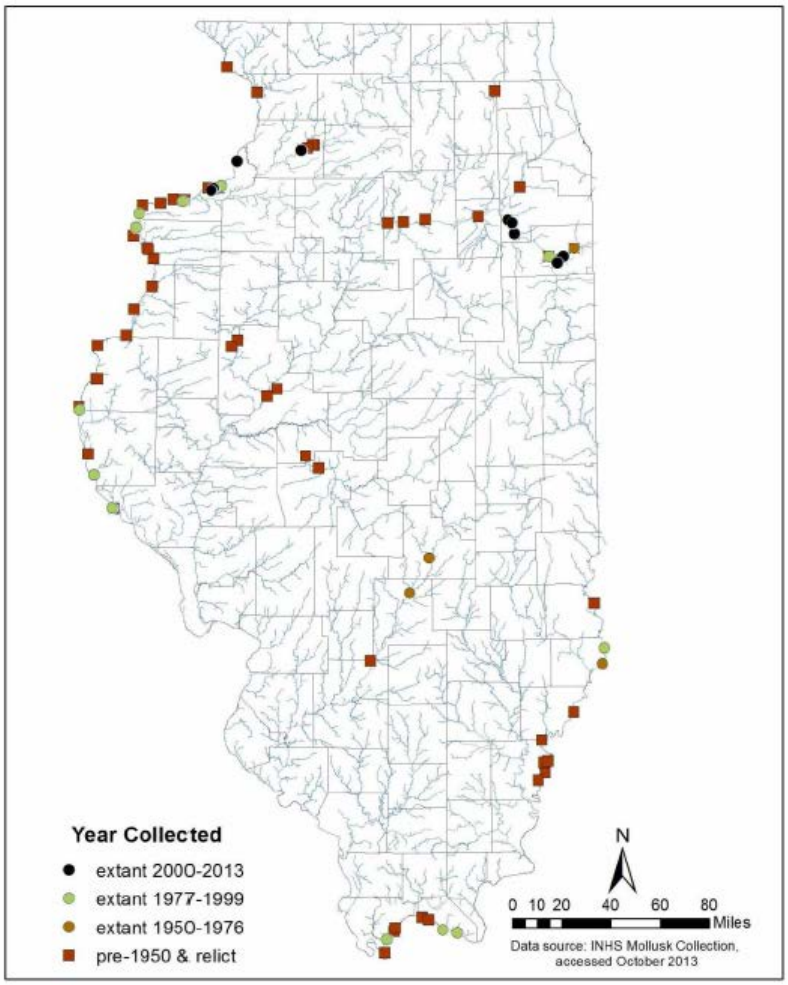


Figure 7. The federally-endangered Sheepnose (*Plethobasus cyphyus*) and its distribution in Illinois (K.S. Cummings photo; map from Stodola et al. 2014).

Appendix 1

This appendix cover page references < 19030_Mississippi_River_Mussel_GIS.zip >, an ArcGIS shapefile with sampling point information for the site discussed in this report. Specifically, this shapefile includes site information for Sylvan Slough at the pedestrian bridge to Sylvan Island in Moline, Rock Island County, Illinois, where a survey for freshwater mussels (Mollusca: Unionoida) was conducted by INHS personnel on 27 May 2015.

The ArcGIS shapefile and this report were both submitted to IDOT via the IDOT Site Assessment Tracking System extranet website (Frostycap) on 8 July 2015.

Unionid Survey for Replacement of a Pedestrian Bridge over Sylvan Slough, Mississippi River Pool 15

Prepared for the Illinois Natural History Survey
Champaign, IL

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November 2015

(ESI Project No. 15-037)

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1.0 Introduction

The Illinois Department of Transportation plans to replace a deteriorating pedestrian bridge over Sylvan Slough, located in Pool 15 of the Mississippi River at mile 484.7 (Figure 1-1). The existing bridge will be removed and a new bridge will be constructed along the same alignment. The abutments on each bank and the center pier in Sylvan Slough will be left in place. A temporary rock causeway and a floating causeway will be placed to facilitate construction.

Pool 15 of the Mississippi River harbors a diverse unionid (freshwater mussel) community. Forty (40) species have been reported from this pool, 30 of which have been collected live in the past 30 years (Table 1-1). Several federal (*Cumberlandia monodonta, Plethobasus cyphyus, Lampsilis higginsii*) and state (*Ellipsaria lineolata, Ligumia recta*) threatened and endangered (T&E) species occur in Pool 15 and have been collected near the pedestrian bridge. Therefore, the Illinois Natural History Survey (INHS) conducted a brail survey at the pedestrian bridge in May 2015 to determine if suitable habitat and/or live unionids, particularly T&E species, were present. Eleven (11) species were collected live in the brail survey, including the Illinois threatened *E. lineolata* (Table 1-1).

Results of the brail survey suggested that habitat was suitable for unionids, and that additional state or federal T&E species could occur in the project area. Therefore, Ecological Specialists, Inc. was contracted to conduct a more extensive mussel survey to better characterize habitat, species richness, and unionid density at the pedestrian bridge. The survey was conducted on August 20, 2015.

2.0 Methods

The pedestrian bridge survey area extended from 10 m upstream to 15 m downstream of the existing bridge centerline (see Figure 1-1). A combination of qualitative and quantitative sampling was used to characterize habitat and the unionid community at the bridge, and to estimate take of T&E species. Qualitative timed searches were used to characterize habitat and determine if T&E species were present. At least 12 5-min searches were to be conducted, with sampling to continue until at least 6 searches were conducted with no new species collected. A total of 19 5-min searches were therefore conducted in the project area. For each search, a diver crawled along the river bottom, collecting all unionids encountered in the 5-min time period. Live unionids were identified to species and categorized as either adults (>5 years old) or juveniles (≤5 years old). Dead shells were identified and categorized as either fresh dead (dead within the past year, nacre shiny, hinge flexible, valves attached, with or without tissue), weathered dead (dead many months to years, nacre chalky, hinge brittle, valves typically separated, periostracum intact), or subfossil (dead many years to decades, periostracum eroded, valves separate, very chalky). At least one individual of each species was photographed. Unionids were returned to the river near their original point of collection. The starting point of each search was recorded with a Trimble GeoXH GPS unit. Depth and substrate characteristics were also recorded for each search.

Quantitative sampling was used to estimate unionid density in the project area, and to estimate take of T&E species. Thirty (30) randomly distributed quadrat samples were collected. Random quadrat locations were generated using Geospatial Modelling Environment (Beyer, 2012). For each sample, a 0.25-m^2 quadrat frame was placed on the river bottom, and material within the quadrat was excavated to a depth of 10 - 15 cm into an attached mesh bag. The sample was retrieved, and all unionids separated from substrate and debris. Live unionids were identified to species, measured (length in mm), and aged (external annuli count). Fresh dead shells were identified and counted to provide an estimate of mortality. Substrate and depth characteristics were also recorded for each sample.

3.0 Results

Habitat was fairly uniform throughout most of the survey area. Substrate was primarily composed of silt, with smaller amounts of cobble, gravel, and sand present in many samples (Figure 3-1; Figure 3-2). Boulder was also common in samples near the center bridge pier and along the left descending bank upstream of the bridge. Depth ranged from 3 ft (0.9 m) near the bank to 9 ft (2.7 m) mid-channel (Figure 3-1; Figure 3-2).

Qualitative sampling yielded 384 live unionids of 17 species (Table 3-1). *Amblema plicata* (34.4%), *Obliquaria reflexa* (18.8%), and *Obovaria olivaria* (9.6%) were the most common species collected. Illinois threatened *E. lineolata* (18 individuals, 4.7%) and *L. recta* (19 individuals, 4.9%) were collected throughout the survey area. Juveniles of most species were present, representing 14.6% of the total. Catch per unit effort (CPUE) was 242.5 unionids/hour (Table 3-1). Unionids were collected throughout the survey area; no trends in distribution were observed in qualitative samples (Figure 3-3).

An additional 92 unionids of 12 species were collected in quantitative samples (Table 3-1). Three species that were not observed in qualitative samples (*Toxolasma parvus, Truncilla donaciformis,* and *Truncilla truncata*) were collected in quantitative samples. Relative abundance differed somewhat from qualitative samples. *Obliquaria reflexa* (43.5%) and *A. plicata* (26.1%) were again the most common species collected, followed by *Fusconaia flava, Quadrula pustulosa,* and *T. donaciformis* (6.5% each). Age distribution also differed significantly; 85.9% of unionids collected in quantitative samples were ≤5 years old. Density averaged 12.3 ± 5.1 unionids/m^2 (Table 3-1). Abundance in quadrats was generally highest near the right descending bank, though unionids were present throughout most of the survey area (Figure 3-4).

4.0 Discussion

This area appears to support a moderately dense, species rich unionid community. A total of 476 unionids of 20 species were collected in qualitative and quantitative samples combined, with 1 additional species (*Potamilus ohiensis*) collected as a fresh dead shell (see Table 3-1). The cumulative species curve developed for qualitative samples suggested that most species were collected (Figure 4-1). Based on the equation of the regression line, an additional 534 unionids would have to be collected to yield 1 new species. Three additional species (*T. parvus, T. donaciformis, T. truncata*) were collected in quantitative samples. As qualitative sampling is biased toward larger individuals, and these 3 species are typically small, they are less likely to be found in qualitative samples.

Species composition in the current survey differed somewhat from the May 2015 brail survey at the pedestrian bridge. *Leptodea fragilis* and *T. donaciformis* were the most abundant species in the brail survey, while only a few individuals of these species were collected in the current survey. These differences may be due to the different sampling methods used. All of the species collected in the brail survey were also collected in the current survey, with the exception of *P. ohiensis*, which was collected only as dead shell material in the current survey.

Two Illinois T&E species, *E. lineolata* and *L. recta*, were collected at the pedestrian bridge. Quantitative samples were collected to provide an estimate of take for T&E species, but these species were only present in qualitative samples. Therefore, to estimate the number of *E. lineolata* and *L. recta* that may occur in the area, data from qualitative and quantitative samples were combined to calculate the abundance of these species relative to the total number of unionids collected. Relative abundance of each species was then multiplied by the estimated total population size in the project area to obtain an approximate population size for each species. At a density of 12.3 ± 5.1 unionids/m^2, approximately 18,130 unionids reside in the project area. *Ellipsaria lineolata* and *L. recta* comprised 3.8% and 4.0%, respectively, of all unionids collected. Thus, approximately 689 *E. lineolata* and 725 *L. recta* may be present in the project area.

No evidence of federal T&E species was observed in the survey. *Cumberlandia monodonta* has been collected around piers of the Interstate 74 bridge approximately 1 mile upstream (ESI, 2014), and potential habitat for this species was present around the center pedestrian bridge pier. However, qualitative searches around the center pier did not yield any live or dead individuals. If this species is present, it is likely present in very low numbers, and leaving the bridge pier in place should minimize potential impacts. Habitat and species composition in the rest of the survey area was similar to nearby sites where *L. higginsii* has been collected. Although this species was not collected in the survey, its presence cannot be ruled out, and more intensive searches (i.e. if a relocation was conducted) could potentially yield live individuals of this species.

The pedestrian bridge project area harbors a moderately dense unionid community that includes 2 Illinois T&E species. Federal T&E species were not collected in the survey, but could potentially be present as well. Replacement of the bridge may directly impact these species. Impacts to unionids could be reduced by limiting streambed disturbance wherever possible. Unionids could also be relocated from direct impact areas as a salvage measure.

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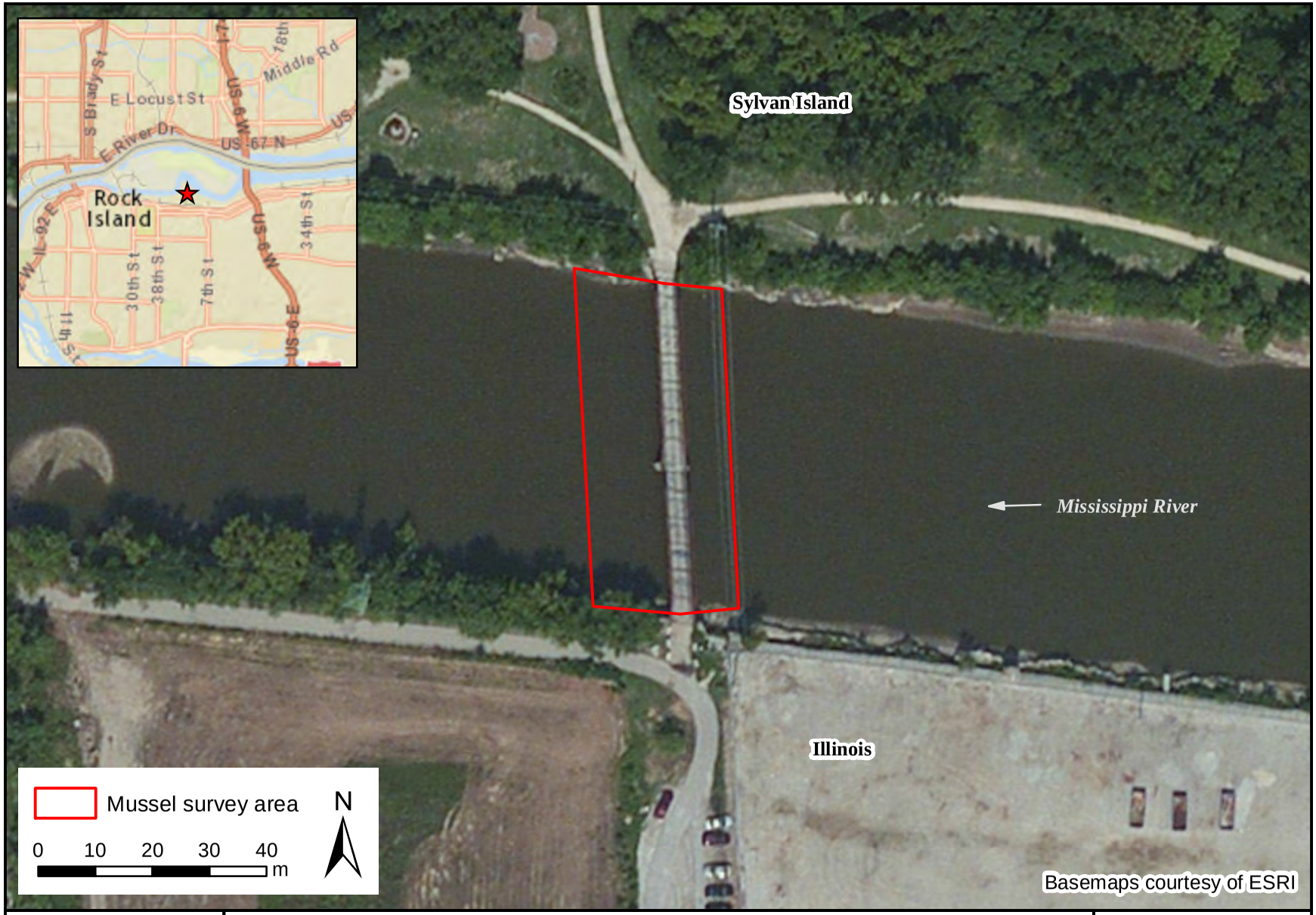

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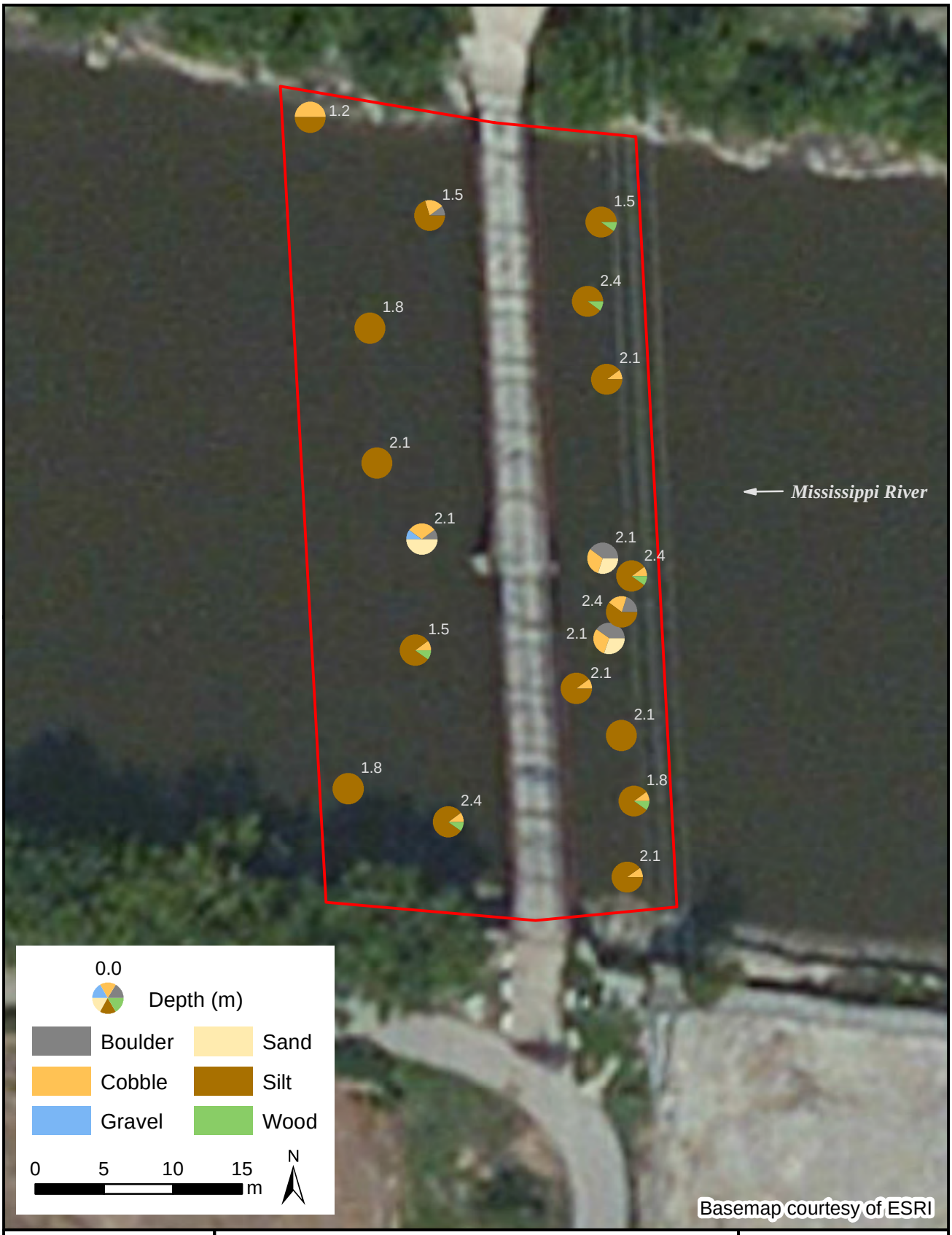
Figure 1-1. Mussel survey area for the Sylvan Slough pedestrian bridge project, Mississippi River mile 484.7.

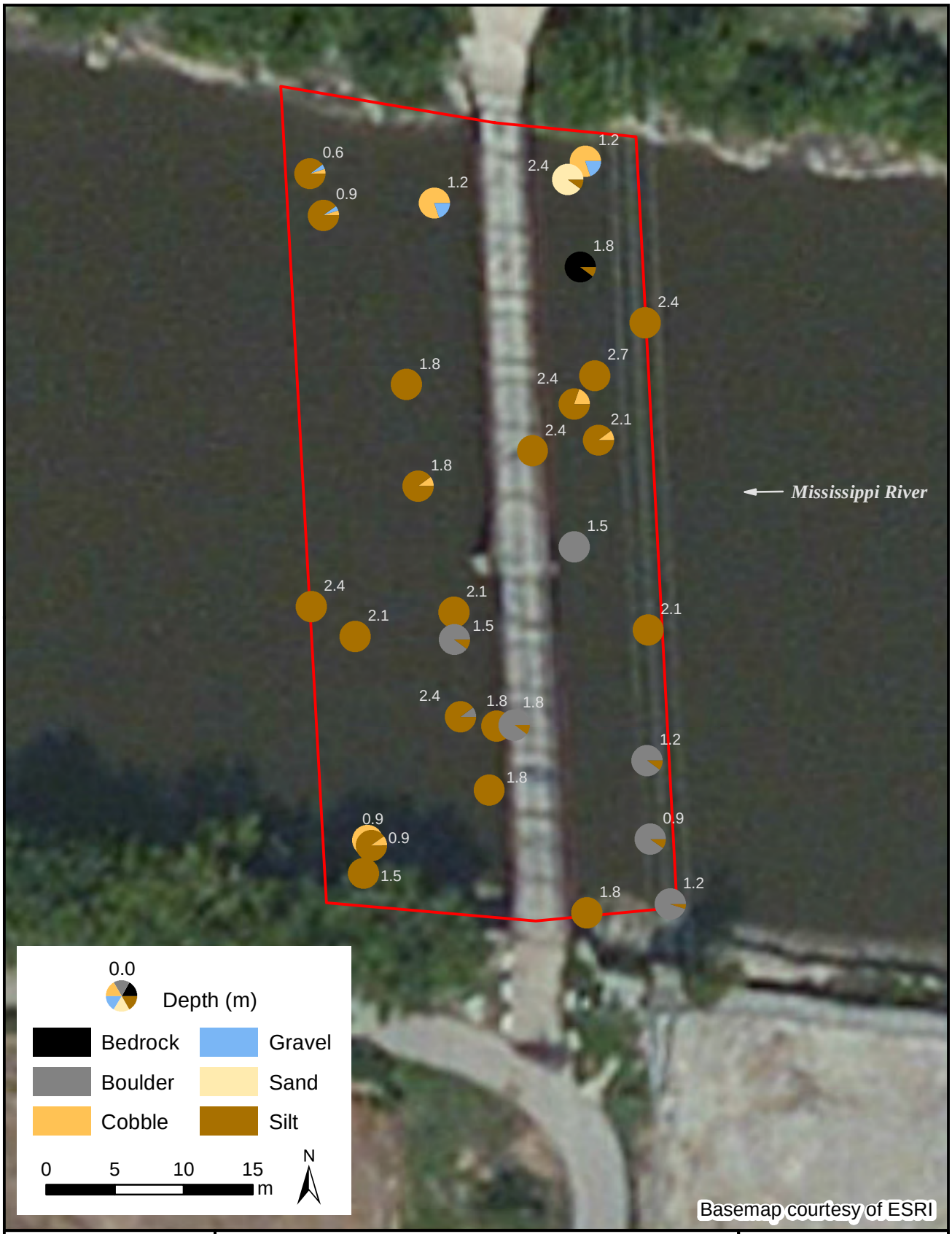
ESI



ECOLOGICAL SPECIALISTS, INC.

Figure 3-1. Depth and substrate composition in qualitative samples, August 2015.

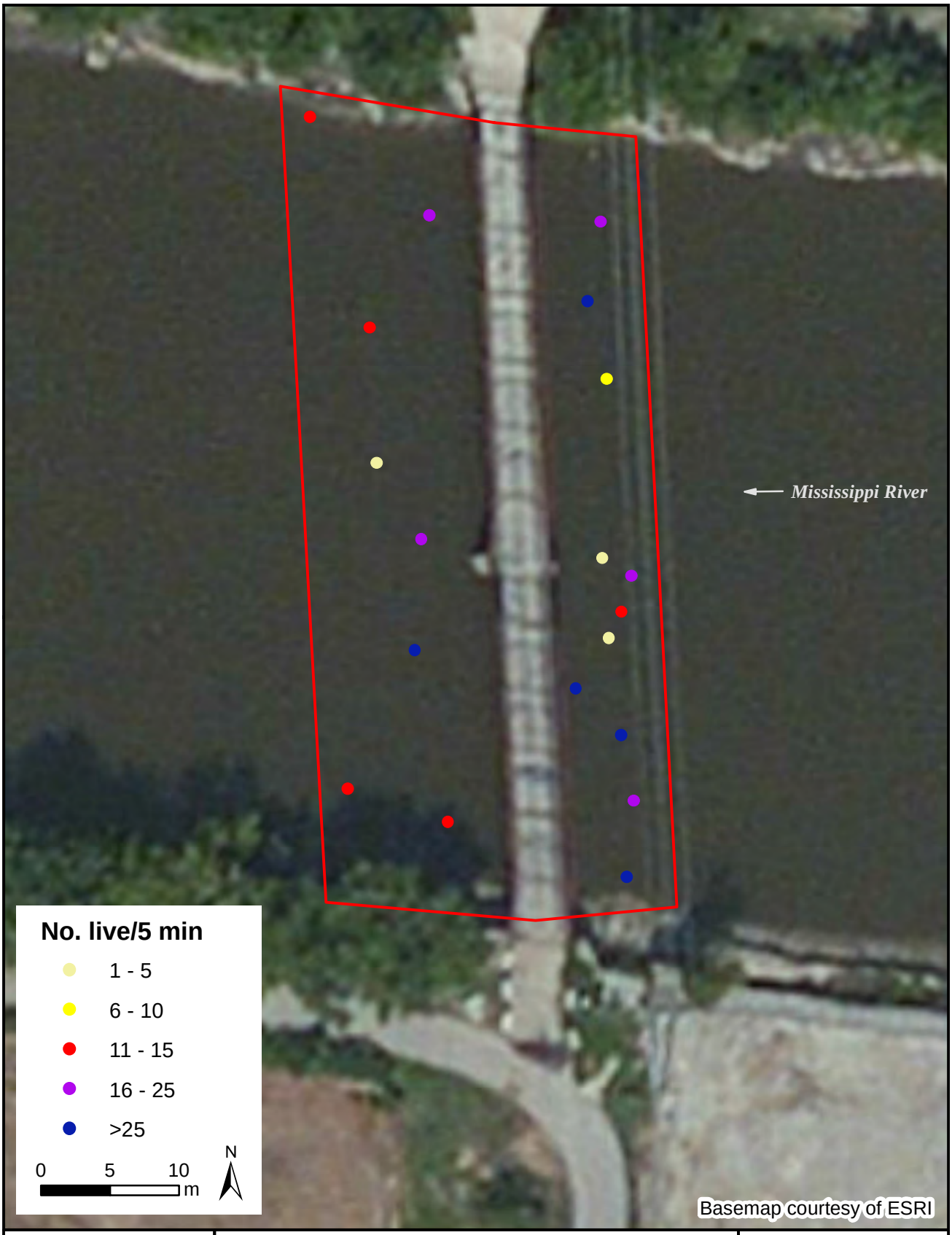
ESI



ECOLOGICAL SPECIALISTS, INC.

Figure 3-2. Depth and substrate composition in quantitative samples, August 2015.

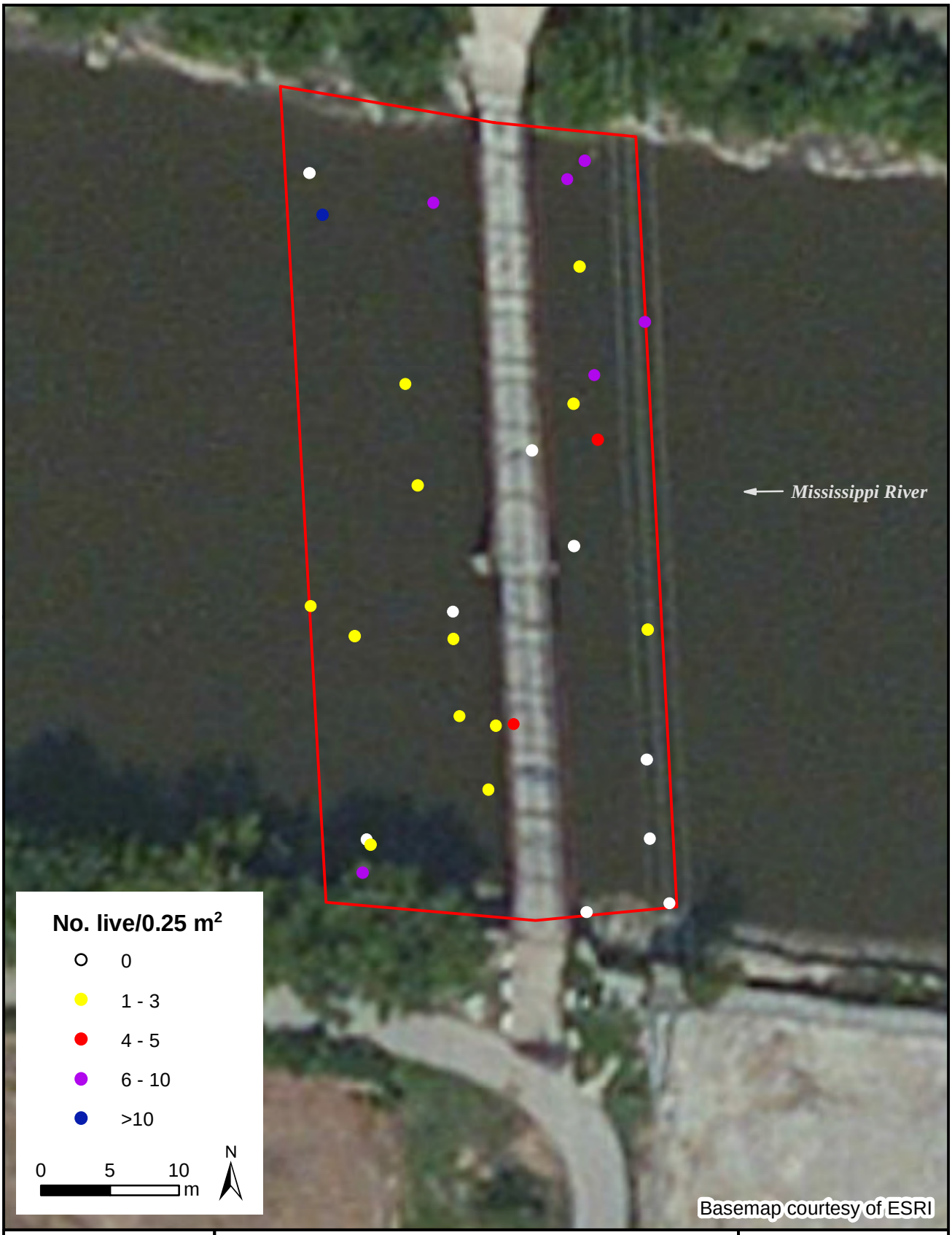
ESI



ECOLOGICAL SPECIALISTS, INC.

Figure 3-3. Live unionids collected in qualitative samples, August 2015.

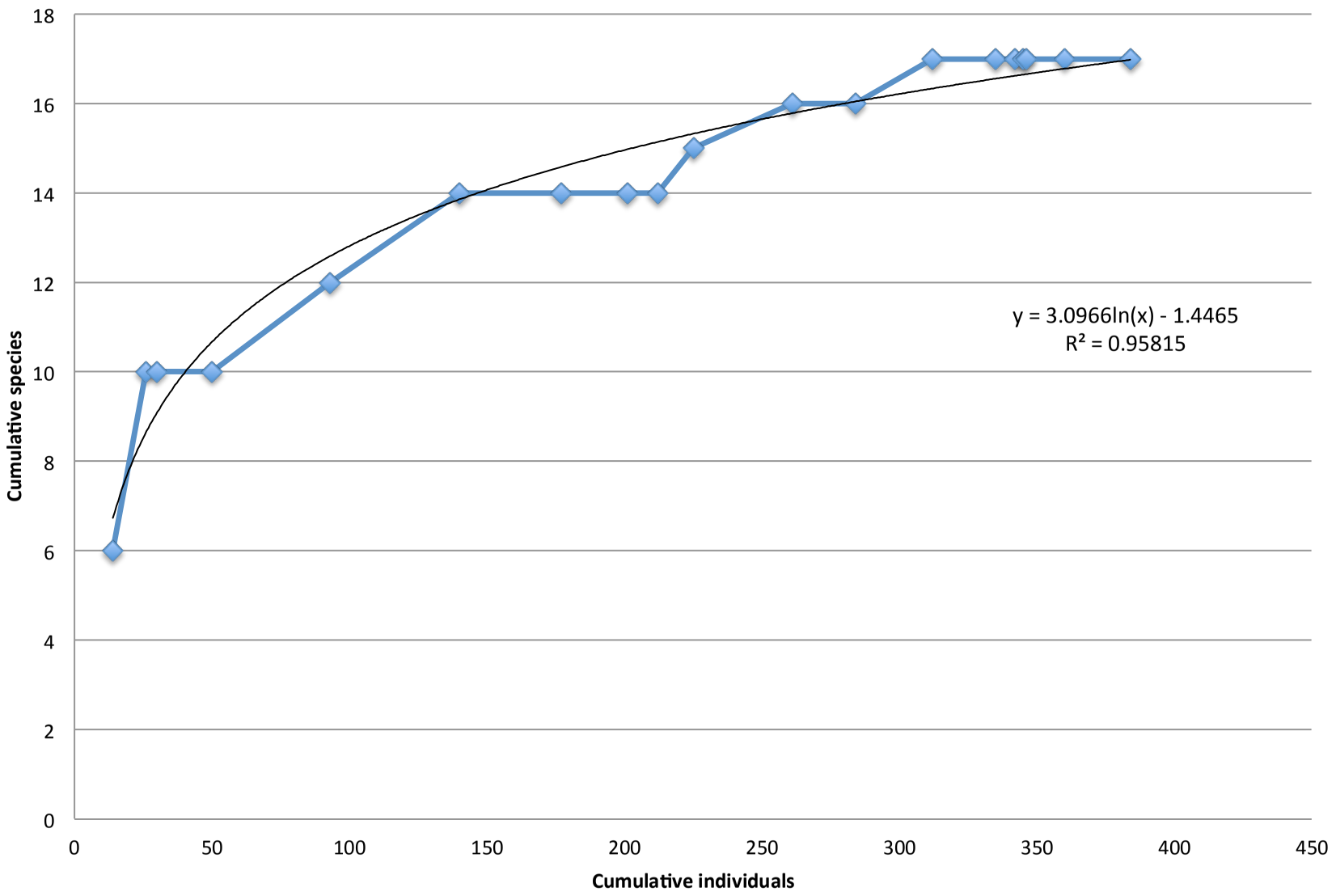
ESI



ECOLOGICAL SPECIALISTS, INC.

Figure 3-4. Live unionids collected in quantitative samples, August 2015.

ESI



ECOLOGICAL SPECIALISTS, INC.

Figure 4-1. Cumulative species curve developed for qualitative samples, August 2015.

ESI

Table 1-1. Unionid species reported from Mississippi River Pool 15.

Species	Common name	Status [1]	Pool 15 [2]	INHS (2015) [3]
Cumberlandinae				
Cumberlandia monodonta	spectaclecase	FE, ILE	R	
Amblemini				
Amblema plicata	threeridge		A	X
Pleurobemini				
Elliptio crassidens	elephant ear	ILT	H	
Elliptio dilatata	spike	ILT	H	
Fusconaia ebena	ebonyshell	ILT	H	
Fusconaia flava	Wabash pigtoe		R	X
Plethobasus cyphyus	sheepnose	FE, ILE	R	
Pleurobema sintoxia	round pigtoe		R	
Quadrulini				
Cyclonaias tuberculata	purple wartyback	ILT	H	
Megalonaias nervosa	washboard		A	
Quadrula metanevra	monkeyface		C	
Quadrula nodulata	wartyback		R	
Quadrula pustulosa	pimpleback		A	X
Quadrula quadrula	mapleleaf		C	
Tritogonia verrucosa	pistolgrip		H	
Anodontini				
Anodonta suborbiculata	flat floater		R	
Arcidens confragosus	rock pocketbook		R	
Lasmigona complanata	white heelsplitter		R	
Lasmigona compressa	creek heelsplitter		H	
Lasmigona costata	fluted shell		H	
Pyganodon grandis	giant floater		R	
Strophitus undulatus	creeper		R	
Utterbackia imbecillis	paper pondshell		R	
Lampsilini				
Actinonaias ligamentina	mucket		R	
Ellipsaria lineolata	butterfly	ILT	A	X
Epioblasma triquetra	snuffbox	FE, ILE	H	
Lampsilis cardium	plain pocketbook		C	X
Lampsilis higginsii	Higgins eye	FE, ILE	R	
Lampsilis siliquoidea	fatmucket		H	
Lampsilis teres	yellow sandshell		R	
Leptodea fragilis	fragile papershell		C	X
Ligumia recta	black sandshell	ILT	R	
Obliquaria reflexa	threehorn wartyback		A	X
Obovaria olivaria	hickorynut		R	X
Potamilus alatus	pink heelsplitter		R	X
Potamilus ohiensis	pink papershell		R	X
Toxolasma parvus	lilliput		R	
Truncilla donaciformis	fawnsfoot		C	X
Truncilla truncata	deertoe		A	
Venustaconcha ellipsiformis	ellipse		H	
Live species			30	11
Historic			10	-
Total species			40	11

[1] FE = federally endangered, ILE = Illinois endangered, ILT = Illinois threatened. USFWS (2015), ILDNR (2015).
[2] H = Records of occurrence but no live collections have been documented since approximately 1980; R = Rare, does not usually appear in sample collections, populations are small either naturally or have declined and may or may not be near extirpation; C = Commonly taken in most samples, can make up a large portion of some samples; A = abundantly taken in most samples. Kelner (2011).
[3] X = collected live

Table 3-1. Summary of unionids collected at the Sylvan Slough pedestrian bridge, August 2015.

	Qualitative			Quantitative				
Species	No. Live	%	No. ≤5yr	No. Live	%	No. ≤5yr	Total	%
Amblemini								
Amblema plicata	132	34.4	13	24	26.1	22	156	32.8
Pleurobemini								
Fusconaia flava	13	3.4	1	6	6.5	3	19	4.0
Quadrulini								
Megalonaias nervosa	25	6.5	2	-	-	-	25	5.3
Quadrula metanevra	2	0.5	-	-	-	-	2	0.4
Quadrula pustulosa	34	8.9	9	6	6.5	4	40	8.4
Quadrula quadrula	1	0.3	-	1	1.1	1	2	0.4
Anodontini								
Arcidens confragosus	2	0.5	2	-	-	-	2	0.4
Lasmigona complanata	2	0.5	-	-	-	-	2	0.4
Pyganodon grandis	4	1.0	-	1	1.1	1	5	1.1
Lampsilini								
Actinonaias ligamentina	1	0.3	-	-	-	-	1	0.2
Ellipsaria lineolata	18	4.7	2	-	-	-	18	3.8
Lampsilis cardium	19	4.9	-	1	1.1	-	20	4.2
Leptodea fragilis	1	0.3	1	2	2.2	2	3	0.6
Ligumia recta	19	4.9	3	FD	-	-	19	4.0
Obliquaria reflexa	72	18.8	20	40	43.5	37	112	23.5
Obovaria olivaria	37	9.6	1	2	2.2	-	39	8.2
Potamilus alatus	2	0.5	2	FD	-	-	2	0.4
Potamilus ohiensis	FD	-	-	-	-	-	FD	-
Toxolasma parvus	-	-	-	1	1.1	1	1	0.2
Truncilla donaciformis	FD	-	-	6	6.5	6	6	1.3
Truncilla truncata	FD	-	-	2	2.2	2	2	0.4
Total	384	100.0	56	92	100.0	79	476	100.0
Live species	17			12			20	
Total species	20			14			21	
% ≤5 yr.			14.6			85.9		
CPUE (no. live/hr)	242.526							
Density (±2SE)				12.3 ± 5.1				

FD = fresh dead shell

Freshwater Mussel survey

Channel Cat Taxi – Moline, Illinois

May 8, 2015

Prepared by

Jon Duyvejonck, US Fish and Wildlife Service

Rock Island Field Office

I Introduction – A new dock along the Ben Butterworth Parkway will be constructed to harbor the Channel Cat Water Taxi. The proposed site is located at approximately River Mile 487.7 LB. A 50 ft. gangway will extend from shore to a 54ft by 54 ft. dock. The dock will be supported by approximately 11 pilings sunk into the river bottom.

This location occurs just upstream (and possibly within) an Illinois Department of Natural Resources freshwater mussel sanctuary. The upstream boundary of the sanctuary is uncertain. Three federally listed species (*Cumberlandia monodonta, Plethobasus cyphyus,* and *Lampsilis higginsii*) are known to occur in the vicinity in addition to several state endangered species. The project area overlaps the Sylvan Slough *L. higginsii* Essential Habitat Area (EHA) on the Illinois bank. EHAs are areas considered capable of supporting reproducing populations of *L. higginsii,* and are defined as areas where L. *higginsii* constitute at least 0.25% of the mussel community and the mussel habitat appears to be stable and supports a dense and diverse mussel community."

II. Methods" – Four "spot dives" were conducted in and adjacent to the project footprint. Each dive consisted of 2 five minute collection efforts. Divers collected any mussels they could feel. Visibility was very poor and visual collection was not possible. Due to high current velocity quantitative data was not collected. GPS coordinates for each location were recorded, along with shell length, substrate composition, depth, and zebra mussel density. The survey was conducted on May 8, 2015. The river stage was 18.3 ft. at Lock and Dam 15.

III Results – A total of 66 mussels of 12 species were collected in the project area (See Figure 1). Table 1 shows the number of species and individuals collected at each sampling location. Sampling depths were approximately 10 ft. at location 1, 2, and 3. Site 4, which was just 5 yards off-shore, was 6 ft. deep. Divers reported that all locations substrate consisted primarily of dead shell, dead zebra mussels, gravel, and occasionally cobble. All live mussels collected had dense infestations of zebra mussels (See figure 2).

No federally listed species were collected, but Illinois State listed species were collected in each of the four samples. The state listed black sandshell (*Ligumia recta*) was collected in all four samples and one butterfly (*Plagiola lineolata*) was collected. The black sandshell was the fourth most numerous species collected.

IV. Summary/Conclusion

Although only 4 locations were sampled, results indicate that the proposed project location could be a continuation of the mussel bed within the Sylvan Slough Mussel Sanctuary. There is no survey information for the area between the proposed project and the sanctuary. At a minimum, the sampled locaiton represents a mussel community of moderate significance. It is likely that further sampling would increase the number of documented species similar to Sylvan Slough. Substrate, depth, and flow conditions are very similar to Sylvan Slough. There is a high likelihood that installation of dock pilings would impact a number of mussels. It is recommended that a mussel re-location be conducted prior to project construction.

Table 1. - Channel Cat Dock Mussel Survey-5/6/2015

Species	**Site 1**	**Site 2**	**Site 3**	**Site 4**	**total**	
Three Ridge *Amblema plicata*	7	5	7	5	24	
Washboard *Megalonaias nervosa*		1	4	5	10	
Pimpleback *Quadrula pustulosa*	1	4	7	1	13	
Black sandshell *Ligumia recta*	1	1	2	3	7	
Deer toe *Truncilla truncata*			1		1	
paper pondshell *Utterbackia imbecillus*				1	1	
Butterfly *Plagiola lineolata*			1		1	
Plain pocketbook *Lampsilis cardium*				1	1	
Mapleleaf *Quadrula quadrula*			1	1	2	
three horn WB *Obliquaria reflexa*	1	1		1	3	
Fragile papershell *Leptodea fragillis*	1				1	
Hickory Nut *Obovaria Olivaria*		2			2	
total spp. =12	11	12	23	18	66	

Figure 1-Channel Cat "Spot dive" Locations

Figure 2- Zebra mussel infestation

Acknowledgements – Illinois DNR biologists Rich Lewis and Nathan Grider participated in this survey. Thanks to Robert Schanzle (retired DNR) for his invaluable diving assistance and mussel identification.

Jon Duyvejonck

LOCATION: Rock Island Co. - Moline, IL

Sample No. 1	Project: Channel Cat Dock		Date 5/5/18
River Mile 482.7	Crew: Robert Schanzle - Diver	Start time 11:47 am	Dive 1
Coordinates UTM 15T 0709001, 4599960		End time 11:54 pm	11:55 pm Dive 2
Collection method: Scoot Dive			12 o 2
	Substrate type: gravel/shell	Water temp.	
Species	depth 10.0	River Stage	

Species	Length													
Three ridge (A.p)	90	83	70	63	55	81	53	D						
3 horn wartyback (O.r.)	62													
Pimpleback (Q.p.)	55	D												
Wartyback (Q.n.)														
Plain pocketbook (L.c.)														
Mapleleaf (Q.q.)														
Monkeyface (Q.m.)														
Mucket (A.l.)														
Spike (E.d.)														
Washboard (M.n.)	D	D												
Fragile papershell (L.f.)	59													
Pink papershell (P.o.)														
White heelsplitter (L.c.)														
Pink heelsplitter (P.a.)														
Rock pocketbook A.c.)														
Black sandshell (L.r.)	125													
Yellow sandshell (L.t.a.)														
Higgins eye (L.h.)														
Hickory nut (O.o.)														
Butterfly (P.l.)														
Deer toe (T.t.)														
Fawn's foot (T.d.)														
Creeper (S.u.)														
Fat mucket (L.s.)														
Wabash pig toe (F.f)														
Round pig toe (P.s)														
Spectacle case (C.m.)														
Sheepnose (P.c.)														
Lilliput (T.p.)														
Paper pondshell (U.i.)														
Giant floater (P.g.)														
Pistol grip (T.v.)														
Fluted shell (L.c.)														
Ellipse (V.e.)														
Creek heelsplitter (L.c.)														
Ebony shell (F.e.)														

Zebra mussel abundance: 6-12 on mussel

Comments: 38 yds from Shore upstream of bow ~ 5 yds

Crew on Boat
Jon Duyvejonck - USFWS
Nathan Grider - IDNR
Rich Lewis - IDNR
Robt Schanzle - IDNR

Sample No. 2	Project: Channel Cat Dock		Date 5-5-15
River Mile 487.7	Crew: [illegible]	Start time 12:19	
Coordinates 15 T-070 8973, 4598961		End time 2:44	
Collection method: [illegible] 415150			
	Substrate type: Dead shell-gravel	Water temp. [illegible]	
Species	depth 10.0 ft	River Stage	

Species	Length													
Three ridge *(A.p)*	75	75	74	71	60									
3 horn wartyback *(O.r.)*	[illegible]	D												
Pimpleback *(Q.p.)*	[illegible]	[illegible]	59	55										
Wartyback *(Q.n.)*														
Plain pocketbook *(L.c.)*														
Mapleleaf *(Q.q.)*														
Monkeyface *(Q.m.)*														
Mucket *(A.l.)*														
Spike *(E.d.)*														
Washboard *(M.n.)*	[illegible]	D	D	D										
Fragile papershell *(L.f.)*														
Pink papershell *(P.o.)*														
White heelsplitter *(L.c.)*														
Pink heelsplitter *(P.a.)*														
Rock pocketbook *A.c.)*														
Black sandshell *(L.r.)*	102													
Yellow sandshell *(L.t.a.)*														
Higgins eye *(L.h.)*														
Hickory nut *(O.o.)*	53	51												
Butterfly *(P.l.)*														
Deer toe *(T.t.)*														
Fawn's foot *(T.d.)*														
Creeper *(S.u.)*														
Fat mucket *(L.s.)*														
Wabash pig toe *(F.f)*														
Round pig toe *(P.s)*														
Spectacle case *(C.m.)*														
Sheepnose *(P.c.)*														
Lilliput *(T.p.)*														
Paper pondshell *(U.i.)*														
Giant floater *(P.g.)*														
Pistol grip *(T.v.)*														
Fluted shell *(L.c.)*														
Ellipse *(V.e.)*														
Creek heelsplitter *(L.c.)*														
Ebony shell *(F.e.)*														
Zebra mussel abundance														

Comments: 47 yds from shore
lots of dead shell

Sample No. 3	Project: Channel cut Dock	Date 5-5-15
River Mile 487.7	Crew: Bob Shanzle Diver	Start time 12:50 p.m.
Coordinates 15 T 0708995, 4598945		End time
Collection method: Spot Dive -90.49542 41.51485		
	Substrate type: Dark shell-gravel	Water temp.
Species	depth 9 ft	River Stage

Species	Length mm													
Three ridge *(A.p)*	61	75	D	65	60	62	87	76						
3 horn wartyback *(O.r.)*														
Pimpleback *(Q.p.)*	D	45	52	42	D	53	114	45	31					
Wartyback *(Q.n.)*														
Plain pocketbook *(L.c.)*														
Mapleleaf *(Q.q.)*	55													
Monkeyface *(Q.m.)*														
Mucket *(A.l.)*														
Spike *(E.d.)*														
Washboard *(M.n.)*	132	D	126	114	115									
Fragile papershell *(L.f.)*														
Pink papershell *(P.o.)*														
White heelsplitter *(L.c.)*														
Pink heelsplitter *(P.a.)*														
Rock pocketbook *A.c.)*														
Black sandshell *(L.r.)*	114	110												
Yellow sandshell *(L.t.a.)*														
Higgins eye *(L.h.)*														
Hickory nut *(O.o.)*														
Butterfly *(P.l.)*	60	D												
Deer toe *(T.t.)*	46													
Fawn's foot *(T.d.)*														
Creeper *(S.u.)*														
Fat mucket *(L.s.)*														
Wabash pig toe *(F.f)*														
Round pig toe *(P.s)*														
Spectacle case *(C.m.)*														
Sheepnose *(P.c.)*														
Lilliput *(T.p.)*														
Paper pondshell *(U.i.)*														
Giant floater *(P.g.)*														
Pistol grip *(T.v.)*														
Fluted shell *(L.c.)*														
Ellipse *(V.e.)*														
Creek heelsplitter *(L.c.)*														
Ebony shell *(F.e.)*														
Zebra mussel abundance	[illegible]													

Comments: 15 yards from shore

Sample No. 4	Project: Channel Cat		Date 8-5-15
River Mile 487.2	Crew: Bob Schanzle - Diver		Start time 1:45pm
Coordinates 15T 0708984 4598938			End time 1:55 pm
Collection method: SCUBA Dive -90.49561 41.514231			
	Substrate type: hardshell - gravel		Water temp. 64
Species	depth 6-	River Stage	
	Length mm		

Species														
Three ridge *(A.p)*	76	78	99	66	55									
3 horn wartyback *(O.r.)*	38													
Pimpleback *(Q.p.)*	17													
Wartyback *(Q.n.)*														
Plain pocketbook *(L.c.)*	65													
Mapleleaf *(Q.q.)*	62													
Monkeyface *(Q.m.)*														
Mucket *(A.l.)*														
Spike *(E.d.)*														
Washboard *(M.n.)*	130	132	130	126	131									
Fragile papershell *(L.f.)*														
Pink papershell *(P.o.)*														
White heelsplitter *(L.c.)*														
Pink heelsplitter *(P.a.)*														
Rock pocketbook *A.c.)*														
Black sandshell *(L.r.)*	123	117	103											
Yellow sandshell *(L.t.a.)*														
Higgins eye *(L.h.)*														
Hickory nut *(O.o.)*														
Butterfly *(P.l.)*														
Deer toe *(T.t.)*														
Fawn's foot *(T.d.)*														
Creeper *(S.u.)*														
Fat mucket *(L.s.)*														
Wabash pig toe *(F.f)*														
Round pig toe *(P.s)*														
Spectacle case *(C.m.)*														
Sheepnose *(P.c.)*														
Lilliput *(T.p.)*														
Paper pondshell *(U.i.)*	38													
Giant floater *(P.g.)*														
Pistol grip *(T.v.)*														
Fluted shell *(L.c.)*														
Ellipse *(V.e.)*														
Creek heelsplitter *(L.c.)*														
Ebony shell *(F.e.)*														
Zebra mussel abundance														

Comments: just off shore - 5 adults

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

REPLY TO
ATTENTION OF

February 10, 2015

Operations Division

SUBJECT: CEMVR-OD-P-2015-116

Mr. Scott Hinton
City of Moline
3635 4th Avenue
Moline, Illinois 61265

Dear Mr. Hinton:

Our office reviewed all materials in the application received, February 6, 2014, concerning the proposed Sylvan Slough pedestrian bridge replacement, including use of a temporary floating causeway, over the Mississippi River in Moline in Section 31, Township 18 North, Range 1 West, Rock Island County, Illinois.

Your project is covered under Nationwide Permit No. 14, as published in the enclosed Fact Sheet No. 7 (IL), provided you meet the permit conditions for the nationwide permits, which are also included in the Fact Sheet. The Illinois Department of Transportation is responsible for the NEPA process for this project which includes compliance with the Endangered Species Act and the National Historic Preservation Act. The Illinois Environmental Protection Agency (IEPA) 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, 2017, 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 this date to complete your activity under the present terms and conditions of this nationwide permit. If your project plans change, you should contact our office for another determination.

Our office has completed a Preliminary Jurisdictional Determination concerning your project area. A copy of our Preliminary Jurisdictional Determination is enclosed. A Preliminary Jurisdictional Determination is not appealable. **Please review, sign, date, and return the form to our office.**

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 – Office 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.bow@illinois.gov.

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

The Rock Island District Regulatory Branch is committed to providing quality and timely service to our customers. In an effort to improve customer service, please take a moment to complete the attached postcard and return it or go to our Customer Service Survey found on our web site at http://corpsmapu.usace.army.mil/cm_apex/f?p=regulatory_survey. (Be sure to select "Rock Island District" under the area entitled: Which Corps office did you deal with?)

Should you have any questions, please contact our Regulatory Branch by letter, telephone or email to Mrs. Kirsten Brown at 309/794-5104 or Kirsten.L.Brown@usace.army.mil.

Sincerely

Donna M. Jones, P.E.
Chief, Illinois/Missouri Section
Regulatory Branch

Copies Furnished (without enclosures):

Mr. Mike Diedrichsen, P.E.
Office of Water Resources
IL Department of Natural Resources
One Natural Resources Way
Springfield, Illinois 62701-1271
Mike.Diedrichsen@illinois.gov (email copy)

Mr. Dan Heacock
Illinois Environmental Protection Agency
Watershed Management Section, Permit Sec. 15
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276
Epa.401.bow@illinois.gov (email copy)

Mr. Mike Harnung
Missman, Inc.
1717 State Street, Suite 201
Bettendorf, Iowa 52722

Mr. Doug DeLong
Illinois Department of Transportation
2300 S. Dirksen Parkway
Springfield, Illinois 62764

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Illinois Department of
Natural Resources

Bruce Rauner, Governor

One Natural Resources Way Springfield, Illinois 62702-1271
www.dnr.illinois.gov

Wayne A. Rosenthal, Director

April 29, 2015

SUBJECT: Permit No. DS2015025
Sylvan Island Pedestrian Bridge
Bridge Replacement & Temp. Causeway
Mississippi River (Mile 484.5)
Rock Island County

City of Moline
ATTN: Scott Hinton
30 18th Street
Moline, Illinois 61265

Dear Mr. Hinton:

Enclosed is Illinois Department of Natural Resources, Office of Water Resources Permit No. DS2015025 authorizing the subject project. This approval is based on our determination that the project will neither appreciably restrict the river's flood carrying capacity nor adversely impact the public's interests in the public body of water and therefore complies with our Part 3700 Floodway Construction and Part 3704 Public Waters rules. In addition to the general conditions of the permit, this approval is subject to the following special conditions:

a) Plans and specifications of the proposed floating causeway shall be submitted to, and approved by, the Illinois Department of Natural Resources, Office of Water Resources before being installed;

b) Incidental Take Authorization for state-listed mussels shall be obtained from the Illinois Department of Natural Resources, Office of Resource Conservation prior to project initiation;

c) Bridge removal shall be conducted such that it will not unnecessarily interfere with navigation of the river or create a hazard to boating safety; and

d) The temporary causeway shall be completely removed upon completion of construction.

This permit does not supersede any other federal, state or local authorizations that may be required for the project.

If any changes of the permitted work are found necessary, revised plans should be submitted promptly to this office for review and approval. Also, this permit expires on the date indicated in Condition (13). If unable to complete the work by that date, the permittee may make a written request for a time extension.

Upon receipt and review of this permit and all of its conditions, please properly execute and return the attached acceptance blank within sixty (60) days from the date of the permit. Please feel free to contact Jerry Bishoff of my staff at 217/558-6617 if you have any questions concerning this authorization.

Sincerely,

Michael L. Diedrichsen, P.E.
Acting Manager, Downstate Regulatory Programs

MLD:JMB:crw
Enclosures:
cc: U.S. Army Corps of Engineers, Rock Island District (CEMVR-OD-P)
IEPA, BOW, Division of Water Pollution Control, Permit Section
Missman, Inc. (Mike Harnung)
IDNR, Division of Ecosystems and Environment (Nathan Grider)

PERMIT NO. DS2015025
DATE: April 29, 2015

State of Illinois
Department of Natural Resources, Office of Water Resources

Permission is hereby granted to:

CITY OF MOLINE
30 18TH STREET
MOLINE, ILLINOIS 61265

to replace a pedestrian bridge superstructure involving the construction of a temporary causeway in Sylvan Slough of the Mississippi River at Mile 484.5 in the Northwest ¼ of Section 31, Township 18 North, Range 1 West of the 4th Principal Meridian in Rock Island County,

in accordance with an application dated January 22, 2015, and the plans and specifications entitled:

SYLVAN ISLAND PEDESTRIAN BRIDGE, EXISTING SITE PLAN; SYLVAN ISLAND PEDESTRIAN BRIDGE, EXISTING PROFILE; SYLVAN ISLAND BRIDGE – MOLINE, ILLINOIS, PROPOSED CAUSEWAY LAYOUT; SYLVAN ISLAND BRIDGE – MOLINE, ILLINOIS, APPROACH SECTIONS (4 Sheets, submitted with application); and GENERAL PLAN & ELEVATION, SYLVAN ISLAND PEDESTRIAN BRIDGE, ROCK ISLAND COUNTY, MOLINE, ILLINOIS (1 Sheet submitted via April 14, 2014 email from Missman, Inc.).

Examined and Recommended:

Michael L. Diedrichsen, Acting Manager
Downstate Regulatory Programs

Approval Recommended:

Dan Injerd, Director
Office of Water Resources

Approved:

Wayne A. Rosenthal, Director
Department of Natural Resources

This PERMIT is subject to the terms and special conditions contained herein.

THIS PERMIT IS SUBJECT TO THE FOLLOWING CONDITIONS:

1) This permit is granted in accordance with the Rivers, Lakes and Streams Act "615 ILCS 5."

2) This permit does not convey title to the permittee or recognize title of the permittee to any submerged or other lands, and furthermore, does not convey, lease or provide any right or rights of occupancy or use of the public or private property on which the activity or any part thereof will be located, or otherwise grant to the permittee any right or interest in or to the property, whether the property is owned or possessed by the State of Illinois or by any private or public party or parties.

3) This permit does not release the permittee from liability for damage to persons or property resulting from the work covered by this permit, and does not authorize any injury to private property or invasion of private rights.

4) This permit does not relieve the permittee of the responsibility to obtain other federal, state or local authorizations required for the construction of the permitted activity; and if the permittee is required by law to obtain approvals from any federal or other state agency to do the work, this permit is not effective until the federal and state approvals are obtained.

5) The permittee shall, at the permittee's own expense, remove all temporary piling, cofferdams, false work, and material incidental to the construction of the project. If the permittee fails to remove such structures or materials, the Department may have removal made at the expense of the permittee.

6) In public waters, if future need for public navigation or other public interest by the state or federal government necessitates changes in any part of the structure or structures, such changes shall be made by and at the expense of the permittee or the permittee's successors as required by the Department or other properly constituted agency, within sixty (60) days from receipt of written notice of the necessity from the Department or other agency, unless a longer period of time is specifically authorized.

7) The execution and details of the work authorized shall be subject to the review and approval of the Department. Department personnel shall have the right of access to accomplish this purpose.

8) Starting work on the activity authorized will be considered full acceptance by the permittee of the terms and conditions of the permit.

9) The Department in issuing this permit has relied upon the statements and representations made by the permittee; if any substantive statement or representation made by the permittee is found to be false, this permit will be revoked; and when revoked, all rights of the permittee under the permit are voided.

10) In public waters, the permittee and the permittee's successors shall make no claim whatsoever to any interest in any accretions caused by the activity.

11) In issuing this permit, the Department does not ensure the adequacy of the design or structural strength of the structure or improvement.

12) Noncompliance with the conditions of this permit will be considered grounds for revocation.

13) If the construction activity permitted is not completed on or before December 31, 2018, this permit shall cease and be null and void.

THIS PERMIT IS SUBJECT TO THE FOLLOWING SPECIAL CONDITIONS:

a) Plans and specifications of the proposed floating causeway shall be submitted to, and approved by, the Illinois Department of Natural Resources, Office of Water Resources before being installed.

b) Incidental Take Authorization for state-listed mussels shall be obtained from the Illinois Department of Natural Resources, Office of Resource Conservation prior to project initiation.

c) Bridge removal shall be conducted such that it will not unnecessarily interfere with navigation of the river or create a hazard to boating safety.

d) The temporary causeway shall be completely removed upon completion of construction.