PERMIT REQUIREMENTS FOR THE STATE OF ILLINOIS

JOINT APPLICATION PROCESS

Construction projects in Illinois waterways, floodplains and wetlands often require both State and Federal authorization. This application packet is designed to simplify the approval process for the applicant seeking project authorizations from the U.S. Army Corps of Engineers (USCOE), The Illinois Department of Natural Resources/Office of Water Resources (IDNR/OWR) and the Illinois Environmental Protection Agency (IEPA). Please refer to the map on page 11 for agency addresses and telephone numbers. Each of these agency's authorities and requirements are briefly explained in the following paragraphs. Application forms are available from any of the listed agencies.

Anyone proposing to construct, operate or maintain any dam, dock, pier, wharf, sluice, levee, dike, building, utility and road crossings, piling, wall, fence or other structure in; or dredge, fill or otherwise alter the bed or banks of any stream, lake, wetland, floodplain or floodway subject to State or Federal regulatory jurisdiction should apply for agency approvals. The appropriate copy of the **joint application form, drawings,** and **copy of any additional support information** should be sent to each of the regulatory agencies. Approvals may be required by any or all of the agencies. Applications filed simultaneously with the USCOE, IDNR/OWR, and IEPA will be processed concurrently in an independent manner, and should result in expedited receipt of all agency determinations. If a permit is not required by one or more of the agencies, they will inform the applicant and the other agencies.

Coordination with the regulatory and other review agencies is recommended as early as possible during the project planning stage. This allows revisions or other measures necessary to meet agency requirements to be made before project plans are finalized.

AGENCY AUTHORITIES AND REQUIREMENTS

1. The basis for the **U.S. Army Corps of Engineers** regulatory function over public waterways was formed in 1899 when Congress passed the Rivers and Harbors Act of 3 March 1899. Until 1968, the Rivers and Harbors Act of 1899 was administered to protect only navigation and navigable capacity of this nation's waters. In 1968, in response to a growing national concern for environmental values, the policy for review of permit applications with respect to Sections 9 and 10 of the Rivers and Harbors Act was revised to include additional factors (fish and wildlife conservation, pollution, aesthetics, ecology, and general Welfare) besides navigation. This new type of review was identified as a "public interest review."

The Corps of Engineers regulatory function was expanded when Congress passed the Federal Water Pollution Control Act Amendments of 1972 and the Clean Water Act Amendments in 1977. The purpose of the Clean Water Pollution Act was to restore and maintain the chemical, physical, and biological integrity of this nation's waters. The "waters of the United States" regulated by the Corps of Engineers under Section 404 of the Clean Water Act includes wetlands.

The Corps of Engineers is responsible for determining the jurisdictional limits of wetlands and other Waters of the United States. Applicants may, however, elect to have a qualified representative conduct the appropriate preliminary wetland delineation for submittal with the permit application. All such determinations are subject to verification and confirmation by the Corps of Engineers. Although applicants are not required to provide a wetland delineation, these can assist in reducing delays associated with normal permit processing. Contact the appropriate Corps District Office for additional information.

WITH YOUR HELP ILLINOIS WATERS CAN BE PROTECTED FOR FUTURE GENERATIONS

2. **The Illinois Department of Natural Resources/Office of Water Resources** regulatory authority is the Rivers, Lakes and Streams Act (615 ILCS, 1994). Under this authority, permits are required for dams, for any construction within a public body of water; and for construction within floodways. Generally, floodway projects also require local authorization. In addition, floodway map revision approvals may be required by IDNR/OWR and by the Federal Emergency Management Agency (FEMA) for major projects. Information and specific project requirements may be obtained as follows:

For Lake Michigan – All projects in or along Lake Michigan are subject to the Regulation of Public Waters rules (17 Illinois Administrative Code, Part 3704). Joint permits are required for any work in Lake Michigan from IDNR/OWR and IEPA. Contact the Illinois Department of Natural Resources/Office of Water Resources, Lake Michigan Management Section, 160 N. LaSalle Street, Suite S-700, Chicago, Illinois 60601, (312) 793-3123, or on the web www.dnr.state.il.us/owr/ResmanPermitProgs.htm.

For Cook, Lake, McHenry, DuPage, Kane and Will Counties – All projects within designated floodways are subject to the Floodway Construction in Northeastern Illinois Rules (17 Illinois Administrative Code Part 3708). Dams are subject to the Rules for Construction and Maintenance of Dams (17 Illinois Administrative Code, Part 3702). All projects in public waters are subject to the Regulation of Public Waters Rules (17 Illinois Administrative Code, Part 3704). All other Floodway construction projects are subject to the Construction in Floodways of Rivers, Lakes and Streams rules (17 Illinois Administrative Code, Part 3700). Contact the Illinois Department of Natural Resources/Office of Water Resources, Northeastern Illinois Regulatory Programs Section, 2050 West Stearns Road, Bartlett, Illinois 60103, (847) 608-3100 ext 2025 or on the web www.dnr.state.il.us/owr/ResmanPermitProgs.htm.

For the remainder of the State – Dams are subject to the Rules for Construction and Maintenance of Dams (17 Illinois Administrative Code, Part 3702). All projects in public waters are subject to the Regulation of Public Waters rules (17 Illinois Administrative Code, Part 3704). All other Floodway construction projects are subject to the Construction in Floodways of Rivers, Lakes and Streams rules (17 Illinois Administrative Code, Part 3700). Contact the Illinois Department of Natural Resources/Office of Water Resources, Downstate Regulatory Programs Section, One Natural Resources Way, Springfield, Illinois 62702-1271, (217) 782-3863, or on the web www.dnr.state.il.us/owr/ResmanPermitProgs.htm.

The **Illinois Department of Natural Resources** is also responsible under Illinois Statutes for conserving and preserving the State's natural resources.

Under the provisions of the Fish and Wildlife Coordination Act (16 U.S.C. 661-664) the Department is given permit review responsibilities relative to Corps of Engineers permit applications.

Under the Illinois Endangered Species Protection Act and the Illinois Natural Areas Preservation Act, the Department is responsible for reviewing actions that are authorized, funded or performed by units of state and local government, if the action will change environmental conditions. Questions pertaining to natural resource reviews should be addressed to the Illinois Department of Natural Resources, Division of Ecosystems & Environment, Impact Assessment, One Natural Resources Way, Springfield, Illinois 62702-1271, (217) 785-5500. To submit a request for consultation on-line, go to http://www.dnrecocat.state.il.us/ecopublic/.

3. **The Illinois Environmental Protection Agency** provides water quality certification pursuant to Section 401 of the Clean Water Act. This certification is mandatory for all projects requiring a Section 404 Permit from the Corps of Engineers. In addition to determining that the proposed work will not violate the applicable water quality standards, the IEPA also makes a determination of additional permit and regulatory requirements pursuant to the Illinois Pollution Control Board rules and regulations. Additional permits may be required for activities such as the construction of sanitary sewers, water mains, sewage and water treatment plants, landfill and mining activities, special waste hauling and disposal (of dredged material). Separate applications are necessary for these other permits.

Individual 401 Water Quality Certification
If it is determined that your project is not covered by an Illinois EPA certified Section 404 nationwide or regional permit issued by the Corps of Engineers and an individual 401 water quality certification is required for your project, you must submit the information specified below and in blocks 9 through 12 in the instructions for dredge and/or fill material to be discharged. In accordance with 35 Ill. Adm. Code Part 302.105, applicants for an individual 401 water quality certification shall provide the Illinois EPA with an anti-degradation report discussing the items listed below, including supporting documentation. In regards to the anti-degradation requirements, it is recommended that you contact the Illinois EPA Water Quality Standards Unit at 217-558-2012 or on the web at epa.401.docs@illinois.gov prior to submittal of your application.

- An assessment of the alternatives to the proposed project that will result in a reduced pollutant load to the water body, no load increase or minimal environmental degradation. Alternatives that result in no discharge to the water body and changes in the location of the activity must be addressed in the submittal. Further, the assessment of alternatives must consider all technically and economically reasonable measures to avoid or minimize the pollutant loading;

- If a pollutant load increase or environmental degradation cannot be avoided (e.g. wetlands are filled), a complete mitigation plan must be provided or reasons provided why mitigation is not proposed;

- Identification and characterization (e.g., the current physical, biological and chemical conditions) of the water body affected by the proposed project and the water body's existing uses, including a wetland delineation report and drainage area (in acres) of the impacted water bodies at the downstream limits of the project area;

- Consideration of the fate and effects of parameters that are proposed to increase the pollutant loading;

- The quantity of the pollutant load increase to the water body. Increases in pollutant loading must be protective of all existing uses of the impacted water body;

- The potential impacts of the proposed project on the water body. The proposed activity must be conducted in a manner that water quality standards are not violated;

- The purpose and anticipated benefits of the proposed project. Benefits for the applicant as well as benefits to the community at large must be discussed.

If an individual 401 Water Quality Certification is required, it is recommended that you contact the Illinois EPA, Bureau of Water, Division of Water Pollution Control, Facility Evaluation Unit, 1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois 62794-9276, (217) 782-3362, or on the web at epa.401.docs@illinois.gov regarding application and anti-degradation assessment requirements.

4. If the project involves the construction of a power plant, utility pipelines, electric transmission of distribution lines, Illinois Commerce Commission approval may be required.

5. Also, depending on the location and type of work to be performed, there may be additional local government approvals required.

INSTRUCTIONS

General

Provide a complete and accurate application (form, drawings, and support information) concerning your project. If the application is incomplete or unacceptable, it will be returned. This usually results in delaying the evaluation of your application.

Four copies of the application form and drawing sheets are required. Submit one copy of the completed application form and drawings to each agency specified on the bottom of each form. The mailing address and telephone number of each agency is provided beginning on Page 8. The copy labeled "Applicant's Copy" is for the applicant's records. Send one copy to the appropriate Corps of Engineers office, one copy to the Illinois EPA and one copy to the appropriate Illinois DNR office. In addition, if available, sending an electronic copy of your application, plans, drawings, etc. to each agency would be appreciated. The application form may be photocopied.

IF YOU NEED ASSISTANCE IN FILLING OUT THE APPLICATION FORM, PLEASE CALL ANY AGENCY OFFICE LISTED.

Additional information may be required by any or all of the agencies before further processing of your application may proceed. The applicant will, however, be notified of such needs by the agencies.

Specific instructions on completing the form and the information to be provided on the drawings are provided below.

DISCLOSURE STATEMENT

Information in the application is a matter of public record. Disclosure of the information is voluntary; however, the data requested are necessary in order to communicate with the applicant and to evaluate the permit application. If necessary information is not provided, the permit application cannot be processed nor can a permit be issued.

18 United States Code, Section 1001, provides that who ever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up by any trick, scheme, or disguises a material fact or makes any false, fictitious, or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than 5 years or both.

APPLICANTS MUST OBTAIN ALL APPROVALS BEFORE WORK CAN BE STARTED. PROCEEDING WITHOUT THE REQUIRED PERMITS IS AGAINST STATE AND FEDERAL LAWS AND MAY RESULT IN LEGAL PROCEEDINGS AND FINES.

SPECIAL INSTRUCTIONS FOR COMPLETING THE JOINT APPLICATION FORM

Blocks 1 and 2 For Agency Use. To be completed by Corps of Engineers and/or Illinois Department of Natural Resources and/or Illinois Environmental Protection Agency.

Block 3(a and b) Applicant(s). The applicant(s) shall be the person(s), firm(s), corporation(s), etc who have or will have the responsibility for the property on which the project will be located by reason of ownership, easement, or other agreement. If the property is not presently owned by the applicant, attach an explanation of any easements or rights-of-way which have been or will be obtained or how such land will be acquired. If a project is being proposed by a lessee, the lessee and lessor should be joint applicants. In some instances, agency staff may request additional information on all parties having a legal or equitable interest in the involved land.

Applicant's Name. Enter the name of the responsible party or parties. If the responsible party is an agency, company, corporation, or other organization, indicate the name of the organization and responsible officer and title. If more than one party is associated with the application, please attach a sheet with the necessary information marked Block 5.
Address of Applicant. Please provide the full mailing address of the party or parties responsible for the application.
Email Address of Applicant. Please provide the email address of the party or parties responsible for the application.
Applicant Telephone Number(s). Please provide the number where you can usually be reached during normal business hours. Include a fax number if available.
List all applicants. Space has been provided for the listing of two applicants. Attach an additional sheet (marked Block 3) if more space is needed.

Block 4 – Authorized Agent. If the applicant designates an authorized agent for the purpose of obtaining the permits, list the name, address, email address, phone and fax numbers of the authorized agent in Block 4. During the permit process, all correspondence, such as requests for additional information, will be sent to the authorized agent.
Authorized Agent's Name and Title. Indicate name of individual or agency, designated by you, to represent you in this process. An agent can be an attorney, builder, contractor, engineer, or any other person or organization. Note: An agent is not required.
Agent's Address and Telephone Number. Please provide the complete mailing address of the agent, along with the telephone and fax numbers where he / she can be reached during normal business hours.
Statement of Authorization. To be completed by applicant, if an agent is to be employed.

Block 5. Names and Mailing Addresses of Adjoining Property Owners, Lessees, etc., Whose Property Adjoins the Project Site. List complete names and full mailing addresses of the adjacent property owners (public and private) lessees, etc., whose property adjoins the water body or aquatic site or whose property is in visual reach where the work is being proposed so that they may be notified of the proposed activity (usually by public notice). If more space is needed, attach an extra sheet of paper marked Block 5.
Information regarding adjacent landowners is usually available through the office of the tax assessor in the county or counties where the project is to be developed.

Block 6. Proposed Project Name or Title. Please provide name identifying the proposed project, e.g., Landmark Plaza, Rolling Hills Subdivision, or Edsall Commercial Center.

Block 7. Project Location.
Latitude and Longitude. Enter the latitude and longitude of where the proposed project is located.
UTMs Northing and Easting. Enter the Northing and Easting coordinates of where the proposed project is located. Include coordinate system information.
Proposed Project Street Address. If the proposed project is located at a site having a street address (not a box number), please enter it here.
Other Location Descriptions. Please provide the Section, Township, and Range of the site, and / or local Municipality that the site is located in or near, as well as the County, State and Zip code.
Name of Waterway. Please provide the name of any stream, lake, marsh, or other waterway to be directly impacted by the activity. If it is an unnamed stream, identify the waterway the tributary stream enters. If a large river or stream, include the river mile of the proposed project site if known.

Directions to the Site. On a separate sheet, please provide directions to the site from a known location or landmark. Include highway and street numbers as well as names. Also provide distances from known locations and any other information that would assist in locating the site. You may also provide description of the proposed project location, such as lot numbers, tract numbers, or you may choose to locate the proposed project site from a known point (such as the right descending bank of Smith Creek, one mile downstream from the Highway 14 bridge). If a large river or stream is within the vicinity of the project, include the river mile of the proposed project site, if known.

Block 8. Project Description. Describe the overall activity or project. Give appropriate dimensions of structures such as wing walls, dikes (identify the materials to be used in construction, as well as the methods by which the work is to be done), or excavations (length, width, and height). Indicate whether discharge of dredged or fill material is involved. Also, identify any structure to be constructed on a fill, piles, or float-supported platforms. The written descriptions and illustrations are an important part of the application. Please describe, in detail, what you wish to do. If more space is needed, attach an extra sheet of paper marked Block 7.

Block 9. Project Purpose and Need. Describe the purpose and need for the proposed project. What will it be used for and why? Also include a brief description of any related activities to be developed as the result of the proposed project. Give the approximate dates you plan to both begin and complete all work.
If additional space is needed, attach an extra sheet of paper marked Block 8.

COMPLETE THE FOLLOWING FOUR BLOCKS IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED. If the project requires an individual 401 water quality certification from Illinois EPA, provide Illinois EPA with the anti-degradation assessment report, material analysis data, mitigation plan and other information identified in item 3 under Agency Authorities and Requirements of these instructions.

Block 10. Reasons for Discharge. If the activity involves the discharge of dredged and/or fill material into a wetland or other water body, including the temporary placement of material, explain the specific purpose of the placement of the material (such as erosion control).

Block 11. Types of Material Being Discharged and the Amount of Each Type in Cubic Yards and Acres. Describe the material to be discharged and amount of each material to be discharged within Corps jurisdiction. Please be sure this description agrees with your illustrations. Discharge material includes: soil, rock, sand, clay, concrete, etc.

Block 12. Surface Areas of Wetlands or Other Waters Filled. Describe the area to be filled at each location. Specifically identify the surface areas, or part thereof, to be filled. Also include the means by which the discharge is to be done (backhoe, dragline, etc.). If dredged material is to be discharged on an upland site, identify the site and the steps to be taken (if necessary) to prevent runoff from the dredged material back into a water body. If more space is needed, attach an extra sheet of paper marked Block 11.

Block 13. Description of Avoidance, Minimization, and Compensation. Provide a brief explanation describing how impacts to waters of the United States are being avoided and minimized on the project site. Also provide a brief description of how impacts to waters of the United States will be compensated for, if mitigation is required. If additional space is needed, attach an extra sheet of paper marked Block 12.

Note: You will need to submit additional information for evaluation of the permit application, including a wetland delineation report; avoidance, minimization and alternatives analysis report; and mitigation plan. This information must be submitted to Illinois EPA, prior to completion of review and public notice of an anti-degradation assessment for the individual 401 water quality certification. This information will also be required by the Corps of Engineers prior to issuance of the Section 404 permit.

Block 14. Date activity is proposed to commence and completed. Please provide the date (if known) that you intend to start work, as well as the date work should be completed.

Block 15. Is Any Portion of the Work Already Complete? Provide all background information on those portions of the proposed project already completed. Describe the area already developed, structures completed, any dredged or fill material already discharged, the type of material, volume in cubic yards, and acres or square feet filled if discharge occurred in a wetland or other water body. If the work was done under an existing Corps permit, identify the authorization, if possible.

Block 16. Information about Approvals or Denials by Other Agencies. You may need the approval of other federal, state, or local agencies for your project. Identify any applications you have submitted and the status, if any (approved or denied) of each application. You need not have obtained all other permits before applying for a Corps permit.

Block 17. Consent to enter property listed in Block 7.

Block 18. Application Verification. The signature shall be an affirmation that the party applying for the permit possesses the requisite property rights to undertake the activity applied for (including compliance with special conditions, mitigation, etc.).

The application must be signed by each applicant. However, the application may be signed by a duly authorized agent (Name in Block 4) if this form is accompanied by a statement by the applicant(s) designating the agent.

NOTE:

a. If the applicant is a corporation, the president or other authorized officer shall sign the application form.

b. If the applicant is a county, city or other political subdivision, the application form shall be assigned by an appropriate authorized officer.

c. If the applicant is a partnership, each partner shall sign the application form.

d. If the applicant is a trust, the trust officer shall sign the name of the trustee by him (or her) as trust officer. A disclosure affidavit must be filed with the application, identifying each beneficiary of the trust by name and address and defining the respective interest therein.

DRAWINGS AND ILLUSTRATIONS

General Information.

Three types of illustrations are needed to properly depict the work to be undertaken. These illustrations or drawings are identified as a Vicinity/Location Map, a Plan View and a Typical Cross-Section Map. Please submit one original, or good quality copy, of all drawings on 8½ x11 inch plain white paper (electronic media may be substituted). Use the fewest number of sheets necessary for your drawings or illustrations.

Each illustration should identify the project, the applicant, and the type of illustration (vicinity map, plan view, or cross-section).

While illustrations need not be professional (many small, private project illustrations are prepared by hand), they should be clear, accurate, and contain all necessary information.

Certified engineering plans may be submitted in lieu of the drawing sheets if the magnitude of the project warrants.

(1) A vicinity/location map which shows:

a. project site;
b. name of waterway;
c. name of and distance to local town, community or other identifying location such as roads; and
d. north arrow.

(2) A plan (overhead) view of the project showing:

a. existing wetland boundary and shoreline of all waterways, including the normal water surface elevation (if mean sea level datum is not used, adjustment should be indicated):
b. adjacent property lines and ownership as listed in the application form;

c. principal dimensions of the structure or work and extent of encroachment into the waterway (as measured from a fixed structure or object);

d. floodway/floodplain lines if established and if known;

e. north arrow; and

f. graphic or numerical scale.

(3) A cross-sectional view of the project showing:

a. wetland boundary and/or shoreline, elevations, extent of encroachment, principal dimensions of the work as shown in plan view; and

b. graphic or numerical scales (horizontal and vertical).

AGENCY MAILING ADDRESSES

Send appropriate copies of the completed application to each agency listed below. (Agencies are specified at the bottom of each sheet in the packet.)

For U.S. Army Corps of Engineers (refer to the IL Regulatory Jurisdictional Boundary Map for your District office):

U.S. Army Corps of Engineers, Rock Island
ATTN: Regulatory Branch
Clock Tower Building
Post Office Box 2004
Rock Island, IL 61204-2004

U.S. Army Corps of Engineers, Chicago District
ATTN: Regulatory Branch
231 S. LaSalle Street, Suite 1500
Chicago, IL 60604

US Army Corps of Engineers, St. Louis District
ATTN: Regulatory Branch
1222 Spruce St.
St. Louis, MO 63103-2833

U.S. Army Corps of Engineers, Louisville District
ATTN: Regulatory Branch
P.O. BOX 59
Louisville, KY 40201-0059

U.S. Army Corps of Engineers, Memphis District
ATTN: Regulatory Branch
167 North Main, B-202
Memphis, TN 38103-1894

Your application to the Illinois Environmental Protection Agency should request Section 401 water quality certification.

Illinois Environmental Protection Agency
Bureau of Water
Division of Water Pollution Control
Facility Evaluation Unit
1021 North Grand Avenue East
Post Office Box 19276
Springfield, IL 62794-9276

For the Illinois Department of Natural Resources

For the majority of the state:

Illinois Department of Natural Resources
Office of Water Resources
Downstate Regulatory Programs Section
One Natural Resources Way
Springfield, IL 62702-1271

For Cook, Lake, McHenry, DuPage, Kane and Will Counties (including all of Chicago District):

Illinois Department of Natural Resources
Office of Water Resources
Northeastern Illinois Regulatory Programs Section
2050 West Stearns Road
Bartlett, IL 60103

For Lake Michigan:

Illinois Department of Natural Resources
Office of Water Resources
Lake Michigan Management Section
160 N. LaSalle Street
Suite S-700
Chicago, IL 60601

In addition, you should complete and submit the attached certification sheet to the Illinois State agencies (the Illinois Department of Natural Resources and the Illinois Environmental Protection Agency) along with your application. The Corps of Engineers does not require this certification.

IMPORTANT:

Mitigation for wetland or stream impacts resulting from your proposed actions may be a permit requirement. Prior to completing your application, it is recommended that you read through the Wetland Mitigation information available on the Web at: http://www2.mvr.usace.army.mil/Regulatory/ . (Click on Wetland Mitigation to open the link to the documents.) This may help you avoid or minimize wetland and stream impacts, thus reducing or eliminating the requirement for mitigation.

Illinois State Permit Applicants

Illinois State Law requires individuals to certify that they are not delinquent in the payment of child support before State agencies can accept applications for State permits, certifications, etc. You must complete the following statement and include it with copies of the joint permit applications you send to the Illinois Department of Natural Resources and the Illinois Environmental Protection Agency. The Corps of Engineers does not require a copy of this statement.

WARNING: Failure to fully complete one of the following certifications will result in rejection of this application. Making a false statement may subject you to contempt of court.

I hereby certify, under penalty of perjury, that I am not more than 30 days' delinquent in complying with a child support order [5 ILCS 100/10-65(c)].

______________________________ Applicant's Signature

______________________________ Applicant's Social Security Number

OR

I hereby certify, under penalty of perjury, that the permit applicant is a governmental or business entity and, therefore, not subject to child support payment requirements.

Patrick Wiseley

Applicant's Name

Patrick Wiseley - QC/Senior Project Manager

Applicant's Representative Signature and Title

JOINT APPLICATION FORM FOR ILLINOIS

ITEMS 1 AND 2 FOR AGENCY USE

1. Application Number	2. Date Received

3. and 4. (SEE SPECIAL INSTRUCTIONS) NAME, MAILING ADDRESS AND TELEPHONE NUMBERS

3a. Applicant's Name:	3b. Co-Applicant/Property Owner Name (if needed or if different from applicant):	4. Authorized Agent (an agent is not required):
Patrick Wiseley P.E.	City of Moline - Rodd Schick (Contact)	N/A
Company Name (if any) : Lunda Construction Company	Company Name (if any):	Company Name (if any):
Address: 620 Gebhardt Road, Black River Falls, WI 54615	Address: 3635 4th Avenue Moline, IL 61265	Address:
Email Address: pwiseley@lundaconstruction.com	Email Address: rschick@moline.il.us	Email Address:
Applicant's Phone Nos. w/area code	Applicant's Phone Nos. w/area code	Agent's Phone Nos. w/area code
Business: (715) 284-9491	Business: (309) 524-2401	Business:
Residence: (920) 450-1357	Residence:	Residence:
Cell: (920) 450-1357	Cell:	Cell:
Fax: (715) 284-9146	Fax:	Fax:

STATEMENT OF AUTHORIZATION

I hereby authorize, (N/A) to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

Applicant's Signature ______________________ Date ______________________

5. ADJOINING PROPERTY OWNERS (Upstream and Downstream of the water body and within Visual Reach of Project)

Name	Mailing Address	Phone No. w/area code
a. City of Moline	3635 4th Avenue St. Moline, IL 61265	309-524-2401
b.		
c.		
d.		

6. PROJECT TITLE:
Bridge Replacement - I-74 River Bridges between Bettendorf, IA and Moline, IL

7. PROJECT LOCATION:

LATITUDE: 41.30039 °N LONGITUDE: 90.27461 °W	UTMs Northing: 567500 Easting: 2471949				
STREET, ROAD, OR OTHER DESCRIPTIVE LOCATION 5417 Old River Road	LEGAL DESCRIPT	QUARTER	SECTION	TOWNSHIP NO. T18N	RANGE R1W

☐ IN OR ☒ NEAR CITY OF TOWN (check appropriate box)
Municipality Name
City of Moline

COUNTY	STATE	ZIP CODE
Rock Island	IL	61265

WATERWAY: Mississippi River

RIVER MILE (if applicable): 488

Revised 2010

☐ Corps of Engineers ☐ IL Dept of Natural Resources ☐ IL Environmental Protection Agency ☐ Applicant's Copy

8. PROJECT DESCRIPTION (Include all features):

Propose temporary installation of roll off piers on land along the water front owned by the City of Moline. This project also includes three temporary 24-inch diameter mooring piles in the Mississippi River. The mooring pile may be installed as soon as permitted and would be removed upon completion of I-74/Mississippi River bridge project by December 31, 2021. It is Lunda's intent to only build the temporary roll off piers which will not be in the waterway. Lunda is submitting the permit application for the three temporary 24-inch mooring piles as a contingency plan.

9. PURPOSE AND NEED OF PROJECT:

A temporary roll off piers are required to transport personnel, construction materials, and equipment to build the new twin I-74 Arch Bridges over the Mississippi River.

COMPLETE THE FOLLOWING FOUR BLOCKS IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

10. REASON(S) FOR DISCHARGE:

11. TYPE(S) OF MATERIAL BEING DISCHARGED AND THE AMOUNT OF EACH TYPE IN CUBIC YARDS FOR WATERWAYS:

TYPE:

AMOUNT IN CUBIC YARDS:

12. SURFACE AREA IN ACRES OF WETLANDS OR OTHER WATERS FILLED (See Instructions)

13. DESCRIPTION OF AVOIDANCE, MINIMIZATION AND COMPENSATION (See instructions)

14. Date activity is proposed to commence: 03/31/2020

Date activity is expected to be completed: 12/31/2021

15. Is any portion of the activity for which authorization is sought now complete? Yes ☐ No ☒

Month and Year the activity was completed

NOTE: If answer is "YES" give reasons in the Project Description and Remarks section. Indicate the existing work on drawings.

16. List all approvals or certification and denials received from other Federal, interstate, state, or local agencies for structures, construction, discharges or other activities described in this application.

Issuing Agency	Type of Approval	Identification No.	Date of Application	Date of Approval	Date of Denial

17. CONSENT TO ENTER PROPERTY LISTED IN PART 7 ABOVE IS HEREBY GRANTED. Yes No

18. APPLICATION VERIFICATION (SEE SPECIAL INSTRUCTIONS)

Application is hereby made for the activities described herein. I certify that I am familiar with the information contained in the application, and that to the best of my knowledge and belief, such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities.

[signature] — Signature of Applicant or Authorized Agent — Date: 2/13/2020

[signature] — Signature of Applicant or Authorized Agent — Date: 2/14/2020

Signature of Applicant or Authorized Agent — Date

☐ Corps of Engineers ☐ IL Dep't of Natural Resources ☐ IL Environmental Protection Agency ☐ Applicant's Copy

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SEE INSTRUCTIONS FOR ADDRESS

LOCATION MAP

See Attachment #A

Revised 2010

☐ Corps of Engineers ☐ IL Dep't of Natural Resources ☐ IL Environmental Protection Agency ☐ Applicant's Copy

PLAN VIEW

See Attachment #H

FOR AGENCY USE ONLY

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☐ Corps of Engineers ☐ IL Dep't of Natural Resources ☐ IL Environmental Protection Agency ☐ Applicant's Copy

Illinois Department of Natural Resources
CONSERVATION PLAN

(Application for an Incidental Take Authorization)

Per 520 ILCS 10/5.5 and 17 Ill. Adm. Code 1080

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

PROJECT APPLICANT: **Lunda Construction Company**

PROJECT NAME: **Mooring Pile for Roll off Piers Application**

COUNTY: **Rock Island**

AREA OF IMPACT (acreage): **The area of impact is limited to the installation of three 24-inch diameter mooring piles and up to twelve 36-inch diameter barge spudding locations. Estimated total acreage of the impact is 0.008 acres.**

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

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

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

Response: Lunda Construction Company is proposing to install three mooring piles in the Mississippi River at Ben Butterworth Park to help facilitate the construction of the I-74 bridge across the Mississippi River. The option(s) discussed in this Conservation Plan are proposed as a **contingency plan** only, should the elevation of the Mississippi River prohibit a no-impact option as defined and described separately.

The project is located in Township 18N, Range 01W in Rock Island County. **Attachment A** is the location map of the area along with an aerial photo. **Attachment B** is the Supervisor's Assessment Map of the location. **Attachment C** includes driving directions to 5417 Old River Drive, Moline, Illinois; the proposed work site. The owner of the property is the City of Moline. The contact for the City of Moline is Mr. Rodd Shick (309) 524-2401.

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

Response: Four relevant surveys/reports are included as appendices to this submittal. The reports provided information on the affected species including life history needs and habitat characteristics. They include:

- Characterization of Unionid Communities at Potential Relocations Areas for the Interstate 74 Bridge Replacement Project, Mississippi River Pools 14 – 16 dated October 2015. See **Attachment D**.

- I-74 Biological Opinion dated July 18, 2016. See **Attachment E**.

- Year 2 Monitoring of Unionids Relocated from the New Interstate 74 Bridge Crossing, Mississippi River Pool 15 dated April 2019. See **Attachment F**.

- I-74 Bridge Replacement Project Illinois Department of Natural Resources Conservation Plan. See **Attachment G**.

The Action Area was initially surveyed in 2015 as part of the relocation efforts for the I-74 Bridge project. Information on the original survey for this area can be found in **Attachment D**. Page 20 of **Attachment D** provides a base map of the density of mussels originally found at the proposed Action Area, located within the "Upstream" site. Table 4-1 in **Attachment D** provides a summary of the species found during investigations conducted from July-August 2015.

Iowa Department of Transportation also relocated mussels to the proposed Action Area from August 1, 2016 through October 25, 2016. The most recent report on this is the Year 2 Monitoring of Unionids Relocated from the New Interstate 74 Bridge Crossing, which can be found in **Attachment F**. See page 30 for a basemap and page 37 for population densities in the relocated areas just upstream of the Action Area (**Attachment F**).

Evaluation of the 2015 survey data found in Characterization of Unionid Communities at Potential Relocation Areas (**Attachment D**) concluded that the potential species of concern in this proposed Action Area are limited to:

- Higgins-eye pearlymussel (*Lampsilis higginsii)*
- Butterfly (*Ellipsaria lineolata)*
- Black Sandshell (*Ligumia recta)*

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

Response: Project activities include:

- Construction of temporary roll off piers on shore (**Attachment H**)

- Installation of three 24-inch diameter mooring piles with barge spudding at six locations (**Attachment H**)

- Transporting the I-74 Arch Deck modules onto barges and then downstream to the I-74 Bridge

- Removal of the roll off piers and three mooring piles with barge spudding at six locations

Detailed Construction Sequence:

Construction will start with Lunda mobilizing to the project site and installing erosion control devices as necessary. Minimal ground disturbance, if any, is expected with the proposed construction. If necessary, Lunda will place silt fence or erosion control socks around the pile bent construction. Inlet protection may also be installed on Old River Drive to prepare the site for construction. Lunda is already conducting weekly erosion control inspections at the Arch deck yard area, and the proposed roll off pier area will be included with those regularly scheduled inspections.

A crane will then be assembled to build the roll off piers. Construction of the roll off piers and support system will occur from land. Next, a surveyor will locate the pile driving locations. The crane will then be placed into position and twelve piles will be driven into the ground to create the support system for the two roll off ramps. The piles will be cut off to the correct grade and support bents will be welded to the support piles. The crane will then move the prefabricated steel ramps and set them into position on the pile supported bents. The crane ramps can be moved up and down via jacks on the support bents. See **Attachment H** for a drawing of the proposed construction.

Lunda will then create a roadbed surface with crushed stone from the existing Arch deck assembly yard extending across Old River Drive, through the existing parking lot to the prefabricated steel ramps. This will provide a smooth and level surface for the Arch deck modules to be transported via Self Propelled Modular Transporters (SPMTs) from the Arch deck yard to the ramps. Lunda is expecting that it will take two to three weeks to build the ramp pier and place the necessary stone up to the steel ramps.

Lunda will also start construction of the three mooring piles in the River during construction of the roll off piers on land. Lunda will use its existing temporary dock facility near the I-74 Bridge and load the drill rig and mooring pile materials onto a barge. One of Lunda's tugboats will then transport the barge upstream to the Action Area. There are two spuds on the barge. Once the barge has been located, the two spuds will be lowered into the river bed to hold barge position. The final mooring pile location will then be confirmed by Lunda's surveyor.

The mooring pile installation process is next. First, the drilling subcontractor will place a temporary steel casing down into the river bottom at the proposed mooring pile location. The temporary steel casing will be above the water level and will prevent disturbed water during the drilling operations from reaching the Mississippi River. Next, the drill rig will drill a hole inside the temporary casing approximately 10 feet into the bedrock for the mooring pile. The spoils from the drilling operations will be placed in steel catch boxes located on the barge. Next, the 24-inch diameter steel mooring pile will be lowered into the temporary steel casing down into the drill hole. The mooring pile will then be filled with pea gravel. The temporary casing will then be pulled, and the barge will move to the next location. This operation will be repeated for the other two mooring pile locations and will take up to two weeks to complete. Once completed, the barge will be taken back by a tugboat to the I-74 temporary dock. There, the drill spoils in the steel catch boxes will be loaded onto a dump truck and the material will be properly disposed of. The following picture shows typical mooring piles near the existing I-74 bridge:

Once the roll off pier and the mooring pile are complete, the next step is to load the Arch deck modules onto the barges. Three barges will be used to transport the six Arch deck modules downstream to the new I-74 Bridge. As can be seen in **Attachment H**, two of the barges are 35′ x 195′ long and the third barge is 50′ x 150′ long. The SPMT train with the Arch deck module will be loaded onto the two 35′ x 195′ barges. The third 50′ x 150′ barge will be used to help position the two SPMT barges. Two tugboats will help bring the barges into position, and the ramps will be lowered down onto the barges. The tug boats will then leave and assist with I-74 construction operations. The SPMTs will be loaded with an Arch deck module, and they will drive from the Arch deck yard across Old River Drive up onto the ramps and then onto the waiting barges. Lunda anticipates that the barges will be located at the ramp for approximately three days. Once the Arch deck module is on the barges, the two tug boats will hook up to the barges, the ramps will be lifted, and the tug boats will take the Arch deck module downstream to the I-74 river bridge. The Arch deck module will then be lifted into place from the barges. Once that operation is complete, the two tug boats will return the three barges to the roll off piers. The roll off pier ramps will be lowered and the SPMTs will return to the Arch deck yard to load another deck module. This process will be repeated for the remaining five westbound Arch deck modules. Lunda anticipates that the transporting of the westbound I-74 Arch deck modules will happen in early summer 2020. There will be an approximate one-year gap between placing the westbound Arch deck modules and the eastbound Arch deck modules (2021). During this time frame, the two prefabricated steel ramps will be removed from the roll off piers. They will be reinstalled just before they are needed again for the eastbound Arch deck modules. Lunda will not store any barges at this location during the timeframe between placing the westbound Arch deck modules and the eastbound Arch deck modules.

The process of loading the Arch deck modules will be repeated and completed for the eastbound I-74 bridge in late spring early summer of 2021. Once the eastbound I-74 Arch deck modules have been lifted into place, Lunda will remove the roll off ramps and piers. First, Lunda will remove the prefabricated steel ramps using a land-based crane. The temporary stone ramp leading to the roll off pier will be removed next. The pile support bents will then be removed, and the support piles will be cut off two feet below grade. Lunda will then perform any necessary restoration of the parking lot and grassy area where operations were conducted. Grassy areas will be mulched and seeded as soon after construction as possible.

Lifecycles of the mussels in the Action Area were considered during the mooring pile removal stage. Lunda will wait until late fall of 2021 to remove the three mooring piles in the Mississippi River to avoid disturbance during active reproductive phases of the mussels. Deconstruction activities will start by loading a barge with the necessary equipment to remove the piles at its temporary dock location near the new I-74 bridge. A tugboat will then transport the barge up to the Action Area. The barge will be placed into position, and the two spuds will be lowered into the river bed. On the barge will be a hydrovac truck and an excavator or crane. The hydrovac truck will remove the pea gravel from inside the mooring pile, then Lunda will pull the mooring pile. Once completed, the tugboat will move the barge to the next location and repeat the same process. It is anticipated that removing the mooring piles will take up to three days. **Table 1** below provides the proposed project schedule.

Table 1- Proposed Project Schedule

Project Phase	Proposed Schedule
Install land-based roll off piers	March 2020 or as early as the permit is approved.
Install three mooring piles	Late April 2020 or as early as the permit is approved.
Launch six arch deck modules onto barges for WB I-74 bridge	May to June 2020
Launch six arch deck modules onto barges for EB I-74 bridge	May to June 2021
Remove roll off piers and temporary stone ramp. Restore parking lot and grassy areas.	July to August 2021
Remove three mooring piles	October to December 2021

D) explanation of the anticipated **adverse effects on listed species**; how will the applicant's proposed actions impact each of the species' life cycle stages.

Response: Potential adverse effects to mussel species include mortality, disturbance and stress to the animals as a result on the mooring pile construction/removal, temporary disruption of reproduction, and temporary displacement of host fish. As provided above, steps, timing, and sequence of construction activities have been designed to minimize disturbance, stress, and mortality. Take estimates for both federal and state-listed mussel species are included in **Table 3**.

Higgins-eye pearlymussel (Lampsilis higginsi) were not observed in the proposed Action Area, located within the "Upstream" site during the survey conducted by Ecological Specialists Inc. (ESI) in August 2015 (**Attachment D**). The presence of Higgins-eye in areas surrounding the Action Area may be possible based on recent I-74 relocation efforts directly upstream from the Action Area; however, based on 2017 and 2018 data from the I-74 Final Report, live relocated species were not observed in large quantities in the buffer zones (outlying areas) of the 2x and 3x density areas, therefore, migration of Higgins-eye mussels outside of the nearby 2x density relocation zone into the action area is considered unlikely.

This species would typically be in brooding period from October to May, which coincides with the proposed installation and removal of the mooring piles and docking systems. If disturbed during the brooding period, glochidia may be prematurely released and therefore unviable if potential host fish are not present (See pg. 45-46 of the I-74 Biological Opinion **Attachment E**). Higgins-eye mussels formerly identified in the Upstream relocation area were not classified as gravid females in the 2015 report, though the presence of gravid females in the surrounding area may have changed as a result of the relocation effort. (See pg. 31 of Characterization of Unionid Communities **Attachment D**).

Black Sandshell (Ligumia Recta) and Butterfly (Ellipsaria Lineolata) mussels were confirmed in the proposed Action Area during the 2015 survey performed by ESI. Both of these species have reproductive cycles similar to that of other riverbed mussels such as the Higgins eye. (See pg. 20-21 of the Conservation Plan (**Attachment G**). Reproductive status of these threatened species in the Upstream area was not included in the 2015 survey. Refer to **Table 3** for an estimate of project impact to the Black Sandshell and Butterfly Mussels.

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

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

Response: Lunda Construction has minimized impacts to the mussels by proposing to build the temporary roll off piers on land behind the rip rap protecting the shore. Original concepts had Lunda building temporary pile bents in the water, which would have higher impact. The construction of the temporary dock will occur from land and will not have an impact on the mussel bed. With Lunda's proposed contingency design, three mooring piles are necessary in the river. This design will require barges to spud down during the installation and removal process of the mooring pile. Lunda will drill/auger the pile in instead of driving the mooring pile to minimize vibration impacts to the mussel bed. The use of a temporary outer casing around the drilling operation will also minimize turbidity issues caused by the drilling operation. The Action Area is limited to the construction and removal footprints found in **Table 2**. Take estimates for the Higgins eye, Black Sandshell, and Butterfly mussels are included in **Table 3**.

Table 2 - Amount of Habitat Affected

Impact Activity	Impact Area
Construction & Removal of Temporary Roll Off Piers	None. All construction to be completed from land.
24-Inch Diameter Mooring Pile Installation – 3 Locations	38 SF*
36x36-Inch Barge Spuds – 6 Locations During Mooring Pile Installation	150 SF*
36x36-Inch Barge Spuds – 6 Locations During Mooring Pile Removal	150 SF*
Total Area =	**338 SF or 31 SM or 0.008Acres**

*Assumes a 2' buffer zone around the mooring pile or barge spud

Table 3 – Take Estimates per Species (based on Survey data collected in 2015 by ESI)

Species	Estimated Take 24-inch Mooring Pile Installation	Estimated Take 36-inch Barge Spuds -Installation	Estimated Take 36-inch Barge Spuds - Removal	Total Est. T&E Species Take for All Activities	Number of Individuals Recovered in Mussel Bed Area (2015 Survey)	Total Est. Number of T&E Mussels in Mussel Bed Area (Original Boundaries)
Higgins Eye*	<1.0	<1.0	<1.0	1.0	3*	6,565*
Black Sandshell (6.7% of species in take area)	0.95 < x < 4.73	3.7< x <18.7	3.7< x <18.7	8.35 < x <42.13	52	113,795
Butterfly Mussel (1.8% species in take area)	0.25 < x < 1.3	1.0< x <5.0	1.0< x <5.0	2.25< x <11.3	14	30,637
Total Est.	1.2 < x < 6.0	4.7 < x < 23.7	4.7 < x <23.7	**10.6< x < 53.4**		**150,997***

*Higgin's-eye Mussels identified in the 2015 survey of the Upstream mussel bed were found in close proximity to each other in one specific area of the mussel bed, upstream (greater than 150 meters away) from the proposed Action Area. Based on the small sample size collected during the survey, the calculated total is likely not representative of mussel activity throughout the mussel bed. A factor of <1.0 mussels likely to be encountered for each phase of the proposed action plan is given to represent the low probability of any encounter with the Higgin's-eye for each activity. An estimated take of 1 is predicted for the sum of the three phases listed in Table 3. The Higgins-eye take has also been confirmed by performing an average density calculation for the expected 31 square meters of impact area.

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

Response: The barges that Lunda proposes to use for installation and removal of the mooring pile as well as transport of the Arch deck modules were inspected for zebra musssels (*Dreissena polymorpha*) prior to use on the I-74 bridge project. They were found to be clear of zebra mussels, and they have been in Pool 15 since 2017.

Natural processes will alllow the holes left from the spuds or mooring piles to fill in and the river bed to settle back to pre-construction conditions.

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

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

Response: Starting in late 2018, Lunda performed due diligence to identify options to mitigate the I-74 schedule. One of the options discussed with the Iowa Department of Transportation was preassembling the Arch decks and lifting the deck modules into place. Due to the sheer size and weight of the deck modules, Lunda was limited to constructing the modules within Pool 15 since the deck modules are too large to fit through the locks. The six deck modules are 100' wide and vary from 81' to 160' long. The arch deck module's pieces weigh between 387,000 to 589,000 lbs.

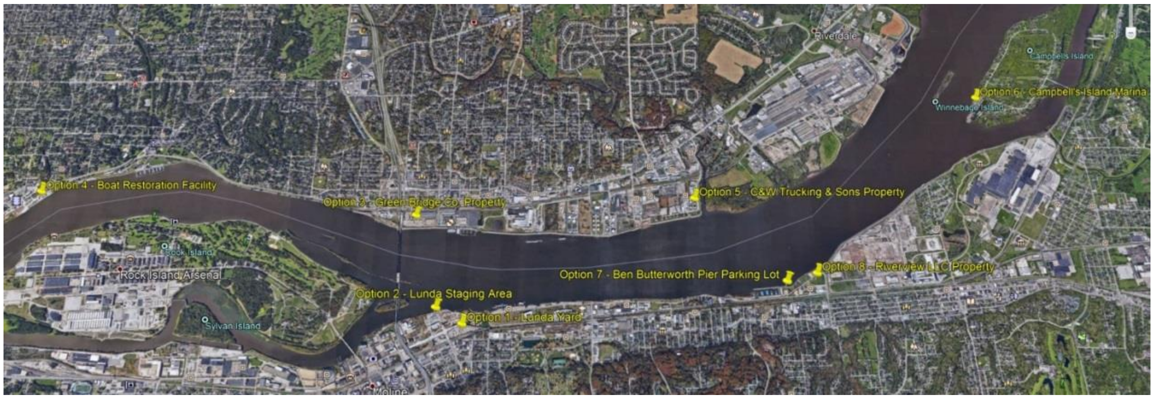
Lunda conducted a thorough review of the Pool 15 area for potential sites. The Arch deck yard site needed to have many specific characteristics, which made finding a suitable location challenging. First, the proposed yard needed to be large enough to construct and store all the deck modules. Second, the area would need to be able to support the heavy weight of the deck modules. Third, the area would need to be clear from utility interferences such as overhead power lines. Fourth, the proposed staging area needed have clear access to the Mississippi River as the modules cannot traverse over elevation changes of more than a few feet. Next, the proposed yard site would need to have good trucking access for the deliveries from Lunda's steel fabricator ISC. The site would then need to be available for a long enough time to support both the WB and EB Arch deck construction. Finally, the launch site near the proposed yard location would need to be deep enough for the barges and tugs. As Lunda found out during our investigation, Pool 15 has many limitations including the levee system, shallow water, low lying areas, public parks, access constraints and existing commercial development.

Lunda considered several locations throughout Pool 15 for the proposed Arch deck yard. **Table 4** lists the locations considered.

Table 4 – List of Locations Considered

Description	Location
Lunda Yard	Moline, IL
Lunda Staging Area	Moline, IL
Green Bridge Company Property	Bettendorf, IA
Boat Restoration Facility	Davenport, IA
C&W Trucking & Sons Property	Bettendorf, IA
Campbell's Island Marina	Campbell's Island, IL
Ben Butterworth Pier Parking Lot (Most suitable for design and cost purposes as documented in **Attachment J**)	Moline, IL
Riverview LLC Property	Moline, IL

The following is a map of Pool 15 with the considered locations and a larger version can be found in **Attachment I**:



Lunda ultimately choose the location at Ben Butterworth Park. The location had an area large enough to build all the Arch deck modules, good access for steel deliveries, no utility interference, straightforward access to the Mississippi River, and water deep enough for the barges to transport the modules downstream to the I-74 Bridge. The following is an aerial picture of the Arch deck yard.

Arch Deck Module Launching Options

Environmental and logistical due diligence measures identified several launching options, all of which would were considered for transporting the arch deck modules from the Ben Butterworth Staging area onto barges. The balance of this discussion focuses on the environmental factors for each option. Seven (7) launching options are listed below with their estimated impact area shown in **Table 5**.

Launching Option 1 - Temporary dock built with fill in the river and mooring piles

Launching Option 2 - Roll off piers with two pile bents in the river bed and upstream mooring piles

Launching Option 3 - Roll off piers with two pile bents in the rip rap and upstream mooring piles

Launching Option 4 - Roll off piers utilizing mooring piles in the toe of rip rap and upstream mooring piles

Launching Option 5 - Removing the existing parking lot and building a canal

Launching Option 6 - Roll off piers on land with three mooring piles in the river moved downstream

Launching Option 7 - Roll off piers on land with no mooring piles

Table 5 – Impact Comparison Summary

Launching Option	Estimated Impact Area
1 – Temporary Dock & Mooring Piles	10,322 SF
2 – Pile Bents In River & Mooring Piles	1,562 SF
3 – Pile Bents In Rip Rap & Mooring Piles	1,562 SF
4 – Mooring Pile Pier & Mooring Piles	723 SF
5 – Remove Parking Lot & Build Canal	> 6,150 SF*
6 – Piers On Land & Mooring Piles	338 SF
7 – Piers On Land & No Mooring Pile	0 SF

*Launching Option #5 is predicted to have a larger potential impact beyond the footprint of disturbance caused by canal construction. A canal may cause large-scale disturbance of the mussel bed and relocation area, which may include but is not limited to: issues associated with increased flow velocity over mussel beds; change in directional flow, which may upset the species of concern as well as alter the behavior of their host fish; increased suspended solids from construction activities; and increased siltation over time, which may suffocate the mussels.

The option with the least environmental impact is Option 7, with no structures in the Mississippi River. This is the preferred method. The roll off piers will be built from land, and there are no mooring piles with this option. This option would not cause any anticipated impact to threatened and/or endangered species. Option 7 is the method that Lunda has chosen to move the Arch deck modules down to the I-74 Bridge; however, high river flows may prevent the barges from safely maintaining their position. Therefore, Launching Option 6 is proposed as a contingency plan for this scenario.

Detailed discussions of the site selection process within Pool 15 and launching options for Ben Butterworth location have been provided in **Attachment J.**

Avoidance/Minimization Measures

Option 6 avoids and minimizes impacts to the mussel bed as follows:

- Builds roll off piers from the land and not from a barge that would have to spud down in the mussel bed
- Installs mooring piles instead of random barge spudding locations when the Arch deck modules are loaded
- Minimizes the number of mooring piles
- Minimizes vibrational impacts by drilling the mooring pile instead of using a vibratory or diesel hammer for installation
- Minimizes sediment dispersion by using a temporary casing around the mooring pile during installation
- Moves the mooring pile farther downstream to be farther away from the relocated I-74 mussels
- Removes the prefabricated steel ramps during the gap between the WB Arch and EB Arch construction to minimize the time they may block sunlight
- Minimizes the amount of time the barges are over the mussel bed

A preactivity meeting including the tug boat captains and any associated subcontractors will be held prior to constructing the roll off piers and mooring piles with Lunda's project management staff. The construction plan will be reviewed, and any questions will be answered prior to moving forward with construction. Special attention will be given to the relocated mussel species in the T&E grid shown in Lunda's drawings in **Attachment H**. The tug boat captains will be instructed to avoid the area with the barges.

As shown in **Table 3** the take estimate ranges from 8 to 43 individuals for the Black Sandshell mussel and from 2 to 12 individuals for the Butterfly mussel. One individual Higgins-eye mussel is predicted to be impacted based on scientific assessment survey data. Lunda in accordance with Section 5.5 of the Illinois Endangered Species Protection Act is seeking an Incidental Take Authorization (ITA). As this action is part of the larger I-74 Bridge project which received an Incidental Take Authorization for mussels, the State of Illinois has deemed the prior mitigation agreement as applicable to this action.

D) plans for **monitoring** the effects of the proposed actions on endangered or threatened species, such as species and habitat monitoring before and after construction, include a plan for follow-up reporting to IDNR.

Response: Information on the preconstruction condition of the Action Area is included with this permit application submittal. Results from the original 2015 mussel bed survey can be found in **Attachment D**. The most recent survey results (2018) from the Action Area can be found in

Attachment F. Survey results for 2019 are not available due to flooding at the time of survey. These documents provide a baseline for the occurence and potential for disturbance, as it applies to this permit application. They also provide a baseline for monitoring colonization and proliferation going forward.

Lunda Construction in cooperation with Iowa DOT will utilize Iowa DOT's post-construction monitoring activities of the Action Area for follow-up reporting to the IDNR. Lunda does not propose to provide monitoring in excess of that originally proposed by the Iowa DOT.

E) **adaptive management practices** that will be used to deal with changed or unforeseen circumstances that affect endangered or threatened species. Consider environmental variables such as flooding, drought, and species dynamics as well as other catastrophes. Management practices should include contingencies and specific triggers. Note: Not foreseeing any changes does not quality as an adaptive management plan.

Response: Lunda considers flooding or elevated water level to be the most likely unpredictable event. Drought is not of significant concern because the USACE controls the water levels in Pool 15. Lunda has conducted a bathometric survey of the Action Area. Minimum water depths at the Action Area are approximately 5.9' at the toe of the rip rap and quickly reach 11.4' at a pool elevation of 561.40. Lunda barges draft approximately 2.5' fully loaded, leaving more than 3' of water under the barges to the river bottom. Lunda will constantly monitor the river depths and if the barges are within 1' of impacting the river bottom, alternative actions will be considered. The barges could be ballasted differently to provide more clearance at the end of the barge that is in the shallower water. Control measures are in place by design, and Lunda's plan will limit, minimize, and possibly eliminate impact to the mussel bed.

Lunda has a fleet of tugboats on the I-74 project that have varying drafts to the bottom of their propellers. Page 95 of 121 of the I-74 Conservation Plan (**Appendix G**) states the following: "At water depths greater than 6 feet, the effects to mussels as a result of propeller wash due to construction barges are expected to be discountable." Lunda will choose the appropriate tugboat to maintain the 6 foot clearance over the mussel bed and this will be verified in the field. Lunda is already minimizing the potential effects of the propeller wash by limiting the amount times a tugboat is over the mussel bed.

If water levels are elevated such that stabilization of barges is required, Launching Option 6 will be employed, which is the least impactful alternative as demonstrated in **Table 5**. The proposed mooring pile will help hold the barges in their proper position while being loaded during a minor flooding event. Operations may be potentially halted during a major flooding event.

Weekly erosion control inspections will be conducted of the area and operations will also be monitored over the mussel bed. Based on the results of the inspection, necessary control modifications will be implemented within seven calendar days and will be documented on the Storm Water Pollution Prevention Plan Inspection Report forms.

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

Response: Lunda Construction has been in business since 1938, and if necessary, can supply the necessary bonds and certificates of insurance. The mussel surveys and reports of the Action Area are being conducted by the Iowa DOT under a previous agreement.

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

Response: The proposed contingency action was selected after evaluating several alternatives, including a No Action alternative. Further discussion of alternatives considered is discussed in previous sections and previous submittals, including **Attachment J**. It is still Lunda's intent to use the No-Action alternative. No impact to T&E species is anticipated if water levels are below flood stage and mooring piles would therefore not be installed in the river.

This permit application is being submitted as a contingency plan.

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

Response: The Upstream mussel bed is approximately 41,032 square meters according to Table 4-2 Characterization of Unionid Communities report found in **Attachment D**. Using the data from this report there are over 1.7 million mussels in the "Upstream" bed. Based upon the percentage of mussels identified during the 2015 survey (Appendix D), it is estimated that approximately 113,795 of the mussels in the bed are Black Sandshell and 30,637 are Butterfly mussels. The Higgins-eye mussel was not found in the original Action Area prior to the relocation effort. Any Higgins-eye mussels relocated upstream of the Action Area are not anticipated to travel to the potential take locations.

The take estimate ranges from 8 to 43 individuals for the Black Sandshell mussel and from 2 to 12 individuals for the Butterfly mussel. The take estimate for the Higgins-eye is one individual. The incidental take of the Higgins-eye mussels, Black Sandshell, and Butterfly mussels will not reduce the likelihood of these species' survival in the wild in Illinois.

In summary, due diligence was undertaken to identify suitable locations for the Arch deck module yard, and further due diligence was undertaken to minimize potential impact to the T&E species, in accordance with regulatory and industry standards. Lunda has met the permit requirements for no impact [if no mooring piles are installed]. The alternative contingency launching option, as presented, may result in a minimal incidental take of T&E species.

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

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

By: 

Patrick Wiseley P.E.
QC/Senior Project Manager
Lunda Construction Co.

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

Response: The IDNR is responsible for the review of this Conservation Plan and for the subsequent issuance of the Incidental Take Authorization.

Post-construction monitoring activities will be conducted by Iowa DOT.

Lunda Construction Co. is responsible for the construction site, the placement and function of the erosion and sediment control, all items in the Incidental Take Authorization, and coordination with the IDNR and the USFWS.

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

Response: Lunda Construction Co. has the authority to carry out its respective obligations under the conservation plan.

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

Response: Project activities, should the contingency plan be invoked, will require a Clean Water Act Section 404 permit from the U.S. Army Corp of Engineers (USACE Rock Island), Rivers and Harbors Act Section 10 Permit (USACE Rock Island District), and a water quality certification from Illinois EPA. Lunda will obtain any necessary federal, state and local permits and comply with all permit conditions.

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

An amended Biological Opinion is anticipated.

PLEASE SUBMIT TO: Incidental Take Authorization Coordinator, Illinois Department of Natural Resources, Office of Resource Conservation, Division of Natural Heritage, One Natural Resources Way, Springfield, IL, 62702 OR DNR.ITAcoordinator@illinois.gov

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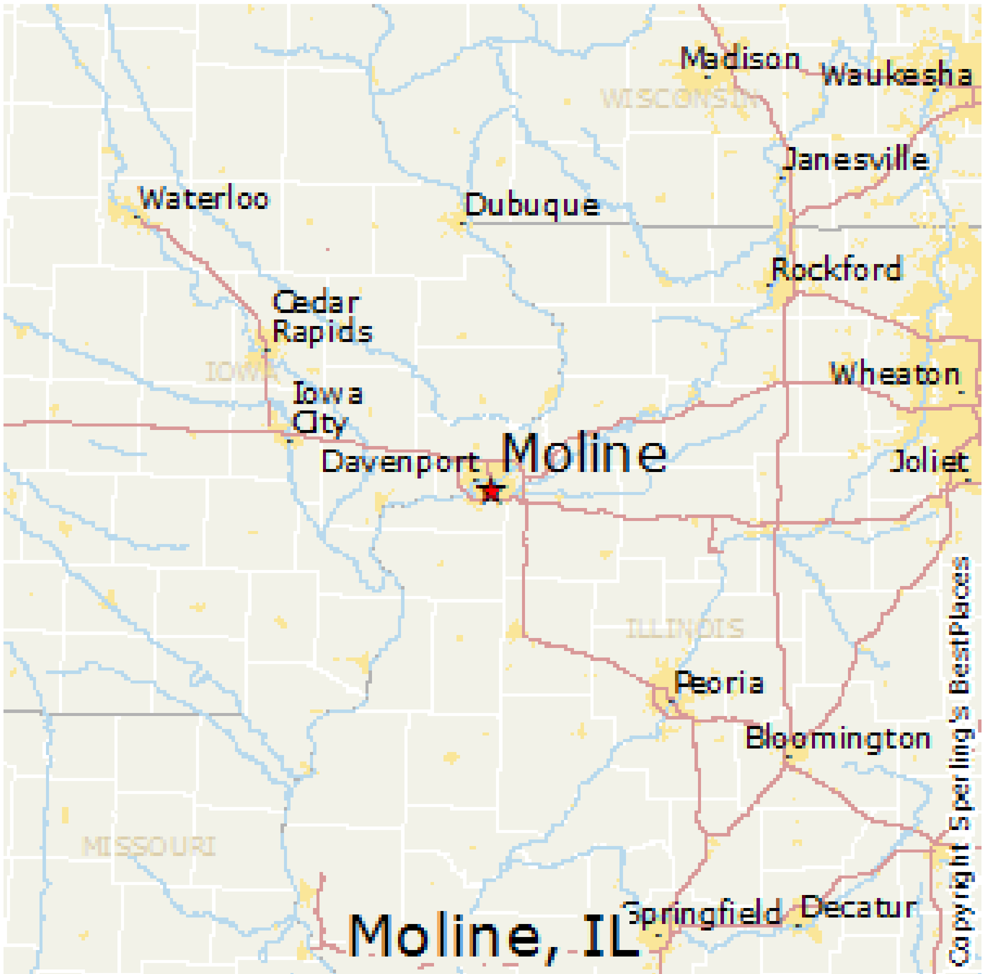
ATTACHMENT A

LOCATION MAP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ILLINOIS
Peoria
Bloomington
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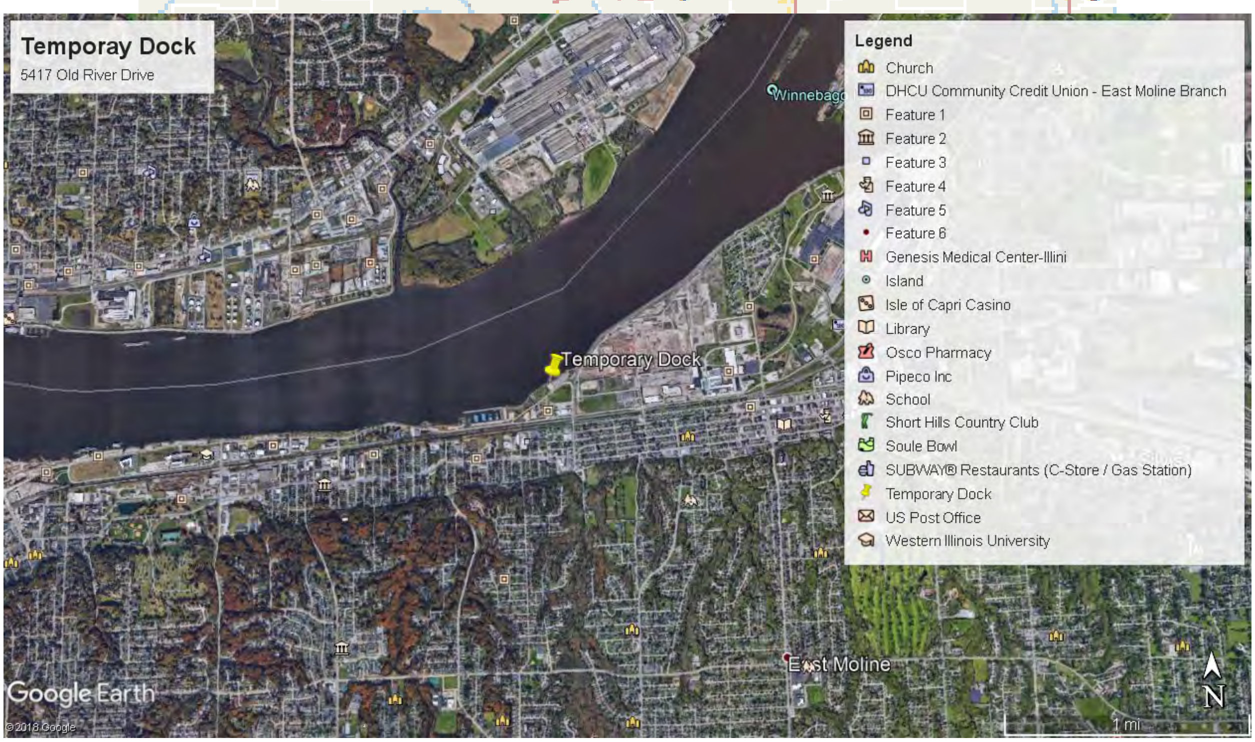
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5417 Old River Drive
Winnebago
Temporary Dock
East Moline
Legend
Church
DHCU Community Credit Union - East Moline Branch
Feature 1
Feature 2
Feature 3
Feature 4
Feature 5
Feature 6
Genesis Medical Center-Illini
Island
Isle of Capri Casino
Library
Osco Pharmacy
Pipeco Inc
School
Short Hills Country Club
Soule Bowl
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Temporary Dock
US Post Office
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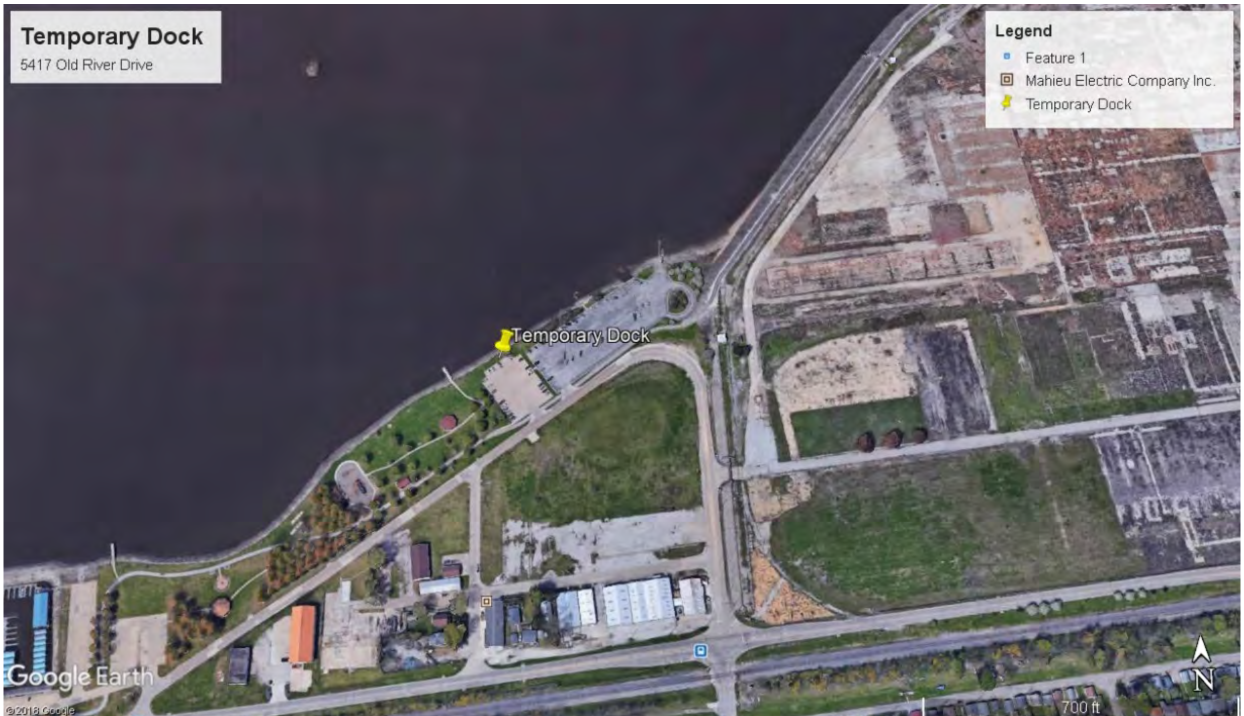
Temporary Dock
5417 Old River Drive
Legend
Feature 1
Mahieu Electric Company Inc.
Temporary Dock
Temporary Dock
Google Earth
700 ft
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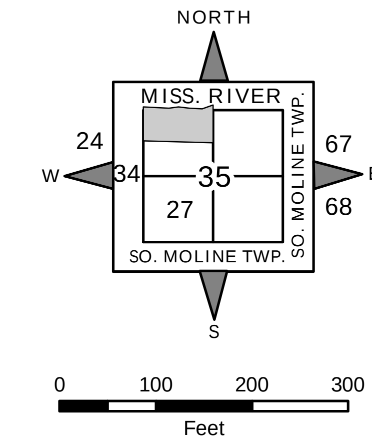
ATTACHMENT B

SUPERVISOR'S ASSESSEMENT MAP

NOTE: STARTING IN 2002, PARCEL NUMBERS WILL NOT REFLECT THE TOWNSHIP ABBREVIATIONS, BUT THE 2-DIGIT TOWNSHIP NUMBER.



GIS DEPARTMENT
ROCK ISLAND COUNTY,
ILLINOIS

(A) MOLINE MANUFACTURING CO.'s 1ST ADD. - FILED MARCH 13, 1908, IN PLAT BOOK 10, PAGE 55. 083670 - 3675

(B) HACKERSON ADD. - FILED JULY 27, 1909, IN PLAT BOOK 11, PAGE 21. 083670 - 3675

(C) MATTSON'S 55TH ST. ADD. - FILED DEC. 2, 1913, IN PLAT BOOK 12, PAGE 43. 084500 - 4508

(D) EAST MOLINE ADD. - FILED JUNE 4, 1891, IN PLAT BOOK 4, PAGE 28. 082652 - 2782

(E) C.G. THULIN'S 2ND ADD. - FILED NOV. 1, 1895, IN PLAT BOOK 6, PAGE 36. 087255 - 7333

(F) C.G. THULIN'S ADD. - FILED DEC. 10, 1892, IN PLAT BOOK 5, PAGE 28. 087215 - 7254

(G) HAUB'S SUBD. - FILED AUG. 30, 1984, IN PLAT BOOK 46, PAGE 144. 089206 - 9207

(H) MOLINE MANUFACTURING CO.'s 2ND ADD. - FILED OCT. 26, 1994. 089266 - 9267

SUPERVISORS' ASSESSMENT MAP OF

LOT 6, LECLAIRE'S RESERVE, T.18N., R.1W., 4TH P.M.

MOLINE TOWNSHIP

SUPPLEMENTAL FOR 2006

08-35

THIS IS NOT A LEGAL DOCUMENT

SHEET 28

ATTACHMENT C

DRIVING DIRECTIONS

Driving Directions to 5417 Old River Drive –Moline, Illinois

(Site of the proposed temporary dock)

- From the I-74 overpass bridge at River Road in Moline, Illinois head east approximately 2.75 miles to the corner of 55th Street and 12th Ave/River Drive
- Head North on 55th Street, past 1st Avenue around the bend (heading west) which turns into Old River Drive
- Head approximately 1/8th of a mile due west on Old River Road and 5417 Old River Drive will be on your right hand side, North side of the street.

ATTACHMENT D

CHARACTERIZATION OF UNIONID COMMUNITIES AT POTENTIAL RELOCATION AREAS FOR THE INTERSTATE 74 BRIDGE REPLACMENT PROJECT, MISSISSIPPI RIVER POOLS 14-16

Characterization of Unionid Communities at Potential Relocation Areas for the Interstate 74 Bridge Replacement Project, Mississippi River Pools 14 – 16

Prepared for:

Stantec Consulting Services, Inc.
Independence, Iowa

Prepared by:

Ecological Specialists, Inc.
O'Fallon, Missouri

October 2015

(ESI Project No. 15-023)

Acknowledgements

This project was funded by the Iowa Department of Transportation (IADOT) through Stantec Consulting Services, Inc. Mr. Terry VanDeWalle coordinated the project for Stantec. Ms. Emily Grossman of Ecological Specialists, Inc. (ESI) was the project manager, field team leader, and primary author of this report. Mr. Robert Williams, Mr. Chet Clark, Mr. Daniel Swanson, and Mr. John Hanley (all of ESI) assisted with the fieldwork. Mr. Ryan Foley and Ms. Heidi Dunn assisted with data QA/QC and report preparation.

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1.0 Introduction

Stantec Consulting Services, Inc. is assisting the Iowa Department of Transportation (IADOT) 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; Figure 1-1). Pool 15 is known to harbor a species-rich unionid (freshwater mussel) community, including several federally endangered species, and the bridge project area overlaps the Sylvan Slough *Lampsilis higginsii* Essential Habitat Area (EHA). Therefore, Ecological Specialists, Inc. (ESI) was contracted to conduct a mussel survey in the bridge project area in 2014. The 2014 survey results indicated that a dense, species-rich mussel bed was present on the Illinois (left descending) bank beneath both the new and existing bridge alignments (Table 1-1; ESI, 2014). Three federally endangered species (*Cumberlandia monodonta, Plethobasus cyphyus, L. higginsii*) and 2 Illinois threatened species (*Ellipsaria lineolata, Ligumia recta*) were collected within this bed. Although unionid abundance was lower, *C. monodonta, L. higginsii,* and the Iowa threatened *E. lineolata* were collected near the existing bridge on the Iowa bank as well (Table 1-1; ESI, 2014).

A mussel mitigation task force was formed following the 2014 survey to aid in developing mitigation options for the bridge project. This task force was composed of representatives from ESI, Stantec, IADOT, Illinois Department of Transportation, Iowa Department of Natural Resources (IADNR), Illinois Department of Natural Resources (ILDNR), U.S. Fish and Wildlife Service (USFWS), Illinois Natural History Survey, and the Federal Highway Administration. In addition to other potential mitigation options, the task force determined that unionids would need to be relocated from project impact areas. The relocation is planned for the 2016 field season to ensure that unionids will be moved before construction begins. Even if the relocation is confined to direct impact areas, the unionids that need to be moved will likely number in the hundreds of thousands. Therefore, relocation areas needed to be selected prior to the relocation effort to ensure that enough sites will be available to accommodate relocated unionids. A list of several potential relocation areas was developed based on existing reports and input from agencies (IADNR, ILDNR, USFWS). These potential relocation areas were surveyed in 2015, with the objective of delineating unionid concentrations and determining species richness and density within those concentrations. Data collected in the survey was used to determine how many relocated unionids could be placed in each area at a particular increase in density.

2.0 Potential Relocation Areas

A list of potential relocation areas was developed in mitigation task force meetings based on agency suggestions and existing reports. Seven (7) sites were investigated as general relocation areas for all species of unionids. An additional 2 sites were investigated specifically for placement of *C. monodonta*, as this species is a habitat specialist and primarily occurs in substrate composed of large rock. Potential relocation areas are described below. A map of the sites is presented in Figure 2-1, and a summary is presented in Table 2-1.

Le Claire Channel

This site is located on the Iowa (right descending) bank of Pool 14 at river mile (RM) 494. IADNR indicated that although this site had not previously been surveyed for unionids, it appeared to have good mussel habitat, and numerous dead shells were observed on the bank in a recent IADNR site visit.

Illiniwek Park

This site is located on the Illinois bank of Pool 15 at RM 493. It was not identified in the task force meetings, but was later proposed by ESI based on high unionid densities (>100/m^2) reported in Whitney et al. (1996). This site is also an Illinois mussel refuge.

Eagle's Landing/Pigeon Creek

The Eagle's Landing/Pigeon Creek site is located on the Iowa bank of Pool 15 at RM 490-491. This area is known to harbor mussels and has been sampled as part of IADNR's annual mussel blitz; however, the boundaries of the unionid concentration had not yet been mapped.

Upstream of I-74 bridge footprint [Upstream]

This site is located on the Illinois bank of Pool 15. The area surveyed extended from RM 486.5 – 488.5 It was proposed by IADNR, as some unionids were known to occur upstream of the bridge footprint. In addition, unionids may be able to move downstream and recolonize the bridge footprint. Whitney et al. (1996) identified a bed on the IL bank at RM 488.5, so most of the survey effort was concentrated in this area.

Sylvan Slough

In the task force meetings, it was suggested that some unionids could be relocated farther downstream into Sylvan Slough (Illinois bank, Pool 15) if suitable habitat and/or unionids were present. Thus, Sylvan Slough was investigated from the downstream edge of the 2014 I-74 survey area to the Arsenal power dam (RM 484.5 – 485.5).

Bed upstream of Buffalo EHA [Buffalo]

This site was recommended by IADNR, and occurs along the Iowa bank of Pool 16 at RM 474, approximately 3 miles upstream of the Buffalo *L. higginsii* EHA. The site harbors a known mussel bed that includes *L. higginsii.*

Fairport bed [Fairport]

This is a known bed near RM 464 (Iowa bank, Pool 16) that was suggested by IADNR. The upstream portion of this bed is a *L. higginsii* reintroduction site that is monitored by the U.S. Army Corps of Engineers (USACE). So as not to interfere with future monitoring efforts, the USACE monitoring area was not considered for placement of relocated unionids. Thus, the survey area began at the downstream end of the USACE monitoring area and continued downstream.

Lateral Dike (C. monodonta)

The lateral dike off the Illinois bank in Pool 15 was suggested as a potential *C. monodonta* relocation area, as the structure of the dike itself may provide habitat for this species. Locations on both sides of the dike were investigated to determine if *C. monodonta* and/or suitable habitat (large rock) were present.

Downstream of Arsenal power dam (C. monodonta) [Arsenal]

The Arsenal Island bank downstream of the Arsenal power dam is rip-rapped to stabilize the bank. This bank was suggested as a potential *C. monodonta* relocation site, as the rip-rap may provide habitat for this species. The survey area included the Arsenal Island bank, as well as several other locations in Sylvan Slough downstream of the Arsenal power dam that appeared to have suitable *C. monodonta* habitat.

3.0 Methods

General relocation areas

The survey objectives at the general relocation areas (i.e. areas suitable for all species of unionids) were to delineate unionid concentrations and determine species richness and density within the concentrations. The objectives were met with a combination of qualitative and quantitative sampling.

Qualitative samples (timed searches) were used to map habitat and unionid distribution at each potential relocation area. To best define the boundaries of unionid concentrations, searches were generally conducted in linear passes throughout each area, beginning at the bank and moving riverward until unionids became scarce and/or substrate became unsuitable (loose sand or bedrock). A diver crawled along the bottom, collecting all unionids encountered in 5 min. At the end of each 5-min interval, the sample was retrieved. Unionids were identified, categorized as either adults (>5 years old) or juveniles (≤5 years old), and returned to the river near their original point of collection. Federally endangered species were also measured (length, width, and height in mm) and aged (external annuli count), and *L. higginsii* were marked with a unique ID number using a Dremel tool. At least 1 individual of each species was photographed, and a dead shell of each species (if available) was retained as a voucher. Depth, substrate composition, and GPS coordinates were recorded at the start of each 5-min search, and where changes in habitat or unionid abundance were observed. Qualitative sampling was conducted until the boundaries of unionid concentrations were sufficiently delineated. Some additional qualitative searches were conducted in the Upstream and Sylvan Slough sites to investigate habitat that appeared suitable for *C. monodonta.* Total search time varied among areas based on the size of the area and the distribution of unionids. Table 3-1 summarizes sample effort for each relocation area.

Quantitative samples (quadrats) were collected within unionid concentrations delineated in qualitative sampling. The purpose of quantitative sampling was to determine unionid density in each area. Habitat and unionid data collected in qualitative samples were used to generate polygons representing unionid concentrations in ArcGIS 10.3. Quadrat locations were determined by generating random points in each unionid concentration using Geospatial Modelling Environment (Beyer, 2012). The number of quadrats at each site was based on the size of the area in which unionids were found. For most of the areas, 60 quadrats were collected (Table 3-1). Due to their larger size, 75 and 90 quadrats were collected in the Upstream and Sylvan Slough areas, respectively. At the Le Claire Channel site, 60 quadrats were originally collected. An additional 30 samples were later collected on the opposite side of the channel, for a total of 90 quadrats (Table 3-1). For each quadrat, the diver excavated all substrate within a $0.25m^2$ quadrat frame into an attached mesh bag (6 mm mesh). Substrate was sieved through 12 and 6 mm sieves and all unionids were retrieved from the sample. Unionids were identified to species, measured (length in mm), and aged (external annuli count). Zebra mussel infestation was also recorded. Depth, substrate composition, and GPS coordinates were recorded for each quadrat.

Data obtained in quantitative sampling was used to determine how many unionids could be placed in each relocation area based on a prescribed increase in density. At some sites, quantitative data suggested that the initial polygons representing unionid concentrations needed to be modified slightly to eliminate areas with poor habitat (e.g. bedrock) or extremely low unionid density. For these sites, only the quadrats within the modified polygons were used to calculate density and number of unionids that the sites could accommodate.

C. monodonta areas

Due to this species' specific habitat requirements, *C. monodonta* relocated from the I-74 bridge will need to be placed in areas with substrate composed of boulder/large rock. Therefore, the lateral dike and Arsenal sites were investigated to determine if suitable habitat or live *C. monodonta* were present. This objective was met using qualitative sampling only; no quadrats were collected. Timed searches were conducted in 5-min increments as described above, with the specific goal of locating boulder substrate and searching any such substrate thoroughly for evidence of *C. monodonta.* Unionids were processed as described above. Depth, substrate composition, and GPS coordinates were recorded for each search.

4.0 Results and Discussion

Potential relocation areas were surveyed July 22-29 and August 13-23, 2015. Mississippi River stage ranged from 5.1 ft to 7.9 ft during sampling (Rock Island gage).

General relocation areas

Le Claire Channel

The Le Claire Channel was characterized by very slow flow and silt substrate. A large patch of submerged, emergent, and floating aquatic vegetation was present along the Iowa bank in the middle of the area. Samples were not collected where the vegetation was extremely thick. Maximum observed depth was 15 ft (4.6 m), but depth was less than 10 ft (3.1 m) throughout most of the area.

Qualitative searches indicated that some unionids were present along the Iowa bank, though abundance was relatively low. Unionids were present in narrow strips at the upstream and downstream ends of the area, and were more widespread in the center (Figure 4-1). Nineteen (19) species were collected live, but the majority of individuals were either widespread, common species (*Amblema plicata, Quadrula quadrula*) or thin-shelled species commonly found in soft substrate (e.g. *Pyganodon grandis, Leptodea fragilis*). Catch per unit effort (CPUE) in qualitative searches was 105.9 unionids/hr.

Quantitative samples were collected throughout most of the area surveyed in qualitative samples, as a clearly defined unionid concentration was not identified. Density was low, averaging only 1.8 ± 0.8 unionids/m^2 (Table 4-1). Although time did not allow for more qualitative sampling, an additional 30 quantitative samples were later collected along the island bank of the Le Claire Channel to determine if this bank provided more suitable conditions for unionids (Figure 4-1). Only 4 unionids were collected, yielding an average density of only 0.5 ± 0.6 unionids/m^2 (Table 4-1).

Although some unionids were collected in the Le Claire Channel, the silt substrate does not provide quality unionid habitat, and most of the species collected were tolerant species and/or thin-shelled species that often occur in silt. This site is not an ideal relocation area for most species. We recommend using the area along the Iowa bank as a relocation area for common species only if capacity at higher-quality relocation areas is exceeded. The Iowa bank area could accommodate approximately 20,000 relocated unionids at a 25% increase in density (Table 4-2). If unionids are placed at this site, they should be preferentially placed at the upstream and downstream ends of the area, where unionid abundance was highest.

Illiniwek Park

Habitat characteristics were similar throughout the Illiniwek Park site. Substrate was a mixture of cobble, silt, and zebra mussel shells. Silt was more common in the upstream half of the area, while cobble and shell were more common downstream. The site was relatively shallow throughout; depth rarely exceeded 6 ft (1.8 m).

Qualitative sampling indicated that unionid abundance was highest upstream and declined with distance downstream. A total of 22 species was collected live, including *L. higginsii* and 3 Illinois threatened species (*Cyclonaias tuberculata, E. lineolata,* and *L. recta*; Table 4-1; Table 4-3; Figure 4-2). The presence of live *C. tuberculata* is of particular interest, as this species has not been reported live from this reach of the Mississippi River in several decades. CPUE in qualitative searches was 273.9 unionids/hr. Unionids were most abundant in a strip within approximately 100 m of the bank; this area was defined as the unionid concentration for further quantitative sampling (Figure 4-2). Density within the unionid concentration averaged 14.7 ± 3.5 unionids/m^2.

The Illiniwek Park site supports a high-density, species-rich unionid community that includes both federal and state-listed species, and could serve as a suitable relocation area for most species. Approximately 213,000 relocated unionids could be placed in this area at a 25% increase in density (Table 4-2).

Eagle's Landing

Habitat at the Eagle's Landing site was variable. Crow Creek enters the Mississippi River near the downstream end of the area; habitat at the confluence consisted of shallow gravel/sand bars and large woody debris. Silt was the dominant substrate constituent immediately upstream of the gravel bars as well as at the upstream end of the area. Substrate was more heterogeneous (cobble/gravel/silt/zebra mussel shells) in the center of the area. Sand was also common in samples farthest from the bank. Maximum observed depth was 12 ft (3.7 m).

Unionids were present throughout most of the survey area. A total of 21 species was collected, including the Iowa threatened *E. lineolata* (Table 4-1). CPUE in qualitative searches was 195.7 unionids/hr. A unionid concentration extending approximately 50 m off the bank was identified in qualitative sampling (Figure 4-3). Density within this unionid concentration was the highest of all the potential relocation areas, averaging 31.0 ± 8.4 unionids/m^2.

The Eagle's Landing site appears to support a high-density, good-quality unionid bed, and should serve as a suitable relocation area for most species of unionids. The site could accommodate approximately 501,000 relocated unionids at a 25% increase in density (Table 4-2). Although *L. higginsii* was not collected, high unionid density and species richness suggests that this species could be present in low numbers. This site could be considered as a placement area for *L. higginsii* (in addition to those sites where *L. higginsii* was present) if needed.

Upstream

Habitat varied throughout the Upstream site. Along the outside bend at RM 488, substrate was a heterogeneous mix of cobble, gravel, sand, silt, and shell, with silt being more common near the bank and sand more common riverward. Patches of bedrock and boulder were also present. Downstream of the bend, substrate contained boulder, cobble, gravel, and silt in varying proportions adjacent to the bank, and transitioned to bedrock within 20 – 30 m of the bank. Rip-rap was present on the bank throughout most of the area, but generally did not extend below the waterline. Maximum observed depth was 15 ft (4.6 m).

Unionid abundance in qualitative samples was highest along the outside bend from the bank to approximately 80-90 m riverward and decreased downstream, where suitable habitat was only present within approximately 20 m of the bank (Figure 4-4). CPUE was relatively low at 82.8 unionids/hr. A total of 21 species were collected, including *L. higginsii, E. lineolata,* and *L. recta* (Table 4-1; Table 4-3; Figure 4-4). Three weathered dead *C. monodonta* shells were collected near the upstream end of the survey area. Additional qualitative searches were conducted where shells were found, but these searches yielded no live *C. monodonta.*

The outside bend at RM 488 was originally selected for quantitative sampling, as this portion of the Upstream site appeared to provide the best habitat and highest unionid abundance. However, substrate was mostly bedrock in many quadrats on the downstream and riverward margins of the original area. Although some unionids were found, they were likely just transient individuals, and relocated unionids should not be placed on bedrock. Therefore, the boundaries of the unionid concentration were modified as shown in Figure 4-5. Density within the modified boundary was 10.1 ± 3.0 unionids/m^2 (Table 4-1).

Although much of the Upstream site was characterized by bedrock substrate and low unionid abundance, an area of suitable habitat was found along the outside bend at RM 488. This area supports a moderate-density unionid community that includes *L. higginsii,* and should serve as a suitable relocation area for most species. The revised unionid concentration could accommodate approximately 104,000 relocated unionids at a 25% increase in density (Table 4-2).

Sylvan Slough

Habitat was similar throughout most of Sylvan Slough. Substrate was primarily was composed of sand, silt, and clay. Rip-rap was present on the Illinois bank at the upstream end of the area and near the head of Sylvan Island. A stone/block wall ran along the bank between the patches of rip-rap. Boulder, cobble, and gravel were present at the toe of the wall. Aquatic vegetation (primarily lotus) was abundant along the Arsenal Island bank, in some cases covering approximately half the width of the river channel. This bank was not searched due to the dense vegetation. Depth was generally shallower at the upstream end of the area and increased downstream. Maximum observed depth was 16 ft (4.9 m) just upstream of the Arsenal power dam.

Unionid abundance was highest at the upstream end of site, and decreased downstream (Figure 4-6). A total of 22 species were collected, including *L. higginsii, E. lineolata,* and *L. recta* (Table 4-1; Table 4-3; Figure 4-6). Additional qualitative searches were conducted in a patch of boulders just downstream of the Rodman Ave. bridge, yielding 9 live *C. monodonta* (Table 4-3; Figure 4-6). Weathered dead *C. monodonta* shells were also found along the Illinois bank just upstream of Sylvan Island. CPUE in qualitative samples was 118.3 unionids/hr (Table 4-1). Quantitative sampling was conducted in the upstream third of the Sylvan Slough. Although unionid abundance was moderate in qualitative samples, few unionids were collected in quadrats, except at the far upstream end of the sample area (Figure 4-6). Density was low, averaging only 3.0 ± 1.2 unionids/m^2 (Table 4-1).

Quantitative sampling indicated that unionid density in the Sylvan Slough survey area was low, except at the far upstream end. As the area with the highest unionid abundance is closest to the bridge, we do not recommend using this site as a general relocation area. However, the patch of boulder downstream of the Rodman Ave. bridge could be used for placement of *C. monodonta*, as live individuals of this species were present. Sylvan Slough between the I-74 bridge and the Rodman Ave. bridge could potentially be used as a monitoring area to investigate indirect effects of bridge construction on unionids downstream.

Buffalo

Habitat was similar throughout most of the Buffalo site. Silt and clay were the dominant substrate constituents near the bank, while cobble, gravel, and sand were more common riverward. A small creek flowed into the river at RM 473. 7, and a shallow gravel bar was present at the confluence. Maximum observed depth was 16 ft (4.9 m) at the riverward edge of the area.

Unionids were present throughout most of the area surveyed; abundance was highest in the shallow depression/outside bend in the bank at RM 474 (Figure 4-7). Twenty-three (23) species were collected live, including *L. higginsii, E. lineolata,* and the Iowa endangered *Pleurobema sintoxia* (Table 4-1; Table 4-3; Figure 4-7). CPUE in qualitative samples was 208.9 unionids/hr (Table 4-1).

Qualitative sampling suggested that unionid abundance was highest within approximately 70 m of the bank in the shallow depression at RM 474, so this area was selected for quantitative sampling. However, the downstream end of the original boundary overlapped the gravel bar, where unionids were scarce. Therefore, the unionid concentration boundary was modified to exclude the gravel bar (Figure 4-8). Density within the revised area was 11.8 ± 2.6 unionids/m^2 (Table 4-1).

The Buffalo site supports a high-density, good-quality unionid concentration that includes both federal and state listed species. Unionids of most species could be placed at the site; approximately 72,000 relocated unionids could be accommodated at a 25% increase in density (Table 4-2).

Fairport

Habitat was similar throughout the Fairport site. Substrate was primarily composed of sand, silt, and clay, with silt/clay more common near the bank and sand more common riverward. Small amounts of boulder, cobble, and gravel were also present in some samples. Maximum observed depth was 20 ft (6.1 m).

Unionids were present throughout most of the area surveyed (Figure 4-9). Unionids were found over 150 m from the bank at the upstream end, but were concentrated within approximately 50 m of the bank downstream. A total of 23 species were collected, including *L. higginsii, P. sintoxia,* and *E. lineolata* (Table 4-1; Table 4-3; Figure 4-9). CPUE was the highest of all the potential relocation areas at 359.6 unionids/hr (Table 4-1).

Quantitative samples were collected throughout most of the survey area. However, substrate was composed primarily of sand in several quadrats along the riverward margin of the area. Although unionids were still relatively abundant, they were likely only transient individuals moving with the bedload, and relocated unionids should not be placed in loose sand. Therefore, the unionid concentration boundary was modified as shown in Figure 4-9. Density within the revised boundary was 7.8 ± 2.4 unionids/m^2 (Table 4-1).

The Fairport site supports a moderate-density unionid community that includes both federal and state listed species. Unionids of most species could be relocated to this site, provided they are kept within the revised unionid concentration boundary shown in Figure 4-9, so as not to interfere with USACE monitoring efforts that may be conducted upstream. This site could accommodate approximately 49,000 relocated unionids at a 25% increase in density (Table 4-2).

<u>*C. monodonta* areas</u>

Lateral Dike

Portions of the lateral dike were searched from RM 486 to RM 487.5. A few searches were conducted on the inside (Illinois side) of the dike, but most searches were conducted on the outside (channel side). Sediment appears to accumulate on the inside of the dike; substrate contained more sand and depths were shallower than on the outside of the dike. Substrate along the outside of the dike was composed primarily of boulder and cobble, with smaller amounts of gravel, sand, and silt also present. Maximum observed depth was 9 ft (2.7 m).

Three (3) weathered dead *C. monodonta* shells were collected along the outside of the dike at RM 487.2 (Figure 4-10). Substrate where the shells were found was primarily boulder with smaller amounts of gravel, sand, and silt, and was similar to other sites in this survey where *C. monodonta* was found live. This area may have previously harbored *C. monodonta,* or may still harbor this species in very low numbers, such that it was not detected in the survey. No evidence *C. monodonta* was found in any other locations along the dike.

Arsenal

Sylvan Slough was investigated downstream of Sylvan Island and the Arsenal power dam for potential *C. monodonta* habitat. The original intent in this area was to search in the rip-rap along the Arsenal Island bank. However, the rip-rap did not extend below the waterline, and therefore did not provide habitat. Additional searches at and downstream of the toe of Sylvan Island located 2 sites with suitable habitat and live *C. monodonta*: one just downstream of the Sylvan Island toe (upstream site) and one in the center of the channel approximately 300 m downstream of Sylvan Island (downstream site; Figure 4-10). Substrate in both sites was boulder interspersed with smaller amounts of cobble, gravel, sand, and silt.

The upstream site yielded 3 live *C. monodonta,* including 1 relatively young individual approximately 6 years old (Table

4-3). Six (6) live *C. monodonta* were collected at the downstream site. Most individuals were estimated to be between 15-20 years old (Table 4-3). Numerous fresh and weathered dead shells, including 2 young (~50 mm) individuals, were collected at both sites, suggesting that these *C. monodonta* populations have been present for some time. Both of these sites should serve as suitable relocation areas for *C. monodonta* relocated from the I-74 bridge.

5.0 Summary and Conclusions

Surveys of potential relocation areas in Pools 14, 15, and 16 identified several areas in which unionids from the I-74 bridge project could be placed. The Illiniwek Park, Upstream, Buffalo, and Fairport sites all harbored moderate to high-density unionid communities that included various state-listed species and *L. higginsii.* The Eagle's Landing site also harbored a high-density community, though *L. higginsii* was not collected. Relocated unionids of most species could be placed at these sites. Together, these 5 sites could accommodate approximately 940,000 unionids at a 25% increase in density at each site. The Le Claire Channel site did not provide high-quality habitat, and should be kept in reserve for placement of common species only if additional relocation areas are needed. Density in the Sylvan Slough site was very low; this site is probably not suitable for placement of relocated unionids, but could serve as a monitoring area to investigate indirect effects of bridge construction.

Three (3) sites in Sylvan Slough were identified that could serve as relocation areas for *C. monodonta:* one just downstream of the Rodman Ave. bridge, and 2 downstream of Sylvan Island. *Cumberlandia monodonta* was collected live at each of these sites, as were numerous dead shells, suggesting these populations have been present for some time. These sites should all provide suitable relocation areas for *C. monodonta* in the I-74 bridge project area.

6.0 Literature Cited

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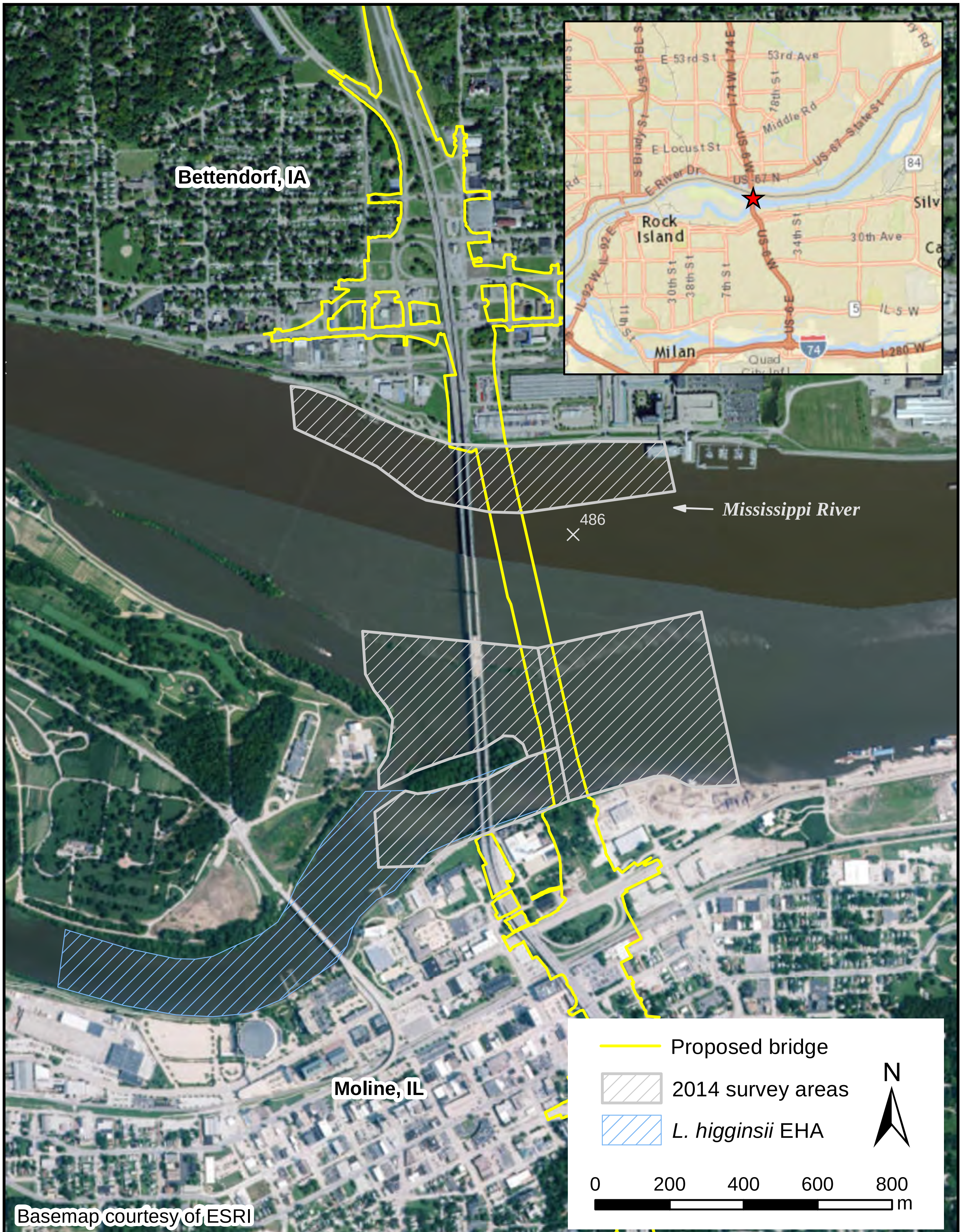
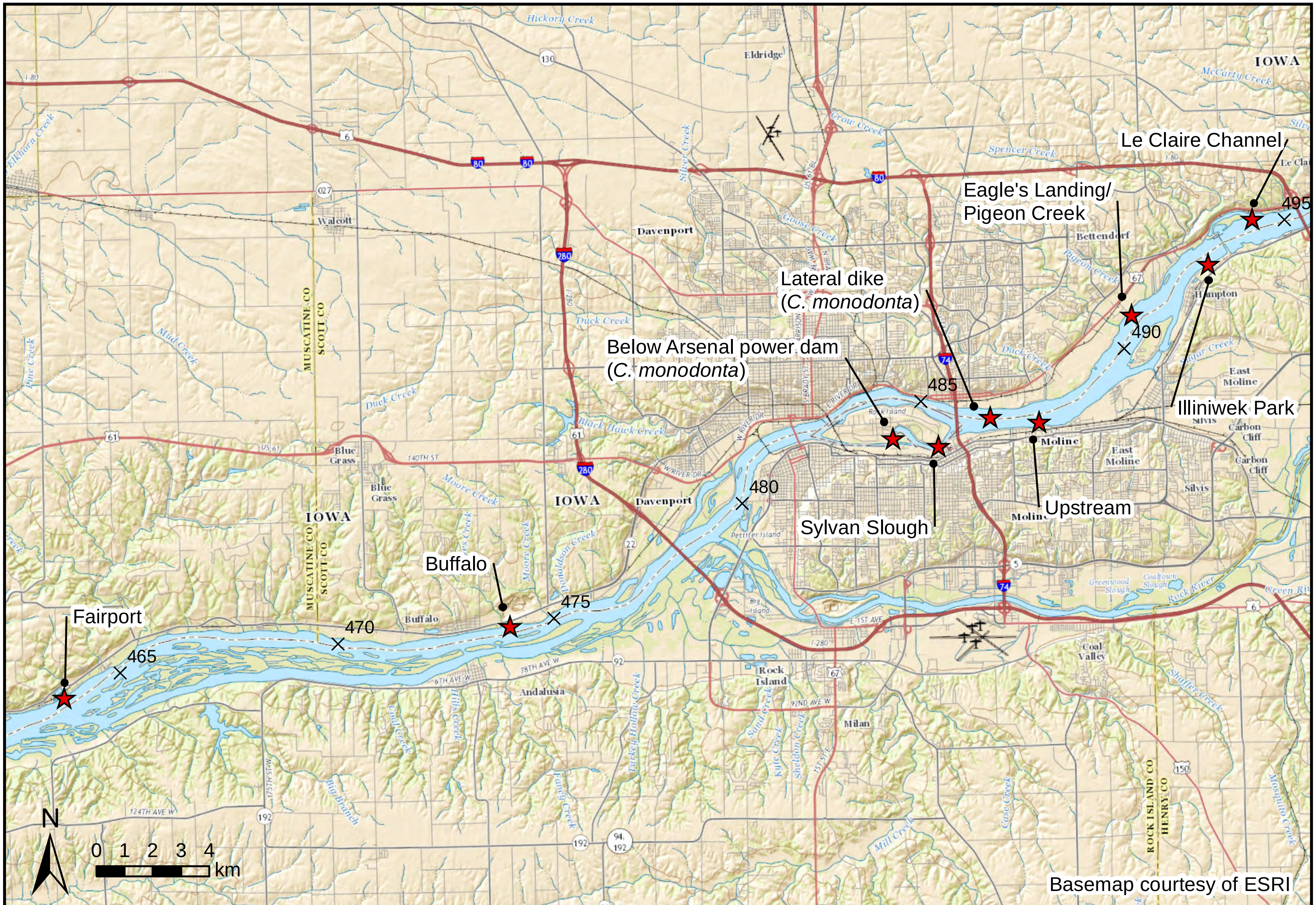


ECOLOGICAL SPECIALISTS, INC.

Figure 1-1. Existing and proposed I-74 bridge alignments, 2014 survey areas, and *L. higginsii* EHA, Mississippi River Pool 15.

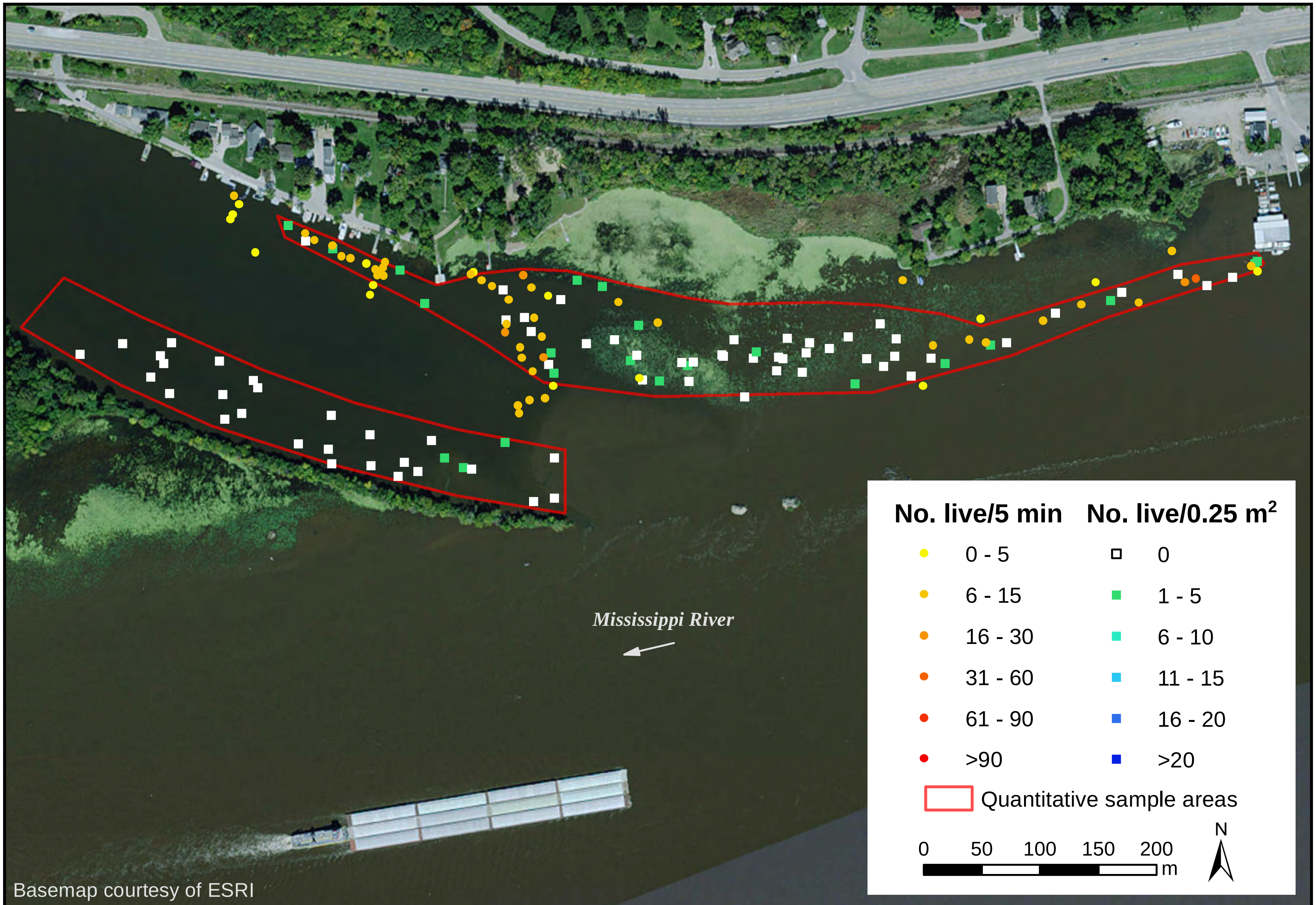
ESI



ECOLOGICAL SPECIALISTS, INC.

Figure 2-1. Potential relocation areas for the I-74 bridge replacement project.

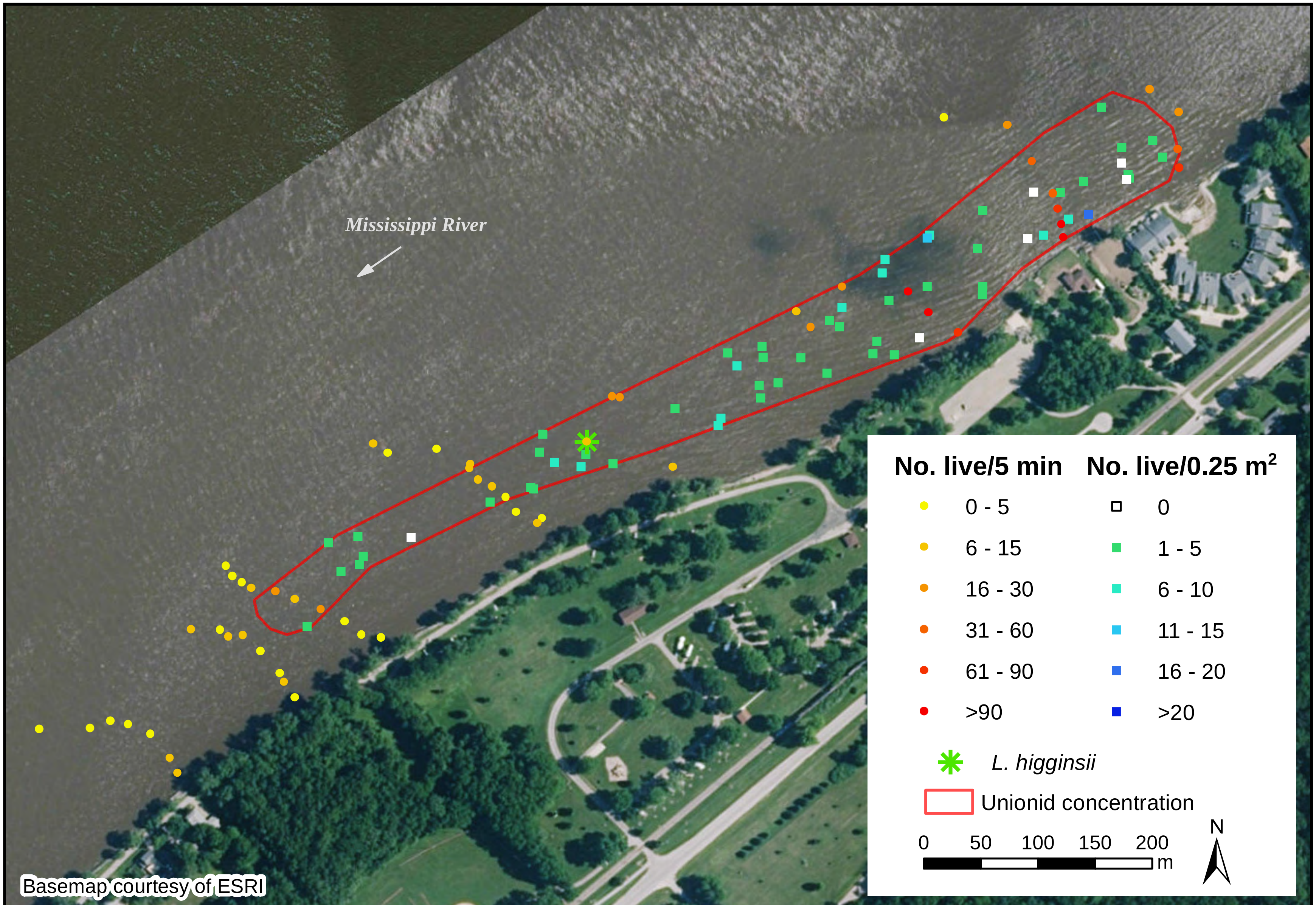
ESI



ECOLOGICAL SPECIALISTS, INC.

Figure 4-1. Unionids collected at the Le Claire Channel site, July-August 2015.

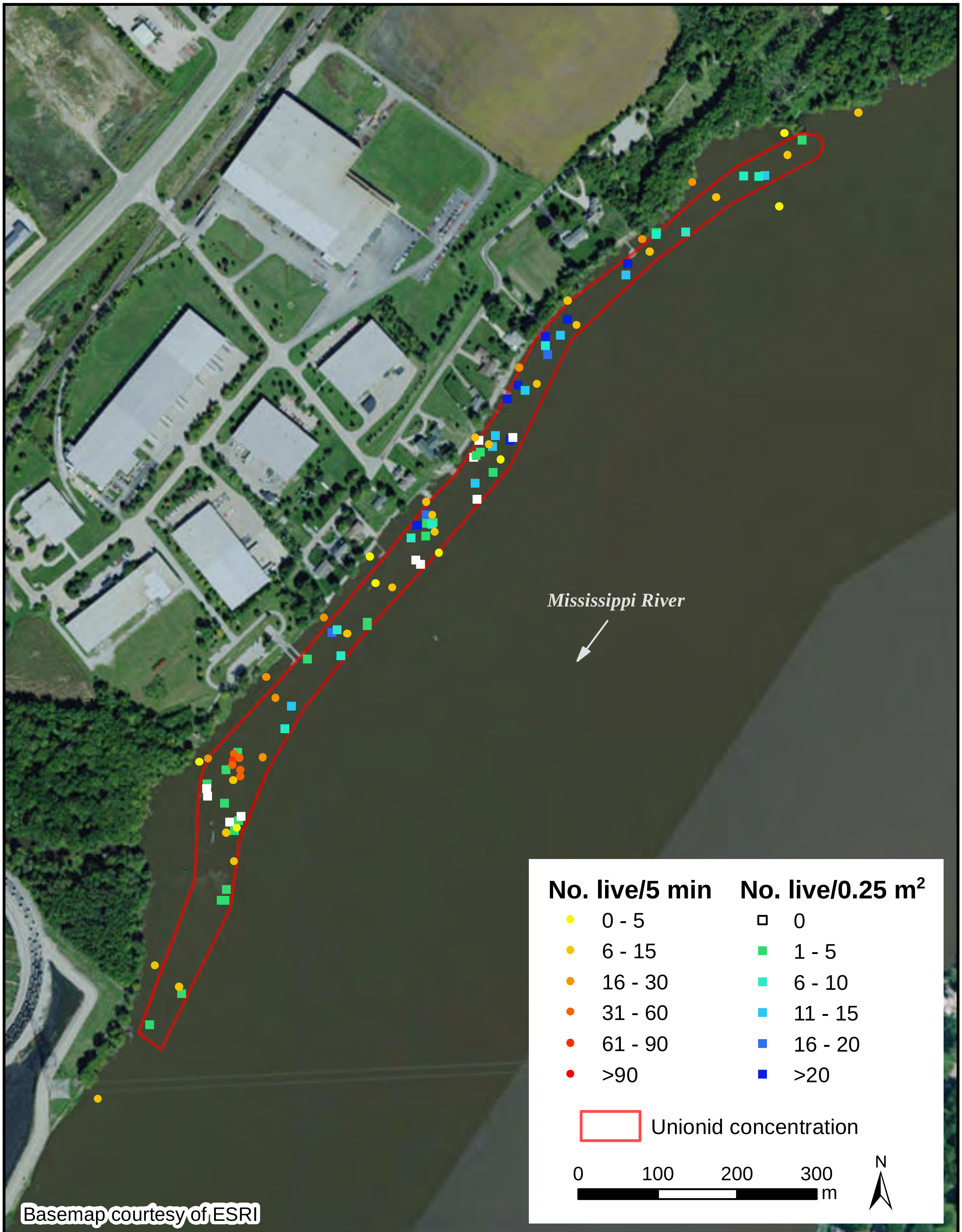
ESI



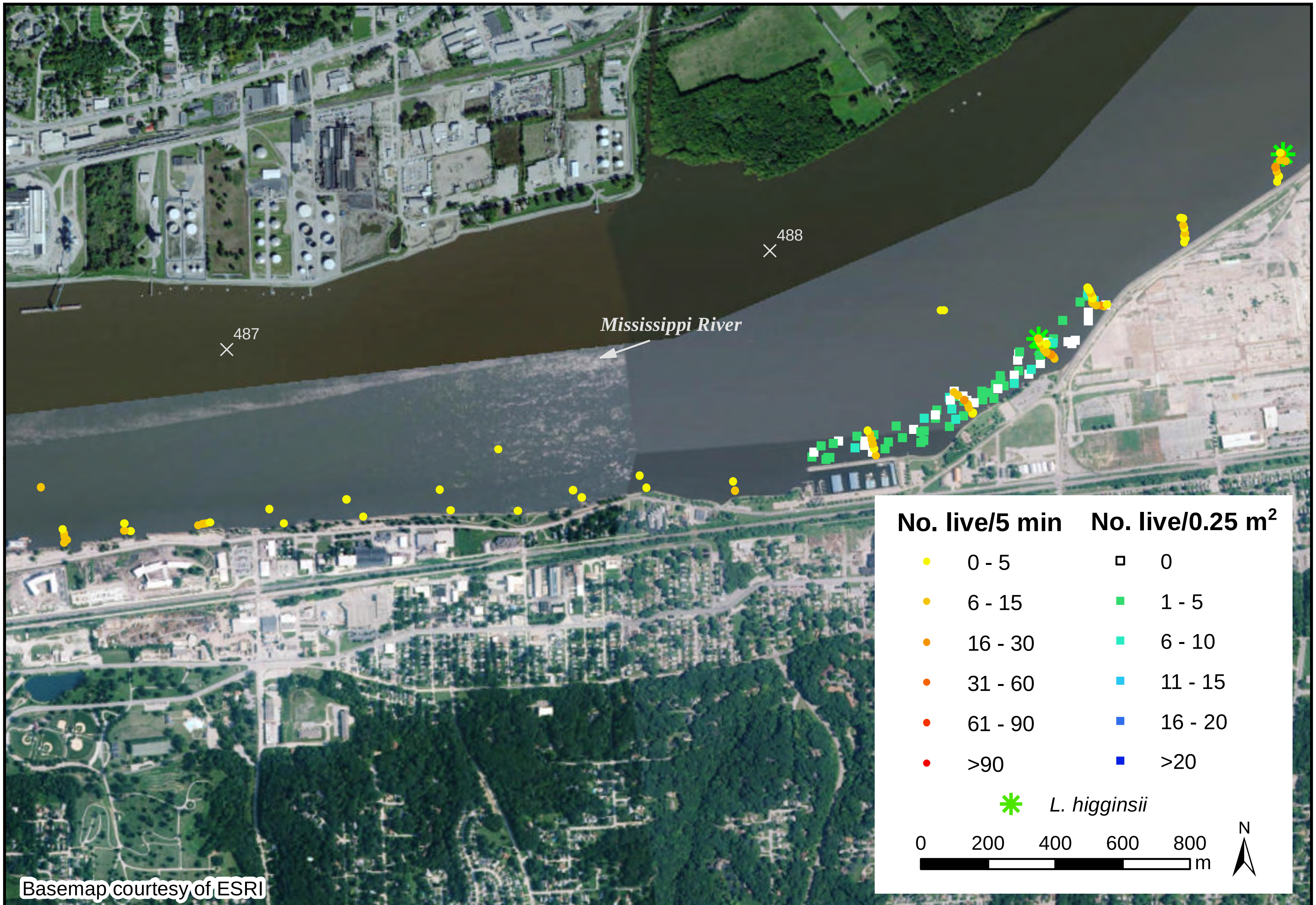
ECOLOGICAL SPECIALISTS, INC.

Figure 4-2. Unionids collected at the Illiniwek Park site, August 2015.

ESI



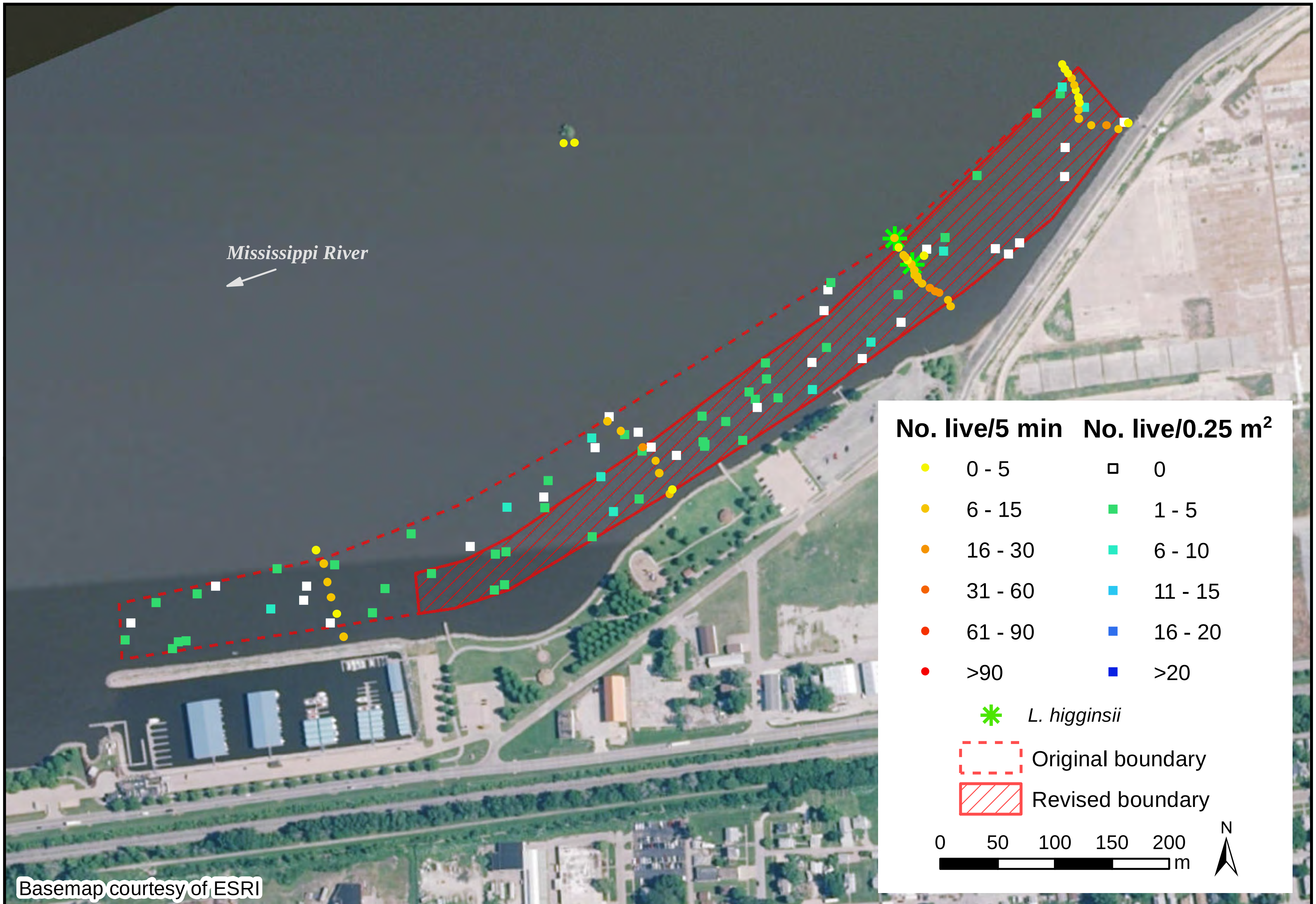
ECOLOGICAL SPECIALISTS, INC.	Figure 4-3. Unionids collected at the Eagle's Landing site, July 2015.	ESI



ECOLOGICAL SPECIALISTS, INC.

Figure 4-4. Unionids collected at the Upstream site, August 2015.

ESI



ECOLOGICAL SPECIALISTS, INC.

Figure 4-5. Modification of Upstream unionid concentration boundaries based on quantitative sampling results, August 2015.

ESI

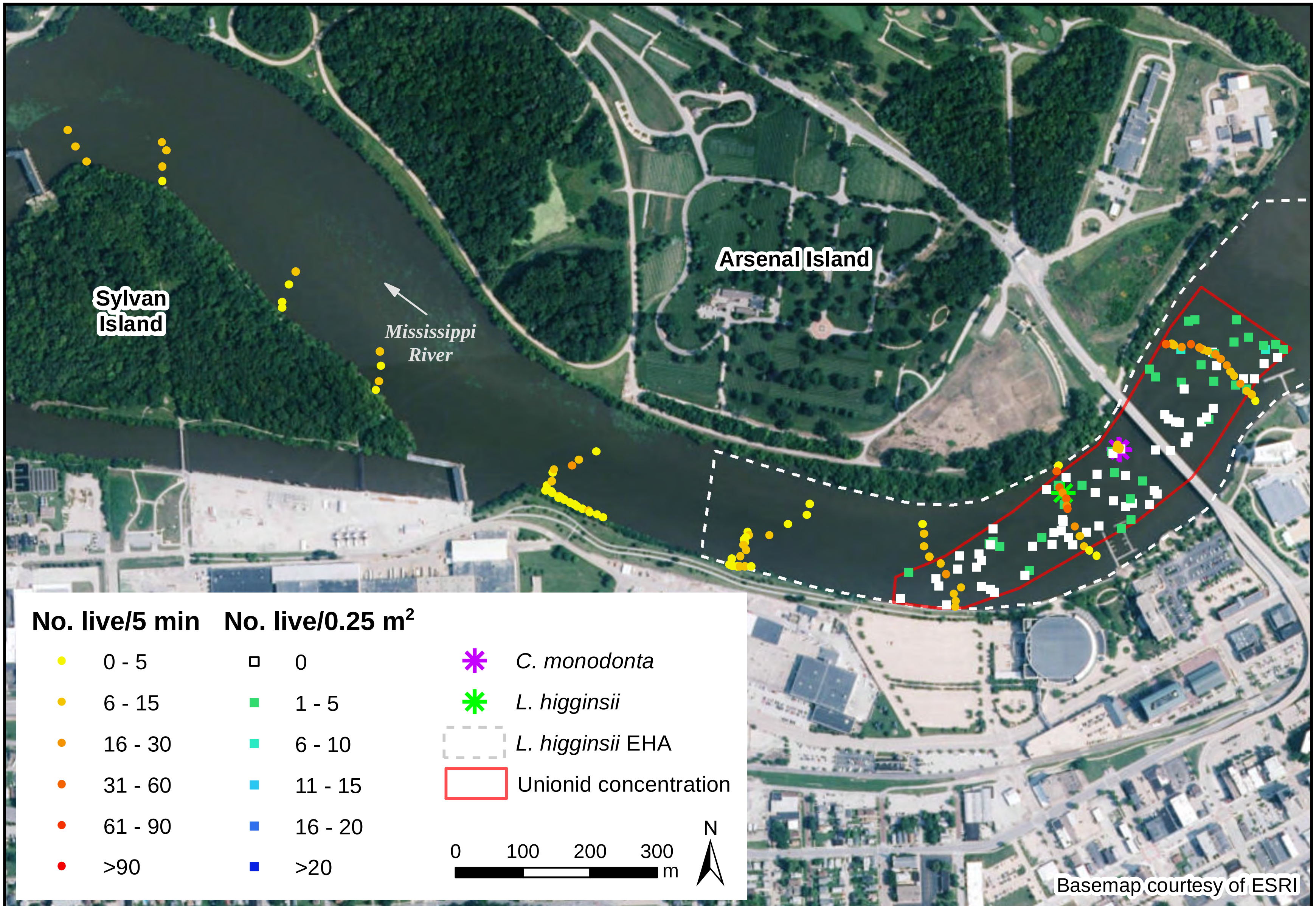
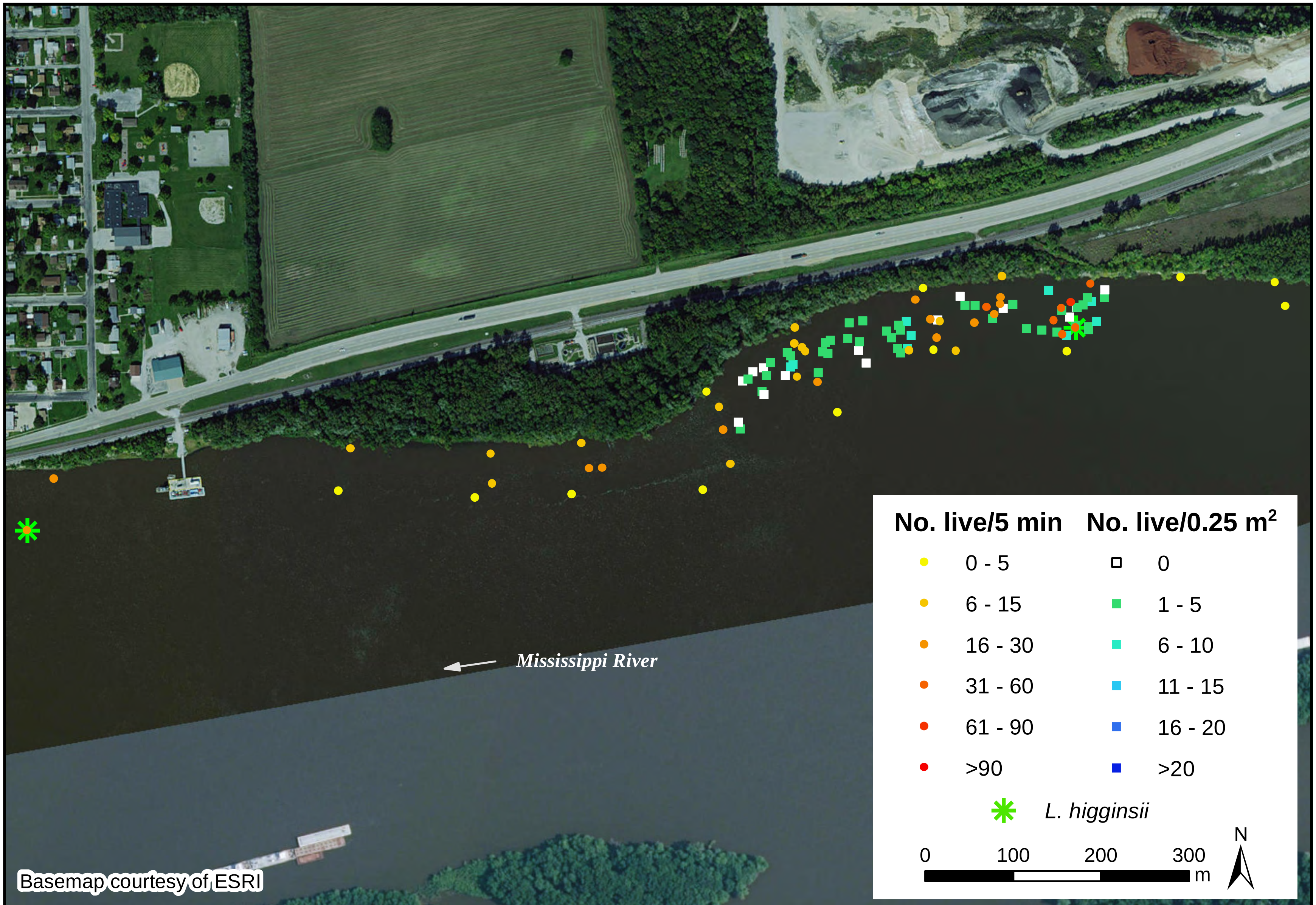


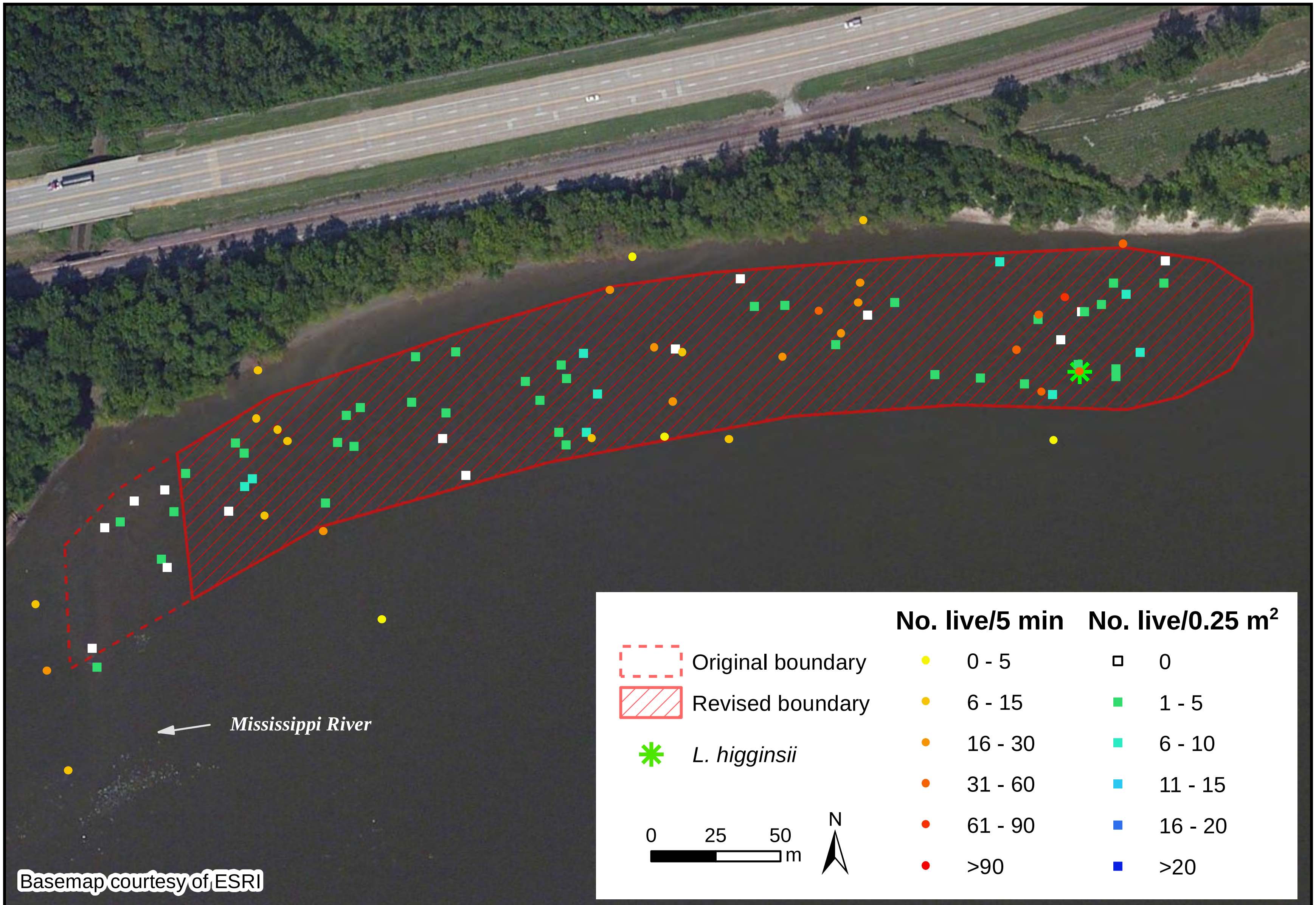
Figure 4-6. Unionids collected in Sylvan Slough, August 2015.



ECOLOGICAL
SPECIALISTS, INC.

Figure 4-7. Unionids collected at the Buffalo site, July 2015.

ESI



ECOLOGICAL SPECIALISTS, INC.

Figure 4-8. Modification of Buffalo unionid concentration boundaries based on quantitative sampling results, July 2015.

ESI

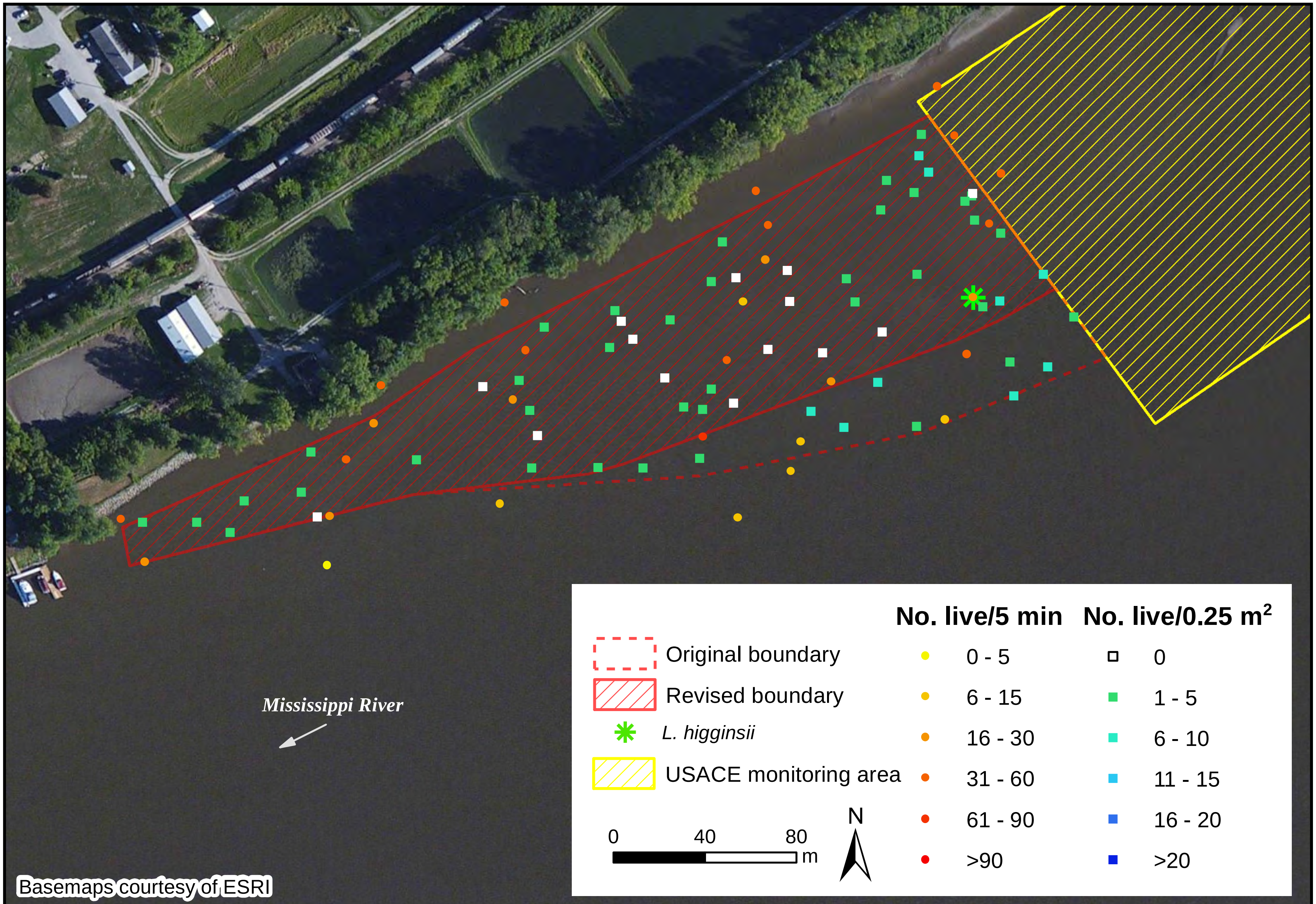


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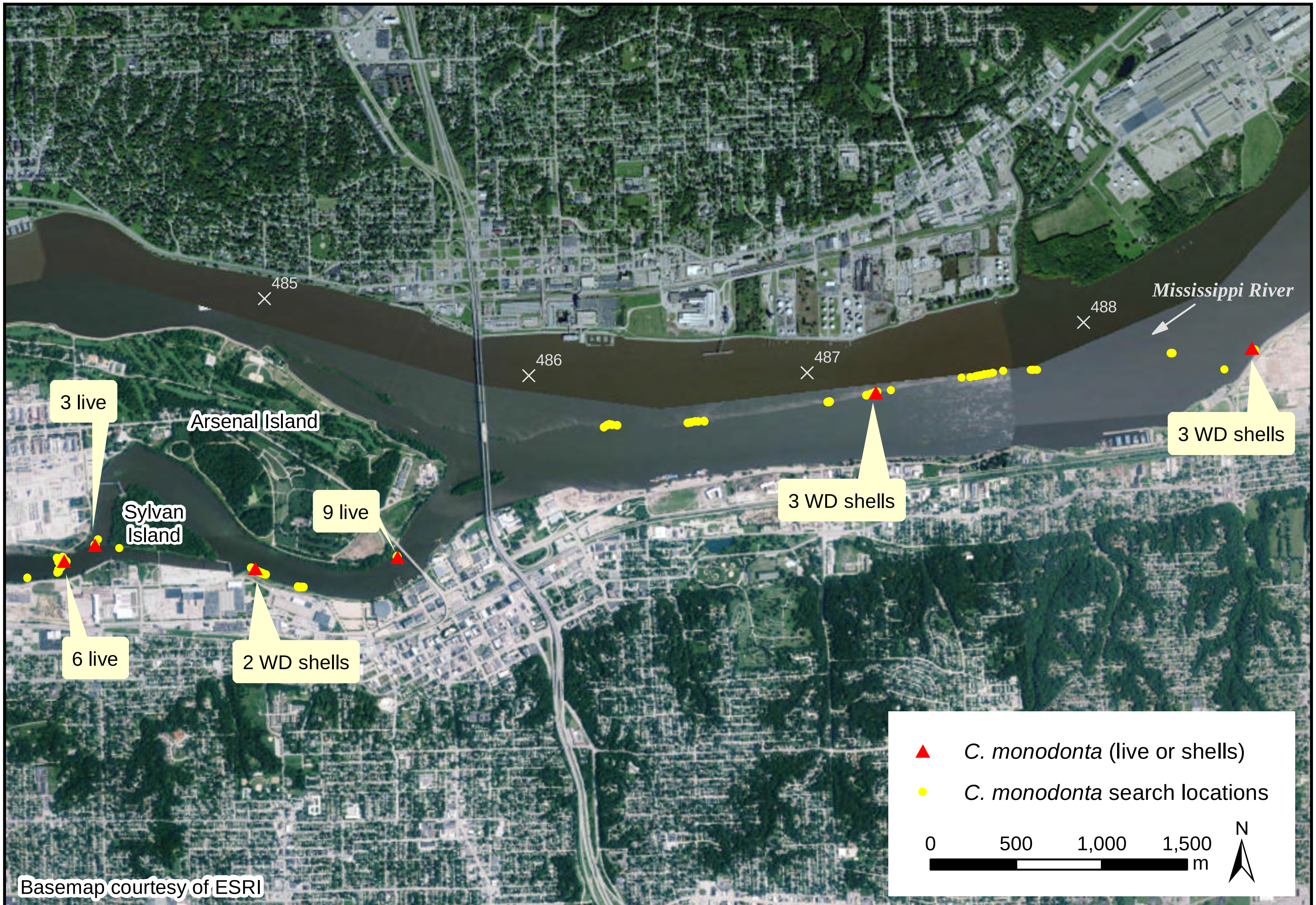
Figure 4-9. Unionids collected at the Fairport site, July 2015.

ESI



ECOLOGICAL SPECIALISTS, INC.

Figure 4-10. Locations of *C. monodonta* live individuals and shells in Pool 15, July-August 2015.

ESI

Table 1-1. Unionid species collected in the I-74 bridge project area, 2014.

Species	Status [1]	IL bank [2]	IA bank [2]
Margaritiferidae			
Cumberlandia monodonta	FE, ILE, IAE	L	L
Amblemini			
Amblema plicata		L	L
Pleurobemini			
Fusconaia ebena	ILT	WD	-
Fusconaia flava		L	L
Plethobasus cyphyus	FE, ILE, IAE	L	-
Pleurobema sintoxia	IAE	L	-
Quadrulini			
Cyclonaias tuberculata	ILT, IAT	WD	-
Megalonaias nervosa		L	L
Quadrula metanevra		L	L
Quadrula nodulata		L	L
Quadrula pustulosa		L	L
Quadrula quadrula		L	L
Tritogonia verrucosa	IAE	WD	-
Anodontini			
Arcidens confragosus		L	L
Lasmigona complanata		L	L
Pyganodon grandis		L	L
Strophitus undulatus	IAT	WD	-
Utterbackia imbecillis		L	L
Lampsilini			
Actinonaias ligamentina		WD	-
Ellipsaria lineolata	ILT, IAT	L	L
Lampsilis cardium		L	L
Lampsilis higginsii	FE, ILE, IAE	L	L
Lampsilis teres	IAE	WD	-
Leptodea fragilis		L	L
Ligumia recta	ILT	L	L
Obliquaria reflexa		L	L
Obovaria olivaria		L	L
Potamilus alatus		L	L
Potamilus ohiensis		L	-
Toxolasma parvus		L	-
Truncilla donaciformis		L	L
Truncilla truncata		L	L
Live species		26	22
Total species		32	22

[1] FE = federally endangered, ILE = Illinois endangered, ILT = Illinois threatened, IAE = Iowa endangered, IAT = Iowa threatened. USFWS (2015), ILDNR (2015), IADNR (2009).

[2] L = live, WD = weathered dead

Table 2-1. Summary of potential relocation areas sampled in 2015.

Site	Pool	Bank	Approx. River Mile
Le Claire Channel	14	Iowa	494
Illiniwek Park	15	Illinois	493
Eagle's Landing	15	Iowa	490 - 491
Upstream	15	Illinois	486.5 - 488.5
Sylvan Slough	15	Illinois	484.5 - 485.5
Buffalo	16	Iowa	474
Fairport	16	Iowa	464
Dike (*C. monodonta*)	15	Illinois	486 - 487.5
Arsenal (*C. monodonta*)	15	Illinois	484

Table 3-1. Summary of sample effort in potential relocation areas, July-August 2015.

Site	Qualitative Search Time (min)	Quantitative (0.25 m^2 quadrats)
Le Claire Channel	290	90
Illiniwek	285	60
Eagle's Landing	210	60
Upstream	450	75
Sylvan Slough	500	90
Buffalo	235	61
Fairport	140	60
Dike (*C. monodonta*)	215	-
Arsenal (*C. monodonta*)	235	-

Table 4-1. Unionids collected in general relocation areas, July-August 2015.

Species	Le Claire Channel	Illiniwek Park	Eagle's Landing	Upstream	Sylvan Slough	Buffalo	Fairport
Margaritiferidae							
Cumberlandia monodonta	-	-	-	WD	9	-	-
Amblemini							
Amblema plicata	224	597	191	181	261	335	351
Pleurobemini							
Elliptio dilatata	-	-	-	SF	-	-	-
Fusconaia ebena	-	-	-	WD	-	WD	-
Fusconaia flava	2	40	15	7	31	51	49
Pleurobema sintoxia	-	-	-	-	-	1	6
Quadrulini							
Cyclonaias tuberculata	-	1	-	WD	WD	-	-
Megalonaias nervosa	2	48	61	32	27	7	20
Quadrula metanevra	-	1	11	3	1	15	37
Quadrula nodulata	1	-	6	2	4	3	8
Quadrula p. pustulosa	9	115	122	163	248	218	93
Quadrula quadrula	81	37	47	20	47	93	103
Tritogonia verrucosa	-	WD	-	WD	-	-	WD
Anodontini							
Anodonta suborbiculata	3	-	-	-	-	-	-
Arcidens confragosus	1	4	11	5	6	10	2
Lasmigona c. complanata	3	10	5	9	12	5	3
Pyganodon grandis	54	2	2	2	6	2	1
Strophitus undulatus	-	-	-	-	WD	-	-
Utterbackia imbecillis	21	FD	61	1	FD	1	1
Lampsilini							
Actinonaias ligamentina	-	2	-	-	-	-	WD
Ellipsaria lineolata	-	13	49	14	1	6	12
Lampsilis cardium	1	24	22	50	72	14	15
Lampsilis higginsii	-	2	-	3	1	2	1
Lampsilis teres	6	-	-	-	-	-	2
Leptodea fragilis	44	33	92	23	8	1	1
Ligumia recta	-	21	17	52	52	11	9
Obliquaria reflexa	22	512	282	175	254	160	228
Obovaria olivaria	WD	4	14	9	1	18	18
Potamilus alatus	30	24	42	22	6	3	2
Potamilus ohiensis	13	5	3	6	4	1	FD
Toxolasma parvus	21	-	-	FD	-	1	10
Truncilla donaciformis	5	17	43	FD	1	19	10
Truncilla truncata	-	10	54	2	2	-	-
Total no. live	543	1522	1150	781	1054	977	982
Live species	19	22	21	21	22	23	23
Total species	20	24	21	28	25	24	26
CPUE (no. live/hour)	105.9	273.9	195.7	82.8	118.3	208.9	359.6
Mean density (±2SE)	1.8 ± 0.8 [1] 0.5 ± 0.6 [2]	14.7 ± 3.5	31.0 ± 8.4	10.1 ± 3.0	3.0 ± 1.2	11.8 ± 2.6	7.8 ± 2.4

L = live, FD = fresh dead, WD = weathered dead, SF = subfossil

[1] Density on Iowa bank of Le Claire Channel site

[2] Density on island bank of Le Claire Channel site

Table 4-2. Number of unionids that could be placed in potential relocation areas.

	Le Claire Channel	Illiniwek Park	Eagle's Landing	Upstream	Sylvan Slough	Buffalo	Fairport
Mean density (±2SE)	1.8 ± 0.8	14.7 ± 3.5	31.0 ± 8.4	10.1 ± 3.0	3.0 ± 1.2	11.8 ± 2.6	7.8 ± 2.4
Area (m^2)	43,955	57,779	64,585	41,032	81,191	24,330	25,167
No. unionids that can be placed with density increase of:							
10%	7,912	85,128	200,214	41,579	-	28,635	19,731
25%	19,780	212,819	500,534	103,948	-	71,586	49,327
50%	39,560	425,639	1,001,068	207,895	-	143,173	98,655

Table 4-3. Characteristics of federally endangered species collected in relocation areas, July-August 2015.

	ID Number	Est. age (years)	Shell measurements (mm)			Sex/Gravidity [1]
			Length	Width	Height	
<u>Illiniwek</u>						
Lampsilis higginsii	ESI 15-04	12	98	52	67	M
Lampsilis higginsii	ESI 15-05	14	90	47	68	M
<u>Upstream</u>						
Lampsilis higginsii	ESI 15-07	7	74	38	55	M
Lampsilis higginsii	ESI 15-08	8	64	38	53	FNG
Lampsilis higginsii	ESI 15-09	14	64	41	50	FNG
<u>Sylvan Slough</u>						
Lampsilis higginsii	ESI 15-06	4	51	26	37	n/a (juvenile)
Cumberlandia monodonta	-	25	126	26	45	-
Cumberlandia monodonta	-	18	110	23	45	-
Cumberlandia monodonta	-	21	134	32	44	-
Cumberlandia monodonta	-	18	114	24	43	-
Cumberlandia monodonta	-	25	135	28	45	-
Cumberlandia monodonta	-	27	129	27	47	-
Cumberlandia monodonta	-	21	119	25	44	-
Cumberlandia monodonta	-	20	114	25	46	-
Cumberlandia monodonta	-	12	78	15	31	-
<u>Buffalo</u>						
Lampsilis higginsii	ESI 15-01	17	97	53	71	M
Lampsilis higginsii	ESI 15-02	12	74	47	60	FNG
<u>Fairport</u>						
Lampsilis higginsii	ESI 15-03	13	77	50	62	FNG
<u>Arsenal - upstream site</u>						
Cumberlandia monodonta	-	18	124	28	47	-
Cumberlandia monodonta	-	15	104	20	37	-
Cumberlandia monodonta	-	30	134	32	50	-
Cumberlandia monodonta	-	25	121	26	50	-
Cumberlandia monodonta	-	15	98	20	38	-
Cumberlandia monodonta	-	15	106	22	43	-
<u>Arsenal - downstream site</u>						
Cumberlandia monodonta	-	16	108	21	43	-
Cumberlandia monodonta	-	23	122	26	48	-
Cumberlandia monodonta	-	6	74	15	33	-

[1] M = male, FNG = female not gravid

ATTACHMENT E

I-74 BIOLOGICAL OPINION

United States Department of the Interior

IN REPLY REFER TO

FISH AND WILDLIFE SERVICE
Rock Island Field Office
1511 47th Avenue
Moline, Illinois 61265
Phone: (309) 757-5800 Fax: (309) 757-5807

Biological Opinion

For the

U.S. Federal Highway Administration's
Replacement of the I-74 Bridge in the Mississippi River,
Scott County, Iowa and Rock Island County, Illinois

Prepared by:
U.S. Fish and Wildlife Service
Illinois-Iowa Field Office

Submitted to:
Iowa Department of Transportation
800 Lincoln Way
Ames, Iowa 50010

Kraig McPeek
Field Supervisor
llinois – Iowa Field Office

Date

EXECUTIVE SUMMARY

The action evaluated in this Section 7 consultation is the replacement of the I-74 Bridge in the Mississippi River between Bettendorf, Iowa and Moline, Illinois, by the Federal Highway Administration (FHWA) in cooperation with the Iowa Department of Transportation (IADOT) and Illinois Department of Transportation (ILDOT). The replacement of the bridge includes construction of a new basket handle twin arch bridge upstream of the current bridge location approximately 400 – 600 feet (Phase 1) and removal of the existing suspension bridge (Phase 2). The U.S. Army Corps of Engineers is proposing to authorize the placement of fill within waters of the U.S. under Section 404 of the Clean Water Act and Section 10 (Rivers and Harbors Act) for this project.

Formal consultation was requested by FHWA for impacts to the endangered spectaclecase mussel *(Cumberlandia monodonta)*, Higgins eye pearlymussel *(Lampsilis higginsii)*, and sheepnose mussel *(Plethoblasus cyphyus)*. No critical habitat will be impacted. Of the eight federally protected species evaluated by FHWA for the I-74 Bridge replacement project, it was determined the project would have no effect on the Indiana bat *(Myotis sodalis)*, northern long-eared bat *(Myotis septentrionalis)*, the eastern prairie fringed orchid *(Platanthera leucophaea)*, prairie bush clover *(Lespedeza leptostachya)* and western prairie fringed orchid *(Platanthera praeclara)*. The U.S. Fish and Wildlife Service (Service) concurred with these determinations.

Detailed information about the current status of the spectaclecase mussel, Higgins eye pearlymussel, and sheepnose mussel is included in the biological opinion, along with information about the impacts of the project on these species. A significant mussel resource is located within the action area of the project. The project will likely impact approximately 958,246 $feet^2$ (22 acres) of mussel habitat which will impact Higgins eye, sheepnose, and spectaclecase habitat. Several conservation measures to avoid and minimize impacts have been incorporated into the project including the relocation of 1,645 Higgins eye, 389 sheepnose, and 366 spectaclecase. Local effects to the population are anticipated, however we do not believe long-term impacts to the populations of these mussels in Pool 15 will persist from this action and there will be no impact at the species level for each of these three mussel species.

The Service concludes that the proposed I-74 Replacement Project will not jeopardize the continued existence of the spectaclecase mussel, Higgins eye pearlymussel, or sheepnose mussel. However, the proposed action will result in incidental take of all three species.

The Incidental Take Statement (ITS) issued exempts the FHWA, Corps, IADOT, and ILDOT from prohibitions of taking under Section 9 of the Endangered Species Act (ESA) provided that such taking is in compliance with the terms and conditions of the ITS. The construction of the new bridge and demolition of the old bridge may result in the harm, harassment, or mortality of approximately 407 spectaclecase mussels, 3,470 Higgins eye pearlymussels, and 856 sheepnose mussels. Incidental take will be monitored, and if it is exceeded, the consultation will be re-initiated.

CONTENTS

CONSULTATION HISTORY

Date	Description
January 2000	The Illinois DOT signed the Statewide Implementation Agreement adopting the merged NEPA-404 process. Agencies in attendance included the U.S. Army Corps of Engineers (USACE) (Rock Island, St. Louis, Memphis, Chicago, Louisville districts), USFWS, U.S. Environmental Protection Agency (EPA) Region 5, U.S. Coast Guard, Illinois DOT and FHWA.
01/24/01	The Notice of Intent to prepare an Environmental Impact Statement (EIS) for the I-74 Quad Cities Corridor Study was published in the Federal Register.
03/19/01	A meeting was held with the Illinois DOT, Iowa DOT, CH2MHill, and Sverdrup Civil, Inc. The purpose of the meeting was to gain agency agreement on the approach to the NEPA-404 process for the project.
06/20/01	NEPA-404 Merged Process Meeting #1 (scoping meeting) was held with the Illinois DOT, Iowa DOT, CH2MHill, USACE, and the Iowa DNR.
07/17/01	A meeting was held to introduce the resource agencies to the project and the NEPA-404 merged process. Agencies in attendance included Illinois DOT, Iowa DOT, CH2MHill, USACE, USFWS, Iowa DNR, Illinois DNR, and FHWA.
12/05/01	Concurrence Points 1, 2, and 3 of the NEPA-404 merged process were completed.
03/21/03	A letter was sent by the Illinois DOT to the Iowa DOT providing an environmental review of the project and recommending that the Iowa DOT secure an Illinois ITA for the project.
10/30/03	The draft EIS for the I-74 Quad Cities Corridor Study was published. The document was signed by FHWA, Iowa DOT, and Illinois DOT.
03/02/05	A meeting was held with FHWA, Illinois DOT, Iowa DOT, Illinois DNR, Illinois Historic Preservation Agency, Iowa DNR, Natural Resources Conservation Service (NRCS), U.S. EPA, USACE, U.S. Coast Guard, and USFWS to recap the NEPA-404 merged process Concurrence Points ahead of Concurrence Point #4.
08/22/07	A meeting was held with USFWS, FHWA, USACE, Iowa DOT, Illinois DOT, Iowa DNR, Illinois DNR, and CH2MHill to discuss Concurrence Point #4 of the merged NEPA-404 process. All agencies concurred on the preferred alternative.

01/08/09	The final EIS for the I-74 Quad Cities Corridor Study was published; this publication included the Illinois Conservation Plan. The document was signed by FHWA, Iowa DOT, and Illinois DOT.
08/12/09	An email was received by the Iowa DOT from the Illinois DOT confirming Illinois DOT would conduct mussel surveys and USFWS coordination for the project.
11/18/13	Meeting was held to discuss the process IADOT should follow to complete section 7 consultation for the removal and replacement of the I-74 bridge. The timing of mussel surveys, and that mussel surveys should include diving was discussed. The development of the scope of work for the musselsurveys was discussed.
01/24/14	An email was sent by the Iowa DOT to the Illinois DOT indicating a decision was made that the Iowa DOT would conduct the mussel surveys and USFWS coordination for the project.
03/13/14	U.S. Fish and Wildlife Service sends correspondence to IADOT and ILDOT recommending completion of Scope of Work for mussel surveys for I-74 bridge project.
07/24/14	Revised Scope of Work for Mussel Surveys for I-74 bridge removal and replacement are received from Ecological Specialists, Inc.
07/25/14	Authorization is provided to conduct the mussel survey for the I-74 bridge project in Pool 15 of the Mississippi River as outline in the Scope of Work and per the conditions of the U.S. Fish and Wildlife Service permit TE 206781-4 (Ecological Specialists).
02/23/15	A meeting was held at the Moline City Water Department with the USFWS, USACE, Iowa DOT, Illinois DOT, Iowa DNR, Illinois DNR, Stantec Consulting Services Inc. (Stantec), and Ecological Specialists, Inc. (ESI) to discuss project background, preparation of the BA, and the potential effort required for mussel relocation. ESI presented the results of the 2014 mussel survey conducted for the project.
03/17/15	A meeting was held at the USFWS Rock Island Ecological Services Field Office with the USFWS, Iowa DOT, Illinois DOT, Stantec, and ESI to discuss the preparation of the BA. Inquiries were made regarding the specifics of construction staging and sequencing. The limits of the action area were generally discussed and the USFWS provided information on topics that should be addressed in the document.

04/21/15 A meeting was held at the Iowa DOT office in Ames, Iowa with the USFWS, Iowa DOT, Illinois DOT and Stantec to discuss preliminary construction activities and requirements for contractors to follow during construction. Specifically, the need for dredging and coffer dams was discussed.

05/28/15 A meeting was held at the Moline City Water Department with the USFWS, Iowa DOT, Illinois DOT, Iowa DNR, Illinois DNR, U.S. Geological Survey, Stantec, and ESI to discuss mitigation and relocation areas. Potential locations were evaluated for suitability as mussel relocation areas.

07/30/15 A conference call was held with the USFWS, USACE, FHWA, Iowa DOT, Illinois DOT, Iowa DNR, Illinois DNR, Stantec, and ESI to discuss the status of the BA. Relocation needs of the spectaclecase mussel were discussed.

12/02/15 A meeting was held at the USFWS Rock Island Ecological Services Field Office with the USFWS, Iowa DOT, Illinois DOT, Iowa DNR, Illinois DNR, Stantec, and ESI to discuss the proposed action area for aquatic resources and format of the BA. The action area presented by the Iowa DOT was agreed to by all parties, and it was decided that one document would be prepared that would cover both construction and demolition activities. A discussion of proposed mitigation as a result of construction will be covered in the BA; however, a discussion of mitigation as a result of demolition activities will be determined once known. ESI summarized the results of mussel surveys for proposed relocation areas. The USFWS, Iowa DNR, and Illinois DNR scheduled a meeting to discuss the three agencies' mitigation requirements to streamline the mitigation efforts.

03/03/16 A meeting was held at the USFWS Rock Island Ecological Services Field Office with the USFWS, Iowa DOT, Illinois DOT, Iowa DNR, Illinois DNR, Illinois Natural History Survey, Stantec, and ESI to discuss the draft BA and discuss project schedule. In addition, DOT's approach to mussel relocation and mitigation and monitoring was discussed. The approach to the relocation effort is dependent upon completion of the Memorandum of Understanding (MOU) between the USFWS, the Illinois DNR and the Iowa DNR; the USFWS indicated the MOU was nearing completion. The Illinois DNR indicated schedule was critical and asked to see the draft BA/Illinois Conservation Plan as soon as possible.

04/21/16 A conference call was held with the USFWS, Illinois DOT, Iowa DOT, Illinois DNR, Iowa DNR, Illinois Natural History Survey, Stantec, and ESI to discuss the mussel relocation plan.

05/01/16 Intergovernmental Agreement between USFWS, the Illinois DNR and the Iowa DNR is developed and signed regarding coordination of state and federally listed mussel resources impacts related to the I-74 Bridge Replacement.

05/05/16 USFWS receives final Biological Assessment from Iowa Department of Transportation.

05/18/16 USFWS holds an intergovernmental and resource agency meeting to discuss potential mitigation and relocation and monitoring scenarios for the I-74 Bridge Replacement per the Intergovernmental Agreement.

06/20/16 USFWS provides FHWA's designee (Iowa Department of Transportation) with the draft biological Opinion for I-74 Bridge Replacement for comments.

BIOLOGICAL OPINION

1. DESCRIPTION OF THE PROPOSED ACTION

The federal action evaluated in this Biological Opinion (BO) is the project proposed by the Federal Highway Administration (FHWA), the lead Federal agency for endangered species consultation which has designated the Iowa Department of Transportation (IADOT), the project sponsor, as the lead for endangered species consultation, and the issuance of a Section 404 Clean Water Act permit by the United States (US) Army Corps of Engineers (the Corps) to the applicant to authorize the placement of fill within Waters of the US and a section 10 (Rivers and Harbors Act) permit for construction and demolition of bridges over the Mississippi River, a navigable waterway.

The U.S. Fish and Wildlife Service (the Service) is issuing this BO pursuant to section 7 of the Endangered Species Act (ESA). Direct and indirect effects of the proposed action and the interrelated or interdependent activities are analyzed to ensure they are not likely to jeopardize the continued existence of federally listed or proposed endangered or threatened species. Direct effects are immediate effects of the proposed action on the species or its habitat, including the effects of interrelated actions and interdependent actions. Indirect effects of a proposed action includes, "…effects that are caused by or result from the action, are later in time but are reasonably certain to occur…" Interdependent actions have no independent utility apart from the proposed action, and interrelated action are part of a larger action and depend on the larger action for their justification (50 CFR §402.02). In their Biological Assessment (BA), Iowa Department of Transportation (DOT) outlined activities that may affect three freshwater mussel species that are federally listed as endangered and inhabit mussel beds within the area of potential effect in the Mississippi River. These species include spectaclecase *(Cumberlandia monodonta)*, Higgins eye pearlymussel *(Lampsilis higginsii)*, and sheepnose *(Plethoblasus cyphyus)*.

1.1 Project Description

The FHWA, the Iowa DOT and and the Illinois DOT (ILDOT) are proposing to replace the Interstate 74 (I-74) bridge across the Mississippi River between Bettendorf, Iowa and Moline, Illinois. Specifically, the bridge project located in Sections 28, 29, 32, 33; Township 78N; Range 04W in Scott County, Iowa, and Sections 28, 29, 32 and 33; Township 18N; Range 01W in Rock Island County, Illinois (Figure 1).

Figure 1. Map of Project

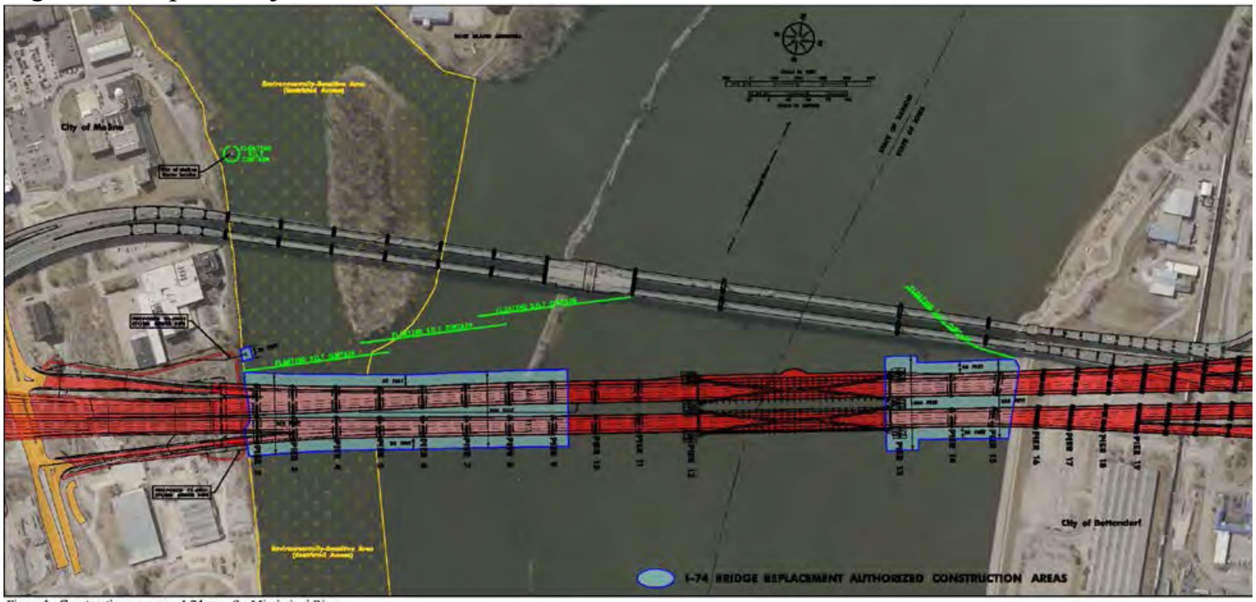


Figure 1. Construction area map, I-74 over the Mississippi River.

The existing I-74 bridge crosses Pool 15 of the Mississippi River near River Mile 486. The proposed project involves construction of a new basket handle twin arch bridge (Phase I) upstream of the current bridge location approximately 400 to 600 feet (122 meters [m] to 243 m) and removal of the existing suspension bridge (Phase II). The proposed bridge consists of 14 concrete piers in-stream supporting the deck and will be approximately 3,372 feet in length. Each pier will consist of eight to 10 columns and each column is seven feet in diameter. The bridge will include six lanes of vehicle traffic and a pedestrian/bike lane.

Construction Schedule

Table 1 provides a summary of the proposed project schedule. Specifics of construction and project components are described below. Project activities will occur year-round weather permitting.

Table 1. Proposed Project Schedule

Project Phase	**Proposed Schedule**
Mussel Relocation (Phase I)	July through September 2016
Installation of Silt Curtain	Summer 2017
Construction of Storm Sewer Outfalls	August through October 2017 (Outfall M6), Fall 2017 or April through July 2018 (Outfall M1B)
Construction of the Proposed Bridge	September 2017 through November 2020 (Eastbound lanes complete November

Project Phase	Proposed Schedule
	2019; westbound lanes complete 2020)
Mussel Relocation (Pre-Phase II)	Fall 2020
Demolition of Existing Bridge	November 2020 through Fall 2021

The existing bridge will remain open to traffic during construction of the new bridge and will be demolished when construction of the new bridge is complete. Demolition will include removal of the bridge deck and all existing piers, with the exception of Pier K located in Sylvan Slough. Pier K will be left in-stream to minimize effects to the existing Sylvan Slough mussel bed and federally listed species found at that location. Demolition activities and staging are discussed below. Demolition activities will occur year-round.

The project will also include construction of two storm sewer outfalls on the north and south sides of the proposed bridge to the Mississippi River on the Moline, Illinois, bank side. The existing storm water sewer systems that drain the current I-74 bridge and a portion of the city of Moline have a history of surcharging (volume of stormwater exceeds the capacity of the drain), resulting in flooding at 3rd, 6th, and 7th Avenues. The two proposed outfalls will be constructed to manage drainage from mainline roads and bridges as well as side roads and are expected to remove some of the water from the existing flood-prone areas. Specifics of the storm sewer outfall projects are discussed below.

<u>Phase I Construction of the New Bridge – Project Components and Activities</u>

Construction Staging Areas and Dredge Activities

The navigation channel of the Mississippi River will be maintained and remain open to river traffic during construction activities. To accommodate the traffic, two staging areas will be used: one each on the Iowa and Illinois shores. Staging will occur primarily within the river and will consist of barges moored to shore or anchored into the riverbed via spuds and pins. The exact location of the staging areas is not known because the construction contractor will be responsible for choosing the location of the staging areas. However, the Iowa DOT restricts contractors from selecting staging areas within certain parts of the river by means of the project-specific Special Provisions (Appendix A and B). Specifically, construction staging will be prohibited in the following areas to avoid potential impacts to mussels:

- IADOT – No construction access within areas approximately 2,000 feet upstream of both the existing and proposed bridge corridors;

- ILDOT – No construction access within Sylvan Slough and extending upstream of the proposed bridge corridor.

Workers will be transported to the construction/demolition areas daily via small watercraft or work barge. Materials will be transported via work barge as needed. It is assumed that transport vehicles will travel the most direct route between the staging areas and the construction/demolition areas. In addition, dredging of the river bottom to accommodate transport of materials and workers will not occur.

Dredging may be required to allow for barge access to the staging areas. Dredging, if required, will occur after relocation of mussels and installation of silt curtains and prior to any other construction/demolition activities. However, the need for, and limits of, dredging will be chosen by the contractor and are not yet known. Should dredging be required outside of the dredging limits, the IADOT will coordinate with the Service, Illinois Department of Natural Resources (ILDNR), and Iowa DNR (IADNR) prior to dredging activities to determine what impacts to mussels may occur. Dredged material will not be placed back into the river and dredged areas will be backfilled with special revetment (i.e. boulders). The deposit site for dredged material is not yet known and may be deposited on shore before being hauled away. In this circumstance, silt fences, perimeter, and slope sediment control devices or low silt berms will be required to limit the re-entry of sediment into the river. In addition, the material will be placed in a confined area that is classified as upland.

Dredging may also be required to allow barge access to construction and demolition areas. It is assumed dredging will be necessary at least once prior to each phase of the project. If additional dredging is required due to unforeseen circumstances (i.e. major flood event fills dredge cut), the contractor will contact IADOT. IADOT and the Service will confer prior to additional dredging activities.

Construction and demolition areas with depths less than six feet will likely need dredging activities, although this is a conservative estimate. Based on this estimate, approximately 271,145 feet^2 (6.2 acres) located between Piers 1 through 5 on the Illinois side, may require dredging of the river bottom prior to construction. The exact limits of dredging required for demolition activities will not be known until closer to demolition. IADOT, the Service, ILDNR, and IADNR will confer and discuss the dredging effort and the minimization of effects to mussels prior to demolition.

Project Components within the River

Silt Curtain

In an effort to protect the City of Moline’s drinking water intake structure, which is located on the Illinois bank downstream of the I-74 Bridge in Sylvan Slough, silt curtains will be installed prior to construction of the bridge to retain sediment created by construction. In addition to protecting the city of Moline drinking water, the silt curtain will minimize sedimentation effects on Sylvan Slough and other downstream mussel beds and other organisms. On the Iowa side of the river, one silt curtain will begin at shore between the existing and proposed bridges and will extend to the navigational channel. On the Illinois side of the river, three silt curtains will be placed downstream of the proposed bridge corridor to protect Sylvan Slough. The three silt curtains will extend from shore to the navigational channel and will overlap where one ends and the next begins.

Silt curtains will be deployed via work barge or small watercraft. The placement of the silt curtains will occur prior to any potential dredging activities that may be required on the Illinois side of the river. No dredging is anticipated as a result of the silt curtain placement. The top of the curtain would be equipped with floating expanded polystyrene float material and navigation markers. The curtain will be held in place by weights resting on the river bottom and placed approximately every 25 feet, each having dimensions of approximately 3 feet by 3 feet. The curtains will remain in place for the duration of construction. Following construction, any accumulated debris at the river bottom upstream of the silt curtain and surface will be removed before curtain removal.

The need for, and placement of, silt curtains prior to demolition activities will be determined prior to commencement of those activities and will be based on the effectiveness of the silt curtains during the construction phase of the project. Currently, silt curtains are planned to surround select piers prior to demolition on the Illinois side.

Bridge Piers

The proposed I-74 bridge consists of 14 piers within the Mississippi River. Each pier will consist of eight to 10 columns and each column is seven feet in diameter. Proposed piers will have spans between piers ranging from approximately 148 feet to 203 feet. Each pier will be approximately 30 feet wide with varying lengths ranging from 86 feet and 8 inches (Pier 9) to 119 feet and 8 inches (Pier 2). Footings for the proposed arch foundations are to be placed on either side of the navigation channel. The total footprint of the proposed bridge piers within the river is approximately 36,900 square feet (0.08 acres).

Foundations for the approach spans (Spans 1-11 and 14-15) will consist of seven-foot diameter shafts and rock sockets drilled 12 feet into the bedrock. Barge mounted drill rigs will be used wherever adequate water depths are present and held in place by spud and pins in the river bottom. If the water depth is insufficient for a barge, a second method would be implemented that would require the construction of temporary supports (falsework), consisting of a steel structure, that would be built in the water to support the drilling work. The falsework would require socketing into the bedrock. This work will occur within a 16.4-feet (5 m) buffer of all proposed pier locations.

For the main span substructure footings, a cofferdam will be required at each of the six locations on either side of the main channel (two outer footings and an interior footing at Piers 12 and 13). Due to very shallow overburden (e.g., silt, rock, sand, etc.), the sheeting for the cofferdams will be embedded into bedrock to provide a seal and obtain adequate toe resistance.

Spoil from pier columns will be placed on barges and taken off site. No fill material will be left in the river.

Storm Sewer Outfall

Construction of two storm sewer outfall structures is proposed as part of the project. Outfall M6 and the proposed 72-inch storm sewer that parallels the existing ramp from River Drive to westbound I-74. It will drain the I-74 roadway from the river bank to 19th Street and will be constructed in August to October 2017. Construction at this location is expected to take approximately three weeks.

Outfall M1B and the proposed 36-inch storm sewer will be constructed in fall 2017 or April to July of 2018. Construction at this location will also require approximately three weeks. However, this structure is smaller than M6 and could be constructed faster.

Construction staging for the storm sewer outfalls would occur on land. Construction will consist of an open cut for installation of the pipe at each location. Cofferdams will be necessary at each outfall into the river unless river levels are exceptionally low. The exact dimensions of the cofferdams, if required, will be determined by the contractor at the time of construction. A conservative estimate indicates the dimensions of the cofferdam at Outfall M6 will be approximately 17 feet by 40 feet (680 $feet^2$) and the dimensions at Outfall M1B will be smaller at 13 feet by 40 feet (520 $feet^2$).

Phase II – Demolition of Existing Bridge

Demolition Staging Areas and Dredge Activities

The navigation channel of the Mississippi River will be maintained and remain open to river traffic during demolition activities. Similar to construction, the demolition activities will have two staging areas: one each on the Iowa and Illinois shores. The exact location of the staging areas is not known because the demolition contractor will be responsible for choosing the location of the staging areas. However, the demolition contractor will also be restricted by the IADOT project-specific Special Provisions.

Workers will be transported to the demolition areas daily via small watercraft or work barge. Materials will be transported via work barge as needed. It is assumed that transport vehicles will travel the most direct route between the staging areas and demolition areas. In addition, dredging of the river bottom to accommodate transport of materials and workers will not occur.

Dredging may be required to allow for barge access to the staging areas, but is less likely around the existing bridge due to deeper water depths. However, the need for and limits of dredging will be chosen by the contractor and are not yet known. Should dredging be required outside of the dredging limits, the contractor and IADOT will follow the same sequence of events as outlined above in Phase I.

Demolition of the existing I-74 bridge is anticipated to occur in late 2020 and be completed by fall of 2021. Activities for this phase of the project include demolition of the bridge railing and concrete deck, and demolition of the existing bridge piers (except Pier K within Sylvan Slough).

The suspended portion of the bridge over the navigation channel will be demolished via explosive demolition and dropped into the channel during the winter months when the lock and dam system is closed for the winter, likely January through early March each year. Subsequent removal of the demolished bridge material from the river bottom within the navigation channel will be accomplished with barge mounted cranes with the material being placed on barges for removal.

In order to reduce impacts to mussels and to the existing mussel bed within Sylvan Slough, explosive demolition will not be permitted on the Illinois side of the river, and no materials will be dropped into the river at this location. Catch barges are recommended by IADOT. Pier K, located within Sylvan Slough provides habitat the spectaclecase mussel and will not be removed. Instead, Pier K will be equipped with navigational lighting and other associated materials, such as a ladder and solar panel, to make it a permanent structure. During demolition activities, the contractor will be restricted from impacting the river bottom within a 16.4-feet (5-m) buffer of Pier K. The 16.4-feet buffer will be delineated with floating markers.

The remaining piers and anchor spans will be removed using barge mounted cranes. The specific method used for pier removal will be chosen by the contractor. Explosives are allowed on the Iowa side of the navigation channel and prohibited on the Illinois side. IADOT Special Provisions and Project Plans recommend expansive materials for pier demolition on the Illinois side (Appendix C – Project Plans). It is anticipated that after expansive or explosive techniques are used on the piers, the pieces will be removed mechanically. On both sides, the piers will be removed from the bedrock by either cutting the pier off at the base and using cranes to lift the material onto work barges for removal or pushing the pier/portions of the pier directly onto the work barges for transport. No material will be dropped into the river as a result of these activities; however, the exact methods will be at the discretion of the contractor. Construction inspectors will be present at all times during construction and demolition activities to ensure compliance with IADOT Special Provisions. Demolition of individual piers is anticipated to take approximately one day per pier.

The need for, and placement of, silt curtains prior to demolition activities will be determined prior to commencement of those activities. Silt curtains are in the recommended project plans from IADOT. The plans include silt curtains placed on the downstream side and river side of Pier L, on the shore side, downstream, and upstream of Pier J, and on all four sides of Pier H.

1.2 Action Area

The project will occur at and near the existing I-74 Bridge, as it crosses Pool 15 of the Mississippi River near River Mile (RM) 486, connecting the cities of Bettendorf, Iowa (Scott County) and Moline, Illinois (Rock Island County).

50 CFR §402.2 defines an "action area" as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." Therefore, all areas which could experience measurable environmental effects resulting from construction, operation, and maintenance of the I-74 bridge facilities will be considered part of the action area. All environmental effects that may provoke a response in federally endangered mussels are considered. Therefore, the action area for Phase I and Phase II of this project includes:

1) The official project footprints for both bridges; the new I-74 bridge and the existing bridge to be demolished, plus a 50-feet buffer upstream and downstream of both bridges.

2) The construction area for stormwater outfalls on the Illinois bank.

3) Areas used to store construction debris/materials, and staging areas for equipment.

4) Any area which will necessitate dredging as well as any dredged material disposal areas.

5) The downstream extent of any turbidity plumes created as a result of construction and areas of extreme levels of vibration due to drilling, demolition, or other activities. The extent of this plume is dependent on many factors, including flow velocity, construction activity, state of the silt curtains, etc.

6) Any geographic area that could be affected by any construction, demolition, and general operation activities

7) Areas associated with conservation measures directly or indirectly related to the project, including suitable relocation areas for mussels.

The bridge action area overlaps the Sylvan Slough, a Higgins Eye Pearly Mussel Essential Habitat Area (EHA) on the Illinois bank. The Higgins eye Recovery Plan has identified EHAs, where the species has a stable and reproducing population and are important to the recovery of the species. The Sylvan Slough EHA is located on the Illinois side of the action area between Arsenal Island, an unnamed small island, and the shoreline. The slough extends upstream under the existing bridge and to the upstream portion of the unnamed island, into the action area where the new bridge will be erected. Sylvan Slough is home to high densities of mussels.

The following sites have been identified as relocation areas and are included in the action area:

- Illiniwek Park – Illinois Bank of Pool 15; RM 494

- Eagle's Landing – Iowa Bank of Pool 15; RM 490-491

- Upstream Site – Illinois Bank of Pool 15; RM 486.5-488.5; Upstream of proposed bridge

- Downstream of the Rodman Avenue Bridge - Sylvan Slough
- Arsenal Power Dam (Spectaclecase only) – Arsenal Island downstream of the Arsenal Power Dam (2 locations)

1.3 Conservation Measures

Conservation measures represent actions taken to benefit or promote recovery of the species. These actions taken by the federal agency and/or applicant serve to minimize or compensate for project effects on the species under review and are included as an integral portion of the proposed action.

The Service recognizes that, individually and/or cumulatively, these conservation measures could contribute to the avoidance and minimization of adverse effects to the Higgins eye, spectaclecase, and sheepnose but that these measures do not necessarily eliminate all adverse effects that may result from the proposed actions.

<u>Silt Curtain</u>

In an effort to avoid and/or minimize impacts to mussel species, floating silt curtains will be installed prior to Phase I construction and Phase II demolition to retain sediment created by said activities. Silt curtains are impermeable devices designed specifically to control suspended solids and turbidity generated in the water column as a result of navigation, construction and dredging operations. Sediment containment within a limited area created by a silt curtain is intended to provide residence time to allow soil particles to settle out of suspension and reduce suspended solids settling in other areas where negative impacts could occur.

Silt, clay, sand, and other fine-grained sediment particles can be readily re-suspended in the water column when hydraulically or mechanically disturbed. Re-suspended matter is generally measured gravimetrically and expressed as total suspended solids (TSS) in milligrams per liter. Increased TSS corresponds with an increase in turbidity of the water. Re-suspended sediments eventually settle out of the water column onto the river bed, causing potential environmental impacts downstream.

<u>Special Provisions</u>

Two project-specific Special Provisions were developed by the IADOT to avoid and minimize potential impacts to mussel species. A full description of these measures are available in Appendix A and B.

Because construction will occur in an environmentally sensitive area, work shall be restricted to the minimum necessary area. Every reasonable effort shall be taken to minimize the adverse impact of the construction on mussels, fish, wildlife and natural areas. The following requirements are interrelated with mussel preservation:

- Construction near the Illinois and Iowa riverbanks is restricted to Authorized Work Areas identified in the project constraints map (Figure 2 in Appendix B). Construction will not be allowed to take place within any “Environmentally Sensitive Areas” (unless within “Authorized Construction Area”) as identified in this map.

- Any construction related condition deemed to be potentially damaging to environmentally sensitive resources by the Engineer shall be rectified immediately or construction will cease until such a time as the condition is rectified.

- Barges and watercraft used for construction activities shall be inspected for the presence of zebra mussels prior to launching into the Mississippi River. Additionally, all watercraft shall be completely dried out (with no standing water anywhere on the craft) for 10 or more days both prior to, and after Phase I and Phase II of the project. Any watercraft or equipment used within the river channel must be dried for 10 days before entering another water body and again before reentering the Mississippi in order to reduce potential infestation by zebra mussels.

- If dredging is needed to convey barges, the discharge will NOT be placed back in the River. The Corps shall be notified of the location of dredging, amount to be dredged, and any 401 water quality testing required shall be done prior to the placement of dredged material.

- If dredging is needed around the temporary slips to convey barges and the discharge will be placed back in the Mississippi River, the Corps shall be notified of the location and amount to be dredged and the required 401 water quality testing shall occur. Dredged materials shall not be deposited in the River. And all temporary constriction shall entirely be removed from the river once it is no longer needed.

- Before hydraulic dredging, a modified elutriate test shall be performed to predict effluent quality or total concentration of contaminants in the effluent. Results shall be forwarded to the Iowa DNR and Illinois DNR. Water quality requirements must be met. Areas disturbed by dredging shall be backfilled with special revetment.

- Native materials removed from cofferdams may be replaced in the cofferdam. Any additional fill materials introduced into the River must be clean (>10% fines pass through a No. 200 – 70 µm sieve)

- Bridge debris shall be removed from the water or riverbed as soon as practicable during the same work day. Debris shall not be allowed to collect in or on the bottom of the River. Measures shall also be implemented to prevent debris from falling into the River.

IADOT Special Provisions (Appendix A) also address measures to avoid and minimize effects to water quality which also protects mussel species.

- All Section 404 permit conditions will be maintained throughout construction Phase I and Phase II.
- Special conditions set up within the Section 401 water quality certifications from IADNR and ILDNR must be followed with the goal of maintaining and protecting all uses of the Mississippi River.
- Dredging will cease if the water quality standards of either the state of Iowa or Illinois are violated.

Dredging may be required to allow for barge access to the staging areas; however, staging areas will be chosen by the contractor so the need for and limits of dredging are not known at this time. Should dredging be required outside of the project constraints (Figure 2, Appendix B), the Iowa DOT will coordinate with the Service, ILDNR, and IADNR prior to dredging activities to determine what, if any, impacts on mussels would occur. Dredged material will not be placed back into the River. Areas disturbed by dredging will be backfilled with special revetment (i.e., boulders) (see Appendix A, B, and C).

Dredging may also be required to allow barge access to construction and demolition areas. Dredging, if required, will occur after relocation of mussel species (see discussion below) and prior to construction and/or demolition activities. The contractor will contact the IADOT which will meet and confer with the Service prior to dredging activities.

<u>Removal of Existing Bridge</u>

In order to reduce impacts to mussels and to the existing mussel bed within and near Sylvan Slough, explosive demolition, and materials will not be dropped into the river on the Illinois side of the river. Pier K, located within Sylvan Slough provides habitat for mussel species, including the spectaclecase mussel, and will not be removed. During demolition activities, the contractor will be restricted from impacting the river bottom within a 16.4 feet (5 m) buffer of Pier K. Outside of the buffer, contractors must stay within accepted buffers surrounding demolished piers.

After the suspension superstructure is dropped into the river channel it will be subsequently retrieved using a sweeping method. Existing I-74 bridge outside of the navigation channel will be removed from above with a crane operating on the existing bridge deck. No material is expected to be dropped into the river on the Illinois side, however, the exact methods used to ensure materials are not dropped into the water as a result of demolition will be at the discretion of the contractor. Construction inspectors will be present at all times during construction and demolition activities to ensure compliance with Special Provisions (Appendix C).

Demolition must comply with conditions listed below related to dropped materials as outlined in the bridge demolition plans (Appendix C):

- *"When bridge components are being removed from each span, precautions shall be taken to ensure nothing falls into the River. Such a precaution could be a containment system which could include a "catch barge" beneath the work site.*

- *Any object accidentally dropped into the River which may constitute a hazard to navigation shall be promptly and completely removed to the satisfaction of the appropriate U.S. Army Corps of Engineers District Commander.*

- *After removal of each span and all substructure components, a thorough sweeping of the area must be made at the contractor's expense. The procedure used to sweep shall be approved by the U.S. Army Corps of Engineers District Commander. The sweep operation shall be performed while an authorized representative of that agency is present to observe results. Mutually agreed upon dates for each sweep shall be coordinated with the Corps of Engineers."*

Areas disturbed by dredging as a result of both construction and demolition will be backfilled with special revetment boulders that may create additional habitat for spectaclecase.

Mussel Relocation

Freshwater mussels will be collected from discrete locations within the action area and will be relocated to areas of equal or better habitat outside of the project influence. The following is a summary of relocation minimization measures to be implemented during Phase I and Phase IIESI 2015). Mussels, regardless of species, will be relocated from around the proposed bridge piers during Phase I and around the existing bridge piers (excluding Pier K) during Phase II.

Phase I will include construction of the new I-74 bridge and two new stormwater outfalls along the Illinois bank. There are an estimated 839,883 live mussels comprised of 25 different species present in the combined Illinois and Iowa Phase I (56,274 m^2) action area based on ESI (2014).

The entire action area will not be searched for mussel relocation. Instead, two field crews will be deployed to locate, collect and relocate 90% of all mussels ≥1 inch in length within the following areas:

1) The stormwater outfall action area.

2) The footprint of Piers 1-5 plus a 10-m buffer around each pier of the new bridge on the Illinois side of the river.

3) The footprint of Piers 13 - 15 plus a 5-m buffer around each pier on the Iowa side.

Although the areas will be searched intensively by the field crews, it is estimated that up to 10% of mussels greater than 1 inch in length and all mussels less than 1 inch could be missed. No mussels will be collected from the action area within the navigation channel during Phase I or Phase II.

It is estimated that 295,922 mussels will be recovered during the Phase I relocation effort. Due to the large number of mussels within the action area, the relocation effort is anticipated to take approximately 60 days. Mussels will be relocated from the action area from August to September 2016, prior to construction. Five relocation areas are identified for Higgins eye and sheepnose mussels, and three relocation areas are slated for spectaclecase relocation since this species inhabits boulder/large rock substrates.

During mussel recovery, a barge will be moored within the action area which will act as a dive platform. Divers will collect mussels using a grid-cell search method. Tenders aboard the barge will record the mussels within each grid cell to determine the percentage of mussel density collected. Mussels will be transported by boat from the barge to a bank crew with a federally permitted malacologist, who, along with others, will identify, measure, and mark all federally endangered mussels. Higgins eye and sheepnose collected will be marked with unique identification numbers using a Dremel tool. Collected spectaclecase will be marked/affixed with passive integrated transponder (PIT) tags. Exposure of the mussels to air will be limited to five minutes or less during processing.

Common and state-listed species will be placed in quadrants doubling and tripling resident density at the three recipient sites (Illiniwek Park, Eagle's Landing, and Upstream). Higgins eye will be placed in grids at the same three recipient sites. Sheepnose will be placed in grids at the same two or three recipient sites depending on the number of individuals collected in the action area for relocation. Spectaclecase will be placed by hand in one of three recipient sites currently occupied by this species (2 sites below Arsenal Power Dam; or downstream of the Rodman Avenue Bridge in Sylvan Slough). Sites for the federally endangered mussels will continue to be monitored annually for the first two years after relocation and then years 4, 7 and 10.

There are an estimated 312,284 live mussels comprised of 26 different species present beneath the existing I-74 bridge. A second round of mussel relocation will occur prior to demolition during this phase of the project. The same relocations procedures will be used in Phase II as in Phae I. However, mussel densities are lower within the existing bridge footprint and impacts during pier removal are expected to be smaller.

The mussel relocation plan has not been finalized for Phase II. Results and observations from Phase I relocation and monitoring studies will be utilized to make final Phase II relocation decisions. It is expected that mussels will need to be relocated from at least a portion of the existing bridge action area prior to demolition. Marking and relocation areas are expected to be the same for Phase II relocation. Less

Additional Mussel Conservation Measures

1. A comprehensive study will be conducted within Pool 15 to map the habitat and distribution of mussel resources throughout the pool. The study will be completed in three phases; Phase 1 - compiling existing data on mussel resources within the pool, Phase 2 – quantitative sampling will be conducted near the banks to map the distribution of mussel beds in channel border habitat, Phase 3 – random sampling will be conducted throughout the pool to calculate poolwide density of mussels and species population estimates. Data from this study will help resource agencies track impacts from the I-74 bridge project on mussel resources and guide future conservation efforts in Pool 15.

2. A study will be conducted to investigate the effects of increasing resident mussel density at varying rates in the I-74 mussel relocations sites. A subset of relocated mussels will be placed in varying densities within the 3 relocation sites. The sites will be monitored to determine whether different densities persist or if the beds will return to pre-relocation numbers. Data from this study will provide valuable information on the potential carrying capacity of mussel beds and inform future relocation efforts.

3. Mussel education and outreach will be conducted during the mussel relocation and construction of the new bridge. Information about the mussel resources impacted by the I-74 bridge project as well as the construction of the new and demolition of the old I-74 bridge will be provided to the public and media outlets through outreach materials and educational programs. An education and outreach Point of Contact will be hired to develop the outreach and educational materials, help coordinate mussel relocation efforts, and compile data from mussel surveys and research into a final document. A document may be developed through this position to address best management practices for future bridge projects that have the potential to impact mussel resources.

4. Host fish for mussel species within the I-74 Bridge Project area will be inoculated with mussel larvae and later released into the action area. The project will deliver approximately 10,000 host fish per year with the goal of delivering juvenile mussels to help repopulate impacted areas and offset the impacts from bridge construction and demolition. Release of inoculated host fish will begin after the new I-74 Bridge is complete and will occur for 5 years. Staff from the IADNR, ILDNR and the Service will determine which mussel species and host fish species will be stocked based on data collected from the mussel relocation and the impacts to mussel beds in the action area of the new bridge.

2. STATUS OF THE SPECIES

2.1 Spectaclecase (*Cumberlandia monodonta*)

Species/critical habitat description

The spectaclecase (*Cumberlandia monodonta*, Say 1829) is a member of the Unionid family Margaritiferidae and can be distinguished by its large size, elongated shape and arcuate ventral margin, poorly developed teeth, white nacre, and its dark coloration and roughened surface (Baird 2000, USFWS 2016a). Spectaclecase are large mussels (reaching at least 9.25 inches in length) with an elongated and often curved shell that is somewhat inflated. Spectaclecase shells are smooth and light yellow, tan, or brown when young; they darken to brown or black and become rough as the mussel ages. They are not sexually dimorphic, although males typically reach sexual maturity (4-5 years) earlier than females (5-7 years).

The Service listed the spectaclecase as endangered on April 12, 2012 (Federal Register 77[49]14914—14949, USFWS 2016b). Reasons for listing spectaclecase include curtailment and degradation of its habitat and range, decreased reproduction or reproductive failure, invasive species, small and fragmented populations which have resulted in their vulnerability to natural or human caused events (USFWS 2016b). Other threats to this species include impoundments from dams; sedimentation and pollution.

Endemic to the Mississippi, Missouri, and Ohio river basins, spectaclecase are found in large rivers with swiftly flowing water. They are typically found aggregated among microhabitats sheltered from the main force of the current such as under slab boulders or bedrock shelves. Because the spectaclecase aggregates among boulders and bedrock slabs, it is considered a habitat specialist, and needs specific habitat conditions to successfully reproduce. Substrates it can be found in range from mud and sand to gravel, cobble, and boulders located in relatively shallow riffles and shoals with a slow to swift current (Cummings and Mayer 1992).

Life history

There is evidence that spectaclecase can live up to 56-70 years (Baird 2000, Butler 2002). Adult mussels suspension-feed, spending their entire lives partially or completely buried within the substrate. As with other Unionid mussels, reproduction involves the release of sperm by males into the water current; female mussels siphoning water for food and respiration also siphon sperm that fertilizes their eggs, which brood in the mussel gills. Fertilized eggs develop into microscopic, parasitic larvae called glochidia. Spectaclecase have the smallest glochidia known of any North American mussel (0.0024 inches; Baird 2000). These glochidia are released en masse in packages called conglutinates, which are gelatinous containers composed of glochidia as well as unfertilized eggs. Spectaclecase conglutinates are flat and white, and some may be forked. Each varies from 0.2-0.63 inches long and 0.1-0.24 inches wide (Baird 2000, Knudsen and Hove 1997).

Lobes on conglutinates are variably shaped with simple branches that are 0.04-0.16 inches long on one or both sides and oriented at 45° angles to the main axis of the conglutinate (Knudsen and Hove 1997). Based on eight Missouri specimens, the number of conglutinates released per individual varied from 53-88, with a mean of 64.5 (Baird 2000). Tens to hundreds of thousands of hookless glochidia may occur within a single conglutinate. The total fecundity per female, according to Baird (2000), is 1.9 – 9.57 million glochidia.

Spectaclecase is a morphologically and taxonomically primitive Unionid. The mantle has not developed into a lure for fish hosts nor are it's conglutinates particularly formed to resemble food items to fish. Instead, the spectaclecase produces large conglutinates which are broadcast into the current. Lee and Hove (1997) in Minnesota observed females in a lab and under boulders in the St. Croix River simultaneously releasing their conglutinates which are entrained along a long, transparent, sticky mucous strand up to several feet in length which eventually breaks off, drifting downstream.

The reproductive cycle of spectaclecase is not entirely known. The species likely has a biannual reproductive cycle, producing two broods and releasing mature glochidia in both the spring and the fall. Howard (1915) first proposed that the spectaclecase engaged in biannual reproductivity based on brooding individuals collected in the Mississippi river in May near Moline, Illinois. Gonads in both male and females at this site showed the onset of spawning. Gordon and Smith (1990) collected brooding females in late October from the Meramec and Gasconade Rivers in Missouri supporting the Howard (1915) theory.

Historical reproductive data are restricted to May through October, and, despite the observations of Howard (1915), cannot conclusively address the question of whether a biannual cycle occurs or not. Post-spawning features are evident from May through June, which probably indicate May spawning, but might reflect a delay in gonadal recovery from the previous fall.

Water temperature likely initiates or closely mediates unionoid spawning behavior (Yokley 1972). A temperature of 14° Celsius (C) is within a range to be expected for the Mississippi River near the Howard (1915) locale for late April and early May. Biannual reproduction evidence suggests that there probably are critical upper and lower thermal limits controlling spawning.

Released glochidia must attach to the gills or fins of a specific host, usually a fish, to complete development into a juvenile mussel. Despite extensive investigation, the specific host fish of spectaclecase remains unidentified. Baird (2000) found spectaclecase glochodia on two species of fish (bigeye chub (*Notropis amblops*) and short-head redhorse (*Moxostoma macrolepidotum*)), but the glochodia showed no evidence of growth while on the gills, so these fish are unconfirmed as hosts.

Once glochidia mature into juvenile mussels and excyst, or drop off their host, they must land in a suitable area in order to continue to grow and mature. Cohorts of spectaclecase are often discovered together in the same location; unlike some other mussel species, spectaclecase do not move very much, except to burrow deeper into substrate. Once dropping to the substrate as a juvenile mussel, the biggest increase in growth in the spectaclecase appears to occur between 10 to 15 years of age, which suggests significant reproductive investment does not occur until they reach 10 years of age (Baird 2000).

Population Dynamics

"Population dynamics, such as species' interactions and community structure, population trends, and population size and age class structure necessary to maintain a long-term viability, have not been determined for this species. Some of the basic elements of the reproductive biology for this species are unknown, such as age and size at earliest maturity, reproductive longevity, and the level of recruitment needed for species survival and long-term viability." (Federal Register 2012).

Populations of spectaclecase are generally small and geographically isolated within boulder/bedrock habitats (Butler 2002). Patchy distribution of populations in short river reaches makes them much more susceptible to extirpation from single catastrophic events, such as toxic chemical spills (Watters and Dunn 1995). Even though changes in the environment may cause populations of animals to fluctuate naturally, it is more likely that small and low-density populations will fluctuate below a minimum viable population (the minimum or threshold number of individuals needed in a population to persist in a viable state for a given interval) (Gilpin and Soule 1986).

Population isolation due to patchy habitat makes natural repopulation of extirpated populations virtually impossible without human intervention. Recruitment reduction or failure is a threat for many small spectaclecase populations range wide, a condition exacerbated by reduced range and increasingly isolated populations (Butler 2002).

Species in the family Marigaritiferidae are the longest lived of all freshwater invertebrates. There is evidence that spectaclecase can live up to 56-70 years (Baird 2000, Butler 2002). Being a large mussel, the species becomes sexually mature later than other freshwater mussels, which can occur as early as one year or, in fingernail clams, even as soon as one month (Smith 2001). Although male spectaclecases are sexually mature at 4-5 years, and females at 5-7 years, these individuals are not investing significant energy into growth before 10-15 years of age, which suggests significant reproductive investment does not occur until they reach at least 10 years of age (Baird 2000). Delayed maturity may make spectaclecase populations more vulnerable to environmental changes such as pollution or increased TSS. There is decreased chance of overall reproductive success over a longer period compared to other mussels. If impacts to a cohort occur during the first 10-15 years of life, significant recruitment may not occur to sustain populations.

Population genetics studies have been undertaken specifically on spectaclecase in the last decade in an effort to prepare for population augmentation and reintroduction of individuals in the future. Inoue et al. (2010), Monroe et al. (2008), and Elderkin (2009) have published genetic research and several other studies are yet to be published. Populations of focus include the Missouri River, the Clinch River, the Ouachita River, the Green River, and the St. Croix River populations. Inoue et al. (2010) identified 17 polymorphic loci which show the genetic structure among extant populations. Further studies will continue to build upon these findings to assess conservation and restoration approaches needed based on current spectaclecase populations (USFWS 2014).

Status and Distribution

Historically, the spectaclecase was found in at least 44 streams of the Mississippi, Ohio and Missouri River basins in 14 states, including long reaches of the UMR. However, it has been extirpated from three states including Illinois besides the Mississippi River and today is found in only 20 streams including the Upper Mississippi River (USFWS 2012a).

Overall, observations of spectaclecase in the UMR are extremely rare, and often limited to a single individual or a small cluster inhabiting the same microhabitat. Populations in the mainstem Mississippi River in the UMR basin were classified as declining in the final listing rule for spectaclecase (USFWS 2012a). With few exceptions, spectaclecase populations are fragmented and restricted to short stream reaches (USFWS 2014).

The spectaclecase is thought to be extant in at least four pools of the Mississippi River mainstem, albeit in very low numbers. Records include Sylvan Slough in MRP 15 in 1998, and the Muscatine area of MRP 16 in 1997 (Illinois Natural History Survey 21355 as cited in USFWS 2002). Spectaclecase are not known to occur downstream of MRP 16 until MRP 19. In 2013, 33 tributaries to the UMR in Illinois from the northwest corner of the state through west central Illinois were surveyed for mussels, and no live or dead spectaclecase were recovered (Stodola et al. 2013). However, these surveys were all conducted in wadeable streams, which is not preferred habitat for spectaclecase.

Sampling efforts following the channelization of the Mississippi River show the spectaclecase to be extremely rare. Of the 20 extant (defined as found live or fresh dead since 1990) populations, five are represented by only one or two recent specimens each. Paul Bartsch conducted sampling at 140 UMR sites in 1907 and found the spectaclecase at approximately nine sites from what is now MRP 9-22. In 1930-1931 Ellis floated the entire UMR, sampling mussels and described finding spectaclecase rarely, as “a matter of chance” (van der Schalie and van der Schalie 1950). No spectaclecase were found live during van der Schalie and van der Schalie’s (1950) survey despite sampling 86 sites containing mussels along the UMR. Havlik and Stansbery (1978) thought the spectaclecase had disappeared from the Prairie du Chien, Wisconsin area (MRP 8) in the 1920s. Thiel (1981) failed to locate living spectaclecase in the Wisconsin portion of the UMR (between MRP 3-11) using brail and self-contained breathing apparatus (SCUBA), but reported dead shells in MRP 11, and Whitney et al. (1996) recorded a single specimen collected from 1994-95 in MRP 15, for a density of $0.004/m^2$. Spectaclecase is presently considered rare in MRP 10 and 15-26, and absent from its historic range upstream of MRP 15, except MRP 10, and absent in the Illinois River (Kelner 2003).

Surveys near the action area have not shown recent populations of spectaclecase. MRP 16 from RM 463.5-464.1 was surveyed by the IADNR in 2007 before the Higgins eye reintroduction effort, but no live or dead spectaclecase were found (Nakato 2007). ESI (2015) surveyed potential relocation areas for rescued mussels within the action area and no spectaclecase were found outside Sylvan Slough, despite sampling at nine different locations. Buffalo and Fairport sites in MRP 16 did not contain the species. Six weathered dead spectaclecase shells were found at two upstream relocation sites along the lateral dike and along the Illinois shore (ESI 2015). Historically, this Upstream site at RM 488 had the highest overall mussel densities that Blodgett and Sparks (1987) had ever observed in 1985 at 139.3/m2. No spectaclecase were recovered from this site in 1983 or 1985. During the relocation survey (ESI 2015) the Upstream site was found to have mussel densities of $10.1/m^2$ in suitable substrates where mussels were actually found. Currently recruiting populations have been observed in the Green River, Kentucky, during the summer of 2015 (USFWS 2016a) and in Sylvan Slough at I-74 bridge Pier K (ESI 2014).

Spectaclecase was not often recovered in historic mussel surveys of Sylvan Slough. In an archeological study of a midden pile in East Moline, Illinois, Van Dyke (1980) did not recover spectaclecase shells out of a total of 6,920 valves at this site. However, spectaclecase shells are thinner than most of the native mussels and may not preserve as well in archeological sites.

Obald (1979) found spectaclecase during a rare mussel rescue for the replacement of the Moline Bridge. During this rescue, rare mussels were relocated to a point directly under the existing I-74 bridge between the Moline, Illinois riverbank and the small island near the Moline, Illinois riverbank (approximate location – at Pier K). Surveys conducted by the Illinois Natural History Survey from 1983 -1995 only found one specimen in 1983 in Sylvan slough out of a total of 3,796 mussels collected (combining both years' surveys). During the survey in 1983, the spectaclecase represented 0.28% relative abundance out of 358 mussels and a density of $0.2/m^2$ (Whitney et al. 1996).

Spectaclecase has been recovered in greater numbers in recent surveys of Sylvan Slough and the action area, but not in any surrounding mussel survey locations. A survey of the aquatic action area conducted in August and September 2014 by ESI (2014) found live spectaclecase in three of the four survey areas. Fourteen were found at the existing bridge Pier K within Sylvan Slough (Survey Area A). Two individuals were found in Survey Area B, north of Sylvan Slough, one of which was found at the north end of a small island, the other was found at an existing pier. Approximately 15 additional spectaclecase were collected at this existing pier in 2015 (ESI 2015). One individual was found near the Iowa bank of the river (Survey Area D) at an existing pier closest to the bank (ESI 2014).

Nine live spectaclecase mussels were found in Sylvan Slough in 2015. Of these, six were found downstream of Sylvan Island and the Arsenal Power dam, and three were found upstream of the island. Fresh and weathered dead shells were also collected at these sites.

Recent survey results are consistent with the historical literature on surveys surrounding the action area. Based on all available survey data, Sylvan Slough appears to be the only known location within MRP 14, 15, or 16 where spectaclecase is currently extant and recruiting.

Analysis of the Species/Critical Habitat Likely to be affected

No critical habitat has been designated for this species.

2.2 Higgins Eye Pearly Mussel (Lampsilis higginsii)

Species/critical habitat description

The Higgins eye is a medium-sized (approximately four inches in length) and oval or elliptical freshwater mussel with a smooth, yellow, yellowish green or brown outer shell and green rays (Baker 1928, USFWS 1983). The shells are thick, inflated, and sexually dimorphic. The shell is broadly rounded anterior and with a pointed posterior in males or sharply truncated with post-basal swelling in females (USFWS 2004, 2016b). The elevated and swollen beak is forward of the central dorsal margin with sculpturing of a few ridges that are slightly looped (Baker 1928). The inside or nacre of the shell is silvery white or salmon-colored and iridescent (Baker 1928, USFWS 2016b). The surface of the shell is marked with irregular growth lines that are well developed and darker during rest periods. The hinge is very large with erect pseudocardinals that can be triangular or pyramidal. Beak cavities are deep and contain the dorsal muscle scars. Anterior adductor scar is deeply excavated and the posterior scar is distinct (Baker 1928).

The Higgins eye feeds by filtering food particles from the water column using the large lamellibranch gills as feeding organs (USFWS 2004). The specific food habits of the species are unknown, but other juvenile and adult freshwater mussels have been documented to feed on detritus, diatoms, phytoplankton and zooplankton (Churchill and Lewis 1924). The diet of Higgins eye glochidia (larvae), like other freshwater mussels, is comprised of fish body fluids (once encysted).

The initial recovery plan (USFWS 1983) indicated that Higgins eye may have never been abundant within its range. Major reasons for listing Higgins eye as federally endangered were the decrease in both abundance and range of the species (USFWS 1983). The species depends on deep and free flowing rivers with clean water, which are rare due to the presence of lock and dams (USFWS 2016b). Coker (1919) indicated that the species was becoming increasingly rare even at the end of the 1800s, however, Miller and Payne (2007) reviewed historical information and data and agreed with the initial recovery plan that Higgins eye was never abundant. There were few records of live specimens from the early 1900s until the enactment of the ESA in 1973 and this was a major factor in its listing in 1976. Currently, zebra mussels (*Dreissena polymorpha*) have been negatively impacting many mussel species within the upper Mississippi River, including Higgins eye. The zebra mussel can affect native mussel species by direct attachment to the outside shell surface which can limit their movement and their siphoning ability. Indirectly, zebra mussels represent competition for food and can affect water quality (USFWS 2004).

The Higgins eye has been characterized as a large river mussel species. The species may be primarily adapted to large river habitats with low to moderate current of <1 m/s during low discharge periods (USFWS 2004). Davis and Hart (1995) indicated that it was found in the more "riverine" areas and in the tailwater reaches of other Mississippi River navigation pools.

Higgins eye has been found in various substrates from sand to boulders (USFWS 2004). In some studies, the species could be found in stable gravelly sand, but not in areas of unstable shifting coarse sands (Miller and Payne 1996, USFWS 2004). Fuller (1978) indicates this species may be found in 8-15 feet of water in mud with a mixture of gravel and stones. Cawley (1996) found that Higgins eye were most common in sand/gravel substrate. Miller and Payne (1996) considered substratum that was free of plants and consisted of stable, gravelly sand as suitable for this species, however, others have found the species within areas of rooted plants (USFWS 2004) and in boulder substrates associated with bridge piers (ESI 2014, Helms 2006). Some substrates this species has not been associated with include firmly packed clay, flocculent silt, organic material, bedrock, or unstable moving sand (Wilcox et al. 1993). Information on habitat associations or requirements for the juvenile stage were not found.

Higgins eye is commonly found in dense mussel beds with various other species. The species has been found with a minimum of two and a maximum of 36 other species, according to Cawley (1996). The species typically accounts for a small percentage of the overall species diversity (USFWS 2004). Other species Higgins eye has been found with include threeridge (*Amblema plicata*), pimpleback (*Quadrula pustulosa*), Wabash pigtoe (*Fusconaia flava*), and plain pocketbook (*Lampsilis cardium*) (Heath 1995).

Life history

The reproductive cycle of the Higgins eye is similar to that of many native freshwater mussels (USFWS 2004). Males release sperm into the water column, often in packets known as volvocoid bodies. The sperm travel downstream and are taken in by the females through their incurrent siphons during feeding and respiration (Fuller 1978). The females retain fertilized eggs in their gills until the glochidia fully develop. Higgins eye is bradytictic, meaning a long term brooder. Spawning occurs in the summer, observed by Baker (1928) to be between May and September and larvae are retained through winter (USFWS 2004). Glochidial release has been observed between May and September by Surber (1912) and during June and July by Waller and Holland-Bartels (1988). This species "lures" host fish by protruding its mantle and gills containing glochidia between the mantle flaps. When the gill tissue is attacked by a fish, glochidia are released. This process enhances the chances glochidia will find the gills of fish to parasitize. The glochidia must attach to the appropriate fish species, which they parasitize for a short time while developing into juvenile mussels. Juvenile development has been observed to take 4-6 weeks in captive breeding (MCT 2002). Reproduction begins early in Higgins eye, typically between age 1-3 years (Haag 2012).

Glochidia host fish were generalized by Waller and Holland-Bartels (1988) as being percids and centrarchids. Early studies indicated that sauger (*Sander canadensis*) and freshwater drum (*Aplodinotus grunniens*) were suitable glochidial fish hosts (Surber 1912, Wilson 1916, Coker et al. 1921, Hove and Kapuscinski 2002). Waller and Holland-Bartels (1988) found four species of fish were suitable hosts, due to a high number of glochidia transformation to juvenile, including largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), walleye (*Sander vitreus*) and yellow perch (*Perca flavescens*). Other species had lower transformation glochidia to juvenile transformation rates and were considered marginal hosts. These species included green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), and northern pike (*Esox lucius*) (Waller and Holland-Bartels 1988). Hove and Kapuscinski (2002) later identified black crappie (*Pomoxis nigromaculatus*) as an additional host species.

Population Dynamics

It is difficult to locate information on populations of Higgins eye that are currently reproducing, however, information has been collected at some EHAs within the last 10 years. The Higgins eye population at Prairie du Chien, Wisconsin, on the upper Mississippi River, exhibited recruitment in 2005 and 2006, but evidence of recruitment was not observed during surveys in 2008 (Miller and Payne 2007, MCT 2008). In 2006, recruitment was also observed at the Cassville MRP 11 EHA on the UMR in Wisconsin. Gravid females and individuals ranging in age from 3–15 years old were present at this location (MCT 2007).

Miller and Payne (2007), in regards to Higgins eye, state in their reexamination paper:

"In river reaches unaffected by zebra mussels Dreissena polymorpha, L. higginsii mean density ranged from 0.0 to 1.4 m–2 (average = 0.25 m–2) and it comprised less than 2% of the unionid fauna. Recent distribution and abundance data indicate that the range of L. higginsii populations was misrepresented on historical maps and suggest that populations were in fact either absent or very uncommon both at the periphery of their historical range and in small tributaries where they were reported historically. Although this species has always been rare, it can usually be found in appropriate habitats within its current range. It was listed as endangered before there were data on its density, recruitment, and relative abundance. Although it was nearly extirpated by D. polymorpha in the late 1990s, L. higginsii appears to be resilient to zebra mussel infestations. A multi-agency conservation plan is now being implemented to reintroduce this species into small and medium-sized rivers within and outside its historical range. Our data indicate that this species is not in imminent danger of extinction, has always been rare, and is not adapted to small rivers. It would be more realistic, and beneficial to L. higginsii, to implement strategies that protect all unionid species and the habitats upon which they depend."

In other words, Miller and Payne (2007) observed Higgins eye populations to be persisting at the similar population percentages, despite the presence of zebra mussels.

Status and Distribution

Higgins eye is the only freshwater mussel endemic to the Upper Mississippi province, which includes the entire Mississippi River system upstream of the mouth of the Ohio River (excluding most of the Missouri River system) (Haag 2012). The first Higgins eye recovery plan listed the historic distribution of the species to include the main stem of the Mississippi River north of St. Louis, Missouri and south of St. Paul, Minnesota; the Sangamon and Rock Rivers in Illinois; the Wisconsin and St. Croix Rivers in Wisconsin; and the Minnesota River in Minnesota (USFWS 1983). Recently, live Higgins eye have been found in parts of the following rivers: the UMR north of Lock and Dam 19 at Keokuk, Iowa, and in three tributaries of the Mississippi River - the St. Croix River between Minnesota and Wisconsin, the Wisconsin River in Wisconsin, and the lower Rock River in Illinois. The species' current range is about 50 percent of its historic distribution which extended as far south as St. Louis, Missouri, and in several additional tributaries of the Mississippi River (USFWS 2004). The historical distribution of Higgins eye historical distribution is not known with certainty.

The 1983 recovery plan listed seven locations as primary habitats and nine locations as potential secondary habitats (USFWS 1983). The revised recovery plan lists 10 EHA, six of which are in the Mississippi River between RM 489 and 656 (USFWS 2004):

- Whiskey Rock (MRP 9; Lansing, Iowa)
- Harpers Slough (MRP 10; near Harpers Ferry, Iowa)
- Prairie du Chien, Wisconsin (MRP 10; main and east channel)
- McMillan Island (MRP 10; Guttenberg, Iowa)
- Cordova, Illinois (MRP 14)
- Sylvan Slough (MRP 15; Moline, Illinois) – located within the I-74 action area

EHAs are locations where Higgins eye are currently reproducing and the recovery plans have designated to be important for the recovery of the species. The revised recovery plan describes two main objectives that indicate the Service’s current management direction (USFWS 2004):

1) Preserving the Higgins eye and its EHAs.
2) Enhancing the abundance and viability of the Higgins eye in areas where it currently exists and restoring populations within its historical range.

The greatest numbers of Higgins eye in the upper Mississippi River occur from MRP 6 to MRP 17 (Cawley 1996). This species has been extirpated from its more southerly locations, such as the Illinois River basin and from the Mississippi River between MRP 18 – 26. It was historically sampled in MRP 19, 20, 21, 23, and at the mouth of the Kaskaskia River south of the Lock and Dam system in Illinois (Stodola 2014).

Current extant populations of Higgins eye near the project area include a population in MRP 14 around the Quad Cities Station although no recruitment was observed for the species in surveys completed between 2006-2008. Eight Higgins eye adults ≤5 years were collected in 2004 in the Cordova Bed (density of 0.4/m2) and more were found in a 2006 survey of the same location as well as at an "Upstream" site. In the Albany and Hanson's Slough Beds in 2007, Higgins eye was "fairly common". Two individuals were found downstream of Steamboat Slough Bed in 2008 (ESI 2008).

In 2008, the Service designated four new EHAs for Higgins eye. Two of these are near the action area. One is the Hanson's Slough Bed (RM 509.1-510) in MRP 14 referenced above, and the other is a bed often called Buffalo Slough near Buffalo, Iowa, in MRP 16 (RM 470-471). The Buffalo Slough site was found to have densities of Higgins eye of $1.8/m^2$ by Helms (2003). Only two Higgins eye were located here during the relocation area survey for the I-74 project (ESI 2015).

Between 1998 and 2000, the Corps proposed the operation and maintenance of the existing 9-foot Channel Project on the UMR for another 50 years, which initiated formal consultation under section 7 of ESA for impacts to Higgins eye. To avoid jeopardy to the species, the Service required the Corps to establish new and viable populations of Higgins eye in areas of the upper Mississippi River and tributaries that are distanced from zebra mussels. Since 2000, 10 relocations and reintroductions have occurred in the MRP 2, 3, 4, and 16, and in the Wisconsin River, Rock River, Iowa River, Cedar River, and the Wapsipinicon River (MCT 2002, 2003). Roughly half of these reintroductions have been confirmed successful, including MRP 2 and 3 where mussels were scrubbed of zebra mussels affixed to their shells.

In 2007, as part of the Corps Reasonable and Prudent Measures and Alternatives plan for the BO on the 9-foot navigation channel, juvenile Higgins eye were stocked in MRP 16 at RM 463.5 – 464.1 near Fairport, Illinois. The survey prior to stocking showed high mussel diversity present in this reach, however, no Higgins eye were present before the stocking. A total of 8,351 juvenile mussels were stocked in this area, representing Castleville and Cordova genetic strain. These juvenile mussels were raised from 167 donor females raised in a cage in Lake Pepin near Lake City. As of 2016, it is still unknown whether this reintroduction of Higgins eye was a success (Kelner 2016). The relocation survey found one Higgins eye in their survey in Fairport downstream of the official Corps monitoring area (ESI 2015).

The Sylvan Slough EHA, located in MRP 15 in Rock Island County, Illinois is found within the action area for the project. Higgins eye exist and were historically found within the boundaries of Sylvan Slough. In an archeological study of a midden pile in East Moline, Illinois, Van Dyke et al. (1980) recovered one Higgins eye shell out of a total of 6,920 valves at this site. Oblad (1980) recovered and relocated common and rare mussels in Sylvan Slough EHA before the construction of the Moline, Illinois, bridge to Arsenal Island in 1979. Rare mussels found during this effort, including three Higgins eye, were relocated to a point directly under the existing I-74 bridge. All three of these Higgins eye were relocated alive the following year.

Whitney et al. (1996) found three Higgins eye in Sylvan Slough out of the total 3,796 mussels in a 1994-95 survey for the Illinois Natural History Survey. These three mussels made for a relative abundance of 0.17% and a density of 0.10/m2. Surveys by Whitney et al. (1996) in Sylvan Slough during 1983 and 1985 recovered no Higgins eye. Farr et al. collected Higgins eye in Sylvan Slough in 2003 (Farr et al. 2004).

The species was collected in several different locations during the 2014 survey of the action area for a total of seven live Higgins eye (ESI 2014). Additionally, one live specimen was also found at an existing bridge pier adjacent to the navigation channel. Higgins eye comprised <1% of the total catch in each area and were generally found in beds with other species of mussels within the search areas (ESI 2014). During the relocation survey, one individual was found downstream of the previous year's sampling area, still within Sylvan Slough (ESI 2015).

Analysis of the Species/Critical Habitat Likely to be Affected

No critical habitat has been designated for this species.

Sylvan Slough has been identified as one of the EHAs identified for Higgins eye. As an EHA, this area is "of utmost importance for the conservation of Higgins eye" (USFWS 2008). Areas of highest mussel density within Sylvan Slough overlap with the project area under the current 1-74 bridge. An estimated 10% of the official Sylvan Slough ESA boundaries are within the direct impact area of Phase II of the project.

2.3 Sheepnose (Plethobasus cyphyus)

Species/critical habitat description

The sheepnose is a member of the mussel family Unionidae and was originally described by Constantine Rafinesque in 1820. Other common names for the sheepnose include ‘‘bullhead’’ and ‘‘clear profit’’. The sheepnose has a thick, oval or oblong, somewhat elongate, and slightly inflated shell that can be up to 5 inches in length with a rounded anterior end and bluntly pointed posterior end. The surface of the shell is smooth except for a row of knobs or tubercles on the center of the valve (Cummings and Mayer 1992). The periostracum is rayless and often a distinctive yellowish color but may also be dark brown. Its nacre is white.

Life history

The sheepnose is primarily a larger stream species, it inhabits medium to large rivers in shallow areas with moderate to swift current that flows over gravel or mixed sand and gravel (Cummings and Mayer 1992). They have also been found in areas of mud, cobble and boulders, and in large rivers they may be found in deep runs (USFWS 2012b). Distribution of the sheepnose and other Unionids occurs, as described by Strayer (1999), within flow refuges—areas which have relatively low particulate movement during flood conditions. They will likely occur where sheer stresses during moderate flooding are too low to displace mussels from the sediment. Adult mussels suspension feed, spending their entire lives partially or completely buried within the substrate (Murray and Leonard 1962). Filtering from both the water column and sediment, adults feed on algae, bacteria, detritus, microscopic animals, and dissolved organic material. They are an important ecological link between multiple trophic levels (Vaughn et. al 2008).

Sheepnose is a short-term (tachytictic) brooder, spawning and releasing young within a few weeks during the summer (Watters et al. 2009). Sheepnose glochidia are expelled in jellylike masses of mucus called conglutinates. Sheepnose conglutinates are narrow, red or pink, and discharged in an unbroken line that look like small worms. Ortmann (1911) observed discharge of sheepnose conglutinates in late July in Pennsylvania. When a fish eats a conglutinate, glochidia are exposed to and attach to the fish's gills. The only confirmed wild host for sheepnose glochidia is the sauger (*Sander canadensis*). Wolf et.al (2012) found in laboratory studies that sheepnose glochidia transformed on 12 different minnow species, including a top minnow. A recent study by Hove et al. (2015) has shown successful laboratory transformation of sheepnose glochidia on many hosts, including 29 cyprinid species and six non-cyprinid species, suggesting sheepnose is a cyprinid specialist. Cyprinid hosts also produced higher numbers of sheepnose juveniles per each surviving fish with non-cyprinid hosts producing much fewer. All known wild and captive suitable fish host species are listed in the table below.

Table 2. Sheepnose Host Fish

Fish Species	**Common Name**	**Wild or Captive Host**
Sander canadensis	Sauger	Wild
Campostoma anomalum	central stoneroller	Captive
Campostoma oligolepis	largescale stonerollor	Captive
Chrosomus erythrogaster	southern red-belly dace	Captive
Cyprinella galactura	whitetail shiner	Captive
Cyprinella lutrensis	red shiner	Captive
Cyprinella spiloptera	spotfin shiner	Captive
Cyprinella venusta	blacktail shiner	Captive
Cyprinella whipplei	steelcolor shiner	Captive
Hybognathus hankinsoni	brassy minnow	Captive
Hybognathus nuchalis	Mississippi silvery	Captive
Luxilus chrysocephalus	striped shiner	Captive
Luxilus cornutus	common shiner	Captive
Luxilus zonatus	bleeding shiner	Captive
Macrhybopsis storeriana	silver chub	Captive
Margariscus margarita	pearl dace	Captive
Nocomis biguttatus	hornyhead chub	Captive
Notemigonus crysoleucas	golden shiner	Captive
Notropis atherinoides	emerald shiner	Captive

Fish Species	Common Name	Wild or Captive Host
Notropis blennius	river shiner	Captive
Notropis hudsonius	spotted shiner	Captive
Notropis nubilus	ozark minnow	Captive
Notropis topeka	topeka shiner	Captive
Notropis volucellus	mimic shiner	Captive
Phenacobius mirabilis	suckermouth minnow	Captive
Pimephales notatus	bluntnose minnow	Captive
Pimephales promelas	fathead minnow	Captive
Pimephales vigilax	bluntnose minnow	Captive
Rhinichthys atratulus	blacknose dace	Captive
Rhinichthys cataractae	longnose dace	Captive
Semotilus atromaculatus	creek chub	Captive
Fundulus diaphanus	banded killifish	Captive
Fundulus olivaceus	blackspotted topminnow	Captive
Gambusia affinis	Mosquitofish	Captive
Culaea inconstans	brook stickleback	Captive
Poecilia sphenops (non-native)	Molly	Captive
Pomoxis nigromaculatus	black crappie	Captive

The brooding period for sheepnose varies in different literature, but fairly consistently occurs in early summer. Specifically, Surber (1912) reports brooding from May–July in Iowa. Other researchers report brooding in May–June in Ohio (Watters et al. 2005), June–July in Pennsylvania (Ortmann 1919), early summer in Tennessee (Parmalee and Bogan 1998), and at least one individual was gravid in August in Alabama (Williams et al. 2008).

Hove et al. (2015) observed roughly one-third of gravid sheepnose bearing immature glochidia during the last six weeks of the brooding period. Brooding sheepnose observed with colored marsupia (red, orange to light orange, or pink to light pink) often had immature glochidia, while mature glochidia were attached to females with swollen, light-colored marsupia. These light colored marsupia are a key indicator of the presence of mature glochidia in sheepnose (Hove et al. 2015).

<u>Population Dynamics</u>

Extant populations of sheepnose appear to be genetically isolated from each other. The likelihood is high that some populations of the sheepnose are below the effective population size required to maintain long-term genetic and population viability (Soulé 1980). Recruitment reduction or failure is a potential problem for many small sheepnose populations range wide, a potential condition exacerbated by its reduced range and increasingly isolated populations (Butler 2002). This level of isolation makes natural recolonization of any extirpated population virtually impossible without human intervention. Population isolation prohibits the natural interchange of genetic material between populations, and small population size reduces the reservoir of genetic diversity within populations, which can lead to inbreeding depression. Kevin Roe, Iowa State University, has proposed (as of 2007) to carry out a genetic structure and intraspecific phylogeography of the sheepnose for the Iowa DNR, however, no study has yet been published.

Status and Distribution

The sheepnose is a federally listed endangered species listed, along with spectaclecase in March of 2013.

Even though one specimen of sheepnose recruitment was documented in 2001, the status of this species in the Mississippi is highly imperiled, with extirpation in some areas possible. Though found across the Midwest and Southeast, according to Parmalee and Bogan (1998), sheepnose has been extirpated throughout much of its former range or reduced to isolated populations. It was historically found in 77 different streams, but now is reduced to only 26. It is currently found in large rivers and streams in Alabama, Illinois, Indiana, Iowa, Kentucky, Minnesota, Mississippi, Missouri, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin. However, Sheepnose have been eliminated from long reaches of former habitat in hundreds of miles of the Illinois, Cumberland, and other rivers, and from several reaches of the Mississippi and Tennessee Rivers.

In the Mississippi River, the sheepnose is a rare species that is becoming rarer. Kelner (2003) states that sheepnose was historically distributed throughout the Upper Mississippi River and its major tributaries but probably was never common. Within the Mississippi River system, the sheepnose had a historic distribution of 26 streams. However, in 2003, only eight of those streams were thought to have extant sheepnose populations remaining. The percentage of sheepnose population losses in the Mississippi River system is 69 percent and a range wide loss of 66 percent (Butler 2003). It may be near extirpation in the UMR and has been extirpated from the Illinois and Minnesota rivers. Currently, several disjunct populations probably exist in very low numbers in in MRP 7, 10, 15-17, 20, and 22-24. A 2001 Pool 7 record was for a single live juvenile 1.3 inches long and estimated to be three (3) years old with five (5) zebra mussels attached to its shell. This individual is the last evidence of recruitment of sheepnose within the UMR. Helms (2003, 2007) conducted mussel surveys at Higgins eye EHAs in the pools surrounding the I-74 action area in 2003 (UMR Pool 16, RM 470), 2006 (UMR Pool 17, RM 451, Muscatine), and 2007 (UMR Pool 14, RM 518.8). Of these three, sheepnose was only present in MRP 17 at RM 451. In 2007, another mussel survey in conjunction with Higgins eye stocking in MRP 16 RM 463.5-464.1 also found no sheepnose (Nakato 2007).

During 2008 Quad Cities Nuclear Station monitoring in MRP 14, ESI found sub-fossil shells of sheepnose in the Albany and Woodward Grove Mussel Beds, indicating that this species historically occurred within these beds (ESI 2008). Additionally, a single live sheepnose was recovered from the Cordova Mussel Bed in 2009, which is downstream of the Quad Cities Station discharge.

Sheepnose was historically present in Sylvan Slough. In an archeological study of a midden pile in East Moline, Illinois, Van Dyke et al. (1980) recovered a total of 141 sheepnose shells out of a total of 6,920 valves at this site, roughly 2% of the population. Oblad (1980) recovered sheepnose during the Illinois Natural History Survey in Sylvan Slough in 1978. In past surveys of MRP 15, Whitney et al. (1996) reported the sheepnose extant in Sylvan Slough. They recorded one live specimen in 1985 and one live specimen in 1987, and 10 specimens from 1994-95. Densities in the latter sampling period were 0.03/foot2. No sheepnose were found during their 1983 survey of Sylvan Slough, or in MRP 14 at RM 494.6 and 494.7. During their 1994-95 study, Whitney et al. (1996) failed to locate sheepnose at either the Case-IH site (RM 488.5), or IIIiniwek (RM 492.4).

A survey of the aquatic action area conducted in August and September 2014 by ESI found one live sheepnose in Sylvan Slough (Survey Area A), representing approximately 0.1% of the total sample (ESI 2014). The action area overlaps the Sylvan Slough, so any extant sheepnose in the action area could directly and indirectly be impacted by construction activities. No sheepnose were collected from any survey locations during the survey of potential relocation areas, spanning seven sites in MRP 14, 15, and 16 (ESI 2015).

Analysis of the Species/Critical Habitat Likely to be Affected

No critical habitat has been designated for this species.

3. ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat, and ecosystem, within the action area.

The existing I-74 bridge was built in two stages. The first part or span was built in 1935 and due to increased traffic a second span of the bridge was built in 1959. The second span was built to be a twin of the first and two lanes of traffic flow in each direction. There are eleven piers in-stream with widths ranging from 48 feet and six inches to 122 feet and eight inches
The total drainage of the Mississippi River at the action area is approximately 88,500 square miles (mi^2). At the crossing of the existing I-74 bridge, near river mile 486, the Mississippi River is approximately 0.63 miles wide (3,349 feet). The new bridge is expected to span 3,372 feet across the river, just upstream of the existing structure. The Corps navigation channel, a 9-ft deep regularly dredged channel, spans roughly 3/8ths of the total river width at the bridge crossing, from mid channel to several hundred feet from the shore on the northern (Iowa) side of the river. At present, a separate BO accounts for mussel take occurring in the dredged navigation channel.

A Habitat Conservation Plan (HCP) exists for the Quad Cities Station, upstream in MRP 14, as well as a BO for maintenance associated with upstream Lock and Dam 14.

South of the navigation channel and downstream of the action area, a string of narrow islands run east/west with the current, acting as a dike separating the northern half of the channel from the southern half. The southern half of the river at this point is called the Moline Gap. Within the action area, the Moline gap comprises all the wetted area south of these narrow islands, Sylvan Slough (also called Moline pool on the upstream end on the USACE Chart No. 76 (2011)), and a small unnamed island on which Pier H of the existing bridge is located. Piers G and J are located just off the north and south sides of the island. Arsenal Island (formerly known as Rock Island) is a 946 acre U.S. Army facility which manufactures weapons, other military equipment, and has a munitions museum. It is located immediately downstream of the existing bridge and the unnamed island. Within the immediate action area, an entirely urbanized landscape dominates both the northern and southern sides of the river.

Within the action area, substrate and depth is widely variable depending on channel location. On the Iowa side of the river, north of the navigation channel, the substrate at the existing piers was primarily sand and bedrock, while at the future pier locations it was primarily sand and zebra mussel shells. Within the navigation channel, substrate was sand mixed with silt, clay, gravel, and often high numbers of zebra mussel shells. See the ESI (2014) report for further detail on sediment data at specific locations. Depths range from 1.8 feet near shore and around the unnamed island to 14 feet in the main channel.

According to data from the U.S. Geological Survey (USGS) Gauge 05420500 at Clinton, Iowa, daily mean discharge (cubic feet per section [cfs]) and temperature (Celsius) are shown by month in the table below. January, on average, experiences the lowest flow rates as well as the lowest temperatures. April has the highest flow rates and July, the highest temperatures.

Table 3. Daily Mean Discharge and Temperature by Month USGS Gauge Mississippi River at Clinton, Iowa

Month	Temperature (Celsius)	Discharge (cfs)
January	1.668	26,290
February	1.714	28,779
March	2.445	50,894
April	8.993	90,733
May	16.790	83,229
June	22.943	71,127
July	25.474	57,490
August	25.303	38,323
September	22.287	37,967
October	14.729	41,253
November	6.993	39,407
December	2.665	28,433

3.1 Status of the Species within the Action Area

The purpose of this section is to analyze the effects on the species and/or critical habitat at the action level. For example, the following issues are considered:

- Percent or amount of the species range in the action area
- Whether effects are quantitative and/or qualitative
- The distribution of affected versus unaffected habitat

Percent or amount of the species range in the action area

Spectaclecase is a widely distributed species. Often populations at a site are represented by only a few individuals but spectaclecase may be present in localized patches in densities exceeding $120/m^2$ (Baird 2000). In the case of Sylvan Slough spectaclecase has not been collected in quantitative surveys in recent years but has been collected in timed searches at densities far lower than the number previously mentioned (ESI 2014, ESI 2015). In contrast, Baird (2000) estimated that population sizes for four sites in the Gasconade River ranged between 2,100 and 5,000 individuals. Estimated population sizes for four sites in the Meramec River ranged between 933 and 23,000 individuals. Similar high density clusters have also been observed in in the St. Croix but apparently do not currently exist elsewhere in the range of this species. Sylvan Slough does represent one of the few examples of recruitment for spectaclecase mussels in its entire range, and the only known example of recruitment in the mid to lower reaches of the Mississippi River system.

Population clusters for sheepnose are known from the Meramec, Bourbeuse, Alleghany, Green, Clinch, and Powell rivers. Even at its greatest abundance sheepnose generally comprises only a small proportion of the assemblage at any given location (generally less than 2 percent). ESI (2014, 2015) collected only one sheepnose in the course of quantitative sampling in areas in the vicinity of the proposed action and in Sylvan Slough. However, because of the small amount of area sampled and the large extent of suitable habitat it is estimated that the total population size could approach 3,000 individuals. This number is reached by multiplying sheepnose density/m^2 (0.036) by the total survey area (Area A = 84,000 m^2). Sylvan Slough is unique in that it represents one of the few locations in the UMR where sheepnose has been consistently detected over the years. Sylvan Slough and the Cordova Mussel Bed (upstream in MRP 14) contain the only known sheepnose found along the Iowa/Illinois border since the 1990s. Only one specimen was found at each of these locations since Whitney et al. in 1996.

In comparison to spectaclecase and sheepnose, Higgins eye, which is limited to the UMR basin, is not as widely distributed. However, within its range it has been described as "widespread" and "common" (Miller and Payne 2007). Higgins eye generally comprises a very small proportion of the assemblage at any given site and is considered abundant when densities exceed 0.25/m2 (USFWS 2008). The southern most viable reproductive population is believed to be in Sylvan Slough (Hornbach et al. 1995). The data of ESI (2014, 2015) were used to estimate population size in the vicinity of the bridge including the EHA in Sylvan Slough using observed densities. The estimated size of the Higgins eye population in these areas is approximately 15,000 individuals. Although this potentially represents a fairly large population it is not an isolated example as several other populations of equal or greater size exist within its range.

Whether effects are quantitative, qualitative, or both

Direct effects from the proposed action such as pier placement, dredging, demolition of the existing bridge, and placement of fill for stormwater outfalls are easily quantified. It is currently estimated that over 1,000,000 mussels will be affected by these activities including 407 spectaclecase, 3,470 Higgins eye, and 856 sheepnose (ESI unpublished estimates). Indirect effects from suspended sediment plumes, noise and vibration, lost reproductive opportunities, etc. can only be described qualitatively. Most of the indirect effects will be discrete localized events that will occur sporadically over the course of a few years. Others, such as water quality effects from increased suspended sediment may extend several thousand meters downstream of the construction area, potentially beyond the downstream limits of the EHA.

The distribution of affected versus unaffected habitat

ESI (2014) collected samples extending approximately 600 m upstream and 300 m downstream of the existing bridge in their efforts to characterize the mussel assemblage in the vicinity of the I-74 bridge project. Based on the Mussel Community Assessment Tool (MCAT) utilized by ESI (ESI, 2014; Dunn et al., 2012) the mussel community here is healthy, and good-quality with the highest quality on the Illinois bank. ESI determined the mussels populations within areas (A, B, and C) are all part of the same mussel bed based on the metrics collected. Beds of this size and density are uncommon in the age of enigmatic mussel declines (Haag 2012). Based on the survey, this mussel community extends upstream and downstream of the existing bridge, well outside of the proposed action area. These results indicate the proposed action may affect approximately one quarter of the total mussel assemblage present at this site.

3.2 Factors Affecting Species within the Action Area

This analysis describes factors affecting the environment of the species within the action area. The baseline includes State, tribal, local, and private actions already affecting the species or that will occur contemporaneously with the consultation in progress. The environmental baseline also includes unrelated Federal actions affecting the species that have completed formal or informal consultation.

Nine-Foot Navigation Channel

The Corps maintains a 9-foot deep navigation channel in order for barge traffic to travel up the Upper Mississippi River. This navigation channel intersects with the project both during Phase I and Phase II. In association with this regularly dredged navigation channel, a BO was created by the Service in 2000 to address its ecological impacts. This BO applies to the entirety of the dredged navigation channel within the action area. As such, take for impacts to endangered Higgins eye associated with regular channel maintenance in these areas was accounted for.

The navigation channel BO assigned a "will jeopardize continued existence" status to the Higgins eye because of take associated with dredging and channel maintenance, but primarily because of the lentic conditions facilitating zebra mussels which the navigation channel creates. "Thus, the Service believes it is reasonably certain that operation and maintenance of the navigation pools and project-dependent commercial barge transportation will facilitate zebra mussel persistence in the UMR to the extent that the likelihood of recovery and survival of Higgins' eye is appreciably reduced" (USFWS 2000).

While this BO did not attempt to quantify take of Higgins eye in the entire UMR, it does state that the navigation channel jeopardizes Higgins eye's continued existence in EHAs and impacts could lead to complete loss of recruitment and substantial mortality. Three reasonable and prudent alternatives were required for the 9-foot channel's continued existence:

1) Implement a monitoring program for Higgins' eye and other unionids in the UMR,

2) Investigate and implement opportunities to protect live Higgins eye individuals within EHAs in the UMR,

3) Develop and implement an action plan to monitor abundance and distribution of zebra mussels on the UMR System.

Water Quality

Water quality in rivers can be impaired by many factors including impoundment, road runoff, fertilizers, pesticides, etc. Impoundment results in the direct loss of riverine habitat and fundamentally alters the hydraulic characteristics of river systems (Haag 2012). The resulting reduction in velocity from within the dam pool makes efficient traps for sediments and contaminants (Steingraeber et al. 1994) such as polychlorinated biphenyls (PCBs), metals, ammonia, and pesticides.

Pesticides and ammonia compounds from fertilizers can also affect water quality. These enter rivers via road runoff flowing into stormwater outfalls, such as the two outfalls proposed for this project located directly upstream from Sylvan Slough. Ammonia compounds will likely be washed into the UMR from public lawns within the Quad Cities. Since the location of the proposed stormwater outfalls is a metropolitan area and not agricultural, ammonia effects from those outfalls may be negligible. Similar to fertilizers, pesticides concentrations from the proposed stormwater outfalls may also be low.

Other pollutants in specifically urban runoff include oil, grease, and other toxins from motor vehicles, heavy metals from roof shingles and motor vehicles, road salts, and thermal pollution from impervious surfaces (USEPA 2016). Due to their filter feeding behavior, freshwater mussels take in chemicals within the water column and their gills, mantle, and kidneys are exposed to these pollutants. The specific organs within mussels in which heavy metals bioaccumulate seems to be dependent on the metal and may be related the presence of binding sites of tissues (Naimo 1995).

Lock and Dam System

Lock and dam systems on large rivers may be negatively affecting spectaclecase, Higgins eye, and sheepnose by genetically isolating populations within man-made pools. Studies done on Higgins eye genetics observed a high degree of genetic variation within populations. The genetic variability is higher in Higgins eye than found in other endangered species. However, there have been relatively few studies done (USFWS 2004). The largest populations of spectaclecase do not appear to be significantly different from each other with regard to genetics (USFWS 2012). However, sheepnose populations appear to be genetically isolated from each other (USFWS 2012).

Increased sedimentation can occur in areas of the UMR due to lock and dam construction. Sediment deposition and siltation have occurred in various pools along the Mississippi River, however, Higgins eye is generally not affected by these factors. The sedimentation and siltation tend to occur on backwaters and Higgins eye habitats are found in the main channel or bordering the main channel (USFWS 2004). The sediment accumulations occurring behind dams may be affecting spectaclecase (Butler 2002). Impoundments on large rivers may be reducing spectaclecase and sheepnose habitat to short and isolated patches (Butler 2002, 2003).

Zebra Mussels

Zebra mussels were discovered in the UMR in 1991. They are currently found in MRP 15, throughout the UMR system, in many of its tributaries, and inland lakes. Zebra mussels have contributed to a sharp decline in freshwater mussel populations since their introduction, competing for the same resources, and attaching directly to freshwater mussels using adhesive structures called byssal threads.

From 1992-1996, UMR Pool 8 saw increases of zebra mussel densities from 1/m^2 to 15,000/m^2 (USGS 2001). Farr and Miller (2003 unpublished data) recorded increasing zebra mussel densities in Pool 10 from 1993 up to four (4) years of densities ~10,000/m^2 by 2002. Coinciding with zebra mussel increases, Unionid densities decreased markedly from ~50/m^2 to next to nothing in 2002. Concurrently, Higgins eye densities plummeted from nearly 1/m^2 in 1995 to next to nothing in 2001-2003. After initial invasion and as populations increased, zebra mussels had their greatest effects on native mussel communities by attaching to the hard substrate of native mussel shells and inhibiting filtration. After the initial stage of invasion, impacts are less predictable, and more likely to be caused by indirect effects through changes in the ecosystem (Karatayev & Burlakova 2015). While distribution of the invasive zebra mussel continues to expand in the US every year (USGS 2015), habitats where populations were established in the 1990's have already experienced the largest direct environmental impacts.

Zebra mussels were first established in MRP 15 in late 1991 or early 1992, becoming abundant in 1995. At the Illiniwek reach of MRP 15, just upstream of Campbell's Island, zebra mussel infestation (percent of Unionid mussels with one or more zebra mussel attached to it) went from 1% in 1994 to 48% in 1995. In 1995, infested Unionids had numbers between 2.3-37 zebra mussels attached per individual. Whitney et al. (1996), upon conducting this survey, predicted Unionids in MRP 15 would "suffer reduced fitness and increased mortality" in years to come. Zebra mussel shells currently compose a large amount of the substratum within the project area of MRP 15 (ESI 2014). Higgins eye has proven somewhat resilient to the zebra mussel invasion (Miller and Payne 2007), perhaps because of biological or behavioral differences.

4. EFFECTS OF THE ACTION

"Effects of the action" refers to the direct and indirect effects of an action on ESA-listed species and designated critical habitat, together with the effects of other activities interrelated and interdependent with that action which will be added to the environmental baseline. The ESA defines direct effects as those immediate effects of the project on the species or its habitat. Indirect effects as those caused by the proposed action and that occur later in time, but are still reasonably certain to occur (50 CFR §402.2). Interrelated actions are those that are part of a larger action and depend on that larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. When conducting an effects analysis, the Service must consider the direct and indirect effects of the proposed action in conjunction with the effects of other past and present federal, state, or private activities within the action area. The Service must also consider the cumulative effects of future state or private activities that are reasonably certain to occur within the action area.

This BO evaluates the anticipated potential direct and indirect effects of the I-74 bridge installation to each of the three freshwater mussels known to occur within the action area, including the spectaclecase, Higgins eye, and sheepnose. No critical habitat has been designated for any of these species; therefore, none will be affected. Sylvan Slough, however, is a designated EHA for Higgins eye and portions of it are within the action area. Below, we assessed each of the various project components and their anticipated effects on the three federally listed mussel species. Avoidance and minimization measures are considered part of the proposed action, so the effects of these measures in reducing, or partially offsetting, effects on these species are considered as well.

Factors to be Considered

Proximity of the action: All three mussel species were found within the action area during freshwater mussel reconnaissance surveys in 2014 (ESI 2014). Higgins eye and spectaclecase were found on both sides of the navigational channel and sheepnose was found only on the Illinois side of the river within the action area (ESI 2014). No critical habitat has been designated for any of the three species. However, essential habitat areas have been designated for Higgins eye by the Service in the original recovery plan that included six areas on the upper Mississippi River (discussed in the "Status of Species/Critical Habitat" section of this document) (USFWS 1983b). Four additional essential habitat areas were added in the revised recovery plan (USFWS 2004). Sylvan Slough is considered an Essential Habitat Area for Higgins eye, which is located directly downstream of the proposed construction and demolition areas.

Distribution: In the BA, the project proponents define the action area (i.e. the zone within which direct and indirect effects are expected to occur) as encompassing all construction areas for the proposed I-74 bridge installation, demolition of the existing bridge, and those areas deemed to be suitable relocation areas for mussel species (as approved by the Service, ILDNR, and IADNR). The action area includes the construction and demolition footprint of the existing and proposed bridges with a 50-ft buffer on the both upstream and downstream sides within the Mississippi River. Additionally, the construction areas for the storm sewer outfalls, cofferdams, and the downstream extent of any turbidity plumes created as a result of construction areas of extreme levels of vibration due to drilling, demolition, or other activities (more details in "Action Area" section). The extent of this plume is dependent on many factors, including flow velocity, construction activity, state of the silt curtains, etc.

Construction and demolition activities will occur within and adjacent to the navigation channel, however, it is dredged by the Corps and the site of constant barge traffic and, therefore, subject to regular disturbance. Dredging frequency in the navigational channel has been reduced in recent years and decades may pass without maintenance, because of various channel control structures that help maintain the channel depth. Due to the regular disturbances, the navigational channel is not considered potential habitat for listed mussel species. No impacts to freshwater mussels are expected within the navigation channel. However, Higgins eye and spectaclecase were found on both sides of the navigational channel and sheepnose was found only on the Illinois side (ESI 2014).

Within the action area, direct mussel habitat disturbance, in the form of silt curtain anchorage, vessel anchorage, dredging, pier construction, and bridge demolition are proposed beneath the existing bridge and in the footprint of the proposed bridge. Therefore, mussel relocation is proposed. In order to accommodate the large-scale freshwater mussel relocation efforts prior to construction, seven sites were surveyed and proposed by ESI (2015) to receive mussels from the direct impact area, and five of these sites will be used. These sites are discussed in detail in the "Action Area" section.

Timing: The freshwater mussel relocation will be the first step in the proposed project schedule and is expected to begin in August 2016 and will be ongoing for approximately 60 days. Construction of the proposed I-74 bridge is scheduled to begin in July 2017 and the eastbound lanes will be complete in November 2019 and the westbound lanes will be complete in November 2020. In-water work is expected to occur during the entire three years of proposed bridge construction. Storm sewer outfall M6 installation will begin between August 2017 and October 2017 and will take approximately three weeks. Storm sewer outfall M1B installation will either begin in fall 2017 or between April–July 2018 and will also last approximately three weeks.

Once construction of new bridge is complete, a second mussel relocation effort is planned for a portion of the footprint of the existing bridge directly prior to demolition. Mussels will likely be relocated from the riprap located around the existing piers, except for Pier K. Demolition of the existing bridge will occur in November 2020 and continue until the fall 2021. Table 4 shows the reproductive cycle of spectaclecase, sheepnose, and Higgins eye.

Table 4. Reproduction cycle and timing for federally endangered mussel species within the action area.

Common Name	Scientific Name	Developmental Stage	J	F	M	A	M	J	J	A	S	O	N	D	Source
Spectaclecase	*Cumberlandia monodonta*	Gonadal Development				■				■					Gordon and Smith 1990, Estimated
		Spawning/ Fertilization				■	■			■	■	■			Gordon and Smith 1990, Baird 2000
		Brooding					■					■			Howard 1915, Gordon and Smith 1990
		Glochidial Release					■	■				■	■		Estimated
		Juvenile Release					■	■	■			■	■	■	Estimated
Sheepnose	*Plethobasus cyphyus*	Gonadal Development				■	■								Estimated
		Spawning/ Fertilization					■	■							Parmalee and Bogan 1998
		Brooding					■	■	■	■					Hove et al. 2015
		Glochidial Release							■	■					Ortman 1911, Williams et al. 1988
		Juvenile Release							■	■	■				Butler 2003, Estimated
Higgins Eye	*Lampsilis higginsi*	Gonadal Development			■	■	■								Estimated
		Spawning/ Fertilization					■	■	■	■	■				Baker 1928
		Brooding	■	■	■	■						■	■	■	USFWS 2004
		Glochidial Release					■	■	■	■	■				Surber 1912, Waller and Holland-Bartels 1988
		Juvenile Release						■	■	■	■	■	■		MCT 2002

The brooding and glochidial release periods are a sensitive time to disturb mussels. Based on project timeframes and information contained in Table 4 the proposed bridge mussel relocation will likely occur during these sensitive reproductive periods for the sheepnose and Higgins eye. If disturbed, mussels could prematurely abort their glochidia with no host fish nearby. Higgins eye spawning also occurs during the initial relocation. Another repercussion of relocation is that male Higgins eye located at the upstream extent of this bed, once moved, will not have the opportunity to fertilize the eggs of females within Sylvan Slough. Higgins eye is a long term brooder and over winters with glochidia stored in its marsupial gills. Long term exposure to increased suspended sediment concentrations has been shown to inhibit glochidial metamorphosis in long term brooders (Gascho Landis and Stoeckel 2016). The major activities for the I-74 bridge project, including construction and demolition, are long term disturbances. Construction will be ongoing for an estimated three years and drilling into bedrock for the construction of piers is expected to occur for two years. During construction and demolition, all mussels will suffer disturbance during all periods of their reproductive cycle. However, fish infected with glochidia at the beginning of construction will likely avoid the action area due to noise, vibration, boat activity, high TSS. Potential or actual fish hosts may be displaced and forced into less suitable habitats.

Nature of the effect: The life cycle of mussels, including sedentary habits, filter feeding, and respiration through gills cause them to be vulnerable to instream construction. While most of the habitat impacts will be short term and occur during construction, long term effects are also expected such as change in substrate composition below the new bridge, loss of habitat in the footprint of the new piers, and a change in habitat where the current piers will be removed. Take of the mussel species due to some of these changes could continue after construction, as the river channel configuration reaches a new equilibrium with the bridge structure.

Relocation of mussels from this project area will reduce the density and species richness within the mussel beds in the aquatic action areas and, as a result, Higgins eye will be adversely affected within the action area. Higgins eye is commonly found in densely populated mussel beds with various species present. Although a population of Higgins eye is present in Sylvan Slough further downstream of the project, this reduction in overall population size may compromise the long term stability of this species in the action area. Spectaclecase may benefit from the I-74 bridge project after construction activities are complete, due to new habitat installation for this mussel in the proposed bridge location. Boulder and large cobble will be installed in dredged areas of the proposed bridge footprint as well as in areas surrounding the piers. Spectaclecase inhabits the current bridge piers and could eventually colonize the new pier riprap placed in the dredge cut areas. Alternatively, it is possible that riprap in the dredged areas could become embedded by fine-grained particles rendering it unsuitable for spectaclecase.

Duration: The I-74 bridge project activities will have short-term, sustained long-term (chronic), and permanent effects on the federally listed species and/or associated habitat within the action area.

Use of explosives is one short-term effect of the I-74 bridge project that could occur periodically during existing bridge demolition for a relatively short duration.

Chronic events will occur for the duration of construction. These include: mussel relocation; water quality degradation resulting from construction activities; sediment plumes that would likely occur in pulses and could follow many construction activities such as dredging and drilling throughout the project duration. The two relocations of mussels out of the action area happen in the short-term, but their effects on the removal areas are sustained. It is unknown when the federally endangered mussel species will repopulate the locations naturally. Other chronic events include dredging and the associated water quality degradation as well as subsequent adjustments to bed topography that may occur over time.

Permanent alteration of habitat in the Mississippi River will occur including pier installation and riprap/boulder installations during and after construction. Permanent events include the removal of the existing bridge piers and the installation of the new bridge piers. Permanent loss of habitat will occur at the fourteen new pier locations. This habitat loss may be partially offset by the potential habitat recovery at the location of the six demolished existing bridge piers through the placement of boulder/large rock habitat for spectaclecase. However, alteration of the substrate may simultaneously degrade suitable habitat currently occupied by Higgins eye and sheepnose. The presence of the piers will permanently alter localized velocity and sediment deposition patterns but should be negligible in areas between the piers. There is no replacement of habitat for these species within the action area.

Disturbance frequency: The construction of the I-74 bridge will result in a number of adverse effects and the recovery rate of mussels from these disturbances is unknown. Dredging is projected to occur several times within the construction footprint. The dredged area is expected to function as a sediment trap, capturing sediment suspended in the water column, saltating on the bed, and/or sloughing in from the edges of the dredge cut. The first instance of dredging is expected to have the greatest impact on resident mussels if present. Dredging kills mussels directly when they are collected along with sediments. It is assumed that subsequent dredging events would only affect mussels that had colonized dredge areas or that were transported into the dredge cut with other sediment. Dredging may also be required in the demolition footprint, but if necessary, will likely be less intensive due to deeper water present in the work areas.

Drilling associated with pier installation is expected to be constant for an estimated two years. Each pier may take a minimum of one month to install. The two piers associated with the arch span, Piers 12 and 13 will likely take much longer. Little is known about the effects of constant drilling on mussels that may be located near the drill sites. When the Mississippi River substrates reach equilibrium with the new bridge structure, disturbance will be limited to occasional bridge maintenance.

Disturbance intensity: Disturbance intensity will be high during the mussel relocation. Direct lethal take of all mussels not relocated will occur from the footprint of both construction and demolition areas of direct streambed disturbance, predominantly by being crushed or dredged. Mussels that are in proximity to, but outside of the direct disturbance area will be harmed and harassed due to vibrations from drilling and cofferdam installation (near the outfall area and 2 piers near the channel), they will experience changes in water velocity, avoidance of the area by host fish, siltation, and other water quality alteration. Mussels may respond to these stressors through valve closure during which respiration, nutrient intake, and reproduction is limited. Disturbed gravid females, especially short term brooders, may abort their young prematurely and larval mussels that do not find suitable host fish will die.

Disturbance severity: The proposed project represents a fairly severe disturbance that will result in relocation or mortality for nearly one quarter of the mussels present in the Mississippi River in the vicinity of bridges. A large percentage of the mussel bed on the Illinois side of the river will be adversely affected by increased suspended sediment concentrations in the water column which could result in lost reproduction for the construction period of at least three years. Overall densities at this location in the river were already in decline. In the period between 1983 and 1987 bed densities near the I-74 bridge ranged between 89.5/m^2 and 115.4/m^2 and during surveys completed in 1994 and 1995 mussel densities ranged between 45.0/m^2 and 68.9/m^2 (Whitney et al. 1996). In 2014, density at Site A (roughly the same location) was 24.9/m^2 (ESI 2014). It is worth noting that some of observed density decreases in the mussel beds were likely due to the zebra mussel invasion, though Higgins eye has proven somewhat resilient to this stressor (Miller and Payne 2007).

4.1 Beneficial Effects

The construction of the proposed I-74 bridge may cause some beneficial effects for mussels. After the construction of the proposed bridge, boulders will be used to fill the dredge cut, which may be beneficial for spectaclecase. Unfortunately, some of this boulder material within the dredge cut may become embedded with smaller sediments due to unsettled post construction material.
Construction and placement of artificial habitat may also facilitate colonization into new habitat by spectaclecase.

It is hoped that stocking host fish inoculated with mussel larvae within the action area will help speed the repopulation of mussels within river substrate impacted by the construction of the new bridge. Artificial stocking of inoculated host-fish may also offset some of the lost reproduction potential of mussels impacted during construction of the new bridge and demolition of the old bridge.

4.2 Direct Effects

<u>Relocation</u>

Direct effects of the mussel relocation effort, prior to bridge construction and demolition includes harassment, harm, and mortality to mussels, as well as loss of habitat. The direct effects to mussels during relocation will be partially offset by the minimization of lethal take to mussel species from construction and demolition activities. Any mussel removed from the action area will be subject to harassment from collection and handling. A 5% mortality rate for mussels during relocation is expected, though the percentage depends on the species. This low mortality percentage can be accomplished by following guidelines during relocation such as: avoidance of temperature extremes (both air and water), use of biologists with unionid experience for collection and relocation, minimization of the duration mussel are exposed to air (less than four hours), and selection of appropriate relocation areas for the species (Waller et al. 1995, Dunn et al. 1999).

The mussel collection areas will be searched by divers until at least 90 percent of all mussels >1 inch in length are collected. Although the area will be extensively searched, it is estimated that up to 10% of mussels >1 inch in length will likely be missed. Based on previous mussel density data from the action area, it is estimated that 95 adult Higgins eye and 21 adult sheepnose will not be relocated, thus being directly taken during project construction. However, no spectaclecase will be missed during the relocation effort because this area lacks habitat for the species. The smaller mussels <1 inch will likely be missed altogether, which includes juvenile Higgins eye and sheepnose. An estimated 226 Higgins eye and 53 sheepnose juveniles will be left in place and directly impacted by project construction activities. Mussels outside of the 10-m diameter buffer of Piers 1 through 5 and 5-meter diameter of Piers 13 through 15 in the proposed bridge construction area will be left in place. In addition to the direct mortality estimates above, it is estimated that approximately 32,555 mussels, of various other species, will be left in the construction area and subjected to potential direct disturbance and possible mortality.

Mussel relocation efforts for the existing bridge demolition will likely involve moving mussels from the riprap surrounding Piers A through J and Pier L, which most likely will include the spectaclecase. No other details about the demolition mussel relocation have been decided. Mussel relocation effort will be decided when it is closer to the demolition event, which is expected to occur from November 2020 and continue until fall of 2021.

<u>Phase 1 – Construction</u>

Silt Curtains

Floating silt curtains are used in this project as a means to protect the city of Moline water supply and to protect mussels within Sylvan Slough from suspended sediments caused by construction activities. The anchors of silt curtains are 3-feet by 3-feet concrete weights that will be placed on the substrate. The direct effects of placement of the silt curtains include incidental crushing and/or burying of mussels beneath the weighted anchors.

Construction activities will occur for approximately three years and during that time, sediments will likely collect behind the silt curtains. The volume of sediment that is collected by the silt curtains depends on the amount of sediment delivered by project activities (e.g., dredging, pier construction, etc.), the type of material delivered (e.g., silt versus sand), streamflow patterns over the construction period, and the resiliency of the silt curtain. Effectiveness of silt curtains depends on the type used and velocity of flow. River velocities in the vicinity of the proposed location for the silt curtains on the Illinois side of the river ranged between 1.0 and 2.0 fps under low flow modeling scenarios (HDR 2008). Velocities could exceed optimal flow ranges during higher discharges and could result in resuspension of accumulated sediment and potentially scour of substrates beneath the curtain (Radermacher et al. 2015).

According to project plans developed by IADOT, five silt curtains will be used for construction of the proposed bridge, including four on the Illinois side of the navigational channel protecting Sylvan Slough and one on the Iowa side of the navigational channel. The silt curtains will remain in place until construction is completed and silt behind curtains will be removed. Despite these efforts, suspended solids are likely to increase turbidity, siltation and sedimentation which will have direct effects on mussels left behind. Silt curtains will be maintained on an as needed basis.

Dredging

Dredging beneath the proposed I-74 bridge construction site will directly affect non-rescued mussels in a variety of ways. Physical disturbance, burial, and mortality are likely due to dredging activities within the bridge footprint. Dredging will occur at least once, but potentially multiple times from bank to bank in areas less than six feet deep within the proposed bridge footprint. Any mussels within the dredge cuts will be killed from being collected with sediments and placed at the upland disposal site (Watters 1999, Aldridge 2000).

Dredging will increase suspended solids concentrations in the water column through contact of the bucket with the bed, retrieval of the bucket through the water column, sediment losses as the bucket is pulled out of the water, spillage or leakage as the bucket is hosted aboard the barge, and the cycling rate of deployment and retrieval (Averett et al. 1996, Anchor 2003). Data characterizing sediment concentration increases in the Upper Mississippi River from prior dredging projects were not readily available at the time this document was prepared. However, dredging in other systems has been found to elevate suspended sediment concentrations between 10 to 500 mg/l over background concentrations (Averett et al. 1996, Nightingale and Simenstad 2001).

These effects are expected to be minimized by the installation of weighted silt curtains that will be placed downstream from the proposed bridge corridor prior to construction of the bridge. While silt curtains have been shown to reduce mean suspended sediment concentrations in the water column, the magnitude of reduction was marginal with substantial overlap in confidence intervals for samples collected upstream and downstream of the curtain (Averett et al. 1996).

One plausible mechanism by which dredging may adversely affect freshwater mussels is by increased sediment deposition around the silt curtains and subsequent burial of mussels. Marking (1979) (as cited in Watters 1999) found that 50 percent of fat muckets (*Lampsilis siliquoidea*) and pocketbooks (*L. cardium*) could successfully extricate themselves when buried in sediment to a depth of nearly seven inches. A similar proportion of Wabash pigtoes (*Fusconaia flava*) self-extricated from a depth of only four inches, an indication of the differential abilities among species. Krueger et al. (2007) experimentally buried mussels under nearly 16 inches of sediment and observed between six and 13 percent mortality after 48 hours. The exact cause of mortality was not determined but was probably sediment anoxia. The trapping efficiency of the silt curtains is currently unknown but sediment deposits of the size described above are not expected. Therefore, listed species may be affected through lost feeding opportunities, energy spent through locomotion, etc. but mortality due to burial is not anticipated.

The influence of suspended sediment concentrations on freshwater physiology has been infrequently researched. Bucci et al. (2008) conducted laboratory experiments on freshwater mussel feeding at various suspended sediment concentrations. They found that valve gape (an indication of feeding activity) for fat muckets during periods of low (<20 Nephelometric turbidity units [NTU]) and high turbidity (20 – 75 NTU) did not differ significantly, whereas valve gape for the invasive Asiatic clam (*Corbicula fluminea*) did. The experimental concentrations did not reach levels sufficient to cause valve closure in the fat mucket. For reference the annual mean turbidity in the Mississippi River near Clinton, Iowa between March of 2015 and May of 2016 was 35.1 Formazin Nephelometric units (FTU; USGS Gauge 5420500). Aldridge et al. (1987) found that mussels will satisfy metabolic demands by reliance on non-protein body stores when exposed to long periods (up to five hours) of high suspended solids. Miller and Payne (1996) observed reduced food clearance rates in unionid mussels exposed to infrequent and frequent turbidity. Payne et al. (2000) found when some species of mussels are exposed to high TSS they had significantly lower nitrogen excretion rates and others had an O(oxygen):N(nitrogen) ratio that was nearly twice as high after high suspended solids.

Recent research has begun to show that increased suspended sediment concentrations may affect reproductive processes in mussels. Suspended sediment concentrations greater than 20 mg/l were found to inhibit fertilization success in the long term brooder pondmussel (*Ligumia subrostrata*) but that once fertilized, gravid females were able to produce glochidia (Gascho Landis and Stoeckel 2016). The lack of fertilization is thought to be a due to either the female not respiring as often or from simultaneously clearing both sperm and heavy accumulations of particulate matter from their gills (Gascho Landis et al. 2012). In contrast, the short term brooder ebonyshell (Reginaia ebenus) exhibited high rates of fertilization under similar conditions but few glochidia developed.

Buessink (2007) found that once fat mucket glochidia had parasitized fish they were resilient to high suspended sediment concentrations. Rates of glochidial metamorphosis at concentrations up to 2,500 mg/l were statistically indistinguishable from experimental controls (0 mg/l). The physiological tolerances of spectaclecase, Higgins eye, and sheepnose are unknown but it is reasonable to assume that threshold effects may be observed at similar concentrations. The suspended sediment dredging plume will almost certainly exceed concentrations shown to inhibit fertilization and/or glochidial development in other species and may affect mussels a considerable distance downstream of the proposed bridge replacement. In other dredging projects, the suspended sediment plume was observed to extend between 300 and 2,600 m (984 and 8,528 ft) from the dredge location (Nightingale and Simenstand 2001). Dredging may affect side channels and sloughs by increasing suspended solids (USFWS 2004a). The exact limits of dredging are still not known, though they are limited by the Iowa DOT Special Provisions to conserve mussel beds. Some portions of the action area are deep enough not to necessitate dredging.

Construction plans currently propose to backfill the dredge area with large coarse material. As described earlier, this structural habitat change could be beneficial for spectaclecase. However, if the coarse substrates become embedded with fine-grained substrates this feature may not be suitable for this species. Dredging will result in indirect effects such as change in the substrates of the proposed bridge footprint, though the extent and duration of these changes are not entirely known. Post-dredging substrate will likely remain unstable and constantly shifting. It will require an unknown amount of time to embed and stabilize. This type of substrate disturbance provides poor habitat for recolonization by mussels (Burky 1983). Loose substrates make especially poor habitat for Higgins eye (Miller and Payne 1996, USFWS 2004b). Most dredge areas are not quickly recolonized by mussels of any kind, though Watters (1999) suggested that this type of stream modification could result in increased soft-substrate adapted mussels. Despite this research, one study observed recolonization of dredge cuts by 14 mussel species at five years of last dredging. Older dredge cuts had 13 – 21 species of mussel recolonize (Eckblad 1999).

Some studies have observed mussels survive or recolonize in areas adjacent to dredge cuts (Miller and Payne 1991). ESI has been monitoring a small dredged area in Pool 19 of the Mississippi River since 2014 to determine the rate of recovery of mussels relative to a nearby undisturbed reference area (Heidi Dunn, personal communication). The dredged area was divided into two segments, one was dredged in 2012 and the other in November 2013. The river bottom was carefully restored to pre-dredging contours. Juvenile mussels were observed in October 2015, which was 2 – 3 years after the last dredging event. The mussel density was 12.7 ± 4.5 unionids/m2. Adult density remains low (1.8 ± 0.8 unionids/m2), but has steadily increased across all sampling events, suggesting more unionids are becoming established in the dredged area. Observations during this project suggest that unionids may move into disturbed areas in as little as a few years, though additional time will likely be needed for the community to return to pre-dredging conditions (Heidi Dunn, personal communication).

Several factors may contribute to the time it takes for mussels to recolonize dredged areas within the action area, including post-dredging contours and how closely they match pre-dredging conditions. Dredged areas near the bridge may also be repopulated via downstream movement of mussels from known upstream aggregations. Fish moving glochidia from other areas could repopulate mussels post-construction, though this will likely occur after construction disturbance has ceased and substrates reach a new equilibrium.

Barges/Watercraft

Direct effects to mussels from barges traveling and spudding in the proposed bridge construction area include mortality by crushing, burying, and scouring. Spudding barges will affect a 1 $feet^2$ hole in the riverbed for every spud, a minimum of one spuds will be needed for each bridge column construction resulting in 140 $feet^2$ of substrate disturbance and potential mussel crushing (USFWS 2015). Barge spuds will only affect mussels left behind on the piers where relocation efforts have been conducted because they are restricted to the area within the mussel relocation buffers of Piers 1 through 5 and 13 through15. Mussels around piers 6 – 12 will be impacted by spudding as mussels surrounding these piers will not be relocated.

Small watercraft will be used for routine construction efforts to move workers and materials from shore to spud barges. Propeller wash from towboats and other construction related watercraft can be a direct effect by dislodging and striking mussels. Juvenile mussels are especially vulnerable to dislodging due to shear stress associated with boats (French and Ackerman 2014). Propellers strikes were found to be a source of mortality during salvage activities after an oil spill in Michigan (Badra 2011). Dislodging of spectaclecase mussels is less likely than the other two species of federally listed mussels. Spectaclecase mussel habitat includes larger, more stable substrates (i.e. boulders), which makes them more difficult to dislodge. In the event that large watercraft are used, velocity from propellers of barges and large ships have been found to have little physiological effect on freshwater mussels unless it is associated to a significant increase in total suspended solids (Payne et al. 2000). The effects of propellers on mussels are expected to be minimal due to water depths of six feet or deeper and the already high amount of boating activity on a navigable river.

Pier installation

Pier installation will directly impact mussels left behind in the proposed bridge footprint. They will likely be crushed and buried by drilling and concrete pouring. The drilling will likely cause vibration for an extended period of time. There is little information on how vibration affects mussels, but a study by Aldridge et al. (1987) observed that frequent turbulence lowered mussel nitrogen excretion rates, which indicates they experienced reduced filter clearance rates. It is not clear if the drilling vibrations could cause death in mussels due to reduced filter clearance rates, but it will likely be harmful in affecting their normal behavior. Habitat will be permanently lost during within the footprint of each pier, which is a direct effect to Higgins eye and sheepnose. Spectaclecase is not affected because the habitat in the pier footprints is not appropriate for this species. At minimum, each pier with eight shafts is removing 308 $feet^2$ and each pier with 10 shafts is removing 385 $feet^2$ of potential habitat for Higgins eye and sheepnose.

The permanent placement of piers in the channel will change localized patterns of flow divergence and convergence. Differences in velocity patterns would be limited to areas in the immediate vicinity of the piers and their associated wake zones which may extend as far as 300 feet downstream of the piers (HDR 2008, HDR 2010, HDR 2015). It is anticipated that these changes in flow patterns will result in alteration of microhabitat variables (e.g., depth, velocity, substrate composition, shear stress) important to mussels (Strayer 1981, Morales et al. 2006, Allen and Vaughn 2010) and their fish hosts (Aadland 1991). These changes could be adverse for some mussel species and beneficial for others (e.g, spectaclecase).

Mussels and their fish hosts may also be directly affected by vibration and other physical disturbances resulting from pier construction. Wysocki et al. (2006) and Gutreuter et al. (2006) observed fish with stress symptoms and reduced fish abundance in areas of persistent noise and vibration. Such stressors may cause behavioral avoidance in potential fish hosts. If suitable host fish are not in the location of gravid female mussels, due to construction activities causing vibrations in the water, increased suspended solids, and other undesirable environment for fish, reproductive opportunities will be lost, potentially affecting the viability of these populations in future years.

Cofferdams

Crushing, burial, dewatering, and noise are also possible direct effects to mussels within and near the cofferdam locations. Cofferdams will be used at the sewer outfall installation locations. However, if the river levels are low enough, they will not be necessary. These cofferdams are planned for areas of dense mussel beds, and the footprints of the cofferdams are included in the mussel relocation (ESI 2014). Remaining mussels will be directly affected in the cofferdam footprints due to excavation, crushing, and burial by heavy equipment traffic, cofferdam placement, and death from dewatering. A conservative estimate indicates the dimensions of the cofferdam at Outfall M6 will be approximately 17 feet by 40 feet (680 feet^2) and the dimensions at Outfall M1B will be smaller at 13 feet by 40 feet (520 feet^2). Six cofferdams are expected to be used to construct the span arch at both Piers 12 and 13. These cofferdam locations are on either side of the navigational channel where the mussel density is low. In these locations, direct effects to mussels are expected to be minimal.

Other direct effects to the mussels associated with cofferdams include noise and soundwaves from the installation process. This is a short-term disturbance which will have minimal effects on mussels.

Accidental spills

Pollution caused by spills of materials being loaded and unloaded at the staging areas could impact mussels near the proposed bridge. Adult mussels are easily harmed by toxins and degraded water quality from pollution because of their sedentary life. This is likely a negligible effect.

Phase II – Demolition

Dredging

Dredging for demolition is not anticipated due to greater water depths at the existing bridge. If necessary, direct effects of dredging on mussels would be similar to those already discussed in the construction section (see "Direct effects – Phase I).

Demolition of existing bridge

Demolition could cause siltation and sedimentation through the destruction of concrete pier structures, digging into substrates to remove shafts down to the bedrock, and other demolition activities. Expansive and explosive demolition of bridge structures will be used and both could cause increased suspended sediment concentrations. The expansive material is required on the Illinois side of the navigational channel and cause less turbidity and pressure waves, therefore reducing suspended sediments. Explosive demolition used on the Iowa side will cause more pressure waves and will likely increase suspended sediment concentrations. Suspended sediments due to demolition could have similar effects as suspended sediments caused by dredging discussed in the previous section. Pieces of the piers are not likely to escape during the explosions due to the use of large gage wire that will be wrapped around piers prior to demolition. Drilling will also be necessary to remove the piers to bedrock level, which will increase suspended solids and vibration. Drilling associated with demolition will likely be similar to the construction of bridge piers and the effects on mussels are also likely to be similar (see "Direct effects – Phase I").

Mortality of individuals could also occur as a result of demolition of the existing piers. To minimize these effects, explosives are prohibited on the Illinois side of the navigational channel. However, explosives will be used on the Iowa side of the navigational channel and any mussels left behind in that area may be killed by the shock waves of explosives.

Barges/watercraft

Similar to construction activities, demolition will require extensive barge use and associated small watercraft to move the spud barges and transport workers and materials to staging areas, which could cause the same direct effects to mussels as mentioned above (see "Direct effects – Phase I").

Silt curtains

The demolition plans for the existing bridge, provided by IADOT, include silt curtains around portions of Piers L and J and on all four sides of Pier H on the Illinois side of the navigational channel, which will minimize concentrations suspended solids plumes. These silt curtains will be similar to those discussed in "Direct effects – Phase I". The only difference is the length of times these curtains would be installed is shorter since demolition will be complete within one year.

Falling materials

Demolition of the existing bridge will include deck and railing disassembly from above. Falling material should be reduced by the use of expansive material on the Illinois side and the use of catch barges during demolition.

Direct effects of demolition include mortality to individuals left behind following the relocation efforts, due to sedimentation, spud barges, potentially and falling materials. Take estimates for demolition activities will be determined as the project moves into demolition phase.

4.3 Indirect Effects

Relocation

Five sites have been identified for the many mussels that will be relocated from the I-74 bridge construction footprint. Two additional sites were found specifically for spectaclecase. Estimates were made on the number of mussels that could be placed at each of these sites. An indirect effect of mussel relocation is that relocation sites could reach or exceed carrying capacity with the large number of mussels that will be moved to them. However, this effect is unlikely if the estimated number of mussels is correct. Currently, the estimate for mussels to be relocated from Phase 1 and 2 is approximately 518,190 individuals, but this number could increase to achieve the 90 percent identified threshold for relocated mussels. If the expected number increases to meet the 90 percent threshold then the potential to reach carrying capacity at relocation sites is more likely.

Phase I – Construction

Dredging

Substrates on the Illinois side of the river near the action area are dominated by sand, silt, clay, and zebra mussel shell (ESI 2014). These particles have very low entrainment thresholds and consequently some potential exists for the dredge cut to destabilize adjacent habitats. This may occur through any one, or combination of, physical processes. First, it is anticipated that the dredge cut will initiate slumping of adjacent sediment. Initially slumping will occur in close proximity to the dredging area, but is expected to propagate outward until the bank slopes reach a semi-stable state. Changes in river discharge may re-initiate this process at some later time. Second, the dredge cut is a discontinuous surface in a river bed that is otherwise uniform. This may produce atypical hydraulic conditions within the dredge cut and eddies or recirculating currents may undermine the upstream and downstream boundaries of the dredged area, particularly under higher discharges. Third, the transport threshold for 1 mm sand grains is approximately 1.6 fps and is even lower for smaller particles (Knighton 1998).

Modeled velocities exceeded this threshold at all but one of the proposed bridge piers during a 0.50 exceedance probability discharge (2-year flood) (HDR 2010). Sediment in motion, whether through saltation or entrainment, will contribute to filling of the dredged area. Other hydraulic adjustments to the changed condition may also occur but are not described here. Whatever the mechanism(s), mussels may be dislodged and entrained during bed adjustments. Channel adjustments may alter the grain size distributions in the mussels beds such that they are no longer soft enough for burrowing yet stable enough for mussels to remain in place during higher flows (Strayer 2008). Channel adjustments of the kind described above are flow dependent and could happen on a time scale of months or years depending on prevailing streamflow patterns.

Piers

The physical presence will alter the structural habitat characteristics of discrete areas along the bridge alignment. Habitats currently populated by one functional group of fish (e.g. benthic invertivores) may be replaced by species with higher affinity for structural cover (e.g. centrarchids). This may affect host fish availability for listed mussels in certain areas.

Cofferdams

Cofferdam construction including the drilling of sheet piling into the bedrock, may cause behavioral avoidance and/or mortality in host fish species. This may result in lost reproductive opportunities that will adversely affect listed mussel populations in future years.

Sewer outfalls

The new sewer outfalls associated with the I-74 bridge construction will increase the amount of discharge released upstream of the mussel beds and Sylvan Slough. This discharge includes runoff from the proposed bridge and the roads nearby in Moline. The indirect effects will come in the form of road salt in winter, car fluid spills, lawn chemicals, metals etc. These pollutants could be sublethal to mussels and bioaccumulate over the years. Mussels may also respond to degraded water quality by valve closure resulting in lost feeding opportunities.

Phase II – Demolition

An indirect effect of demolition of the existing bridge includes displacement and potential removal of fish from existing bridge footprint due to the use of explosives to demolish Piers A-D. The host fish displacement would be for an unknown amount of time. Some fish will likely die during explosive demolition. All removal of host fish from the existing bridge footprint and nearby areas will have an effect on reproductive opportunities for freshwater mussels in the area. If the explosive demolition occurs in fall, low abundance of fish near the mussel beds could affect the reproduction of spectaclecase and Higgins eye and if it occurs in spring, sheepnose reproduction could be affected. Currently, the schedule of demolition stages is unknown.

4.4 Species' response to the proposed action

The Illinois side of the Mississippi River in MRP 15 has large and diverse mussel beds with at least three federally listed species: spectaclecase, Higgins eye, and sheepnose. Federally listed species cumulatively comprise less than 1 percent of the mussel population, although, these species are not known to occur anywhere in large numbers. The three species have been observed in Sylvan Slough in small abundances for many years (Oblad 1980, Whitney et al. 1996, Farr and Alley 2003, ESI 2014, 2015). All three federally endangered mussels are also declining within MRP 15 and already may be stressed by unknown factors. With this project, these mussels (missed during relocation efforts) will be exposed to redistribution of sediments, suspended solids, and unusually high vibration disturbance. Mussels relocated incur stress, harm and harassment. Despite the small percentage of spectaclecase, sheepnose, and Higgins eye within the mussel beds near and within the action areas, there is the potential that the size of the mussel beds will offer some resiliency.

4.5 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this BO. Future federal actions that are unrelated to the proposed action are not considered in this section because they would require separate consultation pursuant to section 7 of the ESA. This section analyzes the added impact from cumulative effects.

The Service is unaware of any other tribal, state, local, or private actions presently occurring or that are reasonably certain to occur in the future, which would destroy, modify, or curtail the mussel habitat within the action area. Therefore, we do not anticipate significant cumulative effects from the proposed action, combined with other reasonably foreseeable non-federal actions.

5. CONCLUSION

The USFWS has based the following determinations on the implementation of project avoidance, minimization, and conservation measures to reduce take and these species are found recruiting in other locations. The major direct and indirect effects to the three federally listed mussel species from the construction of the proposed I-74 bridge and the removal of the existing bridge may affect individuals and populations of the spectaclecase, Higgins eye, and sheepnose mussels at a local scale. Minimization efforts will be used to reduce these local effects through relocation and sediment control measures. Although local effects to the populations under the new bridge and surrounding the piers from the old bridge, we do not believe long-term impacts to the population of these mussels in Pool 15 will persist from this action and there will be no impact at the species level for each of these three mussel species. After reviewing the current status of these species, the environmental baseline for the action areas, the effects of the proposed actions, and the cumulative effects, it is our biological opinion that the I-74 bridge installation project, as proposed, is not likely to jeopardize the continued existence of the spectaclecase, Higgins eye, and sheepnose mussels. No critical habitat has been designated for these species and, therefore, none will be affected.

6. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of endangered and threatened species without special exemption. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR §17.3). Harass is defined by the Service as intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR §17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the DOT and Corps so that they become binding conditions of any permit issued to the IADOT and ILDOT and the FHWA, as appropriate, for the exemption in section 7(o)(2) to apply. The FHWA and Corps (Agencies) have a continuing duty to regulate the activity covered by this Incidental Take Statement. If the Agencies (1) fail to assume and implement the terms and conditions or (2) fails to require the IA and ILDOTs to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of Incidental Take, the Corps or IA and ILDOTs and the FHWA must report the progress of the action its impact on the species to the Service as specified in the Incidental Take Statement (50 CFR §402.14(i)(3)).

Because incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity, this Incidental Take Statement is valid only upon receipt by the IADOT, ILDOT and the FHWA of all appropriate authorizations and permits from federal, state, and local permitting authorities. These permits/authorizations may include, but are not limited to, a permit under section 404 of the Clean Water Act from the Corps; a section 10 Rivers and Harbors Act permit.

<u>Amount of Extent of Take Anticipated</u>

The Service anticipates that take in the form of killing, harm, or harassment (as defined in 50 CFR §17.3) will occur as a result of the proposed actions. We anticipate that spectaclecase, Higgins eye, and sheepnose will be taken during the replacement of the I-74 bridge through direct mortality, injury, and stress. Lethal take will occur during mussel relocation and within the footprints of the cofferdams, piers, silt fence anchors, and due to the use of explosives on the Iowa side of the river. Mortality and injury may also occur outside these directly-affected areas during and after relocation, construction, and demolition due to sedimentation and changes to hydrology related to new bridge design.

Stress, short-term reproductive impairment, and limited mortality, due to changes in hydrology and construction-induced deposition, are possible within an area extending 50 feet upstream to downstream, to the extent of sediment plume of the existing bridge for the entire width of the river. Stressors include low oxygen, decreased food and sperm availability in the water column, and increased silt and other suspended sediments. The project will also result in loss or decreased suitability of mussel habitat due to shifting sediments. These events could result in harm to spectaclecase, Higgins eye, and sheepnose, the glochidial life stage of these species, and populations of host fish. The extent of these adverse effects is dependent on implementation of avoidance and minimization measures and river discharge during the period of construction, when cofferdams are in place, during potential flood events, bridge demolition, and when other instream actions occur.

Take was estimated for listed and non-listed mussel species based on data gathered during a mussel survey of the action area in 2014 (ESI 2014). ESI (2014) estimated the number of mussels in impact areas under both the proposed and existing 1-74 bridges and the new storm sewer outfall. Spatial data from the project area, mussel densities, and qualitative sampling data were used to estimate populations. Because spectaclecase is a habitat specialist and was found primarily adjacent to bridge piers within riprap, estimates for this mussel were calculated with the assumption that it likely only occurs in a 5-m buffer around existing bridge piers. Relative abundance of spectaclecase in qualitative samples was used to extrapolate the number of possible mussels around piers.

The total take estimates as a result of construction and demolition activities for each of the federal mussel species are summarized by state and action in Table 6. Construction estimates include estimated take as a result of the storm sewer outfall projects.

Table 6. Take Estimates for Federal Mussel Species within the I-74 Bridge Action Area

Species	**Take Estimate – Iowa**		**Take Estimate – Illinois**		**Species Total**
	Construction	Demolition	Construction	Demolition	
Spectaclecase	0	1	0	406	**407**
Higgins Eye	107	26	2,219	1,115	**3,367**
Sheepnose	0	0	558	298	**855**

For the purposes of estimating take as a result of placement of the silt curtain anchors, an approximate 66-ft (20-m) buffer was placed around the curtain to calculate the average density of mussels. The total take estimates as a result of silt curtain placement for construction, following the current plan of five, are summarized by state in Table 7.

Table 7. Take Estimates for Federal Mussel Species – Silt Curtain Placement

Species	**Take Estimate – Iowa**	**Take Estimate – Illinois**	**Species Total**
Spectaclecase	0	0	**0**
Higgins Eye	0	3	**3**
Sheepnose	0	1	**1**

The Service anticipates 407 spectaclecase, 3,470 Higgins eye, and 856 sheepnose individuals could be taken as a result of this proposed action. The Service anticipates 958,246 $feet^2$ of mussel habitat that includes these 3 species will be impacted as a result of this proposed action.

6.1 Effect of Take

The Service has determined that based on the proposed project and the conservation measures described; these levels of anticipated take are not likely to result in jeopardy to the spectaclecase, Higgins eye, or sheepnose for Phases I and II of the I-74 bridge project. No critical habitat will be affected by the project, therefore, neither phase of the project will result in adverse modification of critical habitat.

6.2 Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of spectaclecase, Higgins eye, and sheepnose:

1. The FHWA, will ensure that all proposed avoidance and minimization measures to reduce adverse effects to spectaclecase, Higgins eye, and sheepnose are implemented, including:

    a. Ensure mussels are relocated as described in the BO out of the action area.

    b. Ensure that Pier K is in place to preserve spectaclecase habitat surrounding it.

    c. Ensure Special Provisions developed by the IADOT (Appendix A and B) to avoid and minimize potential impacts to mussel species are fully implemented.

2. FHWA will monitor take to verify that the authorized level of take has not been exceeded.

6.3 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the FHWA must comply with the following terms and conditions, which implement the Reasonable and Prudent Measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

RPM 1.

1. The FHWA must ensure that project proponents implement a Service approved plan to salvage and relocate mussels from construction and demolition areas to approved relocation areas. Collection and relocation of mussels must be conducted by federally and state permitted malacologist and will follow relocation plans from ESI (ESI 2015) in coordination with the Service, IADNR, and ILDNR.

2. Develop an erosion and sedimentation control to address all sources of project-related erosion and sedimentation, including, but not limited to, construction of access roads, roadway approaches, staging areas, pier and abutment removal and replacement, cofferdam placement and removal, etc.

3. The FHWA will ensure project proponents develop and implement spill avoidance/remediation plan, based on the most effective prevention and remediation practices, to prevent hazardous materials (e.g. petroleum products, solvents, paints, etc.) from entering the Mississippi River, or contaminating soils or waters within the Mississippi River watershed. Such measure should include, but are not limited to, stationing of emergency response equipment at the project site, and designation of contained fueling and fuel storage areas at least 150 feet away from the Mississippi River.

4. During the bidding process, prospective project contractors will be notified regarding the presence of endangered species in the project area and the special provisions necessary to protect them. The successful contractors will be instructed on the importance of the natural resources in the project area, the need to ensure proper implementation of the required erosion and sedimentation control, and spill avoidance/remediation practices.

RPM 2

1. Assess impacts to spectaclecase, Higgins eye, and sheepnose mussels within the direct and indirect effect areas associated with the I-74 bridge replacement project.
    a. Quantitative and qualitative sampling will occur within the action area of the new bridge to evaluate the impacts to listed mussels from construction. The first monitoring event in the construction zone will occur after the new piers are constructed as soon as it is safely possible to deploy divers to determine impacts to mussels that were not relocated out of the action area. Continued monitoring of the mussels within the construction zone will occur in years 3, 6, and 9. All monitoring will follow approved plans developed by ESA and coordinated with the Service, IA DNR, and ILDNR and is scheduled to be.

    b. Quantitative and qualitative sampling will occur within the demolition action area of the old bridge to evaluate the impacts to listed mussels from removal of the bridge. The first monitoring event in the demolition zone will occur after the bridge is removed as soon as it is safely possible to deploy divers to determine impacts to mussels that were not relocated out of the action area. Continued monitoring of the mussels within the demolition area will occur in years 3, 6, and 9. All monitoring will follow approved plans developed by ESA and coordinated with the Service, IA DNR, and ILDNR and is scheduled to be.

    c. Quantitative and qualitative sampling will occur within the relocation areas to assess the health of translocated sheepnose, Higgins eye, and spectaclecase mussels. Initial and ongoing monitoring of each of the recipient sites will be and will be completed in years 1, 2, 4, 7, and 10. All monitoring will follow approved plans developed by ESA and coordinated with the Service, IA DNR, and ILDNR and is scheduled to be.

The Service believes that no more than 407 spectaclecase, 3,470 Higgins eye, and 856 will be incidentally taken as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The FHWA must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

7. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habits, the Service requests notification of the implementation of any conservation recommendations.

1. Artificial habitat for the spectaclecase mussel could be constructed downstream of known spectaclecase populations within and near the project area. Constructed habitat should be placed downstream of known populations and monitored to determine efficacy of two proposed habitat structure designs proposed by the IDNR. No spectaclecase individuals should be translocated from the old bridge piers during Phase 2 of the bridge demolition into the constructed habitat.

8. REINITIATION NOTICE

This concludes formal consultation for FHWA's actions outlined in your request received May 2016. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over an action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such a take must cease pending reinitiation.

This BO only authorizes incidental take sheepnose, spectaclecase, and Higgins eye for I-74 bridge construction and demolition. Incidental take coverage for additional federally listed species for this project can only be sought through reinitiation of consultation.

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APPENDIX A – DOT SPECIAL PROVISIONS FOR ENVIRONMENTAL PROTECTION

SP- 150XXX
(New)

SPECIAL PROVISIONS
FOR
ENVIRONMENTAL PROTECTION

Scott and Rock Island Counties

Effective Date
[Insert Effective Date]

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150XXX.01 DESCRIPTION

A. The work under this contract is located in an environmentally sensitive area within or near the Mississippi River (the River). The Contractor's work area shall be restricted to the minimum to construct the project and to accomplish related work. Contractor shall make every reasonable effort to execute the construction in a manner so as to minimize any adverse impact of the construction or work on fish, mussels, wildlife, or natural areas.

B. Areas disturbed by excavation for construction of haul roads, docks and other permanent or temporary structures, shall be restored to original contours as noted in contract documents. Areas required for equipment movement, offices, stockpiling, service repairs, and storage shall be kept to a minimum and shall be restricted to the boundaries noted in the plans and contract documents***.***

150.XXX.02 WORK ZONE REQUIREMENTS

A. The I-74 corridor project area crosses the Mississippi River which is an environmentally sensitive resource. All construction activity in the Mississippi River, along its riverbank, and within the area that drains into the Mississippi River should be considered work in an environmentally sensitive area. Work on the Illinois side of the river should be considered work in a particularly sensitive area.

B. Any construction related conditions deemed to be potentially damaging to environmentally sensitive resources by the Engineer shall be rectified immediately or construction will cease until such time as the condition is rectified. At the discretion of the Engineer, construction activities may resume once provisions to rectify the situation are made. The Contractor shall confine equipment and operations to the project right-of-way shown in the contract documents. These designated construction zones shall be protected with temporary sediment control measures in accordance with the details in the contract documents. No work shall commence on this contract until temporary erosion control and sediment control measures identified in the plans have been installed.

C. Any erosion control and sediment control measures implemented, on land or water, shall remain in place and maintained until construction in the area is completed.

D. No tributaries, oxbows or other backwater areas will be “cut off” or blocked from normal flow conditions. Recreational boat traffic closures may be necessary in the area of Sylvan Slough due to construction activities. The contractor is required to secure necessary permits and clearances for closure of any portion of the River.

E. Any sediment control measures implemented, on land or water, shall remain in place and maintained until construction in the area is completed. For areas on the river bank, sediment control measures shall remain in place and be maintained until the area has been stabilized with temporary or permanent seeding. All earthwork operations on shore will be carried out in such a manner to ensure no sediment runoff and soil erosion will enter the river.

F. Temporary sediment control measures removed or damaged due to construction activities or high water levels shall be replaced or repaired, where possible, within the emergency mobilization time of 8 hours or within standard mobilization time of 72 hours. If it is not possible to meet the designated time frames, sediment controls shall be replaced prior to recommencing work that would cause turbidity issues in the water.

G. The clearing of vegetation will be limited to that which is absolutely necessary for construction and operation of the project. All areas disturbed by construction activities and not covered with riprap shall be re-seeded with native grass mix according to Article 2601.03.C,5, of the Standard Specifications, unless otherwise specified in the contract documents. All re-vegetated areas shall be monitored to make certain they succeed.

H. Removal and replacement of any revetment stone placed as part of the project should yield a structure with no significant change in gradation. Any damaged stone shall be replaced with new stone to ensure proper gradation.

I. Any and all barges and other water craft used for construction activities, shall be inspected for the presence of zebra mussels prior to placing the barges into the Mississippi River. Barges shall be completely out of the water for 10 days with all compartments opened that could potentially contain water and therefore harbor adult, larval or juvenile zebra mussel. This will ensure proper drying of the barge(s) and reduction of potential infestation. If the barge is obtained from a local source, United States Fish and Wildlife Service, Illinois Department of Natural Resources and Iowa Department of Natural Resources staff must still be contacted to discuss previous locations at which the barge has been used.

J. The U.S. Army Corps of Engineers (USACE) shall be notified if temporary work is constructed and when it is removed from the river. All temporary construction required shall be removed from the River in its entirety once it is no longer needed for construction of the project. If dredging is needed around the temporary slips to convey barges and the discharge will be placed back into the Mississippi River, the USACE shall be notified of the location of dredging, amount to be dredged, and any required Section 401 water quality testing prior to any discharge of dredged material. Should dredged or excavated material be deposited on the shore before being hauled away, silt fences, perimeter and slope sediment control devices, or low silt berms shall be required to limit the reentry of sediments into the river. In addition, the materials shall be placed in a confined area, not classified as a wetland. All temporary construction required shall be removed from the Mississippi River in its entirety once it is no longer needed for construction of the project.

K. Temporary construction in the River may include an appropriate combination of barges, temporary slips, temporary supports (falsework), and temporary cofferdams. **An elevated earthen/sand/rock work platform (causeway or equipment pad) shall not be used for any**

construction; fills in the River for temporary crossings, causeway, or equipment pad structures are not permitted.

L. A plan for all temporary construction needed shall be submitted to and approved by the USACE and the Office of Location and Environment (OLE) prior to installation. The plan must include but is not limited to the location identified on an aerial photo, the dimensions, construction methods, duration of use and measures that will be used to control turbidity and/or sedimentation. The Contractor shall submit the plan for all temporary construction to the Engineer prior to commencing work. Once approved by the USACE and/or the OLE, the Engineer will notify the Contractor of approval.

M. The substantial girder lengths may require the girders be constructed in segments; therefore, temporary supports may be required. These supports could essentially consist of temporary piers necessary to support girder segments prior to final assembly. Any temporary support work outside of the navigation channel shall be restricted to the work area identified in Special Provision for Mussel Conservation. Temporary supports shall be promptly removed from the River following final girder assembly.

N. If dredging is needed to convey barges the discharge will not be placed back into the River. The USACE shall be notified of the location of dredging, amount to be dredged, and any Section 401 water quality testing required by the Iowa Department of Natural Resources prior to any discharge of dredged material. Should dredged or excavated material be deposited on the shore before being hauled away, silt fences, perimeter and slope sediment control devices, or low silt berms shall be required to limit the reentry of sediments into the river. In addition, the materials shall be placed in a confined area, not classified as a wetland.

O. Prior to commencement of hydraulic dredging, the applicant shall perform a modified elutriate test procedure to predict the effluent quality or the total concentration of contaminants in the effluent. This test simulates the processes occurring during confined disposal and provides information on the dissolved and particulate contaminant concentrations. Results of the elutriate test shall be forwarded to the Iowa Department of Natural Resources and Illinois Department of Natural Resources when available. Should test results prove unsatisfactory, the Iowa Department of Natural Resources or Illinois Department of Natural Resources may amend this Certification to assure that effluent water quality requirements are met. Please note that if mechanical dredging is performed, the testing will not be required.

P. Native materials removed from cofferdams may be replaced in the cofferdam. Other than replacing native materials, any fill materials introduced into the River must be clean (meaning less than 10% fines that would pass through a #200 sieve). Areas disturbed by dredging shall be backfilled with special revetment. Dredging and backfill is included in project BRFIM-074-1(197)5—05-82 and project BRFIM-074-1(198)5—05-82.

Q. The Contractor shall remove any debris from the water or the river bed as soon as practicable during the same work day in order to prevent the accumulation of unsightly, deleterious, and /or potentially polluted materials, as directed by the Engineer. The Contractor shall also implement measures to prevent debris from falling into the river. Should debris enter the river, it shall be retrieved immediately. Debris will not be allowed to collect on the bottom of the river.

R. No materials, including cleared and grubbed vegetation or construction debris, shall be disposed of in such a way that it could enter a wetland or waterway.

S. The contractor shall perform his work in such a way to ensure that no wet or dried concrete shall enter the River, any waterway or wetlands. If concrete does enter these areas the Contractor shall be solely responsible for any remediation necessary. Wash concrete trucks out in such a manner that wash water cannot enter the River, waterway, or wetlands. If a designated area is constructed or identified, that location shall be included in the temporary construction plans.

T. Care shall be taken to prevent materials spilled or stored on site from washing into any wetland or waterway as a result of cleanup activities, natural runoff, or flooding, and that, during construction, any materials, which are accidentally spilled into these areas, will be retrieved.

U. No fuels, lubricants, form oil, or similar products shall be stored in an area that has not been protected by a berm or other spill materials within the project area. All handling and storage of these materials must be done in such a manner as to comply with federal Spill Prevention Control and Countermeasure regulations and protect all water bodies from accidental spills and leaks.

V. The contractor shall perform his work in such a way as to prevent materials spilled or stored on site from washing into the River or any wetland or waterway as a result of cleanup activities, natural runoff, or flooding. If, during construction, any materials are accidentally spilled into these areas, the materials will be retrieved and/or remediated immediately.

W. Spill protection material (i.e., spill kit) shall be readily available at the project site, and on work barges, to contain and absorb accidental spills of fluids from construction equipment. Personnel trained in the implementation of the spill kit shall be readily available onsite to respond to accidental spills.

X. The Iowa Department of Natural Resources regulates open burning and administers regulations that pertain to fugitive dust and opacity (visible emissions). In general “open burning” is prohibited except for the special exemptions listed in the state open burning rules. The open burning rules are contained in 567 IAC rule 23.2(455B). In addition there are a number of definitions in 567 Chapter 20 that are applicable to open burning. The IAC is available on-line at www.legis.state.ia.us/IAChtml. In general, owners or operators must take reasonable precautions to prevent fugitive dust from becoming airborne and crossing the property line. These regulations are contained in 567 IAC paragraph 23.3(2)”c”, and can be found at the website above. In general, visible emissions in excess of 40 percent opacity are not allowed unless specifically exempted under rule. The rules for opacity are under paragraph 567 IAC 23.3(2)”d”, and can be found at the website above.

150XXX.03 PROTECTED SPECIES

A. Sylvan Slough, downstream of the project area, has been identified by the US Fish and Wildlife service as an Essential Habitat Area for the federally endangered Higgins eye pearly mussels. In addition, Sylvan Slough is inhabited by two other federally endangered mussels, spectacle case mussel and sheepnose mussel. Please refer to Special Provision for Mussel Conservation for more information on protecting threatened and endangered species.

B. Attention is directed to the Migratory Bird Treaty Act (15 USC 703-711) 50 CFR Part 21 and 50 CFR Part 10 that protect migratory birds, their occupied nests, and their eggs from disturbance or destruction. Activities that are likely to result in disturbance or destruction of migratory birds include but are not limited to clearing and grubbing, as well as structure cleaning, painting, demolition or reconstruction where bird nests are present. To protect migratory birds, do not conduct construction activities where active nests are present between the dates April 1 and July 15 inclusive or until the birds have fledged and left the structure. If evidence of migratory bird nesting is discovered after beginning work or in the event that migratory bird nests become established, immediately stop work and notify the Engineer.

C. Removal of trees is prohibited between the dates of April 1 to September 30 inclusive to avoid Indiana bat and northern long-eared bat habitat.

D. Removal of trees is prohibited between the dates of December 15 to February 20 to protect bald eagles.

E. If during the course of construction, any discoveries of protected plant or animals are made in the project area, the Contractor should notify the Engineer immediately.

150XXX.04 CLEAN WATER ACT COMPLIANCE

A. A Clean Water Act Section 404 Permit has been obtained by the Contracting Authority that authorizes all construction-related activities affecting waters of the U.S. The 404 Permit contains numerous special conditions, all of which may not have been included in this Special Provision. Failure to follow the provisions of the 404 Permit or this Special Provision may result in enforcement actions being initiated by the USACE. Enforcement actions may include an order to immediately cease all construction activity and/or fines.

B. It will be the Contractor's responsibility to ensure that the day-to-day operations of the project comply with this Special Provision. The Engineer will be available throughout the project to offer guidance to the Contractor regarding compliance with this Special Provision and the Clean Water Act.

C. Included with the Clean Water Act Section 404 Permit are Section 401 Water Quality Certifications from Iowa Department of Natural Resources and the Illinois Department of Natural Resources, which contain numerous special conditions are included by reference in this Special Provision.

D. It is the goal of Iowa's and Illinois' Water Quality Standards that all uses of the Mississippi River be maintained and protected. The dredging will cease if the water quality standards of either the State of Iowa or the State of Illinois are violated.

150XXX.05 PAYMENT

A. No separate payment will be made for costs incurred due to compliance with this Special Provision.

B. No additional time will be provided to the contract unless approved in writing by the Engineer.

APPENDIX B – DOT SPECIAL PROVISIONS FOR MUSSEL CONSERVATION

IOWA DOT

SPECIAL PROVISIONS
FOR
MUSSEL CONSERVATION

Scott and Rock Island Counties
BRFIM-074-1(197)5—05-82
BRFIM-074-1(198)5—05-82

Effective Date
[Insert Effective Date]

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150XXX.01 DESCRIPTION

A. The work under this contract is located in an environmentally sensitive area within the Mississippi River (the River). This work has the potential to impact state and federally threatened and endangered mussels living in the River. In environmentally sensitive areas of the River the Contractor's work area shall be restricted to the areas shown on Figure 1 to construct the project and to accomplish related work. Contractor shall make every reasonable effort to execute the construction in a manner so as to minimize any adverse impact of the construction or work on fish, mussels, wildlife, or natural areas. Contractor's work is not restricted outside of the work areas identified on Figure 1 and the restricted areas on Figure 2.

B. Areas required for equipment movement, stockpiling, service repairs, and storage shall be kept to a minimum and shall be restricted to occur within the boundaries noted in Figure 1 in the River and outside of the areas noted on Figure 2 on the Illinois and Iowa banks of the River.

150XXX.02 WORK ZONE REQUIREMENTS

A. The project area crosses the Mississippi River which is an environmentally sensitive resource. All construction activity in the Mississippi River, along its riverbank, and within the area that drains into the Mississippi River should be considered work in an environmentally sensitive area. Work on the Illinois side of the river should be considered work in a particularly sensitive area. The specific project area addressed in this Special Provision is within the River. All of these areas are environmentally sensitive resources.

B. Any construction related conditions deemed to be potentially damaging to environmentally sensitive resources by the Engineer shall be rectified immediately or construction will cease until such time as the condition is rectified. At the discretion of the Engineer, construction activities may resume once provisions to rectify the situation are made.

C. The Contractor shall confine equipment and operations in the River to the project areas shown in Figure 1. These designated construction zones shall be protected with temporary sediment control measures in accordance with the details in the contract documents. No work shall commence on this contract until temporary sediment control measures identified in the plans have been installed.

D. Concurrently with construction, prior to work in the water, silt curtains shall be deployed as depicted in Figure 1 and as detailed in projects BRFIM-074-1(197)5—05-82 and BRFIM-074-1(198)5—05-82. Any additional sediment control measures will be employed as needed, and at the Engineer’s discretion, to protect waters of the U.S., threatened and endangered mussels and the City of Moline drinking water intake.

E. Construction in the River will require access to the River via the Iowa or Illinois bank. Figure 2 identifies areas that are restricted from being used as River access due to endangered mussel inhabitation. No river access will be allowed within the restricted areas identified on Figure 2.

F. Areas disturbed by dredging shall be backfilled with special revetment.

G. It is the goal of Iowa’s and Illinois’ Water Quality Standards that all uses of the River be maintained and protected. The dredging will cease if the water quality standards of either the State of Iowa or the State of Illinois are violated.

150XXX-03 PROTECTED SPECIES

A. Sylvan Slough, downstream of the project area, has been identified by the US Fish and Wildlife service as an Essential Habitat Area for the federally endangered Higgins eye pearly mussels. In addition, Sylvan Slough is inhabited by two other federally endangered mussels: spectacle case mussel and sheepnose mussel.

B. If during the course of construction, any discoveries of additional protected plant or animals are made in the project area, the Contractor shall notify the Engineer immediately.

C. It will be the Contractor’s responsibility to ensure that the day-to-day operations of the project comply with this Special Provision. The Engineer will be available throughout the project to offer guidance to the Contractor regarding compliance with this Special Provision. Any environmental monitoring, required by the US Fish and Wildlife Service, of environmentally sensitive areas or areas where mussels could be present will be performed by the contracting authority or its designee and coordinated with the contractor through the Engineer.

150XXX.04 MATERIALS

A. Backfill for areas disturbed by dredging (special revetment) is included in project BRFIM-074-1(197)—05-82 and project BRFIM-074-1(198)—05-82.

B. Silt curtain is included in project BRFIM-074-1(197)5—05-82 and project BRFIM-074-1(198)—05-82.

150XXX.05 PAYMENT

A. Except as specified in the Material Section above, no separate payment will be made for costs incurred due to compliance with this Special Provision.

B. No additional time will be provided to the contract unless approved in writing by the Engineer.

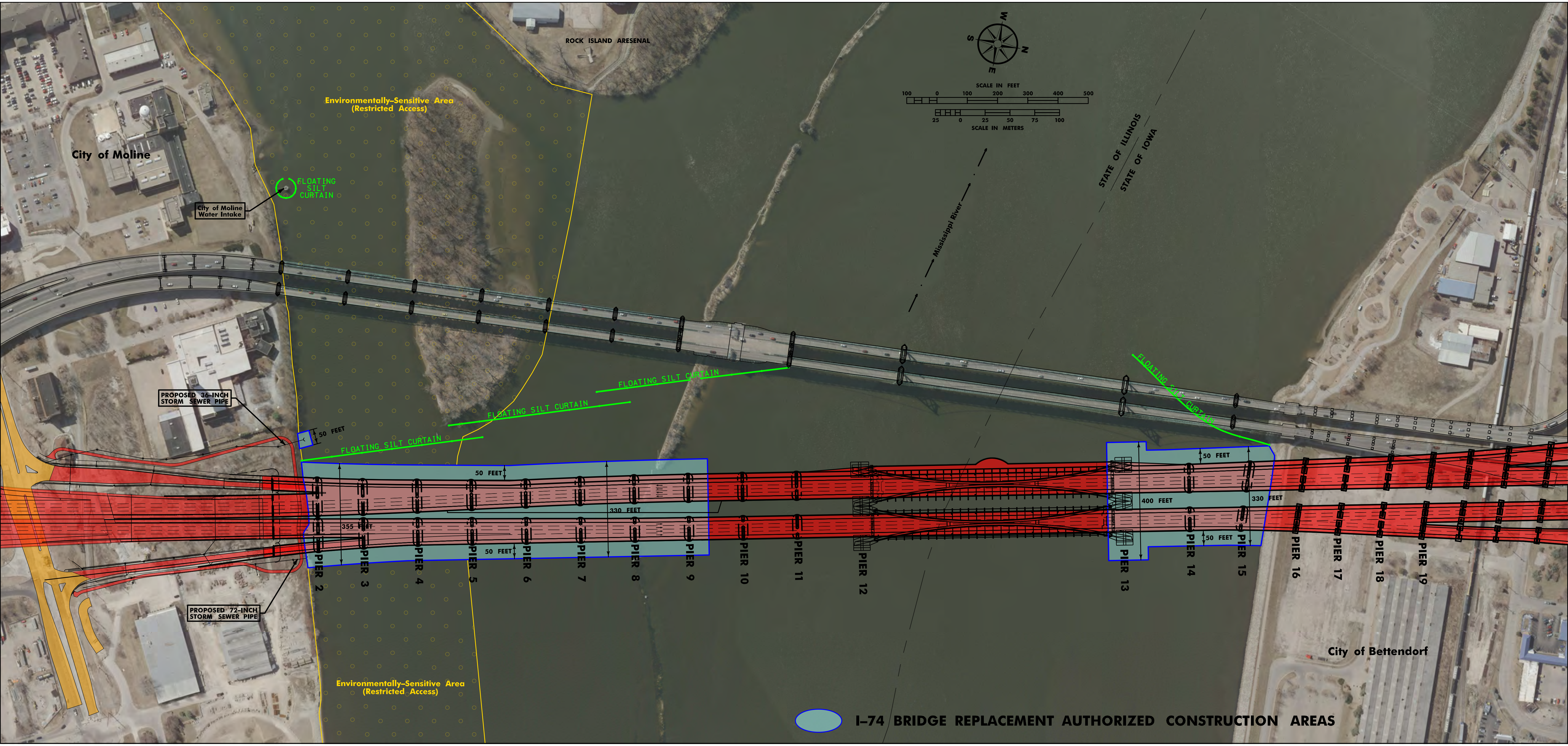


Figure 1. Construction area map, I-74 over the Mississippi River.

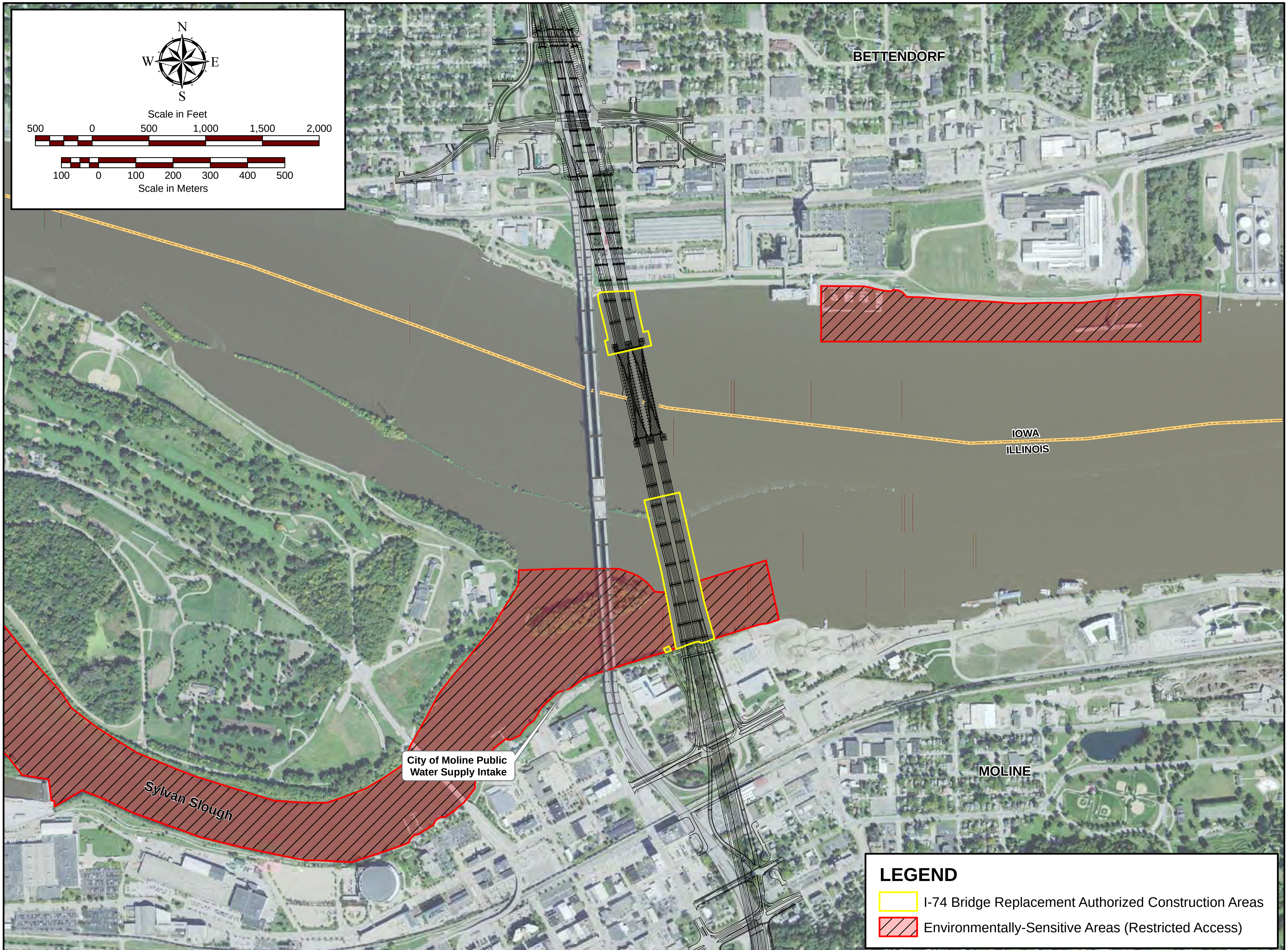


Figure 2. Project constraints map, I-74 over the Mississippi River.

APPENDIX C – PROJECT PLANS

LETTING DATE

BRIDGE REMOVAL
IM-074-1(214)5--13-82

ROCK ISLAND COUNTY

LEGEND

INTERSTATE ROUTE	
FREEWAY OR EXPRESSWAY ROUTE	
U.S. NUMBERED ROUTE	
STATE NUMBERED ROUTE	
COUNTY NUMBERED ROUTE	
LOCAL ROAD OR CITY STREET	
RAILROAD	
CORPORATION LINE	
SECTION LINE	
CUL DE SAC	
SECTION, TOWNSHIP & RANGE NUMBERS	9 , T-8IN , R-30W
PIPELINE	
AIRPORT	
HYDROLOGY	
BRIDGE	
STATE BOUNDARY	
COUNTY BOUNDARY	
CORPORATE LIMIT LINE	
TOWNSHIP LINE	

IOWA DOT

Highway Division

PLANS OF PROPOSED IMPROVEMENTS ON THE

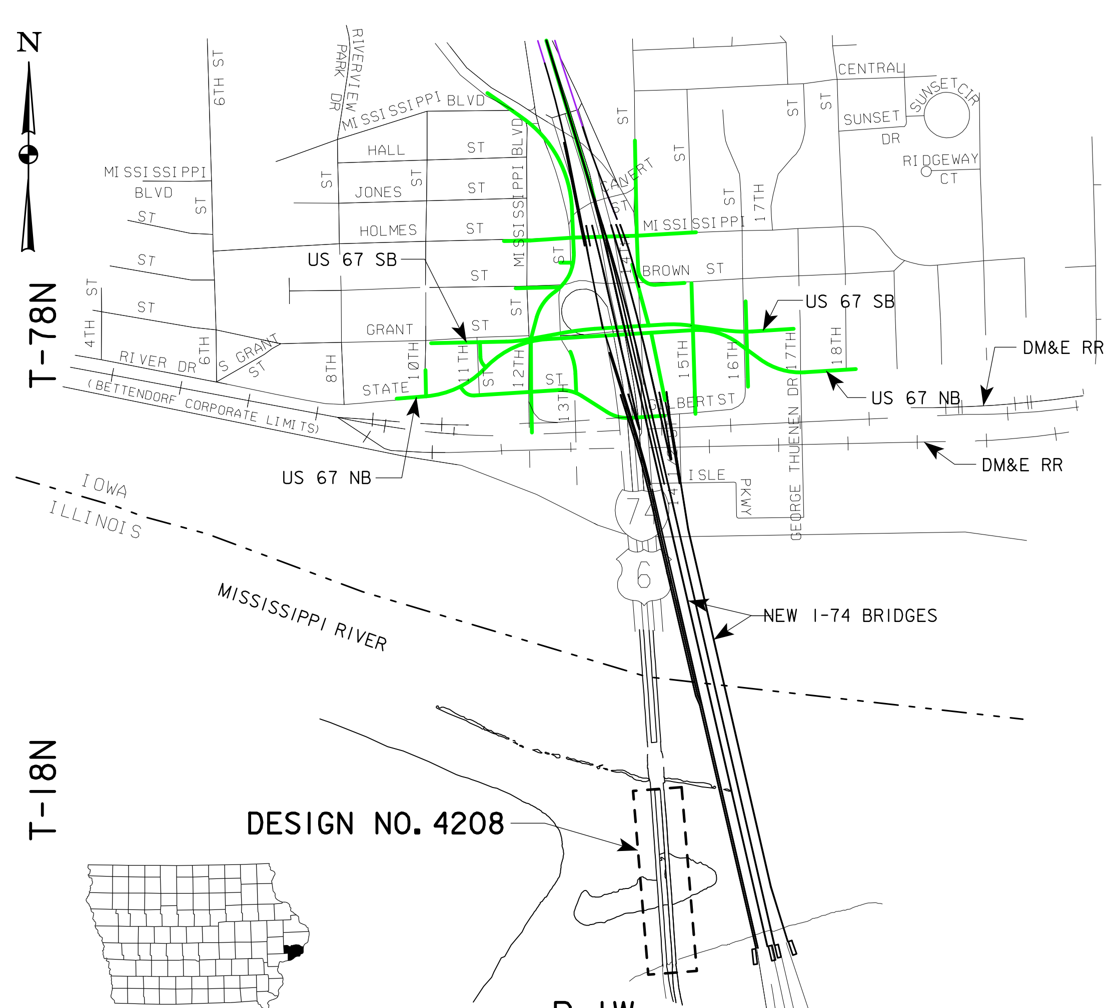
INTERSTATE ROAD SYSTEM

ROCK ISLAND COUNTY

BRIDGE REMOVAL
I-74 MISSISSIPPI RIVER BRIDGES
BETWEEN BETTENDORF, IA AND MOLINE, IL

THE IOWA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION, SERIES 2015, PLUS APPLICABLE GENERAL SUPPLEMENTAL SPECIFICATIONS, DEVELOPMENTAL SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS AND SPECIAL PROVISIONS SHALL APPLY TO CONSTRUCTION WORK ON THIS PROJECT.

IOWA ONE CALL
1-800-292-8989
www.iowaonecall.com
811



LOCATION MAP - PART OF CITY OF BETTENDORF

PROJECT DIRECTORY NAME: P0022000/8207401003

ENGLISH STANDARD BRIDGE PLANS

STANDARD	ISSUED	REVISED

REVISIONS

TOTAL SHEETS
14

PROJECT NUMBER
IM-074-1(214)5-13-82
R.O.W. PROJECT NUMBER
PROJECT IDENTIFICATION NUMBER
03-82-074-010-03

INDEX OF SHEETS

STANDARD ROAD PLANS

STANDARD ROAD PLANS ARE LISTED ON SHEET 2

INDEX OF SEALS

SHEET NO.	NAME	TYPE
1	DAVID J. MORRILL	STRUCTURAL/CIVIL

FINAL PLANS - FOR REVIEW
NOT FOR CONSTRUCTION
DECEMBER 2014

ALL WORKING DRAWINGS INCLUDING SHOP DRAWINGS AND FALSEWORK DRAWINGS WILL BE REVIEWED BY:

ALFRED BENESCH & COMPANY
205 NORTH MICHIGAN AVENUE, SUITE 2400
CHICAGO, IL 60601

STRUCTURAL DESIGN

LICENSED PROFESSIONAL ENGINEER
David J. Morrill
11799
IOWA

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Signature ______ Date ______

David J. Morrill
Printed or Typed Name

My license renewal date is December 31, 2015

Pages or sheets covered by this seal: SHEETS 1-12 AND C.1-C.2

ROCK ISLAND COUNTY - DESIGN NO. 4208

SPECIFICATIONS:

DESIGN: AASHTO LRFD 5th EDITION, SERIES OF 2010 EXCEPT AS NOTED IN THE CURRENT IOWA BRIDGE DESIGN MANUAL.

CONSTRUCTION: IOWA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION, SERIES 2015, PLUS APPLICABLE GENERAL SUPPLEMENTAL SPECIFICATIONS, DEVELOPMENTAL SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS AND SPECIAL PROVISIONS SHALL APPLY TO CONSTRUCTION WORK ON THIS PROJECT INCLUDING:

- DEVELOPMENTAL SPECIFICATION FOR FLOATING SILT CURTAIN (DS-15019)
- SPECIAL PROVISION FOR ENVIRONMENTAL PROTECTION (SP-150XXX)
- SPECIAL PROVISION FOR MUSSEL CONSERVATION (SP-150XXX)

GENERAL NOTES:

THIS DESIGN IS FOR THE REMOVAL OF THE OLD EXISTING I-74 BRIDGES OVER THE MISSISSIPPI RIVER FROM PIERS L TO PIERS E (BUILT IN 1934 AND 1958). PLANS AND SHOP DRAWINGS WILL BE AVAILABLE TO THE CONTRACTOR. CONTACT THE OFFICE OF CONTRACTS- HIGHWAY DIVISION - IOWA DOT- AMES. DIMENSIONS SHOWN ON THESE PLANS ARE BASED ON DESIGN PLANS.

THE LUMP SUM BID FOR "REMOVAL OF EXISTING BRIDGE" SHALL INCLUDE ALL COSTS ASSOCIATED WITH REMOVING AND DISPOSING OF ALL MATERIALS AND PORTIONS OF STRUCTURES AS INDICATED IN THESE PLANS. REMOVALS SHALL BE IN ACCORDANCE WITH SECTION 2401 OF THE STANDARD SPECIFICATIONS. ANY DAMAGE TO OTHER EXISTING STRUCTURES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE REPAIRED AT NO EXTRA COST TO THE STATE.

THE USE OF AN EXPANSIVE DEMOLITION AGENT (NON-EXPLOSIVE) SHALL BE REQUIRED FOR REMOVAL OF PORTIONS OF THE PIERS, AS INDICATED IN THE PLANS, TO MINIMIZE DISTURBANCE. DEMOLITION WITH EXPANSIVE AGENTS IS THE PROCESS OF USING A NON-TOXIC MATERIAL, PLACED INTO DRILLED HOLES WHICH EXPANDS WHEN HYDRATED TO BREAK UP CONCRETE. EXAMPLES OF SUCH AGENTS ARE THOSE PRODUCED BY DEXPAN, EXPANSIVE DEMOLITION CORPORATION, AND BUSTAR. THE EXPANSIVE DEMOLITION AGENT SELECTED SHALL BE NON-TOXIC, NOT HAZARDOUS, PROVIDE FOR SILENT REMOVAL AND BE APPROVED BY OSHA FOR USE IN A WATER ENVIRONMENT.

DURING DEMOLITION OF THIS PROJECT, THE BRIDGE CONTRACTOR WILL BE REQUIRED TO COORDINATE OPERATIONS WITH THOSE OF OTHER CONTRACTORS WORKING WITHIN THE SAME AREA. OTHER WORK IN PROGRESS DURING THE SAME PERIOD OF TIME INCLUDES, BUT IS NOT LIMITED TO, WORK OF THE FOLLOWING PROJECTS:
PROJECT IM-074-1(210)5--13--82

ANY WORK OVER NAVIGABLE WATERWAYS MUST BE COORDINATED WITH THE US COAST GUARD 8TH DISTRICT BRIDGE MANAGEMENT SPECIALIST AT (314) 269-2380. THE CONTRACTOR SHALL SUBMIT TO THE UNITED STATES COAST GUARD FOR APPROVAL TWO COPIES OF THE PLANS AND SCHEDULE OF OPERATIONS FOR WORK OVER THE NAVIGATIONAL CHANNEL AT LEAST 15 DAYS PRIOR TO THE COMMENCEMENT OF ANY WORK OVER THE NAVIGATIONAL CHANNEL. THE IOWA DOT SHALL NOT BE HELD RESPONSIBLE FOR ANY DELAYS SUFFERED BY THE CONTRACTOR FOR FAILURE TO ADHERE TO THIS REQUIREMENT OR TO REQUIREMENTS OF THE COAST GUARD.

NOTE: THE ROADWAY WILL BE CLOSED TO THRU TRAFFIC. ROAD CLOSURE WILL BE THE RESPONSIBILITY OF OTHERS.

DURING ALL OPERATIONS THE CONTRACTOR SHALL NOT BE PERMITTED TO DROP ANY MATERIAL OR DEBRIS FROM THE BRIDGE.

THE CONTRACTOR SHALL PERFORM ALL WORK IN STRICT CONFORMANCE WITH ALL TRAFFIC CONTROL REQUIREMENTS FOR BOTH MARINE AND VEHICULAR TRAFFIC, AS SPECIFIED WITHIN THESE PLANS.

THE CONTRACTOR SHALL NOT DISTURB ANY EXISTING UTILITIES EXCEPT AS SPECIFICALLY DEFINED WITHIN THE SCOPE OF WORK FOR THIS CONTRACT. WHERE WORK AFFECTS OR IS AFFECTED BY THE EXISTING UTILITIES, THE WORK SHALL BE COORDINATED WITH THE UTILITY COMPANY AND/OR OWNER.

THE CITY AND UTILITY COMPANIES WHOSE FACILITIES ARE SHOWN ON THE PLANS, OR KNOWN TO BE WITHIN THE CONSTRUCTION LIMITS, SHALL BE NOTIFIED BY THE BRIDGE CONTRACTOR OF THE CONSTRUCTION STARTING DATE.

THE CONTRACTOR SHALL PROVIDE A DETAILED SCHEDULE AND COORDINATE WITH THE CITY OF MOLINE REGARDING THE WATER INTAKE LOCATED NEAR THE ILLINOIS SHORELINE, WEST OF THE EXISTING STRUCTURE. COORDINATION SHALL TAKE PLACE AT LEAST 30 DAYS PRIOR TO COMMENCING ANY WORK AND 60 DAYS PRIOR TO COMMENCING ANY WORK THAT WILL IMPACT THE RIVER BOTTOM.

THE CONTRACTOR SHALL OBTAIN HIS OWN ELECTRICAL POWER SOURCE FOR ALL CONSTRUCTION OPERATIONS AND SHALL NOT BE PERMITTED TO USE ANY EXISTING UTILITIES ON THE BRIDGE AS SOURCE OF POWER.

SCRAPE SAMPLES WERE TAKEN FROM VARIOUS AREAS OF THE EXISTING BRIDGES TO GET AN INDICATION OF THE EXISTENCE OF AND LEVEL OF TOTAL CHROMIUM AND TOTAL LEAD. ANALYSIS OF TOTAL LEAD IN THESE SAMPLES RANGED FROM 133,000 TO 241,000 PARTS PER MILLION (PPM). ANALYSIS OF TOTAL CHROMIUM IN THESE SAMPLES RANGED FROM 2,230 TO 10,500 PPM. THESE ANALYSES SHOW THE EXISTENCE OF THESE TWO TOXIC CONSTITUENTS. LEVELS INDICATED BY THESE TESTS COULD CREATE CONDITIONS ABOVE REGULATORY LIMITS FOR HEALTH AND SAFETY REQUIREMENTS. NO OTHER CONSTITUENTS WERE ANALYZED. THE BIDDER SHOULD NOT RELY ON THE DEPARTMENT'S TESTING AND ANALYSIS FOR ANY PURPOSE OTHER THAN AS AN INDICATION OF THE EXISTENCE OF THESE TWO TOXIC CONSTITUENTS.

ANALYSIS OF PAINT SCRAPE SAMPLES FROM NEW PAINTING DONE IN 2012 AND 2013 SHOWED TOTAL LEAD RANGING FROM 32 TO 54 PPM. CHROMIUM IN THE NEWLY PAINTED AREAS WAS MEASURED AT 6.3 TO 11 PPM. NEWLY PAINTED AREAS INCLUDE THE SUPERSTRUCTURE STEEL.

THE CONTRACTOR SHALL CONDUCT THEIR OPERATIONS IN SUCH A MANNER THAT ANY PAINT REMOVED DURING DEMOLITION IS CONTAINED, COLLECTED AND DISPOSED OF IN ACCORDANCE WITH STANDARD SPECIFICATION 2508, OF THE STANDARD SPECIFICATIONS. BEFORE DELIVERY OF ANY SCRAP STEEL, THE CONTRACTOR SHALL PROVIDE A WRITTEN NOTICE TO THE RECEIVING FACILITY. THIS NOTICE SHALL AT A MINIMUM INCLUDE:

1. A NOTICE THAT THE SCRAP STEEL IS COATED WITH PAINT THAT HAS REGULATED MATERIALS AT LEVELS WHICH COULD BE HAZARDOUS TO EMPLOYEES OR THE ENVIRONMENT.

2. A COPY OF THE SCRAPE SAMPLE PROVIDED IN THE CONTRACT DOCUMENTS.

3. A SIGNATURE BLOCK FOR THE RECEIVING FACILITY TO CONFIRM THEIR RECEIPT OF THIS INFORMATION.

A COPY OF THIS NOTICE, SIGNED BY THE RECEIVING FACILITY, SHALL BE RETURNED TO THE ENGINEER BEFORE ANY SCRAP STEEL IS REMOVED FROM THE PROJECT.

THE COST OF HANDLING AND DISPOSAL OF ANY PAINTED STEEL OR REMOVED PAINT IS INCIDENTAL TO THE REMOVAL BID ITEM.

SCOPE OF WORK:

OBTAIN ALL REQUIRED PERMITS FROM THE COAST GUARD FOR DEMOLITION WORK.

REMOVE THE EXISTING IOWA BOUND AND ILLINOIS BOUND I-74 BRIDGES OVER THE MISSISSIPPI RIVER BETWEEN PIER E AND PIER L INCLUDING:

REMOVAL AND SALVAGE OF BRIDGE ATTACHMENTS, LIGHTS, CAMERAS AND POLES.

REMOVAL OF THE TRUSS BRIDGE SUPERSTRUCTURES.

INSTALLATION AND REMOVAL OF A FLOATING SILT CURTAIN.

REMOVAL OF PIERS E, F, G, H, J AND L.

INSTALL TWO SOLAR POWERED LED NAVIGATION LIGHTING ASSEMBLIES, SUPPORT PLATFORMS, AND ACCESS LADDERS ON EXISTING PIER K TO REMAIN.

ESTIMATED BRIDGE QUANTITIES

ITEM NO.	ITEM CODE	ITEM	UNIT	TOTAL	AS BUILT QTY
1	2401-6745625	REMOVAL OF EXISTING BRIDGE	LS	1	
2	2408-7800000	STRUCTURAL STEEL	LB	1698	
3	2528-8445110	TRAFFIC CONTROL	LS	1	
4	2533-4980005	MOBILIZATION	LS	1	
5	2599-9999010	NAVIGATION LIGHTING	LS	1	
6	2602-0000212	FLOATING SILT CURTAIN (HANGING)	LF	TBD	
7	2602-0000222	FLOATING SILT CURTAIN (CONTAINMENT)	LF	TBD	
8	2602-0000230	CLEAN-OUT OF FLOATING SILT CURTAIN (CONTAINMENT)	LF	TBD	
9	2602-0000240	MAINTENANCE OF FLOATING SILT CURTAIN	LF	TBD	
10	2602-0000312	PERIMETER AND SLOPE SEDIMENT CONTROL DEVICE, 12 IN. DIA.	LF	TBD	
11	2602-0000320	PERIMETER AND SLOPE SEDIMENT CONTROL DEVICE, 20 IN. DIA.	LF	TBD	

ITEM NO.	ESTIMATE REFERENCE INFORMATION
1	FOR EXCAVATION REQUIRED IN UPLAND AREAS THAT COULD ALLOW RUNOFF INTO THE WATERWAY, LOGS/WATTLES SHALL BE USED TO MITIGATE EROSION. ANY VEGETATED AREAS THAT ARE DISTURBED DURING EXCAVATION AND REMOVAL OF THE EXISTING STRUCTURE SHALL BE RE-SEEDED TO RETURN IN-KIND. THE COST OF THESE MEASURES SHALL BE INCLUDED WITH THIS ITEM. SEE SHEET C.2 FOR SEEDING NOTES.
2	INCLUDES COSTS FOR FURNISHING AND INSTALLING TWO NAVIGATION LIGHTING SUPPORT PLATFORMS AND TWO ACCESS LADDERS ON EXISTING PIER K.
5	INCLUDES TWO ASSEMBLIES CONSISTING OF 180° STEADY BURNING RED LED LANTERNS, SOLAR ARRAY MODULES, STORAGE BATTERIES, PHOTO CONTROLS, MOUNTING PEDESTALS AND BASE PLATES. INCLUDES COST OF FURNISHING AND INSTALLING FOUR (TWO AT EACH ASSEMBLY) HIGH INTENSITY RED RETRO REFLECTIVE PANELS ON EXISTING PIER K.
6	FLOATING SILT CURTAIN SHALL BE INSTALLED AS SHOWN IN THE PLANS TO MINIMIZE THE AMOUNT OF SEDIMENT AND EROSION INTRODUCED INTO THE WATERWAY UPSTREAM OF THE MOLINE WATER INTAKE.

STANDARD ROAD PLANS

NUMBER	DATE	TITLE
EC-202	10-21-14	FLOATING SILT CURTAIN
EC-204	10-16-12	PERIMETER AND SLOPE SEDIMENT CONTROL DEVICES
TC-1	04-16-13	WORK NOT AFFECTING TRAFFIC (TWO-LANE OR MULTI-LANE)
TC-273	04-20-10	CONSTRUCTION SITE ENTRANCE

DESIGN HISTORY AT THIS SITE

DESIGN NO.	WORK DESCRIPTION	YEAR
NA	ORIGINAL CONSTRUCTION - IOWA BOUND (WB) BRIDGE	1934
NA	ORIGINAL CONSTRUCTION - ILLINOIS BOUND (EB) BRIDGE	1958
171	MODIFICATION IN IOWA ILLINOIS BRIDGE	MARCH, 1972
373	MODIFICATION IN IOWA ILLINOIS BRIDGE	MAY, 1973
473	ALUMINUM HANDRAIL - IOWA ILLINOIS MEMORIAL BRIDGE	OCT., 1973
176	BRIDGE FLOOR OVERLAY	APRIL, 1976
584	BRIDGE DECK REPAIR	AUGUST, 1986
594/694	BRIDGE REPAIR ON I-74 E.B./W.B. OVER MISS.	NOV., 1993
596	BRIDGE PAINTING	DEC., 1996
696	BRIDGE PAINTING	DEC., 1996
401/501	REHABILITATION OF I-74 E.B. & W.B. BRIDGES	DEC., 2002
105/205	REHABILITATION OF I-74 E.B. & W.B. BRIDGES	DEC., 2004
110/210	REHABILITATION OF I-74 E.B. & W.B. BRIDGES	NOV., 2010
4208	EXISTING DECK TRUSS SPANS REMOVAL	TBD

POLLUTION PREVENTION PLAN PROVIDED ELSEWHERE IN THESE DRAWINGS

HAZARDOUS PAINT:

THIS WORK INVOLVES REMOVING HAZARDOUS PAINT. REFER TO NOTES.

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312-565-0450 Job No. 10061

DESIGN FOR 0° SKEW

I-74 BRIDGES OVER THE MISSISSIPPI RIVER (ILLINOIS & IOWA BOUND)

4 @ 222'-3½, 2 @ 223'-6½ TRUSS SPANS

QUANTITIES AND GENERAL NOTES

STA. 6754+17.58 - 684.84' LT - I-74 DECEMBER 2014

ROCK ISLAND COUNTY

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

DESIGN SHEET NO. 1 OF 11 FILE NO. 30253 DESIGN NO. 4208

REMOVAL OF EXISTING BRIDGE:

DESCRIPTION: THIS WORK SHALL CONSIST OF THE REMOVAL OF THE EXISTING SUPERSTRUCTURES AND PORTIONS OF THE SUBSTRUCTURE OF THE IOWA BOUND AND ILLINOIS BOUND CONTINUOUS TRUSS SPANS OVER THE MISSISSIPPI RIVER, AS SHOWN IN THESE PLANS. CARE SHALL BE TAKEN DURING REMOVALS TO PROTECT PORTIONS OF THE ADJACENT EXISTING STRUCTURES AS NEEDED. REMOVAL WORK SHALL NOT BEGIN UNTIL THE SUSPENSION SPAN AND DECK TRUSS SUPERSTRUCTURES ARE REMOVED.

REMOVAL: THE CONTRACTOR MUST REMOVE ALL ELEMENTS OF THE EXISTING STEEL TRUSS SPANS, SUBSTRUCTURES AND ANY PARTS OF THE EXISTING PIERS TO THE EXTENT SPECIFIED. CONTRACTOR SHALL NOTIFY THE IOWA DOT PRIOR TO DEMOLITION TO FACILITATE THE REMOVAL OF CAMERAS, SENSORS, RWIS, CABINETS WIRELESS EQUIPMENT AND OTHER RELEVANT ITS EQUIPMENT BY THE ITS MAINTENANCE VENDOR.

THE USE OF EXPLOSIVES ARE PROHIBITED FOR THIS DEMOLITION. THE USE OF EXPANSIVE DEMOLTION AGENTS WILL BE ALLOWED AND REQUIRED IN LOCATIONS AS SHOWN IN THE PLANS. THE COST OF DISPOSAL SHALL BE CONSIDERED INCIDENTAL TO THE REMOVAL.

THE EXISTING PIERS AND FOUNDATION ELEMENTS SHALL BE REMOVED TO THE ELEVATIONS SHOWN ON THE PLANS. ANY TEMPORARY SHORING, SHEETING OR COFFERDAMS USED FOR DEMOLITION SHALL BE CONSIDERED INCIDENTAL TO THE REMOVAL.

BRIDGE DEMOLITION SCHEME: EXISTING BRIDGE DEMOLITION SCHEME AND MEANS AND METHODS ARE THE RESPONSIBILITY OF THE CONTRACTOR. CONTRACTOR SHALL, IN ACCORDANCE WITH ARTICLE 1105.03 OF THE STANDARD SPECIFICATIONS, SUBMIT A DETAILED DEMOLITION SCHEME TO ALFRED BENESCH AND COMPANY (BENESCH) FOR THE REVIEW. BENESCH WILL REVIEW THE PROCEDURE AND COORDINATE COMMENTS FROM THE IOWA DEPARTMENT OF TRANSPORTATION (OFFICE OF BRIDGES AND STRUCTURES, OFFICE OF CONSTRUCTION, OFFICE OF LOCATION AND ENRVIRONMENT, AND RESIDENT CONSTRUCTION ENGINEER), ILLINOIS DEPARTMENT OF TRANSPORTATION, U.S. COAST GUARD, AND BENESCH. THE DEMOLITION SCHEME MUST CLEARLY DEMONSTRATE THE FEASIBILITY OF ALL OPERATIONS PROPOSED AND SAFETY OF THE EXISTING STRUCTURE AND ALL EQUIPMENT, TEMPORARY SUPPORTS AND FALSEWORK FOR ALL STAGES OF THE PROPOSED SCHEME.

THE DEMOLITION PLANS, COMPUTATIONS AND ANY OTHER MATERIAL SUBMITTED FOR REVIEW MUST BE PREPARED AND SEALED BY A LICENSED PROFESSIONAL ENGINEER IN IOWA WITH PRIOR EXPERIENCE ON SIMILAR PROJECTS. CONTRACTOR MAY NOT START OR PROCEED WITH ANY DEMOLITION ACTIVITY UNTIL ALL COMMENTS ARE SATISFACTORILY RESOLVED AND THE DEMOLITION SCHEME IS APPROVED. THE CONTRACTOR'S DEMOLITION SCHEME SHALL INCLUDE PLANS FOR THE PROTECTION OF TRAFFIC (VEHICULAR, PEDESTRIAN, BOAT, ETC.) ADJACENT TO AND/OR UNDER THE STRUCTURES. THESE PLANS SHALL INCLUDE PROVISIONS FOR ANY DEVICES AND STRUCTURES THAT MAY BE NECESSARY TO ENSURE PROTECTION.

THE DEMOLITION SCHEME MUST ALSO DEMONSTRATE THAT THE DEMOLITION OPERATIONS WILL MINIMIZE THE IMPACT ON WATER QUALITY AT THE CITY OF MOLINE WATER INTAKE STRUCTURE WHICH IS DOWNSTREAM OF THE EXISTING BRIDGE.

SUBMITTALS SHALL BE 2 HARD COPIES AND AN ELECTRONIC COPY FOR EACH REVIEWING AGENCY. PLANS AND DETAILS OF THE VARIOUS SUBMITTALS OUTLINED BELOW SHALL BE COORDINATED BY THE CONTRACTOR. SUMMARY OF SUBMISSIONS AND NOTIFICATIONS:

ACTIVITY	DUE
BRIDGE DECK REMOVAL PLAN	60 CALENDAR DAYS PRIOR TO REMOVAL
BRIDGE SUPERSTRUCTURE REMOVAL PLAN	60 CALENDAR DAYS PRIOR TO REMOVAL
BRIDGE SUBSTRUCTURE REMOVAL PLAN	60 CALENDAR DAYS PRIOR TO REMOVAL
NOTIFICATIONS	48 HOURS PRIOR TO ACTUAL DEMOLITION

THE CONTRACTOR'S DEMOLITION PLAN SHALL BE SUBJECT TO THE FOLLOWING U.S. COAST GUARD DEMOLITION CONDITIONS:

CONDITION 1: ALL WORK SHALL BE SO CONDUCTED THAT THE FREE NAVIGATION OF THE WATERWAY SHALL NOT BE UNREASONABLY INTERFERED WITH AND THE EXISTING NAVIGABLE DEPTHS ARE NOT IMPAIRED.

CONDITION 2: TWO WEEKS PRIOR TO THE SCHEDULED DEMOLITION, THE CONTRACTOR SHALL NOTIFY THE FOLLOWING PERSONS OF THE DEMOLITION SCHEDULE:

UNITED STATES COAST GUARD COMMANDER (DWB), BRIDGE BRANCH
ATTN: BRIDGE MANAGEMENT SPECIALIST
1222 SPRUCE ST, SUITE 2.107F
ST. LOUIS, MO 63103-2832

THESE OFFICES MUST BE KEPT INFORMED OF THE DEMOLITION PROGRESS SO CAUTIONARY NOTICES CAN BE ISSUED TO MARINERS. A PROJECT INFORMATION RECORD WILL BE SUPPLIED BY THE USCG TO BE COMPLETED AND RETURNED TO THEIR OFFICE SO THAT THEY CAN DIRECTLY CONTACT THE PERSON RESPONSIBLE FOR COMPLIANCE WITH THEIR CONDITIONS.

THE CONTRACTOR SHALL PROVIDE COPIES OF THE NOTIFICATIONS TO THE CORPS AND USCG AND THE PROJECT INFORMATION RECORD TO THE ENGINEER AND THE IOWA DOT OFFICE OF LOCATION AND ENVIRONMENT.

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CONDITION 3: ONE WEEK PRIOR TO DEMOLITION, THE CONTRACTOR SHALL SCHEDULE A PRE-DEMOLITION MEETING WITH THE COAST GUARD AND ALL INVOLVED PARTIES TO ENSURE THAT ALL EQUIPMENT, MANPOWER AND MATERIALS ARE IN PLACE FOR THE IMPENDING DEMOLITION.

CONDITION 4: THE CONTRACTOR, IF AUTHORIZED IN WRITING TO ACT ON BEHALF OF THE STATE, SHALL FURNISH THE COMMANDER, EIGHTH COAST GUARD DISTRICT, HALE BOGGS FEDERAL BUILDING, 500 POYDRAS STREET, NEW ORLEANS, LA 70130, PRIOR TO COMMENCING OPERATIONS, EVIDENCE OF A GOOD AND SUFFICIENT BOND TO INSURE COMPLIANCE WITH ALL CONDITIONS RESULTING FROM THE COAST GUARD COORDINATION CONDUCTED UNDER CONDITION 2 ABOVE.

CONDITION 5: WHEN BRIDGE COMPONENTS ARE BEING REMOVED FROM EACH SPAN, PRECAUTIONS SHALL BE TAKEN TO ENSURE NOTHING FALLS INTO THE RIVER. SUCH A PRECAUTION COULD BE A CONTAINMENT SYSTEM WHICH COULD INCLUDE A "CATCH" BARGE BENEATH THE WORK SITE.

CONDITION 6: POSITIVE PRECAUTIONS SHALL BE TAKEN TO PREVENT THE DROPPING OF SPARK-PRODUCING, LIGHTED AND OTHER OBJECTS ON TOWS OR VESSELS. ALL FLAME-CUTTING, WELDING, AND SIMILAR SPARK-PRODUCING OPERATIONS SHALL BE CEASED OVER THE CHANNEL WHEN VESSELS ARE PASSING BENEATH THE BRIDGE.

CONDITION 7: ANY OBJECT ACCIDENTALLY DROPPED INTO THE RIVER WHICH MAY CONSTITUTE A HAZARD TO NAVIGATION SHALL BE PROMPTLY AND COMPLETELY REMOVED TO THE SATISFACTION OF THE APPROPRIATE U.S. ARMY CORPS OF ENGINEERS DISTRICT COMMANDER.

CONDITION 8: AFTER REMOVAL OF EACH RIVER SPAN AND ALL SUBSTRUCTURE COMPONENTS, A THOROUGH SWEEPING OF THE AREA MUST BE MADE AT THE CONTRACTOR'S EXPENSE. THE PROCEDURE USED TO SWEEP THE RIVER SHALL BE APPROVED BY THE U.S. ARMY CORPS OF ENGINEERS DISTRICT COMMANDER. THE SWEEP OPERATION SHALL BE PERFORMED WHILE AN AUTHORIZED REPRESENTATIVE OF THAT AGENCY IS PRESENT TO OBSERVE RESULTS. MUTUALLY AGREED UPON DATES FOR EACH SWEEP SHALL BE COORDINATED WITH THE CORPS OF ENGINEERS.

CONDITION 9: IF ANY OBJECTS CAUSING AN OBSTRUCTION TO NAVIGATION ARE PLACED OR ACCIDENTALLY DROPPED INTO THE RIVER, SUCH OBJECTS SHALL BE MARKED BY ONE OR MORE LIGHTED BUOYS. SUCH BUOYS SHALL BE HORIZONTALLY STRIPED ORANGE AND WHITE WITH THE TOP STRIPE ORANGE; THEY SHALL BE ALIGNED CROSS-RIVER AT INTERVALS OF ABOUT 25 FEET OR AS CLOSE AS PRACTICABLE TO THE OBSTRUCTION IN THE RIVER. EACH SUCH BUOY SHALL BE LIGHTED AT NIGHT WITH A QUICK FLASHING WHITE LIGHT (60 FLASHES PER MINUTE). PROVIDED THAT IF STEEL IS EXTENDING ABOVE WATER, ORANGE FLAGS BY DAY AND QUICK FLASHING WHITE LIGHTS BY NIGHT MAY BE DISPLAYED ON THE STEEL IN LIEU OF ANY BUOY.

CONDITION 10: THE COMMANDER, EIGHTH COAST GUARD DISTRICT; SHALL BE NOTIFIED AT LEAST 15 DAYS IN ADVANCE OF ANY ACTION THAT MAY IMPEDE NAVIGATION. ANY REVISION OF WORK SCHEDULE MAY REQUIRE A 15-DAY DELAY FOR ISSUANCE OF REVISED NOTICES. NOTIFICATION SHALL BE UPDATED BY TELEPHONE IF NECESSARY TO ASSURE THAT NAVIGATION INTERESTS ARE AWARE OF IMPENDING EVENTS THAT MAY AFFECT THE MOVEMENT OF RIVER TRAFFIC.

CONDITION 11: THE CONTRACTOR BY ACCEPTANCE HEREOF AGREES TO BE RESPONSIBLE FOR DAMAGES TO PERSONS OR PROPERTIES RESULTING FROM THE WORK AND SAVE AND HOLD HARMLESS THE UNITED STATES COAST GUARD FROM ANY CLAIM FOR DAMAGES RESULTING FROM THIS OPERATION.

CONDITION 12: REQUESTS TO TEMPORARILY BLOCK THE RIVER AND STOP RIVER TRAFFIC MUST BE SUBMITTED, IN WRITING, FOR APPROVAL TO THE COMMANDER, EIGHTH COAST GUARD DISTRICT IN ACCORDANCE WITH THESE CONDITIONS.

CONDITION 13: 60 DAYS PRIOR TO DEMOLITION, THE CONTRACTOR WILL COMPLETE AND ELECTRONICALLY SUBMIT A COAST GUARD CG-2554 APPLICATION IN ADOBE PDF FORMAT. THIS FORM CAN BE DOWNLOADED FROM THE USCG'S WEB SITE AT: HTTP://WWW.USCG.MIL/FORMS/CG/CG-2554.PDF. IN RESPONSE TO THIS SUBMISSION, THE COAST GUARD WILL PRESCRIBE NAVIGATIONAL LIGHTING REQUIREMENTS FOR THE PORTION OF THE STRUCTURE TO REMAIN AFTER DEMOLITION.

CONDITION 14: BARGES AND OTHER WATERCRAFT ENGAGED IN THIS DEMOLITION SHALL DISPLAY SUCH LIGHTS AND SIGNALS AS REQUIRED BY THE "INLAND NAVIGATIONAL RULES OF 1980."

CONDITION 15: ANY TEMPORARY FILLS, RUBBLE, SHORING OR SIMILAR MATERIAL DEPOSITED IN THE RIVER MUST BE APPROVED BY THE APPROPRIATE U.S. ARMY CORPS OF ENGINEERS DISTRICT COMMANDER PURSUANT TO SECTION 404 OF PUBLIC LAW 95-217.

CONDITION 16: THE PLANS FOR ANY TEMPORARY CAUSEWAYS, WORK BRIDGES OR OTHER FALSEWORK TO BE PLACED IN THE RIVER SHALL BE SUBMITTED TO THE COMMANDER, EIGHTH COAST GUARD DISTRICT FOR APPROVAL.

CONDITION 17: ALL RUBBLE SHALL BE SPOILED IN UPLAND, NON-WETLAND AREAS ABOVE ORDINARY HIGH WATER. DISPOSAL SITES MUST BE APPROVED BY THE APPROPRIATE U.S. ARMY CORPS OF ENGINEERS DISTRICT COMMANDER.

LEACH PARK AND THE BETTENDORF RIVERFRONT TRAIL:

LEACH PARK AND THE BETTENDORF RIVERFRONT TRAIL ARE SECTION 4(F) RESOURCES AS DEFINED BY SECTION 4(F) OF THE DEPARTMENT OF TRANSPORTATION (DOT) ACT OF 1966. THIS FEDERAL LAW PROTECTS PUBLICLY OWNED PARKS, RECREATION AREAS, WILDLIFE AND WATERFOWL REFUGES AND PUBLIC OR PRIVATELY-OWNED HISTORICAL RESOURCES. USE OF FEDERAL FUNDS SUBJECTS THE PROPOSED UNDERTAKING TO THE REQUIREMENTS OF THIS LAW. AS SUCH, THE CONTRACTOR SHALL NOT STAGE, STORE, OR REFUEL ANY EQUIPMENT OR VEHICLES ON PARK AND TRAIL PROPERTIES. THE CONTRACTOR SHALL NOT BORROW OR WASTE ANY MATERIAL FROM OR ON THE PARK AND TRAIL PROPERTIES AND SHALL ENSURE THAT NO ANCILLARY CONSTRUCTION ACTIVITIES TAKE PLACE ON THE PARK AND TRAIL PROPERTIES.

THE FOLLOWING LIMITATIONS APPLY TO WORK WITHIN THE RIVER AND ON RIVER BANKS:

REMOVAL AND DISPOSAL OF DEBRIS: CONTRACTOR MUST COORDINATE REMOVAL AND DISPOSAL OF DEMOLITION DEBRIS WITH IOWA DEPARTMENT OF TRANSPORTATION AND OTHER APPLICABLE AGENCIES AND SUBMIT THE REMOVAL AND DISPOSAL PLAN FOR APPROVAL BY THE IOWA DEPARTMENT OF TRANSPORTATION.

ACCESS ROAD AND TEMPORARY DOCKS: ACCESS ROAD TO WORK AREAS ON THE ILLINOIS BANKS MAY BE CONSTRUCTED IN THE EXISTING RIGHT OF WAY. COORDINATE TEMPORARY ACCESS TO WORK SITES WITH THE ILLINOIS DEPARTMENT OF TRANSPORTATION. CONTRACTOR MAY CONSTRUCT TEMPORARY DOCKS WITHIN THE EXISTING RIGHT OF WAY ON THE ILLINOIS AND IOWA BANKS FOR THEIR USE. THE DOCKS MUST BE PILE SUPPORTED AND PLACEMENT OF ANY FILL IS NOT ALLOWED. ANY ACCESS ROADS OR DOCKS CANNOT DAMAGE, OR ALTER IN ANY WAY, EXISTING DYKES, LEVEES AND FLOOD PROTECTION ELEMENTS.

SUGGESTED DEMOLITION SCHEME: THE SUGGESTED DEMOLITION SCHEMES ARE FOR THE CONTRACTOR'S INFORMATION ONLY. ADAPTATION OF THE SUGGESTED DEMOLITION SCHEME, OR PARTS OR A COMBINATION THEREOF IS AT CONTRACTOR'S DISCRETION AND BECOMES THE SOLE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR MUST VERIFY AND PROVIDE COMPUTATIONS DEMONSTRATING THE SAFETY OF EXISTING BRIDGE ELEMENTS TO BE DEMOLISHED AND ANY TEMPORARY FALSEWORK DURING ALL STAGES OF DEMOLITION.

EXISTING STRUCTURE PLANS: THE REPRESENTATION OF THE EXISTING BRIDGES IN THE FOLLOWING SHEETS IS SCHEMATIC ONLY. THE CONTRACTOR IS REFERRED TO THE ORIGINAL PLANS FOR DETAILS.

DESIGN FOR 0° SKEW

I-74 BRIDGES OVER THE MISSISSIPPI RIVER (ILLINOIS & IOWA BOUND)

4 @ 222'-3½, 2 @ 223'-6½ TRUSS SPANS

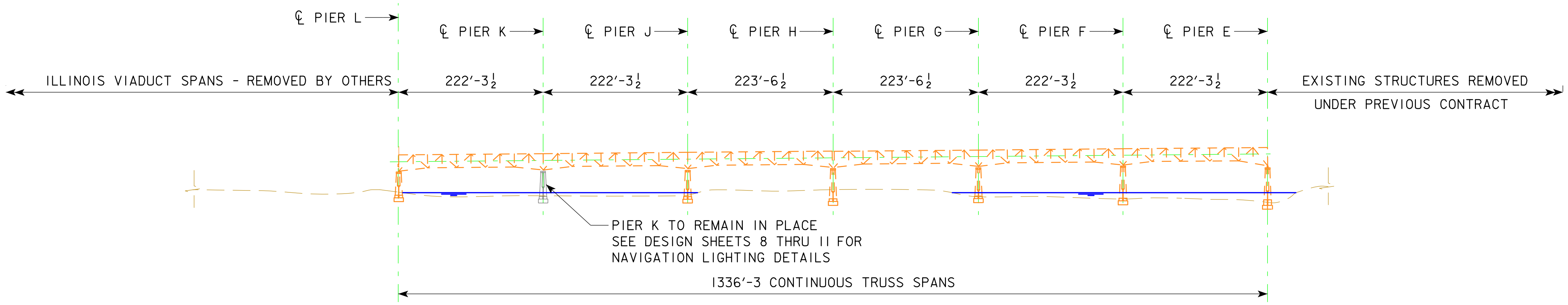
GENERAL NOTES

STA. 6754+17.58 - 684.84' LT - I-74 DECEMBER 2014

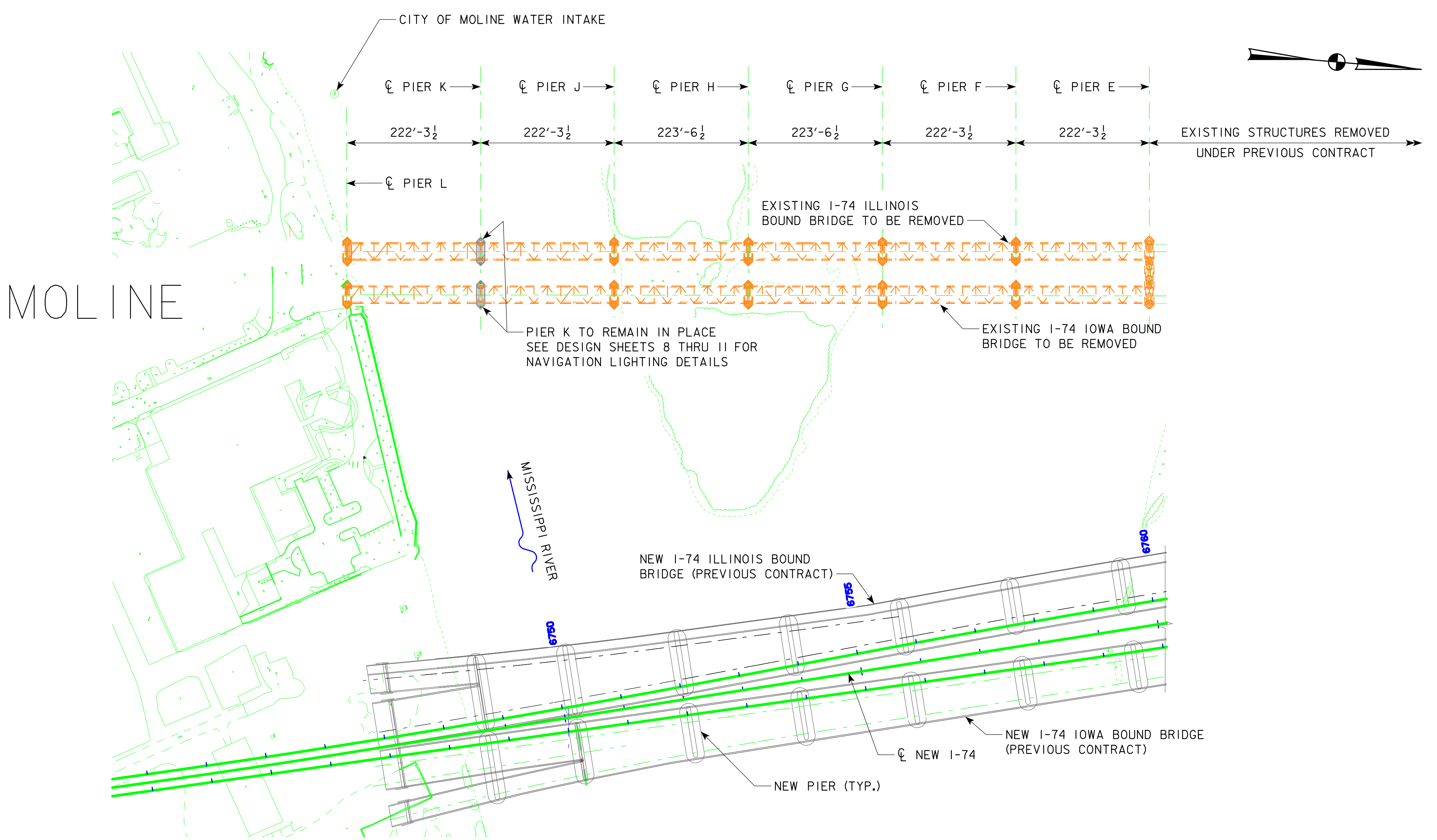
ROCK ISLAND COUNTY

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

DESIGN SHEET NO. 2 OF 11 FILE NO. 30253 DESIGN NO. 4208



ELEVATION



SITUATION PLAN

EXISTING STRUCTURES

TYPE: CONTINUOUS STEEL TRUSS

SPANS: 4 @ 222′-3½, 2 @ 223′-6½
(SPANS LISTED ABOVE ARE FOR 1 BRIDGE)

ROADWAY: 24′-0″± FACE TO FACE SAFETY CURB
ILLINOIS BOUND BRIDGE
23′-3″± FACE TO FACE SAFETY CURB
IOWA BOUND BRIDGE

SKEW: 0°00′00″

TYPE OF DECK: CAST-IN-PLACE CONCRETE

APPROACH SLABS: NONE

ALIGNMENT: TANGENT

BENCHMARK DATA (NAVD 1988)

BENCHMARK NO.: 500 STA. 6781+18.95 LT. 161.23′
ELEV. 575.797, CHISELED "X" IN BOLT E. SIDE
CONCRETE STRUCTURE

ALL ELEVATIONS BASED ON NGVD 1912 DATUM.

THE FOLLOWING CONVERSION APPLIES TO
THE PROJECT LOCATION:
NAVD 88 = NGVD 1912 - 0.727 FT.

I-74 EASTBOUND
& WESTBOUND OVER THE
MISSISSIPPI RIVER
MOLINE, IL
T-18 N R-1 W
SECTION 29
MOLINE TOWNSHIP
ROCK ISLAND COUNTY
IOWA BRIDGE MAINTENANCE NO. 8205.0L074 (W.B.)
IOWA BRIDGE MAINTENANCE NO. 8205.0R074 (E.B.)
IOWA FHWA NO. 47280 (W.B.)
IOWA FHWA NO. 47290 (E.B.)
LATITUDE = 41.513714
LONGTUDE = -90.512630

DESIGN FOR 0° SKEW

I-74 BRIDGES OVER THE MISSISSIPPI RIVER (ILLINOIS & IOWA BOUND)

4 @ 222′-3½, 2 @ 223′-6½ TRUSS SPANS

SITUATION PLAN

STA. 6754+17.58 - 684.84′ LT - I-74 DECEMBER 2014

ROCK ISLAND COUNTY

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

DESIGN SHEET NO. 3 OF 11 FILE NO. 30253 DESIGN NO. 4208

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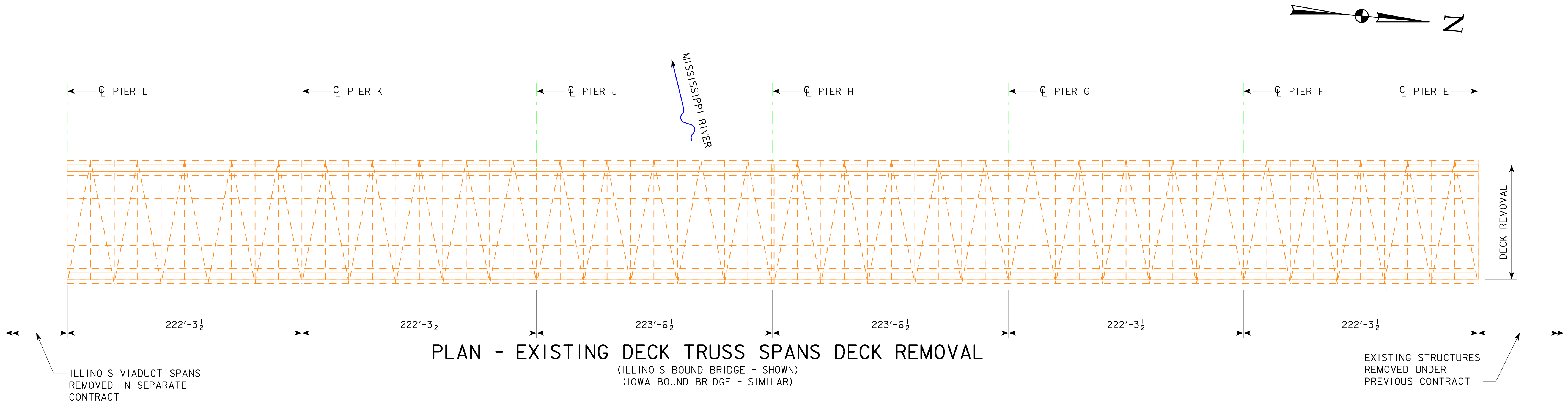
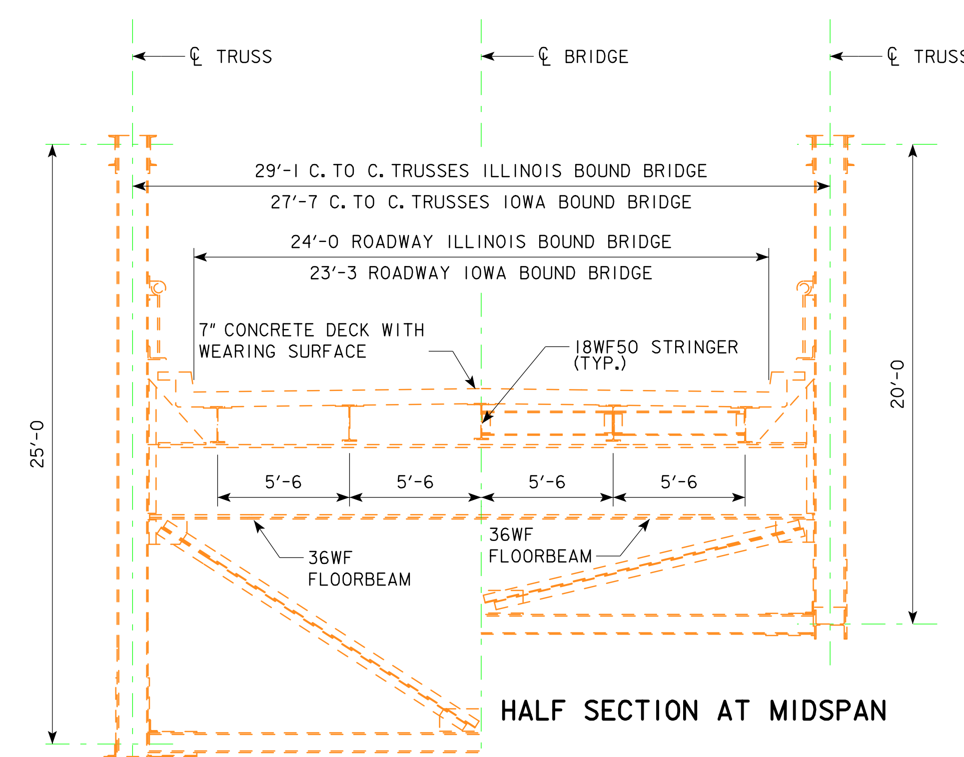


PLAN - EXISTING DECK TRUSS SPANS DECK REMOVAL

(ILLINOIS BOUND BRIDGE - SHOWN)
(IOWA BOUND BRIDGE - SIMILAR)



TRUSS DECK CROSS SECTION

(ILLINOIS BOUND BRIDGE - SHOWN)
(IOWA BOUND BRIDGE - SIMILAR)

DESIGN FOR 0° SKEW

I-74 BRIDGES OVER THE MISSISSIPPI RIVER (ILLINOIS & IOWA BOUND)

4 @ 222′-3½, 2 @ 223′-6½ TRUSS SPANS

BRIDGE DECK REMOVAL

STA. 6754+17.58 - 684.84′ LT - I-74 DECEMBER 2014

ROCK ISLAND COUNTY

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

DESIGN SHEET NO. 4 OF 11 FILE NO. 30253 DESIGN NO. 4208

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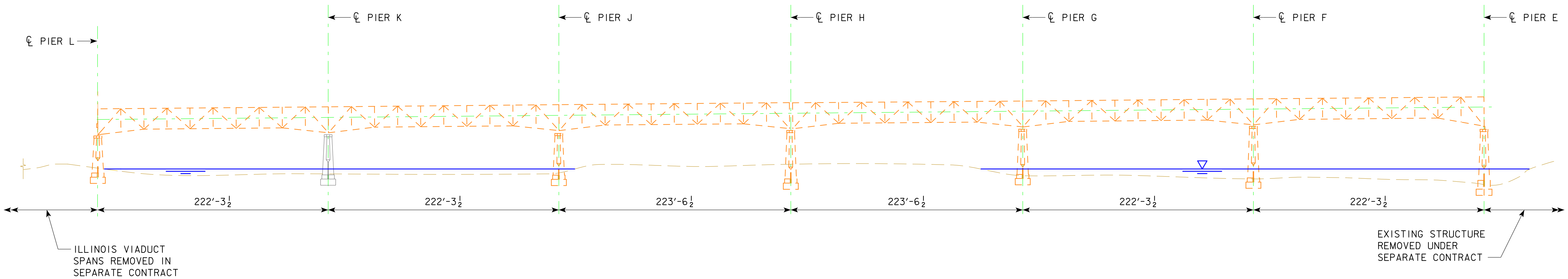
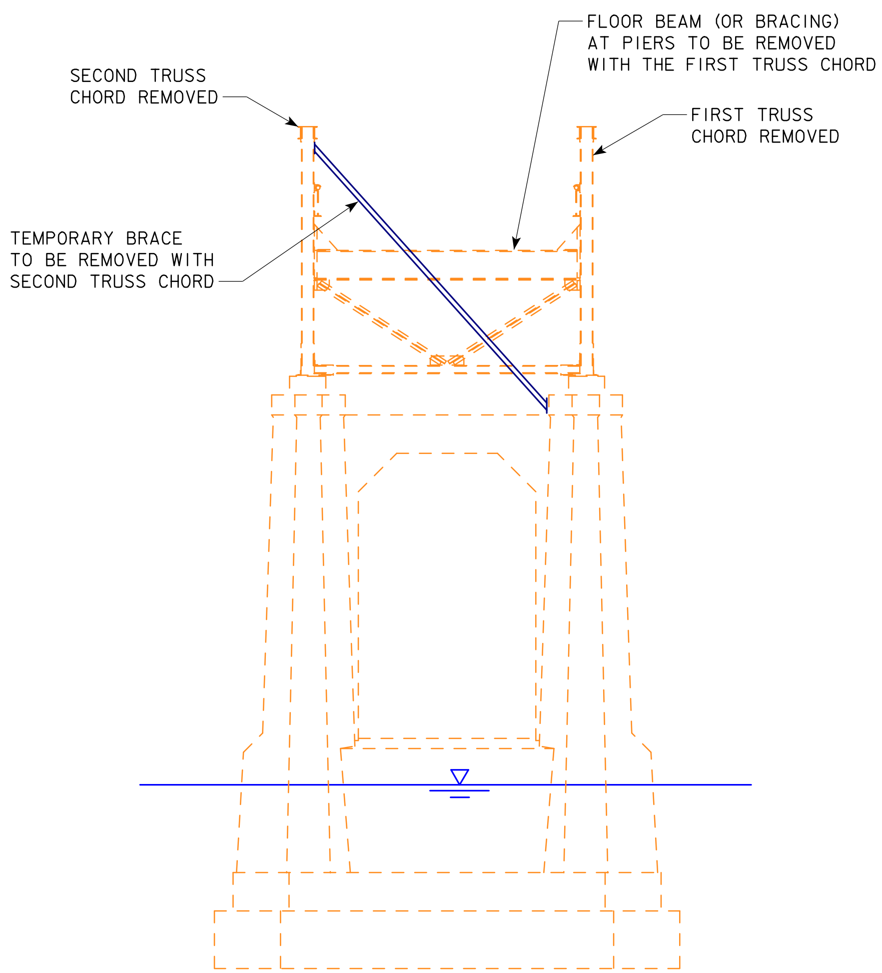


ELEVATION - SUPERSTRUCTURE DEMOLITION



SECTION AT PIER

SUGGESTED SUPERSTRUCTURE DEMOLITION PROCEDURE

STEP 1 REMOVE CONCRETE DECK AND ALL ATTACHED APPURTENANCES ON TRUSS SPANS.

STEP 2 CONSTRUCT TEMPORARY BRACE AT EACH PIER TO STABILIZE THE TRUSS CHORD THAT WILL BE THE SECOND TRUSS TO BE REMOVED FOR EACH SPAN.

STEP 3 REMOVE FLOOR BEAMS, BRACING AND STRINGERS. LEAVE SELECT MEMBERS AS REQUIRED TO BRACE THE TWO TRUSSES AGAINST EACH OTHER.

STEP 4 REMOVE FIRST TRUSS CHORD WITH REMAINING SELECT MEMBERS AS MENTIONED ABOVE. TRUSS CHORDS CAN BE CUT AND REMOVED ONE SPAN AT A TIME.

STEP 5 REMOVE SECOND TRUSS CHORD (WITH TEMPORARY BRACE) AND REPEAT FOR EACH SPAN.

ESTIMATED STEEL WEIGHTS

960	LB/FT	TRUSSES
60	LB/FT	RAILINGS
275	LB/FT	STRINGERS
260	LB/FT	FLOORBEAMS
210	LB/FT	BRACING
1,765	LB/FT	TOTAL STEEL WEIGHT PER FOOT OF BRIDGE (TRUSS SPANS)

TRUSS WEIGHTS TAKEN FROM ORIGINAL PLANS

DESIGN FOR 0° SKEW

I-74 BRIDGES OVER THE MISSISSIPPI RIVER (ILLINOIS & IOWA BOUND)

4 @ 222'-3½, 2 @ 223'-6½ TRUSS SPANS

SUPERSTRUCTURE DEMOLITION

STA. 6754+17.58 - 684.84' LT - I-74 DECEMBER 2014

ROCK ISLAND COUNTY

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

DESIGN SHEET NO. 5 OF 11 FILE NO. 30253 DESIGN NO. 4208

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DESIGN TEAM: AJK/RMG/EHS

ROCK ISLAND COUNTY | PROJECT NUMBER IM-074-1(214)5--13-82 | SHEET NUMBER 6

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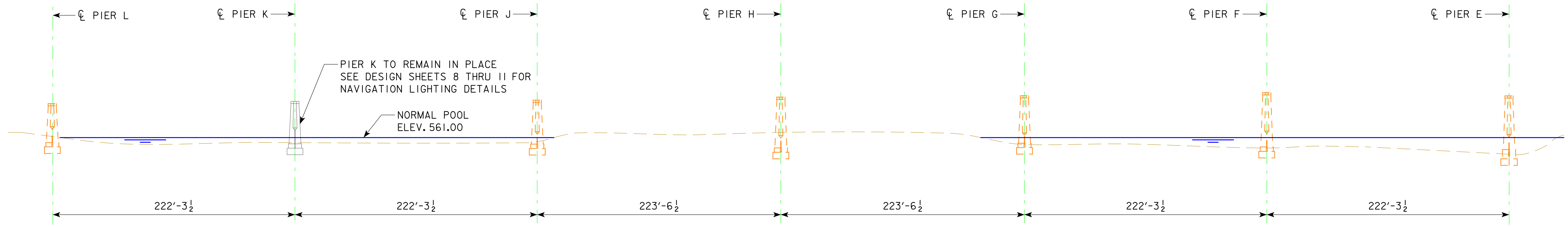
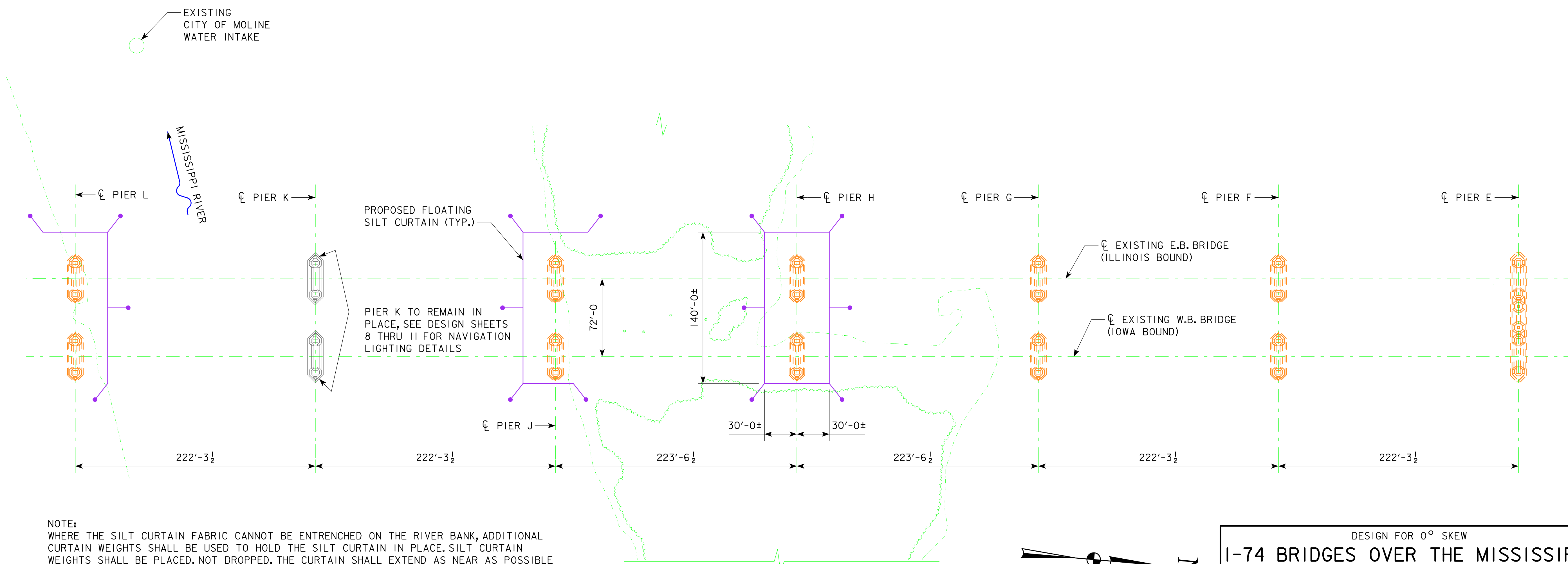


ELEVATION - REMOVAL OF SUBSTRUCTURE



NOTE:
WHERE THE SILT CURTAIN FABRIC CANNOT BE ENTRENCHED ON THE RIVER BANK, ADDITIONAL CURTAIN WEIGHTS SHALL BE USED TO HOLD THE SILT CURTAIN IN PLACE. SILT CURTAIN WEIGHTS SHALL BE PLACED, NOT DROPPED. THE CURTAIN SHALL EXTEND AS NEAR AS POSSIBLE TO THE PIER THAT IS TO BE REMOVED, AND SHALL BE ANCHORED AT THAT LOCATION. THE SILT CURTAIN SHALL BE REMOVED IN A MANNER TO ENSURE THAT THE SILT IS CONTAINED AND NOT RELEASED INTO THE RIVER.

PLAN - REMOVAL OF SUBSTRUCTURE

N

DESIGN FOR 0° SKEW

I-74 BRIDGES OVER THE MISSISSIPPI RIVER (ILLINOIS & IOWA BOUND)

4 @ 222'-3½, 2 @ 223'-6½ TRUSS SPANS

SUBSTRUCTURE DEMOLITION

STA. 6754+17.58 - 684.84' LT - I-74 DECEMBER 2014

ROCK ISLAND COUNTY

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

DESIGN SHEET NO. 6 OF 11 FILE NO. 30253 DESIGN NO. 4208

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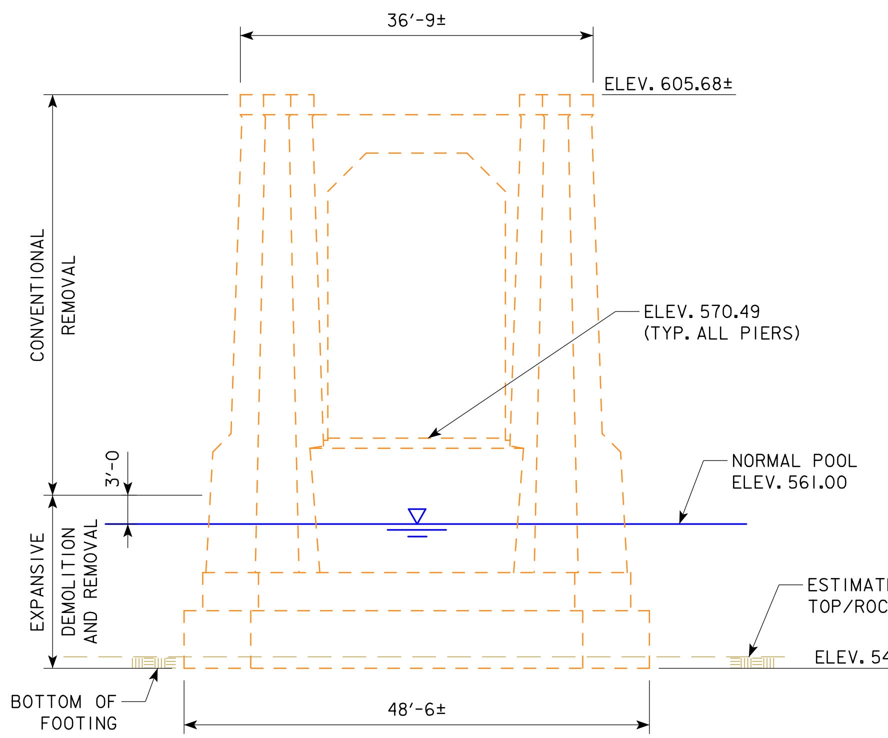
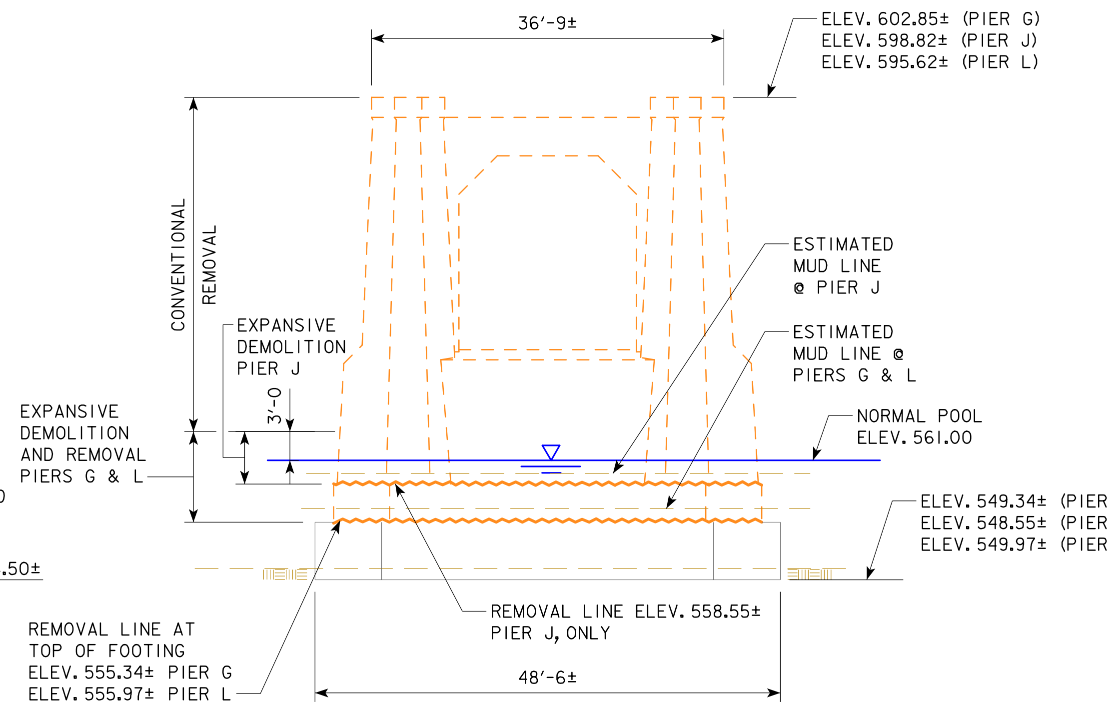
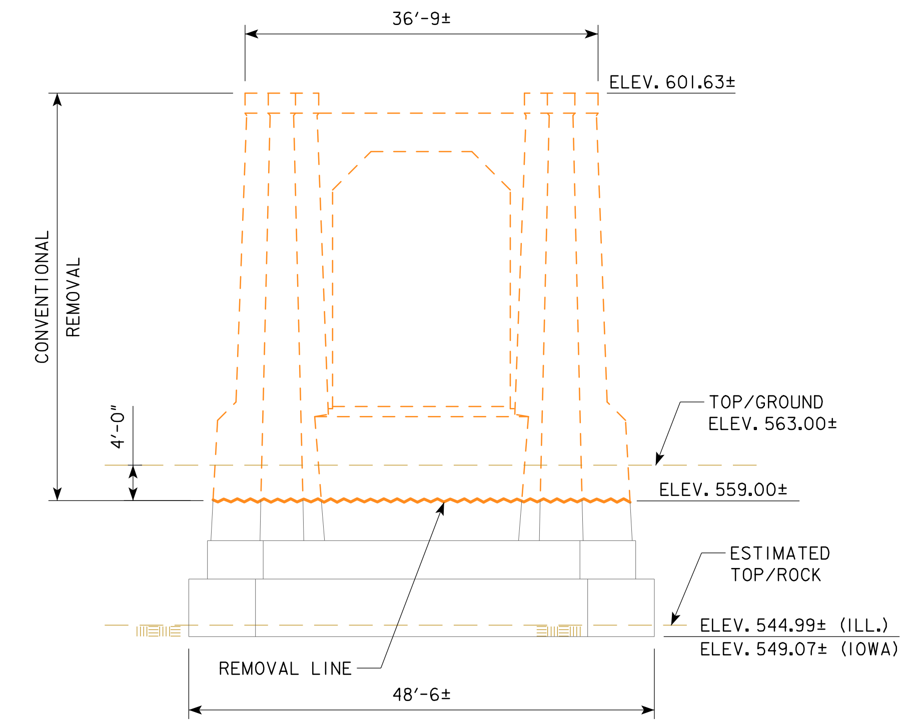
BENCHMARK NO.: 500 STA. 6781+18.95 LT. 161.23'
ELEV. 575.797 (NAVD 1988), CHISELED "X" IN BOLT
E. SIDE CONCRETE STRUCTURE



ELEVATION - PIER F
(ILLINOIS BOUND PIER ELEVATIONS - SHOWN)
(IOWA BOUND PIER - SIMILAR)
(LOOKING NORTH)



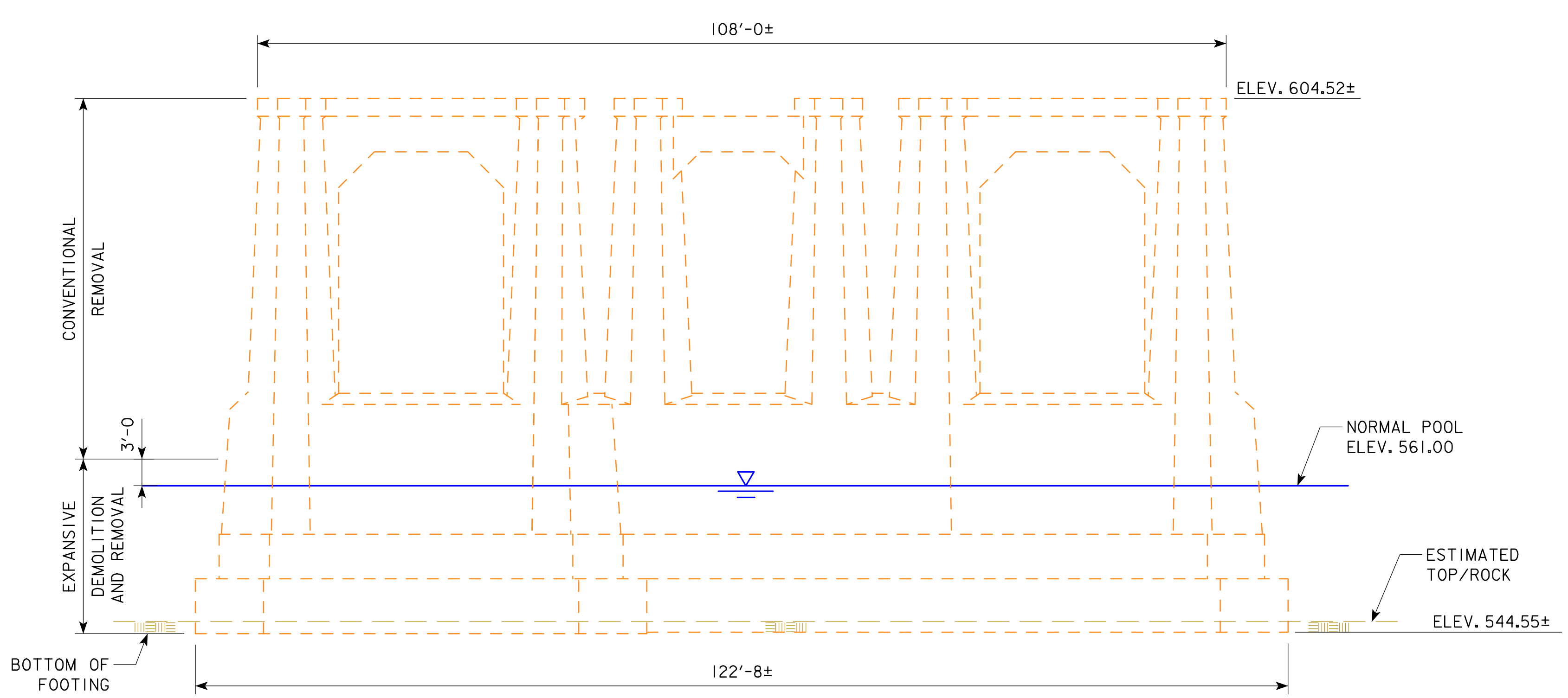
ELEVATION - PIERS G, J & L
(ILLINOIS BOUND PIER ELEVATIONS - SHOWN)
(IOWA BOUND PIER - SIMILAR)
(LOOKING NORTH)



ELEVATION - PIER H
(ILLINOIS BOUND PIER ELEVATIONS - SHOWN)
(IOWA BOUND PIER - SIMILAR)
(LOOKING NORTH)

ALL ELEVATIONS BASED ON NGVD 1912 DATUM.

THE FOLLOWING CONVERSION APPLIES TO THE PROJECT LOCATION:
NAVD 88 = NGVD 1912 - 0.727 FT.



ELEVATION - PIER E
(LOOKING SOUTH)

NOTES:

1. FOR PIERS J AND L, DEMOLITION BELOW ELEVATION 564.00 MUST BE DONE WITH EXPANSIVE DEMOLITION AGENTS TO MINIMIZE THE AMOUNT OF DUST AND DEBRIS INTRODUCED INTO THE WATERWAY.
2. THE ELEVATIONS OF THE REMOVAL LIMITS SHOWN AT PIERS J AND L ARE ESTIMATED. THE REMOVAL LIMIT AT PIERS J AND L SHALL BE 1'-0 BELOW THE MUD LINE AND THE RIVERBED SLOPE SHALL BE RE-MADE TO MEET THE EXISTING RIVERBED.
3. ALL EXCAVATION REQUIRED AT PIER H TO FACILITATE REMOVAL SHALL BE INCIDENTAL TO THE COST OF THE REMOVAL OF THE EXISTING BRIDGE.

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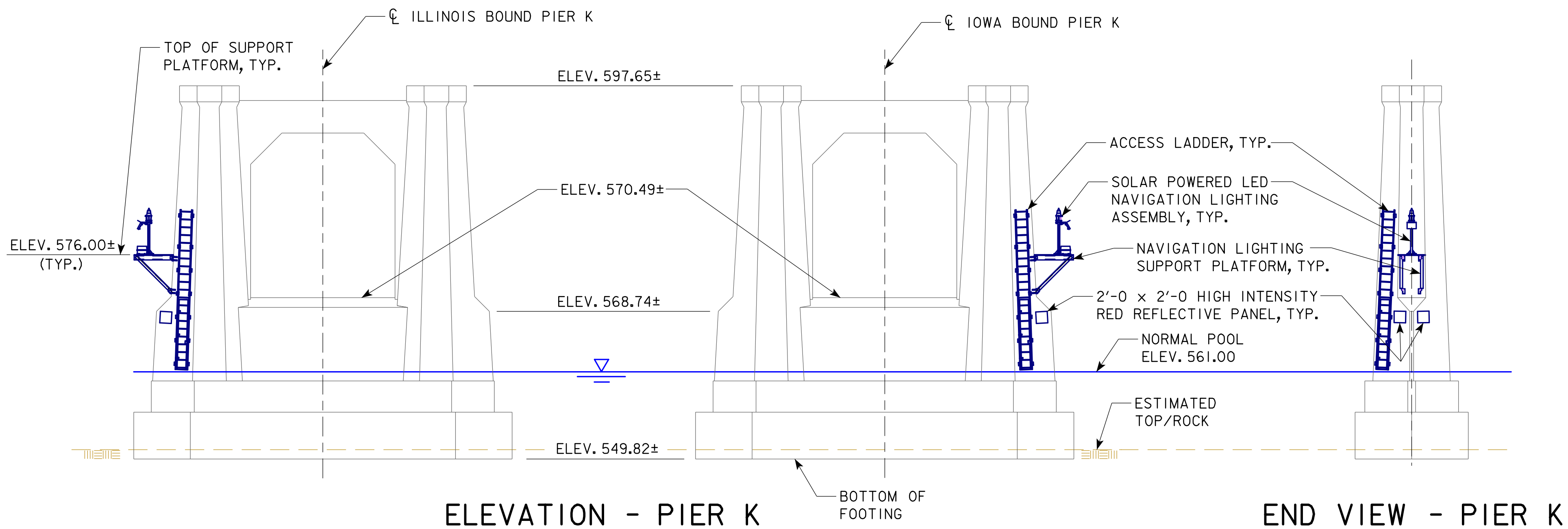
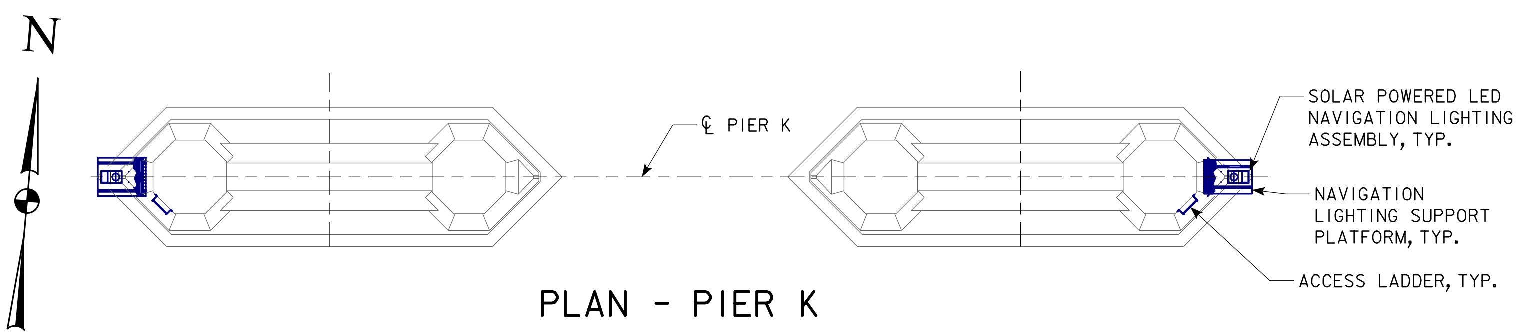
DESIGN FOR 0° SKEW
I-74 BRIDGES OVER THE MISSISSIPPI RIVER (ILLINOIS & IOWA BOUND)
4 @ 222'-3½, 2 @ 223'-6½ TRUSS SPANS
SUBSTRUCTURE DEMOLITION
STA. 6754+17.58 - 684.84' LT - I-74
DECEMBER 2014
ROCK ISLAND COUNTY
IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION
DESIGN SHEET NO. 7 OF 11 FILE NO. 30253 DESIGN NO. 4208

BENCHMARK NO.: 500 STA. 6781+18.95 LT. 161.23' ELEV. 575.797 (NAVD 1988), CHISELED "X" IN BOLT, E. SIDE CONCRETE STRUCTURE

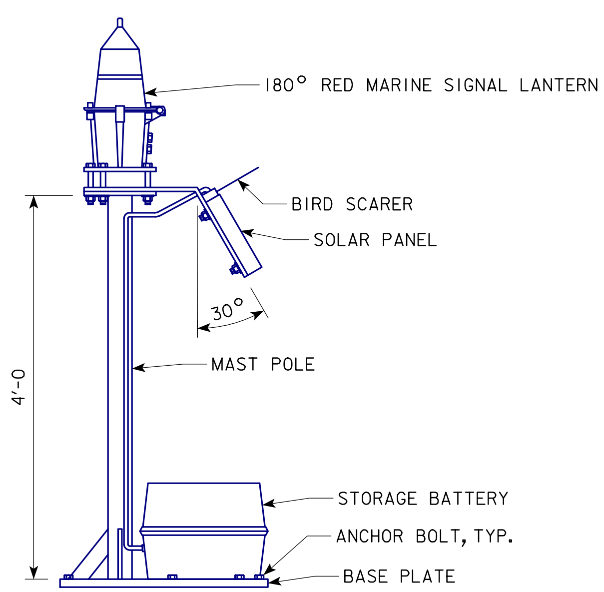


ELEVATION - PIER K
(LOOKING NORTH)

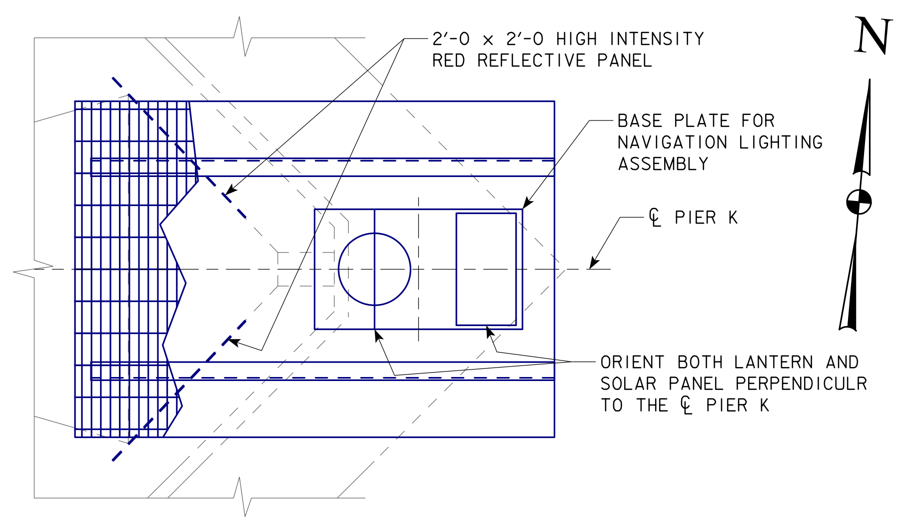
END VIEW - PIER K



PLAN - PIER K



SOLAR POWERED LED NAVIGATION LIGHT DETAIL



NAVIGATION LIGHT ORIENTATION
(EAST PLATFORM SHOWN, WEST SIMILAR)

NAVIGATION LIGHTING UNIT REQUIREMENTS:

GENERAL

NAVIGATION LIGHTING UNIT SHALL BE PROVIDED AS A SINGLE ASSEMBLY CONSISTING OF A LANTERN WITH STEADY-BURNING LED LAMP, SOLAR ARRAY MODULE, BATTERY, PHOTO-CONTROL, AND A MOUNTING PEDESTAL WITH BASE PLATE FOR THE LANTERN AND OTHER COMPONENTS. LIGHTING UNIT SHALL BE DESIGNATED FOR USE AS A MARINE SIGNAL LIGHT PER U.S COAST GUARD REQUIREMENTS AND COMPLY WITH USCG STANDARDS 33CFR118.60, 33CFR84.13, AND 33CFR84.15. RETROREFLECTIVE PANELS, AS SHOWN ON THIS DESIGN SHEET, ARE PRESCRIBED IN ACCORDANCE WITH PART 118.

LANTERN

LENS:

LENS SHALL BE TEMPERED FRESNEL GLASS OR A SINGLE PIECE ACRYLIC FRESNEL LENS. LENS SECTION SHALL PROVIDE 180 DEGREE CONTINUOUS RED ILLUMINATION AND INCLUDE A BIRD SPIKE TO PREVENT THE FOULING OF THE LENS.

LAMP:

LED LAMP SHALL CONSIST OF A DENSE ARRAY OF INDIVIDUAL LEDs WITH THE ENTIRE ASSEMBLY NEATLY POTTED INTO A STEM FITTED INTO A STANDARD MEDIUM BASE. EACH LED SHALL BE ENCASED IN A SOLID CLEAR EPDXY PER INDUSTRY STANDARD AND HAVE A MTBF RATING OF 100,000 HOURS. IN THE EVENT OF FAILURE OF A SINGLE OR MULTIPLE INDIVIDUAL LEDs, THE REMAINING LEDs SHALL CONTINUE TO OPERATE. THE LAMP SHALL BE DESIGNED TO OPERATE AT 12 VOLT OPERATION. LAMP POWER SHALL BE ADJUSTED AS REQUIRED TO PROVIDE A RANGE OF 41 NAUTICAL MILES AT AN ATMOSPHERE TRANSMISSION FACTOR OF 0.70. LAMP POWER DRAW AFTER ADJUSTMENT SHALL NOT EXCEED 1.4 WATTS. LED DRIVE CIRCUIT SHALL BE TEMPERATURE COMPENSATED TO ENSURE UNIFORM BRIGHTNESS WITH AMBIENT TEMPERATURE CHANGE.

HOUSING:

THE LOWER HOUSING SHALL BE CAST ALUMINUM OR A UV STABILIZED GLASS REINFORCED POLYESTER RESIN SUITABLE FOR A MARINE ENVIRONMENT. THE ENTIRE ASSEMBLY SHALL BE WEATHER-TIGHT, FULLY GASKETED, AND DESIGNED FOR LONG LIFE. LAMP SHALL BE READILY ACCESSIBLE FOR SERVICING.

SOLAR ARRAY MODULE AND BATTERY

GENERAL:

THE SOLAR ARRAY MODULE AND BATTERY SHALL BE SIZED AS REQUIRED TO PROVIDE ADEQUATE POWER TO THE NAVIGATION LIGHT THROUGHOUT THE YEAR WITH MINIMUM SIZES AS INDICATED BELOW. THE SYSTEM SHALL PROVIDE A MINIMUM OF 24 DAYS OF AUTONOMY.

SOLAR ARRAY MODULE:

SOLAR ARRAY MODULE SHALL CONSIST OF POLYCRYSTALLINE SOLAR CELLS SANDWICHED BETWEEN TEMPERED GLASS AND ETHYLENE VINYL ACETATE (EVA). THE ASSEMBLY SHALL BE WEATHERPROOF AND FRAMED WITH A CORROSION-RESISTANT, BRONZE ANODIZED ALUMINUM FRAME. PANEL SHALL BE PROVIDED WITH AN APPROPRIATE VOLTAGE REGULATOR. PANEL SHALL PROVIDE SUFFICIENT POWER FOR BATTERY CHARGING DURING DAYLIGHT HOURS WITH A MINIMUM SIZE OF 20 WATTS AT 12 VDC. PROVIDE MOUNTING BRACKET FOR SOLAR PANEL. EQUIP SOLAR ARRAY MODULE WITH BIRD SCARERS. SOLAR PANEL SHALL BE ORIENTED DUE SOUTH AT A 30 DEGREE TILT FROM VERTICAL.

BATTERY:

BATTERY SHALL BE A 12 V TYPE CAPABLE OF 50% DISCHARGE AND WIRED FOR 105AH TOTAL (MINIMUM). PROVIDE A STRUCTURAL PLASTIC BATTERY ENCLOSURE TO HOUSE THE BATTERIES.

PHOTO-CONTROL

PROVIDE INTEGRAL PHOTO-CONTROL WHICH PERMITS DUSK TO DAWN OPERATION.

MOUNTING PEDESTAL WITH BASE PLATE

PROVIDE ALL COMPONENTS INSTALLED AND PREWIRED ON A GALVANIZED STEEL MOUNTING PEDESTAL WITH GALVANIZED STEEL BASE PLATE. PEDESTAL SHALL BE 2" MINIMUM DIAMETER PIPE WHICH IS 4'-0" IN HEIGHT. LANTERN SHALL BE ATTACHED TO THE TOP OF PEDESTAL AND SOLAR ARRAY MODULE ATTACHED TO THE SIDE. THE PEDESTAL SHALL BE WELDED TO A BASE PLATE AND THE BATTERY ENCLOSURE SHALL BE ATTACHED TO THIS BASE PLATE. BASE PLATE SHALL BE ANCHORED TO THE STEEL GRATING OF THE SUPPORT PLATFORM WITH A MINIMUM OF FOUR ANCHOR BOLTS SIZED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

NOTES:

ALL ELEVATIONS BASED ON NGVD 1912 DATUM.

THE FOLLOWING CONVERSION APPLIES TO THE PROJECT LOCATION:
NAVD 88 = NGVD 1912 - 0.727 FT.

RETROFLECTIVE PANEL NOTES:

STEEL PLATE FOR RETROREFLECTIVE PANEL SHALL BE IN ACCORDANCE WITH ARTICLE 4186.02, B40F THE STANDARD SPECIFICATIONS EXCEPT THE PLATE THICKNESS SHALL BE 1/8".

HIGH INTENSITY RETRO REFLECTIVE SHEETING SHALL BE IN ACCORDANCE WITH ARTICLE 4186.03, OF THE STANDARD SPECIFICATIONS.

THE COST OF FURNISHING AND THE INSTALLATION OF MATERIALS FOR THE HIGH INTENSITY RETROREFLECTIVE PANELS SHALL BE INCLUDED IN THE PRICE BID FOR "NAVIGATION LIGHTING."

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DESIGN FOR 0° SKEW

I-74 BRIDGES OVER THE MISSISSIPPI RIVER (ILLINOIS & IOWA BOUND)

4 @ 222'-3½, 2 @ 223'-6½ TRUSS SPANS

PIER K NAVIGATION LIGHTING

STA. 6754+17.58 - 684.84' LT - I-74 DECEMBER 2014

ROCK ISLAND COUNTY

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

DESIGN SHEET NO. 8 OF 11 FILE NO. 30253 DESIGN NO. 4208

SUPPORT PLATFORM NOTES:

DESIGN LIVE LOAD IS 100 PSF UNIFORM LOAD OR A SINGLE 500 LB CONCENTRATED LOAD, EQUIVALENT TO TWO WORKERS WEIGHING 250 POUNDS EACH, INCLUDING THEIR EQUIPMENT.

ALL STRUCTURAL STEEL OTHER THAN THE GRATING SHALL BE ASTM A709 GRADE 50.

ALL BOLTS SHALL BE HIGH STRENGTH. BOLTS, NUTS, AND WASHERS SHALL BE GALVANIZED IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS, ARTICLE 4153.06.

GRATING SHALL BE WELDED TYPE WITH 3/16" BEARING BARS AT 1 3/16" CENTERS AND 1/4"Φ CROSS RODS AT 4" MAXIMUM CENTERS. DEPTH OF BEARING BARS SHALL BE 1", AS SHOWN IN GRATING DETAIL. THE GRATING MATERIAL FOR BEARING BARS AND BANDING SHALL BE OF RECTANGULAR SECTION AND SHALL COMPLY WITH THE REQUIREMENTS OF ASTM A1011 TYPE 2. CROSS RODS SHALL COMPLY WITH THE REQUIREMENTS OF ASTM A510. THE MANUFACTURER SHALL CERTIFY THAT THE GRATING CAPACITY MEETS OR EXCEEDS THE DESIGN LIVE LOAD PLUS DEAD LOAD OF THE GRATING.

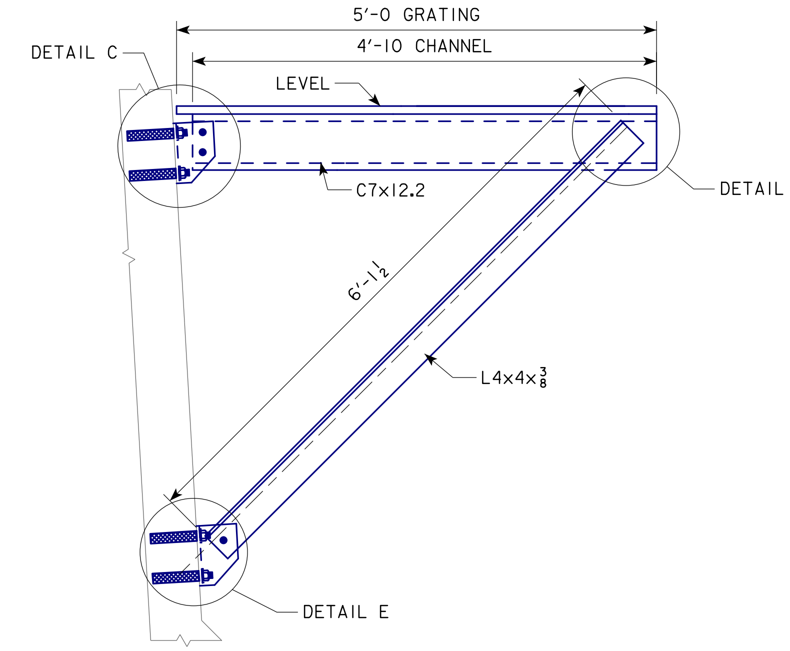
ALL STEEL SHALL BE GALVANIZED IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS AFTER FABRICATION. GRATINGS SHALL BE GALVANIZED AFTER WELDING TO THE CHANNELS.

ALL BOLTS SHALL BE 5/8" DIAMETER UNLESS OTHERWISE NOTED. HOLES FOR 5/8" BOLTS SHALL BE 11/16" DIAMETER. FOR BOLT SPACINGS AND EDGE CLEARANCES NOT SHOWN, AASHTO CRITERIA SHALL BE USED.

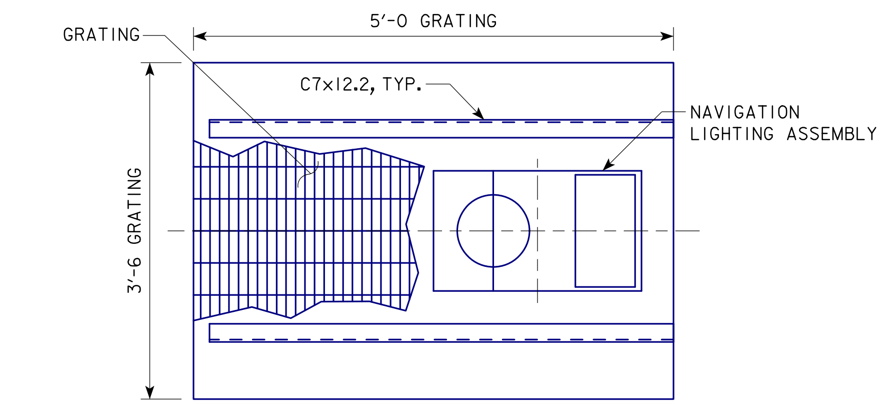
BOLTED STEEL CONNECTIONS MAY BE FABRICATED IN THE SHOP OR INSTALLED IN THE FIELD AT THE CONTRACTOR'S OPTION. USE OF FIELD-DRILLED BOLT HOLES IS PERMITTED FOR FIELD INSTALLATION.

NO FIELD WELDING WILL BE PERMITTED.

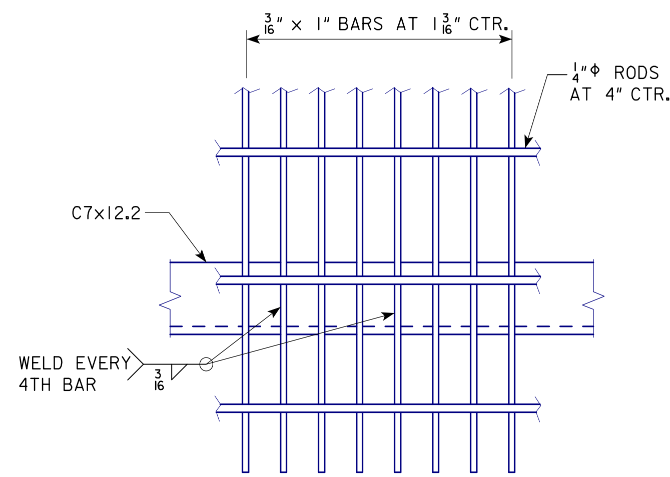
CONTRACTOR SHALL FIELD VERIFY EXISTING PIER END DIMENSIONS PRIOR TO FABRICATION TO INSURE PROPER STEEL FIT UP AND A MINIMUM EDGE DISTANCE OF 8 INCHES FOR THE CONCRETE ANCHORS.



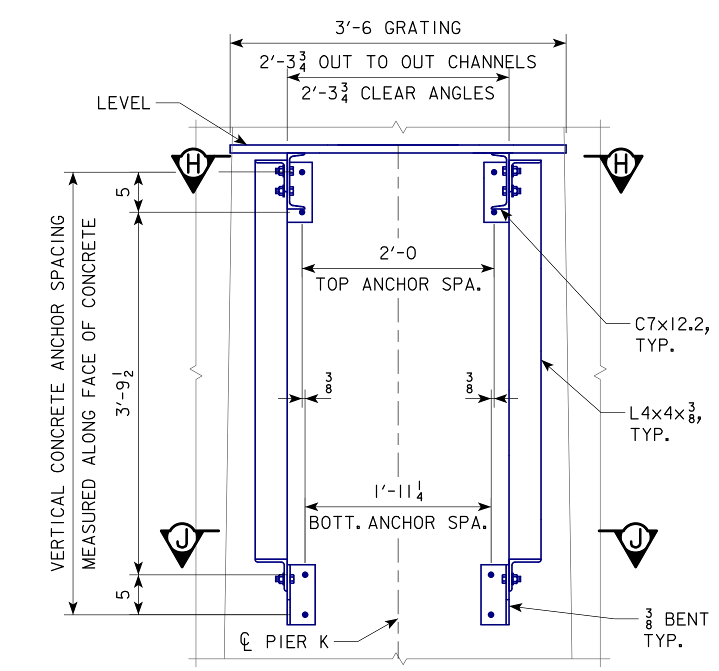
SUPPORT PLATFORM ELEVATION
(NAVIGATION LIGHTING ASSEMBLY NOT SHOWN FOR CLARITY)



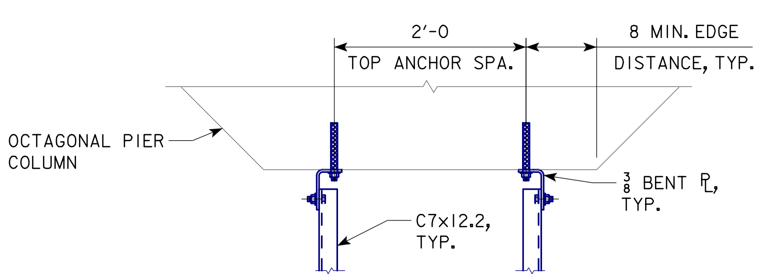
SUPPORT PLATFORM TOP PLAN



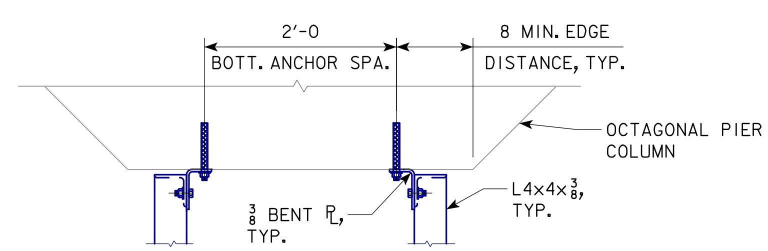
GRATING DETAIL
(PLAN VIEW)



SUPPORT PLATFORM END VIEW
(NAVIGATION LIGHTING ASSEMBLY NOT SHOWN FOR CLARITY)



SECTION H-H



SECTION J-J

NOTES:

FOR DETAILS C, D, & E, SEE DESIGN SHEET 10.

FOR CONCRETE ANCHOR NOTES, SEE DESIGN SHEET 10.

DESIGN FOR 0° SKEW

I-74 BRIDGES OVER THE MISSISSIPPI RIVER (ILLINOIS & IOWA BOUND)

4 @ 222'-3 1/2, 2 @ 223'-6 1/2 TRUSS SPANS

PIER K NAVIGATION LIGHTING

STA. 6754+17.58 - 684.84' LT - I-74 DECEMBER 2014

ROCK ISLAND COUNTY

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

DESIGN SHEET NO. 9 OF 11 FILE NO. 30253 DESIGN NO. 4208

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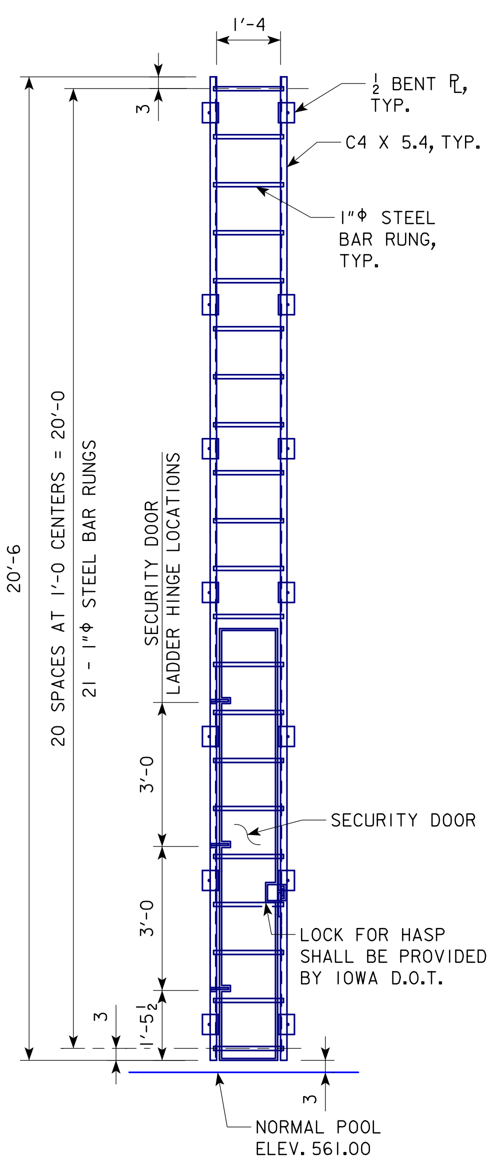
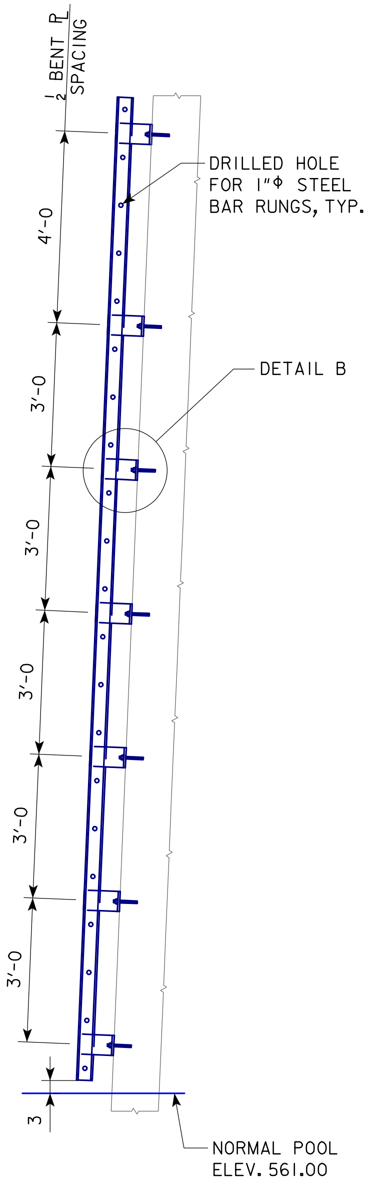
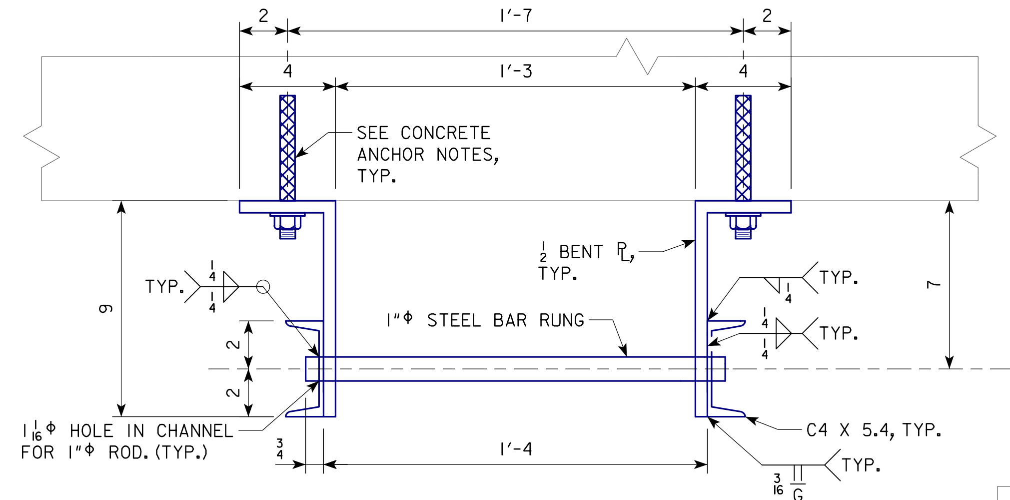
BENCHMARK NO.: 500 STA. 6781+18.95 LT. 161.23′ ELEV. 575.797
(NAVD 1988), CHISELED "X" IN BOLT, E. SIDE CONCRETE STRUCTURE



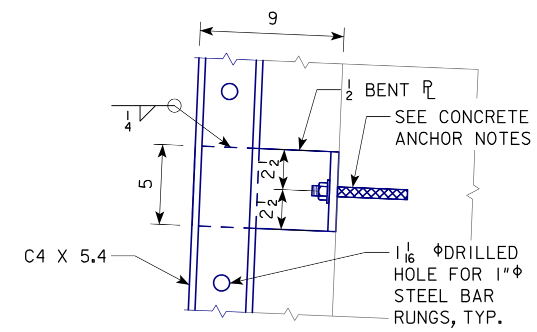
ACCESS LADDER ELEVATION
(VIEW PERPENDICULAR TO CONCRETE FACE)



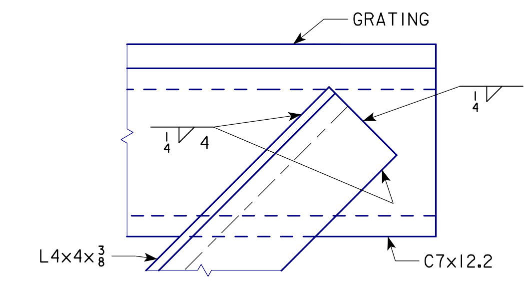
ACCESS LADDER SIDE VIEW



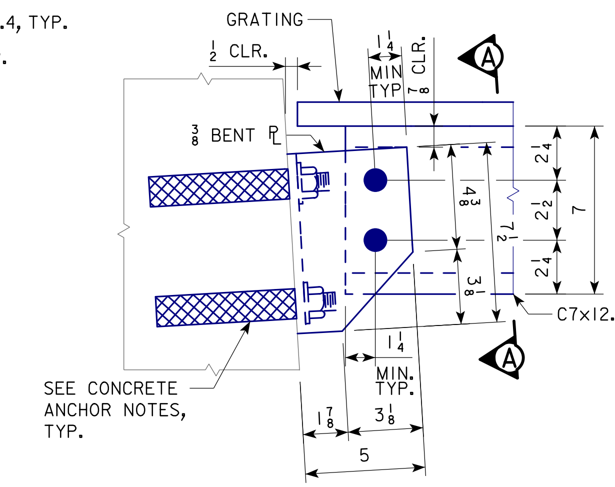
ACCESS LADDER TOP VIEW



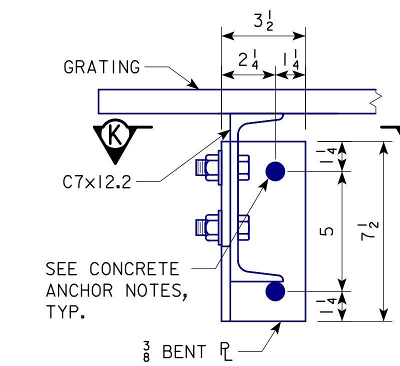
DETAIL B



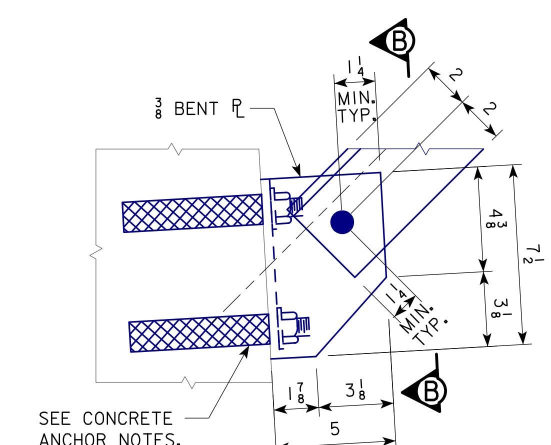
DETAIL D



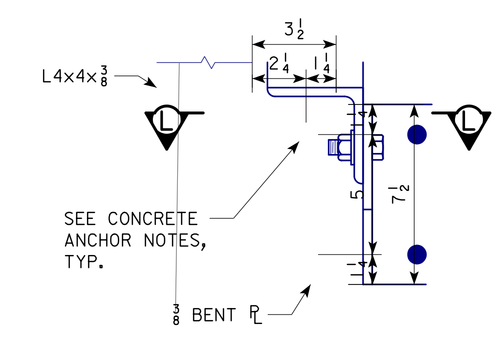
DETAIL C



VIEW A-A
(VIEW PERPENDICULAR TO CONCRETE FACE)



DETAIL E



VIEW B-B
(VIEW PERPENDICULAR TO CONCRETE FACE)

CONCRETE ANCHOR NOTES:

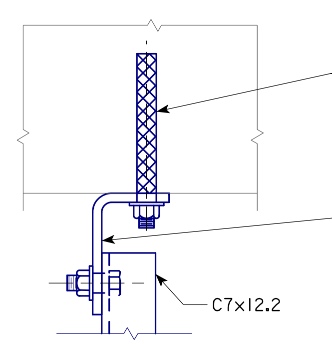
ALL CONCRETE ANCHORS SHALL BE MECHANICAL CONCRETE ANCHORS THAT CONFORM TO MATERIALS IM 453.09.

MECHANICAL CONCRETE ANCHORS SHALL BE HOT DIP OR MECHANICALLY GALVANIZED STEEL ONLY. ELECTRODEPOSITED ZINC COATING WILL NOT BE ALLOWED.

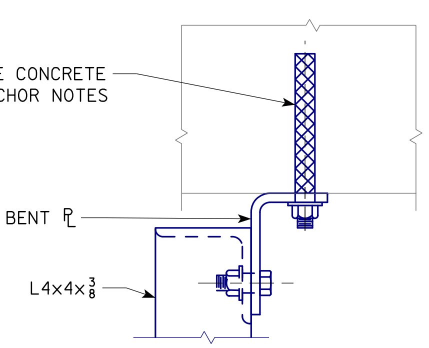
HOLES DRILLED FOR THE CONCRETE ANCHORS SHALL BE LOCATED SUCH THAT THEY MISS THE EXISTING PIER REINFORCING STEEL.

CONCRETE ANCHORS SHALL HAVE A MINIMUM ALLOWABLE SHEAR LOAD OF 5000 LBS, A MINIMUM ALLOWABLE TENSION LOAD OF 2500 LBS. CONCRETE ANCHORS SHALL BE ⅝″Φ, HAVE A MINIMUM EMBEDMENT OF 4⅜″, AND BE PLACED A MINIMUM OF 8″ FROM THE NEAREST CONCRETE EDGE.

THE COST FOR FURNISHING ALL THE MATERIAL, EQUIPMENT & LABOR REQUIRED TO INSTALL THE CONCRETE ANCHORS SHALL BE INCLUDED WITH THE PRICE BID FOR "STRUCTURAL STEEL".



SECTION K-K
(SECTION PARALLEL TO CONCRETE FACE)

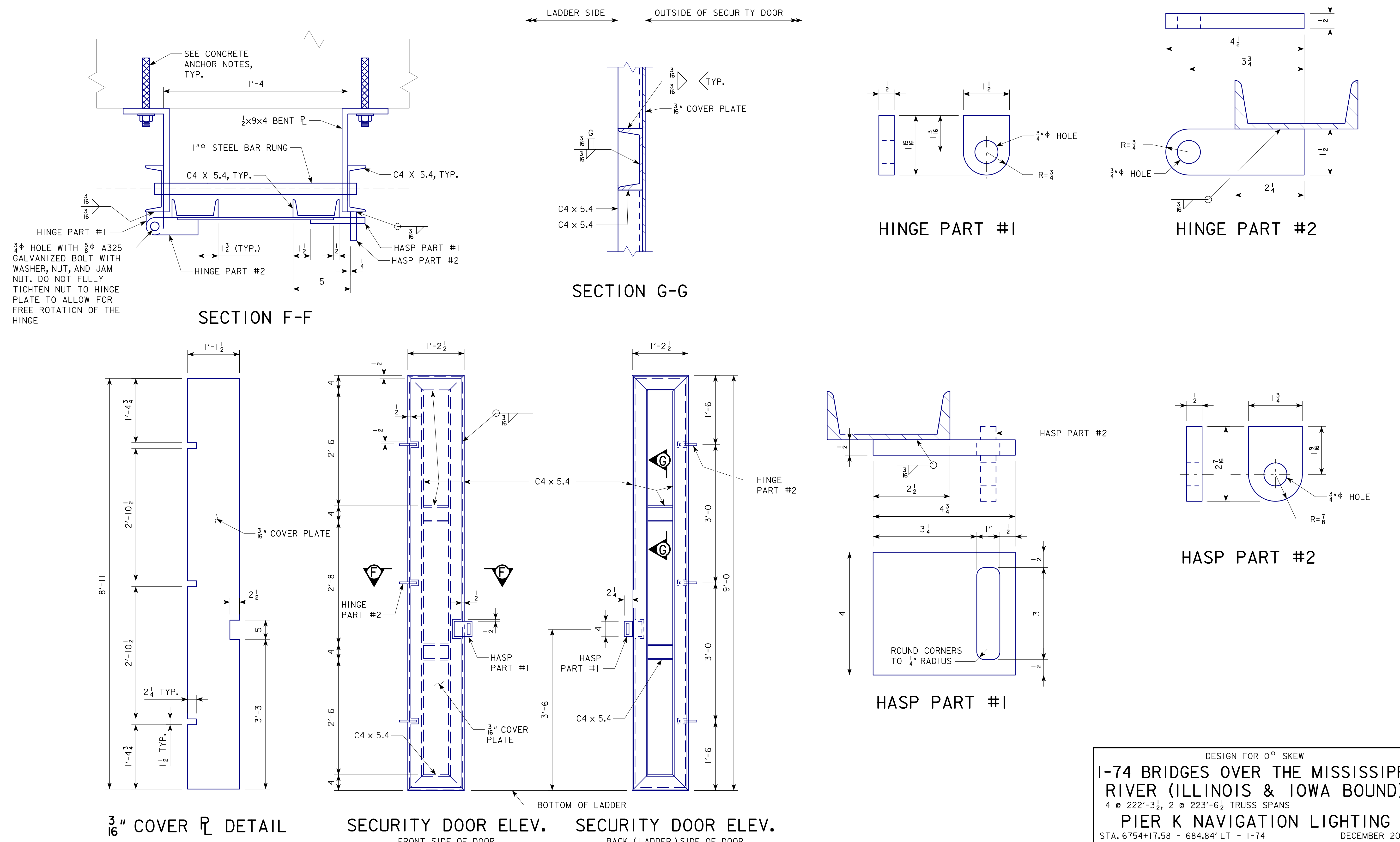


SECTION L-L
(SECTION PARALLEL TO CONCRETE FACE)

benesch
engineers · scientists · planners
Alfred Benesch & Company
205 North Michigan Avenue, Suite 2400
Chicago, Illinois 60601
312-565-0450 Job No. 10061

DESIGN FOR 0° SKEW
I-74 BRIDGES OVER THE MISSISSIPPI RIVER (ILLINOIS & IOWA BOUND)
4 @ 222′-3½, 2 @ 223′-6½ TRUSS SPANS
PIER K NAVIGATION LIGHTING
STA. 6754+17.58 - 684.84′ LT - I-74 DECEMBER 2014
ROCK ISLAND COUNTY
IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION
DESIGN SHEET NO. 10 OF 11 FILE NO. 30253 DESIGN NO. 4208

BENCHMARK NO.: 500 STA. 6781+18.95 LT. 161.23' ELEV. 575.797 (NAVD 1988), CHISELED "X" IN BOLT, E. SIDE CONCRETE STRUCTURE



DESIGN FOR 0° SKEW

I-74 BRIDGES OVER THE MISSISSIPPI RIVER (ILLINOIS & IOWA BOUND)

4 @ 222'-3½, 2 @ 223'-6½ TRUSS SPANS

PIER K NAVIGATION LIGHTING

STA. 6754+17.58 - 684.84' LT - I-74 DECEMBER 2014

ROCK ISLAND COUNTY

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

DESIGN SHEET NO. 11 OF 11 FILE NO. 30253 DESIGN NO. 4208

benesch engineers · scientists · planners
Alfred Benesch & Company
205 North Michigan Avenue, Suite 2400
Chicago, Illinois 60601
312-565-0450 Job No. 10061

110-12A
04-21-15

POLLUTION PREVENTION PLAN

This Base Pollution Prevention Plan (PPP) includes information on Roles and Responsibilities, Project Site Description, Controls, Maintenance Procedures, Inspection Requirements, Non-Storm Water Controls, Potential Sources of Off Right-of-Way Pollution, and Definitions. This plan references other documents rather than repeating the information contained in the documents. A copy of this Base Pollution Prevention Plan, amended as needed per plan revisions or by contract modification, will be readily available for review.

All contractors shall conduct their operations in a manner that controls pollutants, minimizes erosion, and prevents sediments from entering waters of the state and leaving the highway right-of-way. The prime contractor shall be responsible for compliance and implementation of the PPP for their entire contract. This responsibility shall be further shared with subcontractors whose work is a source of potential pollution as defined in this PPP.

I. ROLES AND RESPONSIBILITES

A. Designer:
1. Prepares Base PPP included in the project plan.
2. Prepares Notice of Intent (NOI) submitted to Iowa DNR.
3. Signature authority on the Base PPP and NOI.

B. Contractor/Subcontractor:
1. Affected contractors/subcontractors are co-permittees with the IDOT and will sign a certification statement adhering to the requirements of the NPDES permit and this PPP plan. All co-permittees are legally required under the Clean Water Act and the Iowa Administrative Code to ensure compliance with the terms and conditions of this PPP.
2. Submit a detailed schedule according to Article 2602 of the Specifications and any additional plan notes.
3. Install and maintain appropriate controls.
4. Supervise and implement good housekeeping practices.
5. Conduct joint required inspections of the site with inspection staff.
6. Signature authority on Co-Permittee Certification Statements and storm water inspection reports.

C. RCE/Inspector:
1. Update PPP whenever there is a change in design, construction, operation or maintenance, which has a significant effect on the discharge of pollutants from the project.
2. Maintain an up-to-date list that identifies contractors and subcontractors as co-permittees.
3. Make these plans available to the DNR upon their request.
4. Conduct joint required inspections of the site with the contractor/subcontractor.
5. Complete an inspection report after each inspection.
6. Signature authority on storm water inspection reports and Notice of Discontinuation (NOD).

II. PROJECT SITE DESCRIPTION

A. This Pollution Prevention Plan (PPP) is for the construction of I-74 mainline, ramps, and local roads.

B. This PPP covers approximately 52 acres with an estimated 41 acres being disturbed. The portion of the PPP covered by this contract has 1.4 acres disturbed.

C. The PPP is located in an area of one soil association Kenyon-Floyd-Clyde. The estimated average SCS runoff curve number for this PPP after completion will be 86.

D. Storm Water Site Map - Multiple sources of information comprise the base storm water site map including:
1. Drainage patterns – Plan and Profile sheets and Situation plans.
2. Proposed Slopes – Cross Sections.
3. Areas of Soil Disturbance – construction limits shown on Plan and Profile sheets.
4. Location of Structural Controls – Tabulations on C sheets.
5. Locations of Non-structural Controls – Tabulations on C sheets.
6. Locations of Stabilization Practices – generally within construction limits shown on Plan and Profile sheets.
7. Surface Waters (including wetlands) – Plan and Profile sheets.
8. Locations where storm water is discharged – Plan and Profile sheets.

E. The base site map is amended by contract modifications and progress payments of completed erosion control work.

F. Runoff from this work will flow into Mississippi River.

III. CONTROLS

A. The contractor's work plan and sequence of operations specified in Article 2602.03 for accomplishment of storm water controls should clearly describe the intended sequence of major activities and for each activity define the control measure and the timing during the construction process that the measure will be implemented.

B. Preserve vegetation in areas not needed for construction.

C. Section 2601 and 2602 of the Standard Specifications define requirements to implement erosion and sediment control measures. Actual quantities used may vary from the Base PPP and amendment of the plan will be documented via fieldbook entries or by contract modification. Additional erosion and sediment control items may be required as determined by the inspector and/or contractor during storm water monitoring inspections. If the work involved is not applicable to any contract items, the work will be paid for according to Article 1109.03 paragraph B.

1. EROSION AND SEDIMENT CONTROLS

a. Stabilization Practices
1) Site plans will ensure that existing vegetation is preserved where attainable and disturbed portions of the site will be stabilized.
2) Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased.
3) Temporary stabilizing seeding shall be completed as the disturbed areas are constructed. If construction activity is not planned to occur in a disturbed area for at least 21 days, the area shall be stabilized by temporary seeding or mulching within 14 days. Other stabilizing methods shall be used outside the seeding time period.
4) Stabilization measures to be used for this project are located in the Estimated Project Quantities (100-1A) and Estimate Reference Information (100-4A) located on the C sheets of the plan. Additional items may be found in the Inspector's Daily Reports (IDR) or Contract Modifications.

b. Structural Practices
1) Structural practices will be implemented to divert flows from exposed soils and detain or otherwise limit runoff and the discharge of pollutants from exposed areas of the site.
2) Structural items to be used for this project are located in the Estimated Project Quantities (100-1A) and Estimate Reference Information (100-4A) located on the C sheets of the plan, as well as all other item specific Tabulations. Typical drawings detailing construction of the devices to be used on this project can be found on the B sheets of the plan or are referenced in the Standard Road Plans Tabulation.

c. Storm Water Management
1) Measures shall be installed during the construction process to control pollutants in storm water discharges that will occur after construction operations have been completed. The installation of these devices may be subject to Section 404 of the Clean Water Act.

110-12A
04-21-15

POLLUTION PREVENTION PLAN

2. OTHER CONTROLS

a. Contractor disposal of unused construction materials and construction material wastes shall comply with applicable state and local waste disposal, sanitary sewer, or septic system regulations. In the event of a conflict with other governmental laws, rules and regulations, the more restrictive laws, rules or regulations shall apply.
1) Vehicle Entrances and Exits - Construct and maintain entrances and exits to prevent tracking of sediments onto roadways.
2) Material Delivery, Storage and Use - Implement practices to prevent discharge of construction materials during delivery, storage, and use.
3) Stockpile Management - Install controls to reduce or eliminate pollution of storm water from stockpiles of soil and paving.
4) Waste Disposal - Do not discharge any materials, including building materials, into waters of the state, except as authorized by a Section 404 permit.
5) Spill Prevention and Control - Implement procedures to contain and clean-up spills and prevent material discharges to the storm drain system and waters of the state.
6) Concrete Residuals and Washout Wastes - Designate temporary concrete washout facilities for rinsing out concrete trucks. Provide directions to truck drivers where designated washout facilities are located.
7) Vehicle and Equipment Cleaning - Employ washing practices that prevent contamination of surface and ground water from wash water.
8) Vehicle and Equipment Fueling and Maintenance - Perform on site fueling and maintenance in accordance with all environment laws such as proper storage of onside fuels and proper disposal of used engine oil or other fluids on site.
9) Litter Management - Ensure employees properly dispose of litter.

3. APPROVED STATE OR LOCAL PLANS

During the course of this construction, it is possible that situations will arise where unknown materials will be encountered. When such situations are encountered, they will be handled according to all federal, state, and local regulations in effect at the time.

IV. MAINTENANCE PROCEDURES

The contractor is required to maintain all temporary erosion and sediment control measures in proper working order, including cleaning, repairing, or replacing them throughout the contract period. This shall begin when the features have lost 50% of their capacity.

V. INSPECTION REQUIREMENTS

A. Inspections shall be made jointly by the contractor and the contracting authority at least once every seven calendar days. Storm water monitoring inspections will include:
1. Date of the inspection.
2. Summary of the scope of the inspection.
3. Name and qualifications of the personnel making the inspection.
4. Rainfall amount.
5. Review erosion and sediment control measures within disturbed areas for the effectiveness in preventing impacts to receiving waters.
6. Major observations related to the implementation of the PPP.
7. Identify corrective actions required to maintain or modify erosion and sediment control measures.

B. Include storm water monitoring inspection reports in the Amended PPP. Incorporate any additional erosion and sediment control measures determined as a result of the inspection. Immediately begin corrective actions on all deficiencies found and complete all actions within 3 calendar days of the inspection.

VI. NON-STORM WATER DISCHARGES

This includes subsurface drains (i.e. longitudinal and standard subdrains) and slope drains. The velocity of the discharge from these features may be controlled by the use of patio blocks, Class A stone, erosion stone or other appropriate materials.

VII. POTENTIAL SOURCES OF OFF RIGHT-OF-WAY (ROW) POLLUTION

Silts, sediment, and other forms of pollution may be transported onto highway right-of-way (ROW) as a result of a storm event. Potential sources of pollution located outside highway ROW are beyond the control of this PPP. Pollution within highway ROW will be conveyed and controlled per this PPP.

VIII. DEFINITIONS

A. Base PPP - Initial Pollution Prevention Plan.
B. Amended PPP - May include Plan Revisions or Contract Modifications for new items and fieldbook entries made by the inspector.
C. IDR - Inspector's Daily Report - this contains the inspector's daily diary and item postings.
D. Controls - Methods, practices, or measures to minimize or prevent erosion, control sedimentation, control storm water, or minimize contaminants from other types of waste or materials.
E. Signature Authority - Representative from Designer, Contractor/Subcontractor, or RCE/Inspector authorized to sign various storm water documents.

CERTIFICATION STATEMENT

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

____
Signature

Jeffrey J. Tardy
Printed or Typed Name

232-3B
10-20-15

EROSION CONTROL
(URBAN SEEDING)

Following the completion of work in a disturbed area, place seed, fertilizer, and mulch on the disturbed area as follows:

Use seed mix and fertilizer meeting the requirements of Article 2601.03,C,4 and Section 4169 of the Standard Specifications.

Use mulch meeting the requirements of Articles 2601.03,E,2,a and 4169.07,A of the Standard Specifications.

Preparing the seedbed and furnishing and applying seed, fertilizer, and mulch is incidental to mobilization and will not be paid for separately.

ATTACHMENT F

YEAR 2 MONITORING OF UNIONIDS RELOCATED FROM THE NEW INTERSTATE 74 BRIDGE CROSSING, MISSISSIPPI RIVER POOL 15

Year 2 Monitoring of Unionids Relocated from the New Interstate 74 Bridge Crossing, Mississippi River Pool 15

Prepared for:
Stantec Consulting Services, Inc.

Prepared by:
EcoAnalysts, Inc.

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Final Report
April 2019

EcoAnalysts, Inc.

ACKNOWLEDGMENTS
This project was funded by the Iowa Department of Transportation (IADOT) through Stantec Consulting Services, Inc. Mr. Terry VanDeWalle and Ms. Mary Kay Solberg coordinated the project for Stantec and IADOT, respectively. Ms. Emily Grossman of EcoAnalysts, Inc. was the project manager, field team leader, and primary author of this report. Mr. Robert Williams, Mr. Chris Bailey, Mr. Mitchel Williams, Mr. Jerry Holmes, Mr. Benjamin Dunn, Mr. Kendall Cranney, Mr. Ryan Foley, and Mr. David Ford (EcoAnalysts) assisted with the field effort. Ms. Heidi Dunn (EcoAnalysts) assisted with report preparation.

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1.0 INTRODUCTION

The Iowa and Illinois Departments of Transportation are replacing the Interstate 74 bridge over the Mississippi River. The existing bridge crosses Pool 15 near river mile 486, and connects the cities of Bettendorf, Iowa (Scott County) and Moline, Illinois (Rock Island County; Figure 1-1). Pool 15 is known to harbor a species-rich unionid (freshwater mussel) assemblage, including several federally endangered species, and the bridge project area overlaps the Sylvan Slough *Lampsilis higginsii* Essential Habitat Area (EHA). Therefore, Ecological Specialists, Inc. (now EcoAnalysts) was contracted to conduct a mussel survey in the bridge project area in 2014. The 2014 survey results indicated that a dense, species-rich mussel bed was present on the Illinois (left descending) bank beneath both the proposed and existing bridge alignments, and a lower density unionid community was present on the Iowa (right descending) bank; these assemblages included 3 federally endangered species (*Lampsilis higginsii, Plethobasus cyphyus,* and *Margaritifera [=Cumberlandia] monodonta*) as well as species listed as threatened or endangered (T&E) in Illinois and/or Iowa (ESI, 2014).

A mussel mitigation task force was formed following the 2014 survey to aid in developing mitigation options for the bridge project. The task force determined that unionids would need to be relocated from project impact areas and proposed additional studies and monitoring projects to mitigate impacts to unionids. A Biological Assessment (BA) was prepared to evaluate effects of the bridge replacement project on federally endangered species (Stantec, 2016). A Conservation Plan (CP) was prepared to evaluate effects of the bridge replacement project on Illinois state threatened and endangered (T&E) species (Appendix A of the BA).

The U. S. Fish and Wildlife Service (USFWS) issued a final Biological Opinion (BO) in response to the BA on July 14, 2016. The BO concluded that the bridge project would not jeopardize the continued existence of *M. monodonta, P. cyphyus,* or *L. higginsii,* but that incidental take of these species would occur. Therefore, several Reasonable and Prudent Measures (RPMs) were identified to minimize impacts to federally listed species, including relocation of unionids from construction and demolition areas and subsequent monitoring of relocation areas to assess the health and survival of relocated individuals. An Incidental Take Authorization (ITA) was also issued in response to the CP to allow the incidental take of Illinois state T&E species. The Illinois Department of Natural Resources, Iowa DOT, and Illinois DOT signed the Incidental Take Authorization in July 2016. The RPMs were included in the ITA as mitigation.

Per the RPMs set forth in the BO and ITA, EcoAnalysts (formerly Ecological Specialists, Inc.) relocated unionids from proposed pier construction areas in the new bridge Action Area in August – October 2016 and May – June 2017 (Figure 1-1). Common and state T&E species collected from the Illinois piers were distributed among several relocation areas examining the effects of increasing unionid density by a large percentage. Common and state T&E species collected from the Iowa piers were distributed throughout a single relocation area along the Iowa bank upstream of the bridge crossing. *Lampsilis higginsii* and *P. cyphyus* were placed in several monitoring grids, while *M. monodonta* were placed at a previously-selected site downstream of the bridge corridor. All placement sites will be monitored for a period of 10 years post-relocation. This report presents the results of the second monitoring event at the placement sites.

2.0 METHODS

2.1 Density study

Relocation of unionids from the I-74 bridge footprint provided an opportunity to investigate the effects of increasing unionid density at varying rates in relocation areas. Anecdotal evidence suggests that unionid assemblages often return to pre-relocation densities over time, and that increasing density by a large percentage may be detrimental (Dunn, pers. obs.). To examine the effects of such density increases on resident unionid assemblages, common and state T&E unionids collected from the Illinois pier construction areas were placed in study areas in varying numbers, and monitoring was conducted to describe post-relocation changes in unionid density, mortality, or other assemblage characteristics.

Study area design

The density study was designed using 3 different unionid beds (Illiniwek Park, Eagle's Landing, and Upstream; Figure 2-1) to determine if different beds may have different carrying capacities and to allow results to be replicated. Within each bed, 3 equally-sized study areas were established for 3 treatments: a control area in which no unionids were placed, an area in which resident unionid density was to be doubled, and an area in which density was to be tripled (Figures 2-2; 2-3; 2-4). Study area locations were randomly selected by generating 3 random points in each unionid bed. The size of the areas was determined based on the existing density in each bed and the expected number of unionids to be relocated and was initially set at 2,200 m^2. Based on data collected in July 2016 baseline samples, the study areas were reduced to 1,286 m^2 and were redrawn as squares to facilitate marking the boundaries during the relocation effort (Figures 2-2; 2-3; 2-4). The number of unionids that could be placed in each area at the prescribed density increase was recalculated using the revised areas, and the new estimates were used to guide placement of unionids during the 2016 and 2017 relocation efforts. If the capacity (estimated number of unionids that the area could accommodate) of a study area was reached during the relocation, no additional unionids were placed in the area.

Sample collection

Quantitative sampling was used to estimate baseline (pre-relocation) unionid density and to assess changes in unionid density after the relocation. Eighty (80) randomly distributed samples were collected in the initial study areas in July 2016 to estimate density with 15-20% precision. The original density study areas were revised using the July 2016 data. Relocated unionids were placed in the revised study areas, and all subsequent sampling was conducted in the revised study areas. Forty (40) random samples were collected in the double (2x) and triple (3x) density treatment areas in November 2016 to obtain post-relocation density estimates. However, due to the smaller sample size, the confidence interval for November 2016 density estimates was approximately 50% of the mean. Quantitative sampling was repeated in all density study areas in August 2017 and September-October 2018. Sample size for the 2017 and 2018 monitoring events was again increased to 80 random samples per study area to achieve a confidence interval within 20-25% of the mean.

General sample collection and unionid processing methods were the same for all sampling events. For each sample, a diver excavated all substrate within a 0.25-m^2 quadrat frame into an attached mesh bag (6 mm mesh). Substrate was sieved through 12 mm and 6 mm sieves and all unionids were retrieved from the sample. Live unionids were identified to species, measured (length in mm), and aged (external annuli count), and zebra mussel infestation was recorded. Sex and gravidity (when applicable) were recorded for sexually dimorphic species. Federally endangered species were also measured for height and width and marked with a unique ID number using a Dremel rotary tool. 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). Fresh dead shells were counted to estimate mortality. Unionids relocated from the bridge were etched with a slash mark on the anterior edge of the shell prior to placement in the study areas. All live and fresh dead unionids collected in post-relocation monitoring events were checked for marks and were recorded as either resident (unmarked) or relocated (marked) to evaluate density and mortality of relocated individuals. Depth, substrate composition, and GPS coordinates were recorded for each sample.

Unionid community characteristics were assessed separately for resident and relocated unionids to better understand changes in unionid density and distribution. Density estimates were compared among years using R (R Core Team, 2018). Data were first tested for normality using the Shapiro-Wilk test. Density estimates were compared using the Kruskal-Wallis test, with post-hoc pairwise comparisons conducted using the Dunn test. Average length (mm) of relocated unionids was also compared using Kruskal-Wallis and Dunn tests to assess growth. The expected number of species at a sample size of 100 individuals (ES_100; estimated via rarefaction) was calculated to allow for more robust comparisons of species richness among years.

The objective of the density study was to evaluate changes in resident and relocated unionid assemblages following large increases in density. The initial goal of doubling or tripling the pre-relocation density was not met in most study areas, but unionid density was increased at different rates in different study areas. The 6 treatment areas were categorized based on the estimated percent density increase after placement of relocated individuals. Density was increased by approximately 200% in the Upstream 3x Density, approximately 100% in the Illiniwek Park 2x Density, Illiniwek Park 3x Density, and Upstream 2x Density areas, and <50% in the Eagle's Landing 2x Density and Eagle's Landing 3x Density areas. Density and mortality were examined along the gradient of relative density increase to determine if patterns or trends in these metrics were related to the magnitude of the density increase.

<u>Additional sampling</u>

Density of relocated unionids in 2016 and 2017 post-relocation monitoring was lower than expected, given the number of individuals placed. The distribution of relocated unionids in 2017 suggested that some relocated unionids may have been swept downstream out of the study areas. Additional samples were collected in 2018 to determine if relocated unionids were present outside the study areas. A 15-m buffer was established shoreward, riverward, and downstream of the 2x and 3x Density areas in each bed (no shoreward buffer was included on the Eagle's Landing 3x Density area as the edge of the study area is adjacent to the bank; Figures 2-2; 2-3; 2-4). The 15-m buffer distance was selected to avoid overlap with other nearby study areas (Control area downstream of the 3x Density area in the Eagle's Landing bed, and T&E grid downstream of the 2x Density area in the Upstream bed; Figure 2-3; Figure 2-4).

Relocated unionids were concentrated in the downstream portions of the Illiniwek 2x Density, Eagle's Landing 2x and 3x Density, and Upstream 2x Density areas in 2017. Thirty (30) randomly distributed quantitative samples were collected in the 15-m buffer around each of these areas in 2018. Samples were collected and unionids were processed as described above. In contrast, relocated unionids were more evenly distributed in the Illiniwek 3x Density and Upstream 3x Density areas in 2017, suggesting that fewer unionids may have moved outside these areas. Therefore, qualitative searches were conducted in the 15-

m buffer rather than quantitative samples. Eighteen (18) 5-min searches, distributed throughout the buffer, were conducted in each area. For each sample, a diver searched the substrate by hand, collecting all unionids encountered in 5 min. Unmarked (resident) unionids were identified, counted, and categorized as adult (>5 years old) or juvenile (≤5 years old). Marked (relocated) unionids were identified, measured, and aged as in quantitative samples. Fresh dead shells were identified, counted, and recorded as resident (unmarked) or relocated (marked). Depth, substrate, and GPS coordinates were recorded at the start of each search.

2.2 Endangered species grids

Monitoring of federally endangered unionid species was conducted to evaluate the health of unionids after relocation and to ensure that take estimates were not being exceeded. All *L. higginsii* collected in the 2016 and 2017 relocation efforts were distributed among 3 grids, 1 each in the Illiniwek Park, Eagle's Landing, and Upstream unionid beds, while *P. cyphyus* were distributed among 2 grids, 1 each in the Illiniwek Park and Eagle's Landing beds (Figures 2-2; 2-3; 2-4). Grids were divided into 4 cells. Relocated individuals were hand-placed in randomly selected grid cells at a rate not to exceed 50% of the existing density, and the initial placement location (bed and grid cell number) of each individual was recorded. At the end of the 2016 relocation, grids were marked with earth anchors at the corners of each grid.

Grids were monitored in 2017 and 2018 to quantify survival and growth of relocated individuals. For the 2017 monitoring, the grids were delineated with ropes, weights, and the previously-placed corner anchors, and each grid cell was searched visually and tactually, collecting all unionids encountered. Multiple passes of each cell were conducted until the cell had been thoroughly searched and the final pass(es) returned few or no marked individuals. This method, while ensuring most marked individuals in the grid were likely to be collected, required substantial disturbance of the substrate throughout the grids. Monitoring methods for 2018 were therefore modified to reduce disturbance. Rather than qualitatively searching the entire grid, quantitative samples were collected with the goal of collecting approximately 10% of the marked individuals in each grid. To meet this goal, 4 haphazardly-distributed samples were collected in each grid cell, for a total of 16 samples per grid. Samples were collected and resident (unmarked) unionids were processed as in the density study, described above. All marked federal T&E species were measured (length, width, and height in mm) and aged, and the unique ID number of each individual was recorded. Sex and gravidity were also recorded for *L. higginsii.* After processing, all unionids were spread by hand throughout the grid cell from which they were collected.

2.3 *Margaritifera (=Cumberlandia) monodonta* monitoring

Margaritifera monodonta is typically found in boulder or large rock substrate; therefore, a site with habitat suitable for this species was identified for placement of individuals collected from the new bridge corridor. Several *M. monodonta* were experimentally relocated in October 2015 to 3 sites harboring existing populations and were subsequently monitored using PIT tags to evaluate suitability of these sites for placement of additional individuals (ESI, 2016; Figure 2-5). PIT tags were affixed to the outer shell of all *M. monodonta* collected in the 2016 and 2017 relocation efforts in the same manner as the experimentally relocated individuals. Tagged individuals were hand-placed at the Sylvan Slough site, as this site had the best recovery of previously relocated individuals.

The 3 relocation sites were monitored in late October 2015 and April 2016, prior to placement of additional individuals. Monitoring was repeated in 2017 and 2018 to assess survival of relocated *M. monodonta*, including both the initial group of relocated individuals and those relocated from the bridge in 2016 and 2017. A Biomark HPR Plus tag reader with a custom-designed antenna (Biomark, Boise, ID) was used to detect tagged individuals. A diver passed the antenna over the substrate while the topside crew directed the diver to the site and informed him of any detections. If a tag was detected, the diver searched the substrate by hand to locate the tagged individual. Tagged shells were brought to the surface to assess their status and were subsequently returned to the substrate at their original collection location. General observations about the position of mussels in the substrate, presence of resident (untagged) individuals, and habitat were also recorded.

2.4 Sylvan Slough silt monitoring

Silt curtains were originally proposed as a conservation measure during construction of the new I-74 bridge to minimize the effects of silt accumulation on unionids in Sylvan Slough. However, the U.S. Fish and Wildlife Service, Illinois Department of Natural Resources, and Iowa Department of Natural Resources later recommended removing the silt curtains as a conservation measure due to concerns about direct impacts of the silt curtains on unionid resources. Monitoring unionids and habitat characteristics within Sylvan Slough was suggested as an alternative to assess whether silt accumulated over the substrate, and whether sedimentation affected unionids downstream of the construction area as in-stream work progressed.

The silt monitoring area began at the west (downstream) edge of the new bridge corridor and extended downstream approximately 500 m (Figure 2-6). Semi-quantitative, qualitative, and quantitative sampling methods were used to assess changes in habitat and unionid assemblage characteristics. Semi-quantitative transects were used to evaluate habitat characteristics at regular intervals downstream of the new bridge corridor. Four (4) transects were established perpendicular to flow across the width of Sylvan Slough. Transects were placed 50 m, 100 m, 200 m, and 400 m downstream of the new bridge crossing (Figure 2-6). Transects were marked at 10 m intervals. A diver crawled along the transect line and determined the substrate composition at each 10-m mark. If silt was observed on top of the substrate, the diver estimated the depth of silt present. Transects were sampled in early August 2017 to describe baseline (pre-construction) habitat conditions, and in September 2017, October 2017, and October 2018 to monitor habitat characteristics and silt accumulation as construction progressed. Semi-quantitative sampling only included collection of habitat data; no unionids were collected.

The City of Moline's water intake is located just downstream of the existing I-74 bridge (Figure 2-6). Potential silt accumulation around this structure was also a concern. Qualitative searches were conducted around the intake structure to monitor changes in habitat. The topside crew directed the diver around the structure, and the diver reported observations regarding substrate composition and silt depth at various points around the structure. No diving was conducted in the immediate vicinity of the intake opening for safety reasons. As in semi-quantitative sampling, qualitative searches only included collection of habitat data.

Quantitative sampling was used to evaluate unionid density and assemblage characteristics. One hundred (100) quantitative samples, arranged in a 3 random start design, were collected in August 2017 to obtain a baseline (pre-construction) density estimate. Quantitative sampling was repeated in October 2018 to assess changes in habitat and/or unionid density as construction progressed. Samples were collected and unionids were processed as in the density study, described above.

2.5 Construction area

Quantitative monitoring of the new bridge construction area was included as an RPM in the BO to evaluate the effects of construction on unionids that were not relocated, and to determine if recolonization occurs over time. The first monitoring event will occur when construction of the piers has been completed and divers can safely be deployed. Pier construction was still underway during the 2018 field season, so formal quantitative monitoring was not conducted. Instead, qualitative searches were conducted in safely accessible areas to assess the condition of the unionid assemblage in the interim. Work barges were spudded throughout much of the construction area; access was limited to the Illinois side of the river between Piers 3 and 4 (westbound [downstream] span only) and between Piers 4 and 5 (both spans; Figure 2-7). Six (6) 5-min searches were conducted between Piers 3 and 4, and 12 searches were conducted between Piers 4 and 5. For each search, the diver crawled along the bottom, collecting all live and recently dead (i.e. valves still attached) unionids encountered in 5 min. Live unionids were identified, counted, and categorized as adult or juvenile. Federally endangered species were measured (length, width, and height in mm), aged, and marked with a unique ID number. Common and state-listed species were returned to the river from the surface; federal T&E species were hand-placed in the substrate as water temperature was below 50°F. Fresh dead shells were identified and counted to estimate mortality. Depth, substrate composition, and GPS coordinates were recorded at the start of each search.

2.6 Iowa relocation area

Common and state T&E species collected from the Iowa pier areas were placed in a single relocation area along the Iowa bank upstream of the bridge crossing (Figure 2-1). This area was scheduled for Year 2 monitoring in 2018. However, high river levels and staged construction barges precluded safe sampling. This area will be sampled in the 2019 field season if/when the area can be safely accessed.

3.0 RESULTS AND DISCUSSION

3.1 Density study

3.1.1 Illiniwek Park

The Illiniwek Park bed is located on the left descending bank just downstream of Lock and Dam 14. The Control and 3x Density areas are in the upstream portion of the bed (see Figure 2-2). Substrate in both areas consisted primarily of silt and clay, with smaller amounts of shell, detritus, and woody debris present in some samples (Table 3-1). Both areas were relatively shallow; maximum observed depth in all sampling events was 1.8 m (6 ft) in the Control area and 2.4 m (8 ft) in the 3x Density area (Table 3-1). Substrate in the 2x Density area, located farther downstream, was comprised primarily of sand and shell, and depth ranged from 1.5 m (5 ft) to 4.0 m (13 ft) across all sampling events (Table 3-1).

<u>Resident unionids</u>

Resident unionid density and assemblage characteristics varied somewhat among study areas and years. Total density of resident unionids in the Control area in 2018 was 10.4 ± 1.4 unionids/m^2. Total density, adult density, and juvenile density in the Control area did not change significantly among sampling events (Table 3-2). Total resident density was 30.1 ± 3.0 unionids/m^2 and 22.1 ± 2.1 unionids/m^2 in the 2x Density and 3x Density areas, respectively. In both areas, total density was significantly lower in November 2016 than in other sampling events (Table 3-3; Table 3-4). This pattern may be associated with seasonal changes in unionid distribution; unionids may have burrowed deeper into the substrate in colder temperatures, resulting in some unionids being missed in the November 2016 sampling event. Juvenile density fluctuated in both areas, likely due to variable recruitment, particularly in opportunistic species such as *Leptodea fragilis*. Variation in recruitment, and therefore in juvenile density, appeared to be one of the primary drivers of total density fluctuations in the 2x and 3x Density areas, as adult density did not differ in either study area except in November 2016. Density of fresh dead shells in 2018 was 1.2 ± 0.5 shells/m^2 in the Control and 2x Density areas, and 1.9 ± 0.6 shells/m^2 in the 3x Density area (Tables 3-2; 3-3; 3-4). Density of fresh dead shells was higher in all areas in 2018 than in the baseline (July 2016) sampling event. However, percent mortality fluctuated among years with no apparent trend, and mortality in most sampling events was less than 10%, which is considered typical of many Mississippi River assemblages (Tables 3-2; 3-3, 3-4).

Resident species richness and composition varied somewhat among the Illiniwek Park study areas but were similar among sampling events within areas. In all sampling events, species richness was lowest in the Control area (11 - 14 species), intermediate in the 3x Density area (12 - 17 species), and highest in the 2x Density area (15 - 20 species; Tables 3-2; 3-3; 3-4). *Amblema plicata* and *Obliquaria reflexa* were the 2 most abundant species collected in the Control and 3x Density areas in all years. These species were also abundant in the 2x Density area, as was *Cyclonaias (=Quadrula) pustulosa* (Tables 3-2; 3-3; 3-4).

No strong trends in resident unionid density or mortality were observed in the Illiniwek Park study areas. Density in the 2x and 3x Density areas fluctuated, but these fluctuations appear to be caused primarily by changes in juvenile density associated with variable recruitment. Percent mortality and density of fresh dead shells fluctuated among years in all 3 study areas. Although density of fresh dead shells was higher in 2018 than in the baseline sampling event, no trends in percent mortality were observed, and mortality was less than 10% in most years. In addition, changes in fresh dead shell density were observed in the Control area as well as both treatment areas, suggesting that placement of relocated individuals in the treatment areas is not likely associated with increased mortality of resident individuals.

Relocated unionids

During the 2016 and 2017 relocation efforts, 23,694 unionids were placed in the Illiniwek Park 2x Density area and 28,053 unionids were placed in the 3x Density area (Table 3-5). Changes in density of relocated unionids were observed over time in both study areas. Total density of relocated unionids in 2018 was 6.6 ± 2.5 unionids/m^2 in the 2x Density area and 7.1 ± 2.0 unionids/m^2 in the 3x Density area (Table 3-3; Table 3-4). Total density and adult density did not differ significantly among years in the 2x Density area, but juvenile density decreased from 2016 to 2017 and remained low in 2018 (Table 3-3). In contrast, total density and adult density in the 3x Density area were significantly higher in 2017 than in other years. The increase in density in 2017 may be due in part to the placement of additional individuals in early 2017. Juvenile density in the 3x Density area was lower in 2018 than in 2017 but was not different from 2016 (Table 3-4). The proportion of juveniles (% ≤5 years old) decreased over time in both study areas, which was expected to occur as young individuals aged. Density of fresh dead shells was 0.2 ± 0.2 shells/m^2 in the 2x Density area and 0.7 ± 0.4 shells/m^2 in the 3x Density area in 2018 (Table 3-3; Table 3-4). No significant variation in fresh dead shell density were detected among years, and percent mortality of relocated unionids was less than 10% in all sampling events. Several additional marked shells from both study areas were categorized as weathered dead and were not included in estimates of recent mortality. Average length of relocated unionids increased from 2017 to 2018 in the 2x Density area but was not different among years in the 3x Density area (Table 3-3; Table 3-4). However, growth was qualitatively observed in unionids in both study areas, particularly in younger individuals, which typically exhibit faster growth than older individuals.

Species richness and composition of relocated unionids varied little in either study area. Although actual species richness varied somewhat among years, ES_100 remained similar, ranging from 12 to 13 species in the 2x Density area and 11 to 13 species in the 3x Density area (Table 3-3; Table 3-4). Species composition in monitoring events reflected the species composition of unionids placed in the areas. *Cyclonaias pustulosa, O. reflexa,* and *A. plicata* were the most abundant species placed in the study areas and were the most abundant species recaptured in all monitoring events (Table 3-3; Table 3-4).

Relocated unionids were not evenly distributed throughout the study areas. Individuals were concentrated in the downstream shoreward corner of the 2x Density area in both 2017 and 2018 (Figure 3-1). Distribution in the 3x Density area appeared to shift between 2017 and 2018. Most relocated unionids were collected in the shoreward half of the area in 2017. However, most individuals were collected in the upstream half of the area in 2018, and marked individuals were scarce in the downstream shoreward corner, where they had been moderately abundant the previous year (Figure 3-1). The change in distribution in this area could indicate active movement by relocated unionids; perhaps the softer silt/clay substrate in this study area allows for more unobstructed movement. Other factors, such as unionids being displaced by high flow or chance variation in sample placement from year to year, could play a role as well.

Density in both Illiniwek Park study areas was expected to increase approximately 100% after placement of relocated unionids, resulting in estimated densities of 18.4 unionids/m^2 in the 2x Density area and 19.3 unionids/m^2 in the 3x Density area after the 2016 relocation (Table 3-6). The November 2016 sampling results did not reflect this increase, as density was estimated at only 9.4 ± 4.2 unionids/m^2 in the 2x Density area and 11.2 ± 5.5 unionids/m^2 in the 3x Density area. Density estimates in 2017, after additional unionids were placed, suggested that 10,674 live unionids remained in the 2x Density area, while 386 unionids had died, accounting for only 46.7% of the total number of unionids placed. An estimated 21,605 live unionids and 257 dead unionids were present in the 3x Density area, accounting for 77.9% of unionids placed (Table 3-6). When confidence intervals are considered, the number of unionids in the 2x Density area declined between 2016 and 2017; however, the upper confidence interval on the estimated number of unionids remaining in the 3x Density area was similar to the initial number placed (Figure 3-2).

Distribution patterns in 2017 suggested that the discrepancy could have occurred in part because unionids had been washed downstream when they were initially placed in the study areas, as river levels were unusually high throughout the summer and fall of 2016. Additional samples collected outside the study areas in 2018 indicated that relocated individuals were present outside the areas in low abundance (Table 3-6; Figure 3-1). Density of relocated individuals outside the 2x Density area was 1.1 ± 1.6 unionids/m^2. If unionids occurred throughout the 15-m buffer at this density, approximately 2,266 additional individuals could be present (Table 3-7). However, all marked individuals were collected near the downstream shoreward corner of the main study area, and few individuals likely occur along the shoreward or riverward edges of the area. Samples in the study area and buffer combined accounted for approximately 11,629 unionids (49.1% of unionids placed), similar to the estimated number of unionids present in 2017 (Table 3-6; Figure 3-2). Approximately 10,031 relocated unionids may be present in the 3x Density area, accounting for 35.8% of all unionids placed (Table 3-6; Figure 3-2). Although an estimate of the total number of relocated unionids in the buffer cannot be generated from qualitative data, a few additional unionids appear to be present. The presence of unionids in buffer areas suggests that some unionids were passively transported out of the study area or that unionids may be actively spreading out from their original clumped distribution. Collecting additional samples in the buffer area and/or placing samples systematically (rather than randomly) could help to clarify changes in density and distribution of relocated unionids in future monitoring.

Density was approximately doubled (nearly 100% increase) in both the 2x Density and 3x Density areas. Density of relocated unionids did not change among years in the 2x Density area but was significantly higher in the 3x Density area in 2017 than in other years. However, less than 50% of the relocated unionids were accounted for in 2018. Growth was qualitatively observed for many marked unionids during sampling; average length increased in the 3x Density area from 2017 to 2018 but was not different among years in the 2x Density area. No significant variation in density of fresh dead marked shells was observed, and mortality of relocated individuals was less than 10% in all years. Additional samples outside the study areas suggested that some unionids were displaced downstream, perhaps farther than the 15-m buffer that was sampled, as abundance of individuals outside the study areas was low. Lower than expected density of relocated individuals may be due to a combination of factors, including underestimated mortality rates, some movement of individuals outside the study areas, and clumped distribution of individuals inside the study areas.

3.1.2 Eagle's Landing

The Eagle's Landing bed is located on the right descending bank between the confluences of Pigeon Creek upstream and Crow Creek downstream. The Control and 3x Density areas are in the upstream portion of the bed, while the 2x Density area is farther downstream (see Figure 2-3). Habitat was comparable in all areas, consisting primarily of mixed sand, silt, and shell. Cobble and gravel were present near the shoreward edges, and sand was the dominant substrate constituent riverward (Table 3-8). Depth ranged from 0.3 m (1 ft) to 3.4 m (11 ft) in the Control area, 0.3 m (1 ft) to 3.7 m (12 ft) in the 2x Density area, and 0.6 m (2 ft) to 3.0 m (10 ft) in the 3x Density area (Table 3-8).

Resident unionids

Resident unionid density varied among Eagle's Landing study areas, but similar patterns were observed in all areas. Total density of resident unionids in 2018 was 38.7 ± 7.7 unionids/m^2 in the Control area, 24.3 ± 3.4 unionids/m^2 in the 2x Density area, and 52.3 ± 7.3 unionids/m^2 in the 3x Density area (Tables 3-9; 3-10; 3-11). Total density declined sharply after the July 2016 sampling event in all study areas, then remained unchanged in the Control and 2x Density areas (Table 3-9; Table 3-10). Total density increased in the 3x Density area from November 2016 to 2018 but was still lower in 2018 than in July 2016 (Table 3-11). As at Illiniwek Park, variation in juvenile density appeared to be a primary driver of the total density decrease after July 2016, as juvenile density was significantly higher in July 2016 than in any other sampling event. High juvenile density in July 2016 is likely due to high recruitment in the opportunistic species *Utterbackia imbecillis*; this species was one of the most abundant species in all study areas in July 2016 but was scarce in subsequent sampling events. In contrast, adult density was not different among years in the Control area and fluctuated with no apparent increasing or decreasing trend in the 2x and 3x Density areas. Density of fresh dead shells was lowest (1.4 ± 0.6 shells/m^2) in the 3x Density area and highest (3.0 ± 1.0 unionids/m^2) in the Control area in 2018, and percent mortality was less than 10% in all study areas. Both fresh dead shell density and percent mortality fluctuated over time in the study areas, but no apparent trends were observed (Tables 3-9; 3-10; 3-11).

Resident species richness and composition were comparable in the study areas. Species richness varied somewhat among years, but at least 20 species were collected in all sampling events except November 2016; the lower richness in this event may be due to lower sample size and fewer individuals collected. ES_100 over all sampling events was 13 – 15 species in the Control and 3x Density areas and 12 – 14 species in the 2x Density area (Tables 3-9; 3-10; 3-11). *Obliquaria reflexa, C. pustulosa,* and *A. plicata* were typically the most abundant species in all study areas. *Utterbackia imbecillis* was present in high abundance in July 2016 but not in other years, and *L. fragilis* was more abundant in 2018 than in previous years in the Control and 3x Density areas. These species exhibit high variability in recruitment, and their relative abundance in a particular year appeared to vary accordingly, with high relative abundance in years with high recruitment.

Total and juvenile resident unionid density were significantly higher in July 2016 than in post-relocation monitoring events in all Eagle's Landing study areas; this appeared to be due to high recruitment, and therefore high relative abundance, of *U. imbecillis* in 2016 but not in subsequent years. No increasing or decreasing trends in adult density were observed, suggesting changes in total density are primarily driven by fluctuations in recruitment. Percent mortality and density of fresh dead shells also fluctuated among years in all 3 study areas but did not increase significantly in treatment areas post-relocation. Placement of relocated unionids in treatment areas does not appear to be affecting resident unionids.

Relocated unionids

During the 2016 and 2017 relocation efforts, 28,164 unionids were placed in the Eagle's Landing 2x Density area and 28,378 unionids were placed in the 3x Density area (Table 3-5). Total density of relocated unionids in 2018 was 6.8 ± 1.9 unionids/m^2 in the 2x Density area and 8.7 ± 2.5 unionids/m^2 in the 3x Density area (Table 3-10; Table 3-11). No significant changes in total, adult, or juvenile density were detected among years in either study area. The percentage of juveniles (≤5 years old) decreased from 2016 to 2018, as was expected, though the percentage of juveniles was slightly higher in 2018 than in 2017 in both areas (Table 3-10; Table 3-11). Density of fresh dead shells was the same (0.2 ± 0.2 shells/m^2) in both study areas in 2018. No differences in fresh dead shell density were detected among years in the

2x Density area, but density of dead shells was higher in 2017 than in other years in the 3x Density area. Percent mortality of relocated unionids fluctuated over time but was less than 10% in all sampling events (Table 3-10; Table 3-11). Several weathered dead marked shells (not included in mortality estimates) were collected in both study areas as well. Average length of relocated unionids increased significantly between 2017 and 2018 in both areas, and growth was qualitatively observed in some unionids, particularly young individuals.

Species richness and composition of relocated unionids varied little in either study area. Actual species richness ranged from 12 to 14 species in the 2x Density area and 11 to 13 species in the 3x Density area. In the 2x Density area, ES_100 was higher in 2016 (16 species) than in other years (12 species); ES_100 in the 3x Density area was 11 or 12 species in all years (Table 3-10; Table 3-11). As in Illiniwek Park, species placed in the study areas at the highest abundance (*C. pustulosa, O. reflexa, A. plicata*) were the most abundantly encountered species in subsequent monitoring events (Table 3-10; Table 3-11).

Relocated unionids were not evenly distributed throughout the study areas, but distribution was similar among years. Individuals were concentrated in the downstream shoreward corner of the 2x Density area and in the downstream riverward corner of the 3x Density area (Figure 3-3). Within these concentrations, samples with the highest numbers of marked unionids were clumped near each other. This distribution is likely related to the way unionids were released in the area; although unionids were scattered from the boat, most individuals were released near the center of the area to ensure they were not released outside the study area boundary.

As in Illiniwek Park, the density of relocated individuals was lower than expected in both Eagle's Landing treatment areas, given the number of individuals placed. Expected density of relocated unionids after the 2017 relocation was 21.9 unionids/m^2 in the 2x Density area and 22.1 unionids/m^2 in the 3x Density area (Table 3-6). Observed density in 2017 was only 12.2 ± 3.6 unionids/m^2 in the 2x Density area and 12.9 ± 4.6 unionids/m^2 in the 3x Density area. Based on these estimates, approximately 15,689 live and 643 dead unionids were present in the 2x Density area, and 16,589 live and 900 dead unionids were present in the 3x Density area, accounting for 58.0% and 61.6% of the total unionids placed in each area, respectively (Table 3-6; Figure 3-2). Displacement of unionids outside the study area was hypothesized as a potential explanation for this discrepancy, and additional samples were collected outside the study areas in 2018 to determine if unionids were present outside the study area. No live marked individuals were collected in samples downstream, shoreward, and riverward of the 2x Density area, but 1 dead shell was collected (Table 3-7; Figure 3-3). Including live and dead individuals in both the 2x Density area and the surrounding buffer, approximately 9,208 individuals (32.7% of unionids placed) were accounted for in 2018 samples (Table 3-6; Figure 3-2). Only 4 marked individuals of 3 species were collected outside the 3x Density area for a density of 0.5 ± 0.5 unionids/m^2 (Table 3-7). If unionids occurred throughout the buffer at this density, approximately 650 additional individuals could be present in the buffer area (Table 3-7). However, all marked individuals were collected near the downstream riverward corner of the main study area, and few individuals likely occur along the riverward edge of the area. Samples in both the 3x Density area and surrounding buffer accounted for approximately 12,615 relocated individuals (44.5% of unionids placed; Table 3-6; Figure 3-2). The presence of unionids in buffer areas suggests that some unionids were passively transported out of the study area or that unionids may be actively spreading out from their original clumped distribution. However, fewer relocated unionids were accounted for in both areas in 2018 than in 2017, suggesting that some individuals have been lost. Collecting additional samples in the buffer area and/or placing samples systematically (rather than randomly) could help to clarify changes in density and distribution of relocated unionids in future monitoring.

Relocated unionids increased density in their respective areas less than 50%. Density of relocated unionids did not change significantly among years in either of the Eagle's Landing treatment areas but was less than 50% of expected density. Growth was qualitatively observed for many marked unionids during sampling and average length of marked individuals increased from 2017 to 2018. Density of fresh dead marked shells and percent mortality of relocated individuals fluctuated over time, but no trends toward increasing mortality were observed. Additional samples outside the study areas suggested that some unionids were displaced or actively moved out of the study area, but most marked individuals appeared to remain in the study areas. Lower than expected density of relocated individuals may be due to a combination of factors, including underestimated mortality rates, some movement of individuals outside the study areas, and clumped distribution of individuals inside the study areas.

3.1.3 Upstream

The Upstream bed is located on the left descending bank near the Ben Butterworth Parkway boat ramp. Substrate in the Control and 2x Density areas, located just downstream of the boat ramp (see Figure 2-4), was primarily composed of mixed sand, silt, and shell. Smaller amounts of other constituents (e.g. cobble, gravel, clay) were present in some samples, and bedrock was present in samples near the riverward edge of the areas (Table 3-12). Depth ranged from 0.3 m (1 ft) to 4.0 m (13 ft) in the Control area and from 1.5 m (5 ft) to 4.6 m (15 ft) in the 2x Density area. Habitat conditions were more variable throughout the 3x Density area. The shoreward portion of the area fell on a shallow mud flat with silt and clay substrate. Riverward of the mud flat, substrate was comparable to the other study areas, consisting primarily of sand and shell, with some bedrock present near the riverward edge. Depth ranged from 0.6 m (2 ft) to 4.3 m (14 ft; Table 3-8).

<u>Resident unionids</u>

As in the other unionid beds, density of resident unionids varied somewhat among Upstream study areas and sampling events. Total density of resident unionids was 20.7 ± 2.9 unionids/m^2 in the Control area, 13.7 ± 2.9 unionids/m^2 in the 2x Density area, and 18.4 ± 3.2 unionids/m^2 in the 3x Density area in 2018 (Tables 3-13; 3-14; 3-15). Different patterns of variation were observed in each study area. In the Control area, total density, adult density, and juvenile density were lower in 2017 than in 2016 or 2018 (Table 3-13). Total density and juvenile density in the 2x Density area were not significantly different among years, but adult density fluctuated and was lower in November 2016 and 2017 than in other sampling events (Table 3-14). In the 3x Density area, total density, adult density, and juvenile density were all significantly higher in 2018 than in the first 2 sampling events (Table 3-15). In contrast to the other beds, in which adult density remained relatively stable while juvenile density fluctuated, adult density changed significantly among years in all Upstream study areas, while few changes in juvenile density were observed. These fluctuations may simply represent normal variation in the unionid assemblage within this bed, as no long-term trends toward increasing or decreasing density were observed. Density of fresh dead shells also varied among years. Shell density was 4.8 ± 1.3 shells/m^2 in the Control area in 2018 and was higher than shell density in previous years (Table 3-13). Shell density in the 2x Density area (2.9 ± 0.8 shells/m^2) was higher in 2018 than in 2017 but was not different from 2016 sampling events (Table 3-14), and shell density in the 3x Density area (1.2 ± 0.5 shells/m^2) was lower than in 2016 sampling events but not different than 2017 (Table 3-15). No trends toward increasing or decreasing mortality were observed in any of the study areas. Like the variation in live unionids, variation in fresh dead shell density and percent mortality may represent normal variation in this bed, though subjective differences among malacologists in labeling shell condition likely plays a role as well.

Resident species richness varied among sites and years, with total species richness typically being higher when more individuals were collected. ES_100 ranged from 12 – 14 species in the Control area but varied more widely in the 2x Density (12 – 16 species) and 3x Density (12 – 17 species) areas (Tables 3-13; 3-14; 3-15). Species composition was similar among areas, with *O. reflexa, C. pustulosa,* and *A. plicata* being the most abundant species in all study areas in all years.

Resident unionid density varied among years in the Upstream study areas. Unlike the Illiniwek Park and Eagle's Landing beds, adult density appeared to be more variable than juvenile density in the study areas. Such changes may simply represent stochastic variation in density over time. Percent mortality and density of fresh dead shells also fluctuated among years in all 3 study areas but no trends toward increasing mortality in post-relocation sampling events were observed. Placement of relocated unionids in treatment areas does not appear to be affecting resident unionids in Upstream study areas.

<u>Relocated unionids</u>

During the 2016 and 2017 relocation efforts, 14,457 unionids were placed in the Upstream 2x Density area and 26,048 unionids were placed in the 3x Density area, increasing density approximately 100% and 200%, respectively (Table 3-5; Table 3-6). Total density of relocated unionids in 2018 was 3.6 ± 1.3 unionids/m^2 in the 2x Density area and 9.8 ± 2.4 unionids/m^2 in the 3x Density area (Table 3-14; Table 3-15). Patterns of variation were similar to the Illiniwek Park study areas. Total density and adult density did not differ significantly among years in the Upstream 2x Density area, but juvenile density was lower in 2018 than in previous years, and the percentage of juvenile individuals declined over time (Table 3-14). In contrast, total density and adult density in the 3x Density area were significantly higher in 2017 than in 2016 or 2018, perhaps because of the placement of additional individuals in early 2017. Juvenile density did not differ among years, and percent juveniles was higher in 2018 than in previous years (Table 3-15). Density of fresh dead shells in the 2x Density area was 0.4 ± 0.3 shells/m^2 in 2018 and was not different from shell density in previous years (Table 3-14). In the 3x Density area, 2018 shell density was higher than in 2017 but not different from 2016 (Table 3-15). Percent mortality in both areas varied among years but was greater in 2018 than in previous years. Average length of relocated unionids increased from 2017 to 2018 in the 3x Density area but was not different among years in the 2x Density area (Table 3-14; Table 3-15). However, growth was qualitatively observed in some unionids, particularly young individuals, in both areas.

Species richness varied somewhat for relocated unionids. Actual species richness ranged from 8 to 11 species in the 2x Density area and 11 to 14 species in the 3x Density area. In the 2x Density area, ES_100 ranged from 9 to 14 species, while ES_100 in the 3x Density area was 11 or 12 species in all years (Table 3-14; Table 3-15). Species placed in the study areas at the highest abundance (*C. pustulosa, O. reflexa, A. plicata*) were generally the most abundantly encountered species in subsequent monitoring events. *Ligumia recta* was also abundant in the 2x Density area in November 2016 (Table 3-14; Table 3-15).

As in the other study areas, relocated unionids were not evenly distributed throughout the Upstream study areas. Relocated individuals were primarily collected in the shoreward half of the 2x Density area in both 2017 and 2018, and samples with the greatest abundance of marked individuals were clustered near the middle of the area (Figure 3-4). Marked individuals were present throughout most of the 3x Density area, though, like the 2x Density area, samples with the highest numbers of relocated individuals were clustered near the middle (Figure 3-4).

As in other study areas, the density of relocated individuals was lower than expected in both Upstream treatment areas. Expected density after the 2017 relocation was 11.2 unionids/m^2 in the 2x Density area and 20.3 unionids/m^2 in the 3x Density area (Table 3-6). Based on observed density in 2017, approximately 8,102 live and 257 dead unionids were present in the 2x Density area, and approximately 20,447 live and 386 dead unionids were present in the 3x Density area, accounting for 57.8% and 80.0% of the total unionids placed in each area, respectively (Table 3-6). When confidence intervals are considered, the high end of the 95% confidence limit in 2017 samples overlaps the number of animals placed in the 3x Density area (Figure 3-2). Distribution of relocated unionids in 2017 suggested that some individuals may have moved, actively or passively, outside the study area boundaries, particularly in the 2x Density area. Additional samples were collected outside the study areas in 2018 to determine if unionids may have left the study area. Seven (7) relocated individuals of 4 species were collected outside the 2x Density area, and 9 individuals of 4 species were collected outside the 3x Density area (Table 3-7). Density of relocated individuals outside the 2x Density area was 0.9 ± 1.4 unionids/m^2. If unionids occurred throughout the 15-m buffer at this density, approximately 1,854 additional individuals could be present (Table 3-7). However, most marked individuals were collected near the downstream shoreward corner of the main study area, and few individuals likely occur along the shoreward or riverward edges of the area (Figure 3-4). One (1) marked individual was found riverward of the main study area; this individual may have actively moved outside the study area or could have drifted downstream from the 3x Density area. Including live and dead unionids in both the 2x Density area and surrounding buffer, 2018 samples accounted for approximately 7,616 unionids (52.7% of unionids placed), near the number of unionids accounted for in 2017 samples (Table 3-6; Figure 3-2). Relocated individuals were found downstream, shoreward, and riverward of the 3x Density area, suggesting that some individuals may have actively moved outside the study area (Figure 3-4). Because only qualitative samples were collected around the 3x Density area, the number of relocated individuals in the buffer area cannot be estimated. Samples within the 3x Density area accounted for approximately 14,403 relocated unionids (55.3% of individuals placed), but additional individuals appear to be present in the surrounding buffer as well (Table 3-6; Figure 3-2). As in other study areas, marked dead shells were found outside the 2x and 3x Density areas, indicating that some dead shells are washed downstream and suggesting that mortality in the study areas may be somewhat underestimated.

Marked unionids were present outside both the 2x Density and 3x Density areas, but abundance outside the study areas was low. One of the T&E grids (also sampled for I-74 monitoring) is located approximately 15 m downstream of the 2x Density area, but no live or dead marked individuals from the 2x Density area have been collected in this grid in any monitoring event. The low abundance of marked individuals found outside the treatment area, including in areas farther downstream, suggests that most marked individuals remain in the study areas.

Density of relocated unionids did not differ among years in the Upstream 2x Density area but was higher in the 3x Density area in 2017 than in other years. Growth was qualitatively observed for many marked unionids during sampling and average length of marked individuals in the 3x Density area increased from 2017 to 2018. Density of fresh dead marked shells and percent mortality of relocated individuals fluctuated over time, but no trends toward increasing mortality were observed. Additional samples outside the study areas suggested that some unionids moved (actively or passively) outside the study areas, but most marked individuals appeared to remain in the study areas. Lower than expected density of relocated individuals may be due to a combination of factors, including underestimated mortality rates, some movement of individuals outside the study areas, and clumped distribution of individuals inside the study areas.

3.1.4 Variation among sites

The 6 study areas in which relocated unionids were placed (2x and 3x Density areas in each bed) were ranked according to the relative increase in density after placement of unionids, and patterns of variation in density and mortality of both relocated and resident unionids were examined along this gradient. Few significant changes in density of relocated unionids were observed over time. The only 2 study areas in which density of relocated individuals changed significantly were the Upstream 3x Density and Illiniwek Park 3x Density areas, in which density was increased by approximately 200% and 100%, respectively. In both areas, density of relocated individuals increased from November 2016 to 2017 and decreased from 2017 to 2018. However, similar (though not statistically significant) patterns were observed in most of the other study areas, as mean density in most study areas was somewhat greater in 2017 than in 2016 or 2018. Fewer marked individuals were collected in 2018 than in 2017 in all 6 study areas, which may point to the loss (either by movement or mortality) of marked individuals in all study areas, not just those with high relative density increase (Figure 3-2). When unionids collected in buffer areas were considered, the estimated number of unionids accounted for in the Illiniwek 2x Density and Upstream 2x Density areas were similar to the estimated number of unionids accounted for in 2017, suggesting that unionids in these areas may simply be spreading out. Samples in the remaining 4 study areas, including surrounding buffers, accounted for fewer unionids in 2018 than in 2017, suggesting that more unionids may have been lost from these areas (Figure 3-2). Mortality of relocated unionids did not appear to be associated with the magnitude of the density increase. Few significant changes in fresh dead shell density were detected in any of the study areas, and the few changes that were detected did not follow any trends with respect to relative density increase.

No apparent trends in density or mortality were observed with respect to the magnitude of the density increase in the study areas. However, similar patterns were observed in study areas with similar habitat, suggesting that habitat may affect relocated unionids more than the magnitude of the density increase. The Illiniwek Park 3x Density and Upstream 3x Density areas both have more silt/clay substrate than any of the other study areas and had similar patterns in density (higher in 2017 than in other years). Unionids in these areas were generally more evenly distributed, and marked individuals were found both shoreward and riverward of the primary study area in buffer area samples. Perhaps unionids can move more easily in the softer substrate and are spreading out at a faster rate than in other sites. The Illiniwek Park 2x Density and Upstream 2x Density sites also have similar habitat and had similar estimates of relocated unionids accounted for in both 2017 and 2018, though some of those unionids were found in the surrounding buffer areas in 2018 (Figure 3-2). Finally, the 2 Eagle's Landing areas have similar habitat, and had fewer unionids accounted for in 2017 than in 2018, even including unionids in the surrounding buffer areas. Both study areas have loose sand substrate at the riverward edge; unionids that were placed or moved into the sand substrate could have been displaced from the study area as this substrate is less stable and moves with the bedload.

High relative increases in unionid density do not appear to be affecting resident unionids. Density of resident unionids either remained unchanged or increased in all study areas post-relocation, suggesting that placement of relocated unionids did not overtop the carrying capacity of these areas. Conversely, the only observed increase in density of fresh dead shells was in the Illiniwek Park 3x Density site between

2017 and 2018. Fresh dead shell density either remained unchanged or decreased over time in all other study areas. Placement of relocated unionids, even in numbers that increased overall density by a large percentage, does not appear to have affected the resident unionid assemblages in the study areas. Density study sampling will be repeated in Years 4, 7, and 10 (2020, 2023, 2026) to continue to monitor changes in resident and relocated unionid assemblages over time. Sampling could be modified to include systematic rather than random samples both in the study areas and surrounding buffer areas to better answer questions about the distribution and density of relocated individuals.

3.2 Endangered species grids

Five (5) grids for placement of federally endangered species were distributed among the 3 unionid beds used for the density study. The Illiniwek Park grids (1 for *L. higginsii* and 1 for *P. cyphyus*) were located between the 2x Density and 3x Density areas (see Figure 2-2). The Eagle's Landing grids (1 for *L. higginsii* and 1 for *P. cyphyus*) were located immediately downstream of the Control area (see Figure 2-3). The Upstream grid (*L. higginsii* only) was located immediately downstream of the 2x Density area (see Figure 2-4).

Lampsilis higginsii grids

The objective of the 2018 sampling design was to collect approximately 10% of the *L. higginsii* placed in each grid. This objective was met in all *L. higginsii* grids. Recapture rate was similar among grids, ranging from 13.1% in the Illiniwek Park grid to 14.0% in the Upstream grid (Table 3-16). No mortality was observed in the Illiniwek Park or Eagle's Landing grids, but 1 dead *L. higginsii* was collected in the Upstream grid, resulting in 0.4% mortality in the grid. Cumulative mortality across all grids was low, as only 3 individuals (0.4% of all individuals placed) were found dead in 2017 and 2018 combined. Average length of relocated individuals in the Eagle's Landing and Upstream grids increased significantly from 2017 to 2018. Average length of individuals in the Illiniwek Park grid did not increase from 2017 to 2018 but was higher than at initial placement in both years (Table 3-16). The percentage of gravid females ranged from 47.4% in the Illiniwek Park grid to 76.9% in the Eagle's Landing grid (Table 3-16).

Substrate disturbance caused by thoroughly searching the grids in 2017 was a concern, as such extensive disturbance may have been detrimental to individuals in the grids. Relocated individuals were collected at a rate consistent with expected results in 2018, and resident (unmarked) unionids were abundant in all grids, suggesting that the substrate disturbance did not negatively affect many unionids in the grids. The quantitative sampling method used in 2018 limited excavation to a few small areas and could be repeated in future monitoring events to minimize disturbance. The quantitative method does result in fewer individuals being collected, but the survival and condition of those unionids can be used to draw reasonable conclusions about the status of others in the grid.

Movement of individual unionids between grid cells was not quantified, as the grid boundaries were delineated with rope, which may not have provided a consistent boundary between cells among years. Divers made an effort to distribute individuals throughout their respective grid cells upon completion of the 2017 monitoring, but the marked individuals still appeared to be clumped rather than distributed evenly throughout the cells, as some samples yielded several *L. higginsii* while other samples yielded few or none. The clumped distribution of these individuals suggests that there was little active movement of marked individuals over time.

Some relocated *L. higginsii* were not found in the extensive searches conducted in 2017, and the average density of *L. higginsii* in 2018 appeared lower than would be expected if all individuals remained in the grid. Based on the density of *L. higginsii* in 2018, approximately 206 individuals may remain in the Eagle's Landing and Upstream grids (83.1% and 87.2%, respectively), and 225 individuals (84.0%) may remain in the Illiniwek Park grid (Table 3-16). As in other relocation areas, unusually high discharge during the 2016 relocation effort and in fall 2018 may have displaced some individuals downstream. Actual mortality may also be somewhat higher than observed, as some dead shells may have been washed out of the grid. However, monitoring results suggest that most relocated individuals are still present in the grids.

The objective of collecting approximately 10% of relocated *L. higginsii* was achieved in all grids. Only 1 dead individual was collected, resulting in less than 1% mortality both in individual grids and cumulatively. Individuals recaptured live generally appeared healthy. Average length increased significantly from 2017 to 2018 in 2 of the 3 grids, indicating that relocated individuals grew over the past year. In addition, gravid females were collected in all grids, indicating that some reproduction is occurring, though the percentage of gravid females varied among sites. Although some individuals may have been lost from the grid due to unobserved mortality or displacement of live individuals, most individuals appear to remain in the grids. Monitoring will be repeated in Years 4, 7, and 10 (2020, 2023, 2026) to obtain long-term data on the health and survival of relocated *L. higginsii*.

Plethobasus cyphyus grids

The objective of the 2018 sampling design was to collect approximately 10% of the *P. cyphyus* placed in each grid. This objective was met in the Eagle's Landing grid (14.8% of individuals recaptured) but not in the Illiniwek Park grid (5.7% recaptured; Table 3-16). One (1) dead *P. cyphyus* was collected in the Illiniwek Park grid (1.9% mortality); this is the only dead *P. cyphyus* shell collected in either grid in all monitoring events. The single *Cyclonaias tuberculata* in the Illiniwek Park grid was also recaptured live in 2018 (Table 3-16). Average length of relocated *P. cyphyus* did not change among years. However, many of the individuals placed in the grids were older individuals, which would be expected to grow slowly. As in the *L. higginsii* grids, substrate disturbance in the 2017 monitoring was a concern. Relocated individuals were collected at a rate consistent with expected results in the Eagle's Landing grid 2018, but fewer individuals than expected were collected in the Illiniwek Park grid. However, recapture of *P. cyphyus* in the Illiniwek Park grid was low in 2017 relative to other grids as well, suggesting that the low recapture rate in 2018 is not due to excessive disturbance in 2017. Resident (unmarked) unionids were abundant in both grids as well, further suggesting that the substrate disturbance did not negatively affect many unionids in the grids.

Movement of individual unionids between grid cells was not quantified, as the grid boundaries were delineated with rope, which may not have provided a consistent boundary between cells among years. Divers made an effort to distribute individuals throughout their respective grid cells upon completion of the 2017 monitoring, but the marked individuals in the Eagle's Landing grid still appeared to be clumped rather than distributed evenly throughout the cells, as some samples yielded several *P. cyphyus* while other samples yielded few or none. The clumped distribution of these individuals suggests that there was little active movement of marked individuals over time.

Some relocated *P. cyphyus* were not found in the extensive searches conducted in 2017, and the average density of *P. cyphyus* in 2018 appears lower than would be expected if all individuals remained in the grid, particularly in the Illiniwek Park grid, where recapture rates were lower than all other grids in both years.

Based on the density of this species in 2018, approximately 56 *P. cyphyus* (91.8%) may remain in the Eagle's Landing grid, and 19 *P. cyphyus* (35.8%) may remain in the Illiniwek Park grid (Table 3-16). As in other relocation areas, unusually high discharge during the 2016 relocation effort and in fall 2018 may have displaced some individuals downstream. Actual mortality may also be somewhat higher than observed, as some dead shells may have been washed out of the grid. However, monitoring results suggest that most relocated individuals are still present in the Eagle's Landing grid.

It is not clear why so few individuals were recaptured in the Illiniwek Park grid. Two (2) of the marked *P. cyphyus* (1 live individual and the dead shell) collected in 2018 were not observed in 2017, suggesting that some individuals were still present in the grid in 2017 but were not detected despite intensive searches. Displacement of individuals downstream does not appear to explain low recapture rates; the Illiniwek Park *L. higginsii* grid is located <10 m riverward of the *P. cyphyus* grid and is subject to similar flow conditions, but most of the individuals in the *L. higginsii* grid appeared to remain. Observed mortality does not account for the low abundance, as only 1 individual was found dead in both monitoring events, though, as noted above, actual mortality may be somewhat higher than observed because some dead shells are likely swept downstream out of the grid. Divers noted that, although the *P. cyphyus* grid was <10 m from the *L. higginsii* grid, substrate composition differed somewhat, with more woody debris, cobble, and gravel in the *P. cyphyus* grid than in the *L. higginsii* grid. Perhaps substrate in the grid, while apparently suitable for most resident unionids, is less suitable for *P. cyphyus*, and individuals moved out of the area. This species may also burrow more than *L. higginsii*, resulting in fewer *P. cyphyus* collected. Conducting a few qualitative searches in the area around this grid in the next monitoring event could help to determine if individuals moved out of the grid.

The objective of collecting approximately 10% of relocated *P. cyphyus* was achieved in the Eagle's Landing grid but not in the Illiniwek Park grid. The single *C. tuberculata* in the Illiniwek Park grid was also recaptured. Only 1 dead *P. cyphyus* was collected, resulting in less than 1% mortality. Qualitatively, individuals recaptured live appeared healthy. Average length did not increase significantly in either grid, but most *P. cyphyus* in the grids are older, slow-growing individuals. Although some individuals may have been lost from the grid due to unobserved mortality or displacement of live individuals, most individuals appeared to remain in the Eagle's Landing grid. Few individuals apparently remain in the Illiniwek Park grid, perhaps due to some combination of these factors and/or habitat suitability. Monitoring will be repeated in Years 4, 7, and 10 (2020, 2023, 2026) to obtain long-term data on the health and survival of relocated *P. cyphyus.*

3.3 *Margaritifera monodonta* monitoring

Ten (10) live *M. monodonta* and 5 weighted dead shells were distributed among 3 relocation areas (Sylvan Slough, Arsenal Up, and Arsenal Down) in October 2015 (ESI, 2016). An additional 24 live individuals were placed at the Sylvan Slough site in the 2016 relocation, and 1 additional individual was placed during the 2017 relocation.

Recapture rates varied among the 3 relocation sites. All 5 of the tagged individuals placed at the Sylvan Slough site in 2015 were recaptured in all monitoring events (Table 3-17). The original 3 live individuals placed at this site have now survived for 3 years post-relocation; no mortality was observed. These individuals were not measured or aged in 2018, so growth could not be assessed. However, the 3 individuals were all relatively old individuals and growth was likely minimal.

Of the additional 25 live individuals placed at the Sylvan Slough site during the I-74 relocation, 15 (60%) were recaptured live in 2018 (Table 3-17). Two (2) additional tags were detected with the PIT tag reader, but the diver could not locate the individuals to determine whether they were alive or dead (Table 3-17). Most of the individuals recaptured in 2017 were observed again in 2018. Several individuals not detected in 2017 were collected in 2018 as well; only 2 individuals were not detected in either year. Three (3) individuals were found dead, resulting in 12.0% mortality in 2018 and cumulative mortality of 20% since relocation (Table 3-17). Mortality may be related to differences in handling and/or placement of individuals collected in the 2016 – 2017 relocation versus individuals experimentally relocated in 2015. Individuals were held in mesh bags placed in the river during the 2016 – 2017 relocation but were typically not released at the Sylvan Slough site until the end of each day, so some individuals were held for several hours. *Margaritifera monodonta* is a habitat specialist, generally occurring among or under large rocks on the edge of fast flowing water. However, the exact habitat requirements are largely unknown. Although habitat was qualitatively similar where all individuals were placed, small differences in habitat characteristics may exist within the site, and suitability of habitat may have varied slightly where each individual was placed, resulting in variable survival. The continued survival of the individuals initially placed at this site in 2015, as well as the presence of numerous untagged (resident) *M. monodonta*, suggests that this site does provide suitable habitat for the species, and that *M. monodonta* can successfully persist for several years after being relocated.

Recapture rates varied at the Arsenal Up site. Only 1 live individual was recaptured in 2015, but no tagged individuals were detected at this site in 2016, despite extensive searching by multiple divers. However, all the tagged shells were found in 2017, and no mortality was observed. Recapture rate decreased again in 2018; only 2 tagged shells were detected (Table 3-17). Both recaptured individuals were alive and appeared healthy. The apparent absence of the remaining tagged shells could indicate those shells were dislodged and swept downstream, or that the remaining live individual died after the 2017 monitoring. However, the recapture of all 5 tagged shells in 2017, after 2 years of low or no recaptures, suggests that simply not having the PIT tag antenna in exactly the right location is just as likely an explanation. The detection distance of the antenna is short (i.e. the antenna must be within approximately 0.5 m of a tag to detect it), and results from the past several years of monitoring suggest that some tagged individuals are frequently not detected even though they remain in the area. Additional GPS points and notes were recorded in 2018 to aid in locating the site for future monitoring.

One (1) live individual and 1 tagged dead shell were recaptured at the Arsenal Dn site in 2015. The same 2 shells were recaptured in 2016 and 2017; however, the live individual was found dead in 2017, and the tagged dead shell was not detected again in 2018 (Table 3-17). The remaining 3 live individuals were not detected in any monitoring event. Detection of the same 2 tagged shells over time suggests that the appropriate area was searched but remaining live individuals may have moved or burrowed beyond the range of the antenna. The site is located at an old bridge crossing, and substrate consisted of both natural boulders and larger slabs of concrete and debris, forming more cracks and crevices where tagged individuals could have moved outside the detection range. Divers noted that habitat conditions were similar at initial placement and in the 2015 monitoring event. However, in 2016, portions of this site had been inundated with silt, and silt was also observed in the 2017 and 2018 monitoring events. The apparent increase in silt may have contributed to the death of the tagged individual and may have negatively affected the remaining 3 live individuals as well. It appears that this site is less stable than the other sites and may not be as suitable for the species.

3.4 Sylvan Slough silt monitoring

Habitat sampling (transects and qualitative sampling around the water intake) was conducted in August, September, and October 2017 and in October 2018 to evaluate changes in habitat and silt accumulation as construction progressed. Substrate composition along transects was similar among sampling events in both years. Sand, silt, and zebra mussel shells were the primary substrate constituents throughout most of the area. Silt and clay were more abundant near the banks, particularly at the downstream end, and small amounts of cobble and/or gravel were present in some samples (Figure 3-5). Much of the silt was mixed in with other substrate constituents rather than in a layer on top of the substrate. The percentage of silt as a substrate constituent varied among sampling events, likely due to subjective differences among divers.

In addition to percent substrate composition, divers estimated the amount of silt on top of the substrate. Silt depth was generally low in all 2017 sampling events, with divers reporting a light dusting of silt (<1.3 cm [0.5 in]) over the substrate in most samples (Figure 3-6). Some patches of deeper silt (up to 7.6 cm [3 in]) were observed, but the patches were not large, and are likely typical for this river reach. Conditions did not appear to change substantially between the last 2017 monitoring event and the 2018 event. Divers reported little or no silt (<1.3 cm [0.5 in]) on top of the substrate along most transect segments in 2018 (Figure 3-6). Some patches of silt up to 7.6 cm (3 in) were observed, particularly on the Illinois (left descending) bank, but similar patches were observed in previous monitoring events as well. The amount of silt observed in both 2017 and 2018 is likely typical for this river reach. River levels could play a role in silt accumulation downstream of the construction area, with unusually high discharge in fall 2018 removing accumulated silt from the area. However, river levels were more moderate in summer and fall 2017, and silt depth in the 2017 monitoring events was still minimal, suggesting that substantial amounts of silt are not accumulating downstream of the construction area.

Divers also conducted qualitative spot dives around the City of Moline water intake to evaluate silt accumulation. Conditions around the intake were comparable in all sampling events. Large woody debris was present immediately upstream and shoreward of the intake structure. Downstream and riverward, substrate was composed of gravel, sand, and zebra mussel shells, with small amounts of silt on top of the substrate. Gravel, sand, and shell were also the primary constituents upstream of the intake, but somewhat more silt was present. However, depth of silt on top of the substrate was comparable to that observed in transects and did not exceed 5.0 cm (2 in). Silt was also present shoreward of the intake, but silt and clay were the primary substrate constituents near the bank in both transects and quantitative samples, so this likely represents normal conditions. Divers did not investigate the area immediately riverward of the intake for safety reasons. However, substrate at the downstream end of the intake structure and in the main channel of Sylvan Slough was covered in only a light dusting of silt in most sampling events, and conditions at the intake opening are likely similar.

Quantitative sampling in the Sylvan Slough silt monitoring area was conducted in August 2017 to provide pre-construction estimates of unionid density and community characteristics and was repeated in October 2018 to assess conditions after construction was underway. Like the habitat transects, substrate in quantitative samples was primarily composed of sand, silt, and zebra mussel shells mid-channel, with more silt and clay near the banks. Depth ranged from 0.3 m (1 ft) to 3.0 m (10 ft) in 2017 and from 0.6 m (2 ft) to 4.0 m (13 ft) in 2018.

Quantitative samples yielded 275 unionids of 17 species in 2018 (Table 3-18). Total density was 11.0 ± 2.3 unionids/m^2 and was significantly lower than in 2017 (17.8 ± 4.2 unionids/m^2). Adult density did not differ among years, but juvenile density was significantly lower in 2018, and juvenile unionids (≤5 years old) comprised a lower percentage of the total (Table 3-18). Percent mortality was slightly higher in 2018 (12.7%) than in 2017 (9.7%), but density of fresh dead shells did not differ among years. Actual species richness was higher in 2017, but ES_100 was the same (14 species) in both years, suggesting that lower species richness in 2018 is likely due to fewer individuals being collected. *Cyclonaias pustulosa, O. reflexa,* and *A. plicata* were the most abundant species in both years. Species composition of the remaining species varied somewhat among years; a few species were collected in only 1 sampling event, including *P. cyphyus* and *L. higginsii*, which were only collected in 2018 (Table 3-18).

Unionid distribution also varied somewhat among years. In both years, unionids were distributed throughout most of the area, with lower abundance adjacent to the island (right descending) bank and on the Illinois (left descending) bank downstream of the City of Moline water intake (Figure 3-7). In 2017, abundance was highest along the Illinois bank from the new bridge crossing to the City of Moline water intake. Although unionids were still abundant in some samples, overall abundance along the Illinois bank appeared lower in 2018. In addition, several samples upstream of the existing bridge produced no live unionids in 2018, while unionids were present in most samples in this part of the area in 2017 (Figure 3-7).

It is not clear whether the observed changes in unionid density and distribution are related to bridge construction. Density of adult unionids and fresh dead shells did not differ in 2017 and 2018, suggesting that increased mortality or loss of adult individuals downstream is not occurring. Juvenile density decreased significantly from 2017 to 2018; however, there is no strong evidence to suggest that this decline may be associated with increased sedimentation from construction activities. Haag (2012) notes that, while juvenile unionids have long been regarded as being particularly sensitive to sedimentation, studies do not strongly support this assumption, and several studies found that juvenile unionids may be somewhat dependent on fine sediment for growth (e.g. Yeager et al., 1994; Gatenby et al., 1996). Further, estimates of substrate composition and depth of silt in Sylvan Slough were comparable in all monitoring events, and no long-term increase in depositional sediment was observed. Other physical factors, such as unusually high river levels and low water temperature (approx. 46-47°F) during the 2018 monitoring event, may play a role. When data from the initial 2014 I-74 unionid survey were incorporated into the analysis, significant changes in total density, adult density, and density of fresh dead shells were detected between 2014 and 2017 as well, suggesting that some variation in density and mortality may simply be typical of this unionid assemblage (Table 3-18).

Some variations in the amount of silt on top of substrate were observed among sampling events. However, much of this variation is likely due to subjective estimates by divers. Small amounts of silt were present on top of the substrate throughout the area, but this is likely typical for Sylvan Slough, and for this reach of the Mississippi River in general. None of the information reported by the divers suggested that silt accumulation was increasing significantly as construction progressed. Some changes in unionid density were observed from 2017 to 2018, but changes may not be attributable to increased sedimentation from construction. Other factors, such as high river levels, cold temperatures, or stochastic variation may be implicated. Quantitative sampling could be repeated in summer 2019, at river levels and temperature more comparable to the 2017 sampling event, to better assess which of these factors, if any, may be affecting sampling results.

3.5 Construction area

Qualitative searches in the construction area were conducted in late October 2018 to briefly assess unionid status, as formal quantitative monitoring was not possible during ongoing construction. Substrate in qualitative searches was composed of mixed sand, silt, clay, and shell. Clay was the dominant substrate constituent in some samples, while some samples had more equal proportions of sand, clay, and shell. Clay was perhaps somewhat more common than in previous surveys of the area, but several of the 2018 searches were conducted near the head of the small island in Sylvan Slough, where clay was more common in previous years as well. Depth was comparable to previous surveys, ranging from 2.1 m (7 ft) to 3.4 m (11 ft).

Qualitative searches yielded 55 live unionids of 11 species (Table 3-19). As in most other study areas, *A. plicata* (21.8%) and *C. pustulosa* (12.7%) were among the most commonly encountered species. *Lampsilis cardium* (21.8%) and *L. recta* (12.7%) were also abundant, while *O. reflexa*, one of the most abundant species in previous Sylvan Slough surveys, was less so, comprising only 7.3% of the total. One (1) federally endangered *L. higginsii* was also collected. Observed recruitment was low, with only 1 juvenile individual (1.8%) collected, and mortality was 8.3% (Table 3-19). Catch per unit effort (CPUE) was 36.7 unionids/hr and was substantially lower than in the initial I-74 bridge survey, in which CPUE was over 100 unionids/hr in all Illinois bank survey areas (ESI, 2014).

At first glance, results of the qualitative searches might suggest that unionid abundance and species richness had declined relative to previous surveys. However, cold water temperatures probably strongly influenced the findings. Searches were conducted in late October when water temperature was approximately 47°F. Divers' ability to locate unionids in the substrate was likely hampered by the cold and by the heavy gloves and thermal protection worn in these conditions. Species composition was strongly biased toward larger-bodied species, which are easier to collect by hand. Large species such as *L. cardium*, *L. recta,* and *Megalonaias nervosa*, although not uncommon in previous surveys, were particularly abundant in 2018 searches, while smaller *O. reflexa,* which are typically very abundant, were less commonly encountered (Table 3-19). Additionally, over half of the total individuals were collected in the first 2 searches. Although spatial distribution of unionids in the search area may partially explain this result, it is also likely that the cold water caused the diver's efficiency to decrease quickly as searches continued. Unionids typically burrow deeper in the substrate as temperatures decline, further reducing divers' ability to locate them visually or tactually. Few fresh dead shells were found, and percent mortality was within the range of previous surveys, suggesting that mortality of unionids in the construction area has not increased substantially since construction began.

Unionid abundance and species richness were lower in 2018 than in previous surveys in and near the construction area. However, cold water temperatures and heavy thermal protection likely reduced search efficiency significantly. The results of these searches should not be taken as an indication that unionid abundance has declined since construction began. Formal monitoring, with quantitative (excavated) samples and qualitative searches conducted in more moderate temperatures, will provide a more complete assessment of the unionid assemblage at the new bridge crossing.

4.0 SUMMARY AND CONCLUSIONS

Unionids relocated from the new I-74 bridge pier construction areas in 2016 and 2017 were placed in various relocation areas throughout Pool 15. All relocation areas/placement sites except the Iowa relocation area were monitored in September and October 2018. Common and state T&E species collected from the Illinois piers were placed in study areas to examine the effects of large increases in density. Significant changes in resident unionid density were observed in some study areas. However, most changes appear to be due to fluctuations in recruitment, particularly of a few opportunistic species, and resident unionid density in several study areas increased over time. Estimates of resident unionid mortality also varied, but no trends toward increasing mortality were observed, suggesting that placement of relocated unionids in study areas has not affected the survival of resident unionids. Density of relocated unionids was lower than expected in all study areas, but few significant changes were observed over time. Mortality of relocated unionids was under 10% in most sites, and density of fresh dead shells did not change in most sites. However, fewer relocated unionids were collected in all 6 study areas in 2018, which could be indicative of a larger trend. Examination of sites on a gradient from high to low relative density increase showed no meaningful trends in density or mortality related to the magnitude of the density increase. Some relocated unionids may have displaced out of the study areas due to high discharge during the 2016 relocation. Additional samples collected outside the study areas indicated that a few relocated unionids were present outside the study areas, but most individuals appeared to have remained in the study areas. Future monitoring will continue to quantify changes, if any, in both resident and relocated unionids in the study areas.

Lampsilis higginsii and *P. cyphyus* were placed in monitoring grids in the same 3 unionid beds used for the density study. Monitoring in 2018 was modified to minimize substrate disturbance and was designed to collect approximately 10% of the relocated individuals in each grid. Recapture rates of *L. higginsii* ranged from 13.1% to 14.0%. One (1) individual was found dead, but cumulative observed mortality to date was <1% for all grids combined. Average length of *L. higginsii* increased significantly in 2 of the 3 grids between 2017 and 2018, indicating that many individuals had grown, and gravid females were collected in all grids. Recapture rate of *P. cyphyus* was 14.8% in the Eagle's Landing bed but was only 5.7% in the Illiniwek Park grid, and 1 individual was found dead. Average length did not increase in either grid, but many of the *P. cyphyus* individuals placed in the grid were older, slow-growing individuals. Estimates of the number of individuals remaining in each grid, based on 2018 density, suggests that some individuals were lost, perhaps due to active movement out of the grids or unobserved mortality (i.e. dead shells swept downstream out of the grid). However, most individuals appear to remain in the grids, and those individuals collected live generally appeared healthy. Future monitoring will continue to quantify survival and growth of relocated *L. higginsii* and *P. cyphyus*.

Several *M. monodonta* were experimentally relocated to 3 sites in 2015, and individuals collected from the new bridge corridor in 2016 and 2017 were added to the Sylvan Slough site. Recapture rate of the original individuals was high at the Sylvan Slough site (100% recapture, no mortality). Most (60%) of the individuals relocated from the new bridge piers were recaptured live, but 3 additional individuals (12%) were recaptured dead in 2018, and cumulative mortality was 20%. Mortality of individuals from the 2016-2017 relocation may be due to small differences in habitat within the placement area or stress caused by handling during the relocation. However, long-term survival of the individuals placed in 2015, as well as most of the individuals placed in 2016 – 2017, indicates that long-term post-relocation survival can be achieved for this species. Recapture rate varied at the Arsenal Up site among years, highlighting the importance of being able to accurately locate the placement site. Only 2 tagged shells (1 live and 1 dead) were detected at the Arsenal Down site in previous monitoring events, but the single live individual was found dead in 2017, and none of the tagged individuals (including the tagged empty shell) were found in 2018. Apparent increases in silt accumulation at the site may have rendered habitat unsuitable for the remaining individuals. Future monitoring will continue to track the survival of these individuals.

As an alternative to the use of silt curtains during bridge construction, habitat and unionids were monitored in Sylvan Slough to evaluate silt accumulation and potential effects on unionids. Substrate composition along habitat transects was comparable among sampling events, with no apparent increase in the percentage of silt as a substrate constituent. Likewise, the depth of silt on top of the substrate varied little, and no apparent increase in silt deposition was observed. Quantitative sampling detected a significant decrease in total unionid density and juvenile unionid density from 2017 to 2018. It is not clear whether this decrease is attributable to changes in habitat due to construction, as habitat was generally similar to pre-construction surveys, mortality was not significantly higher than in 2017, and other factors such as high river levels and cold temperatures may play a role. Sampling this area again in the 2019 field season, with flow and temperature conditions more comparable to the pre-construction (August 2017) sampling event, could aid in explaining the changes observed in 2018.

Formal quantitative monitoring of the construction area will be conducted to assess the status of unionids not relocated from the new bridge corridor, and to determine if recolonization occurs. Because construction is ongoing and access to the construction area was limited, several qualitative searches were conducted in safely accessible areas to briefly evaluate the unionid assemblage in the interim. Habitat characteristics were comparable to pre-construction surveys. Unionid abundance and species richness were low relative to previous surveys, but cold temperatures likely reduced divers’ ability to locate unionids in the substrate, and these results should not be taken as an indication of declining unionid abundance. Formal quantitative monitoring will provide a more objective assessment of the unionid assemblage, and qualitative searches included in the monitoring should be conducted when water temperature is more moderate.

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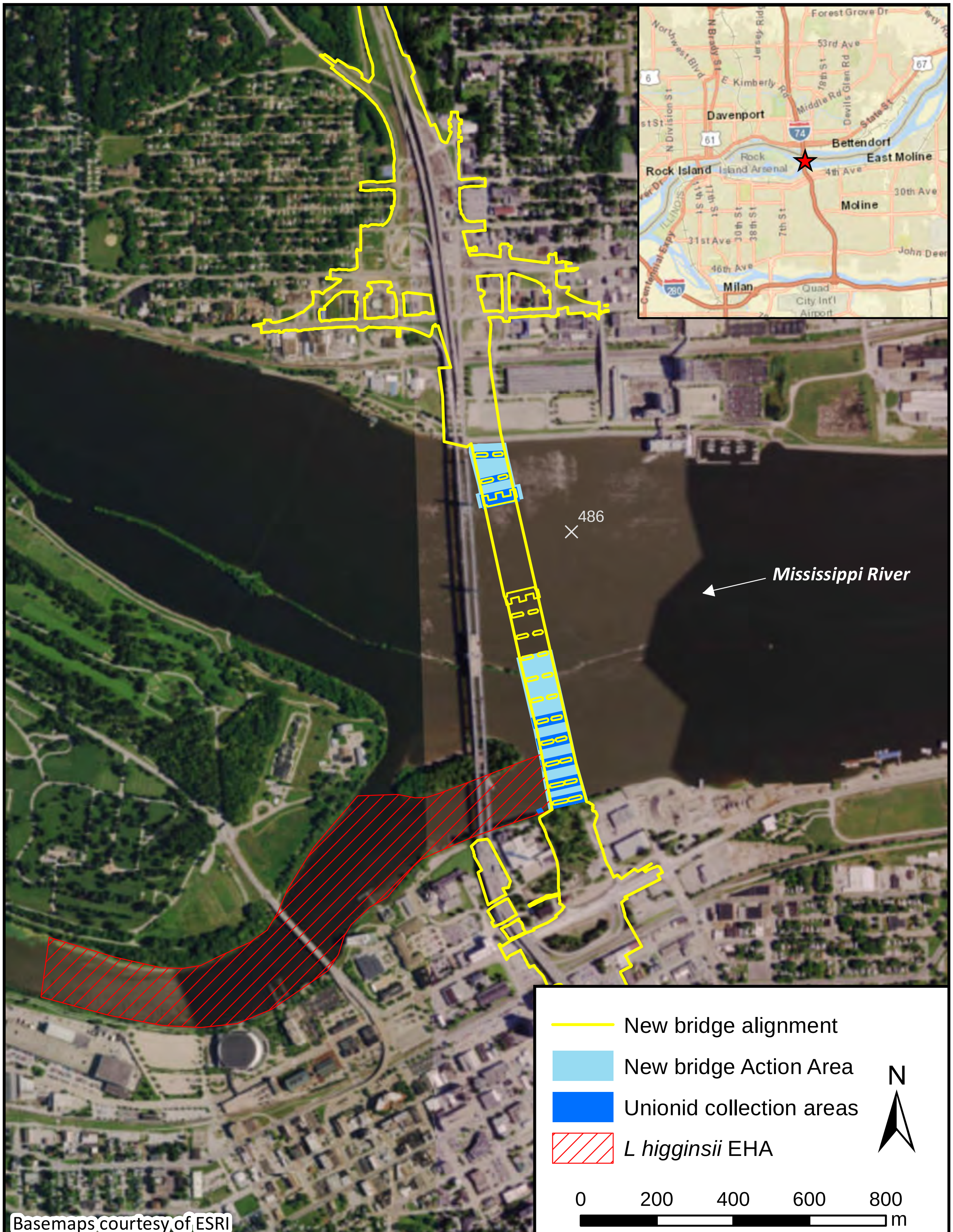

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Figure 1-1. New and existing I-74 bridge alignments, unionid collection locations within the new bridge Action Area, and *L. higginsii* EHA, Mississippi River Pool 15.

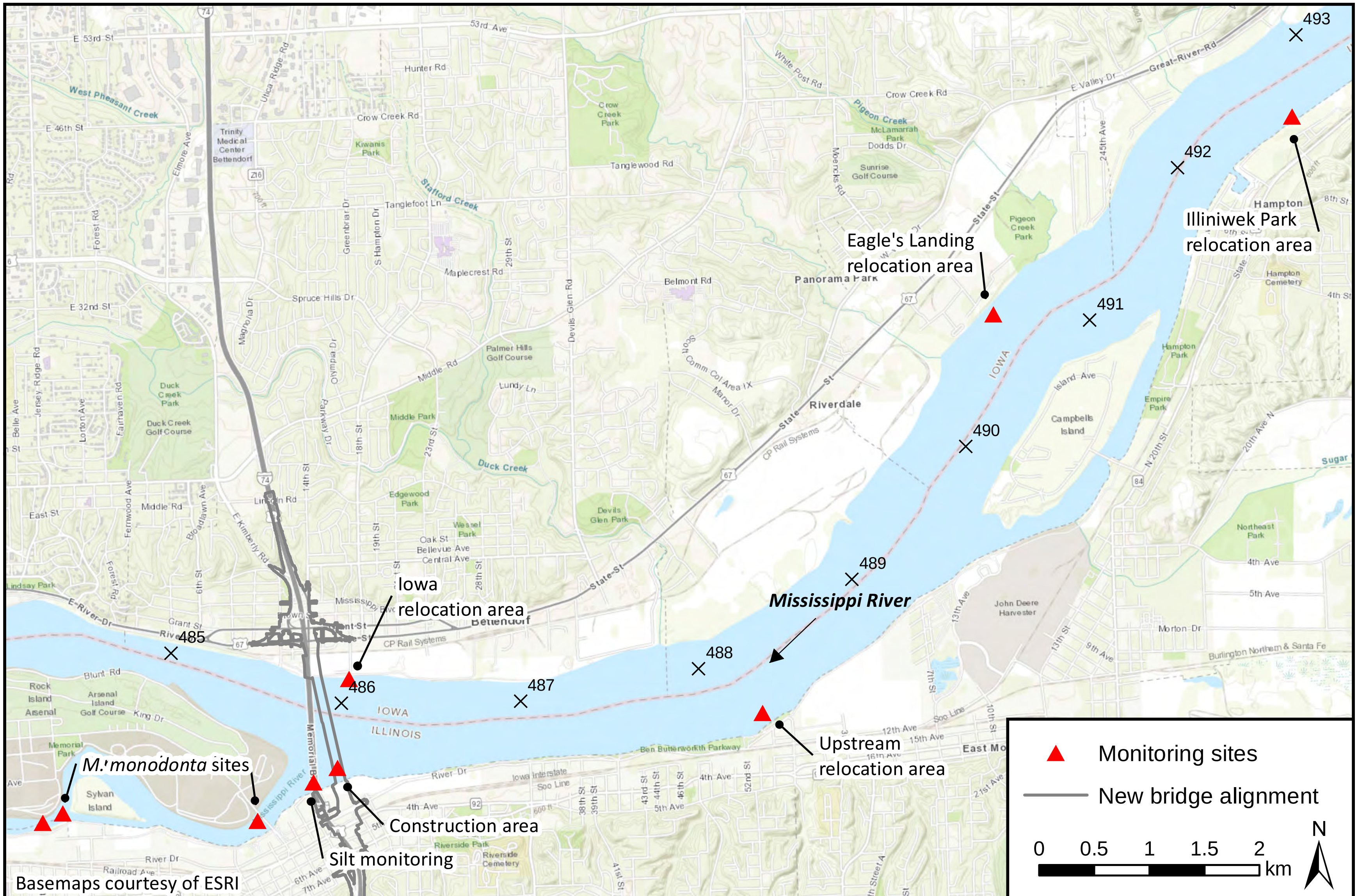

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Figure 2-1. Unionid monitoring sites in Mississippi River Pool 15, 2018.

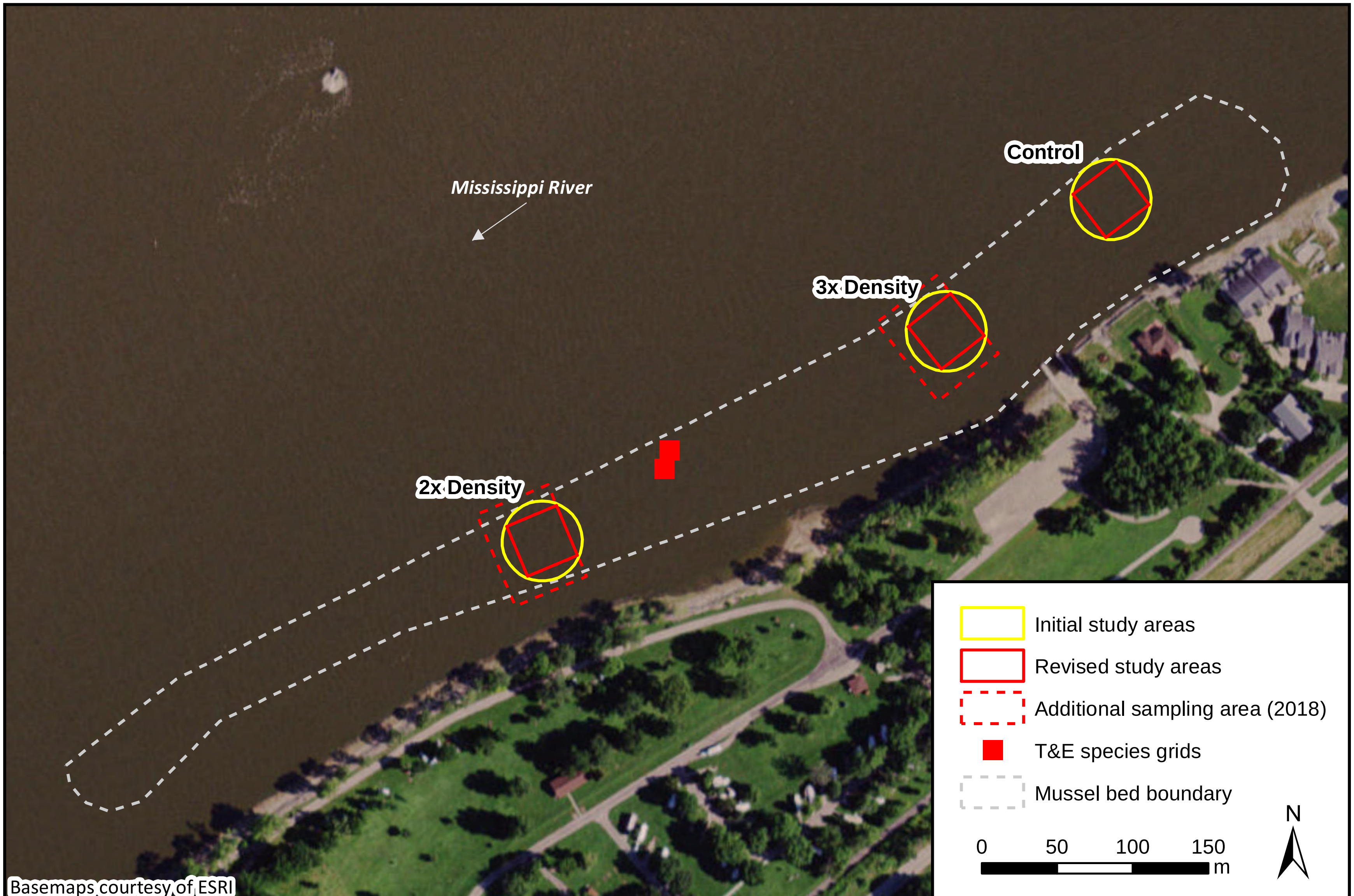

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Figure 2-2. Density study/relocation areas in the Illiniwek Park bed, 2016 - 2018.

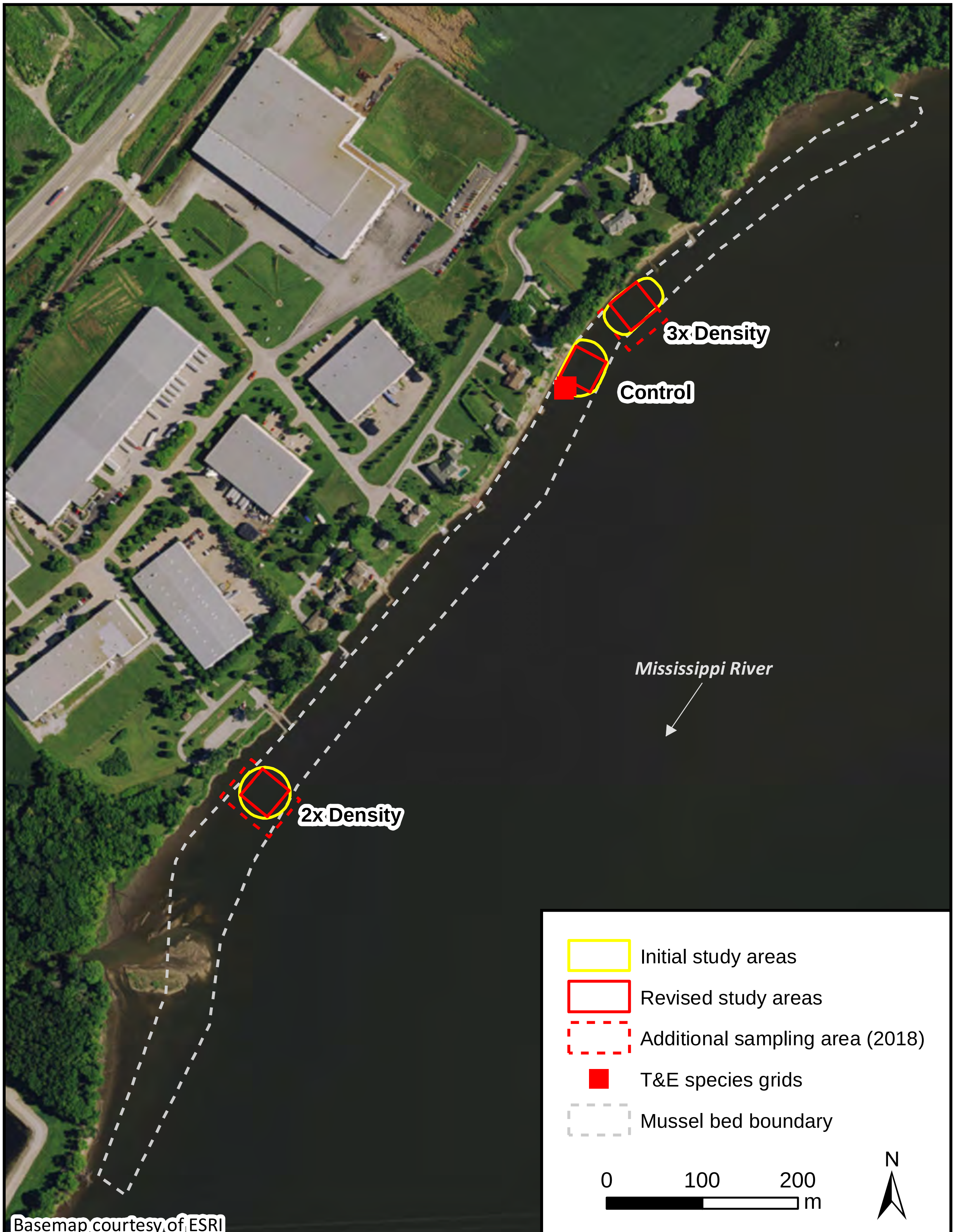

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Figure 2-3. Density study/relocation areas in the Eagle's Landing bed, 2016 - 2018.

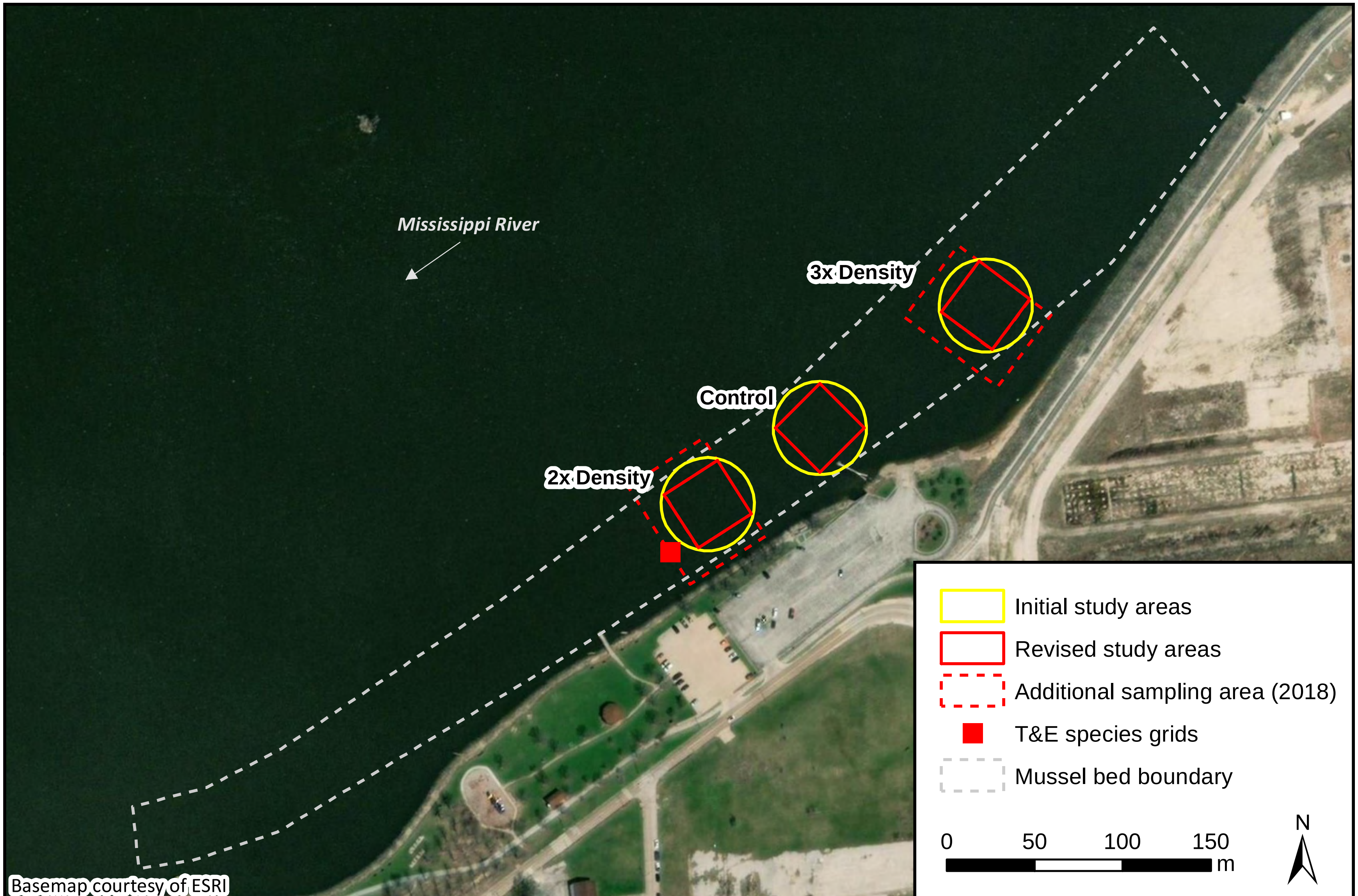

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Figure 2-4. Density study/relocation areas in the Upstream bed, 2016 - 2018.

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Figure 2-5. *Margaritifera monodonta* relocation and monitoring sites, 2015 - 2018.

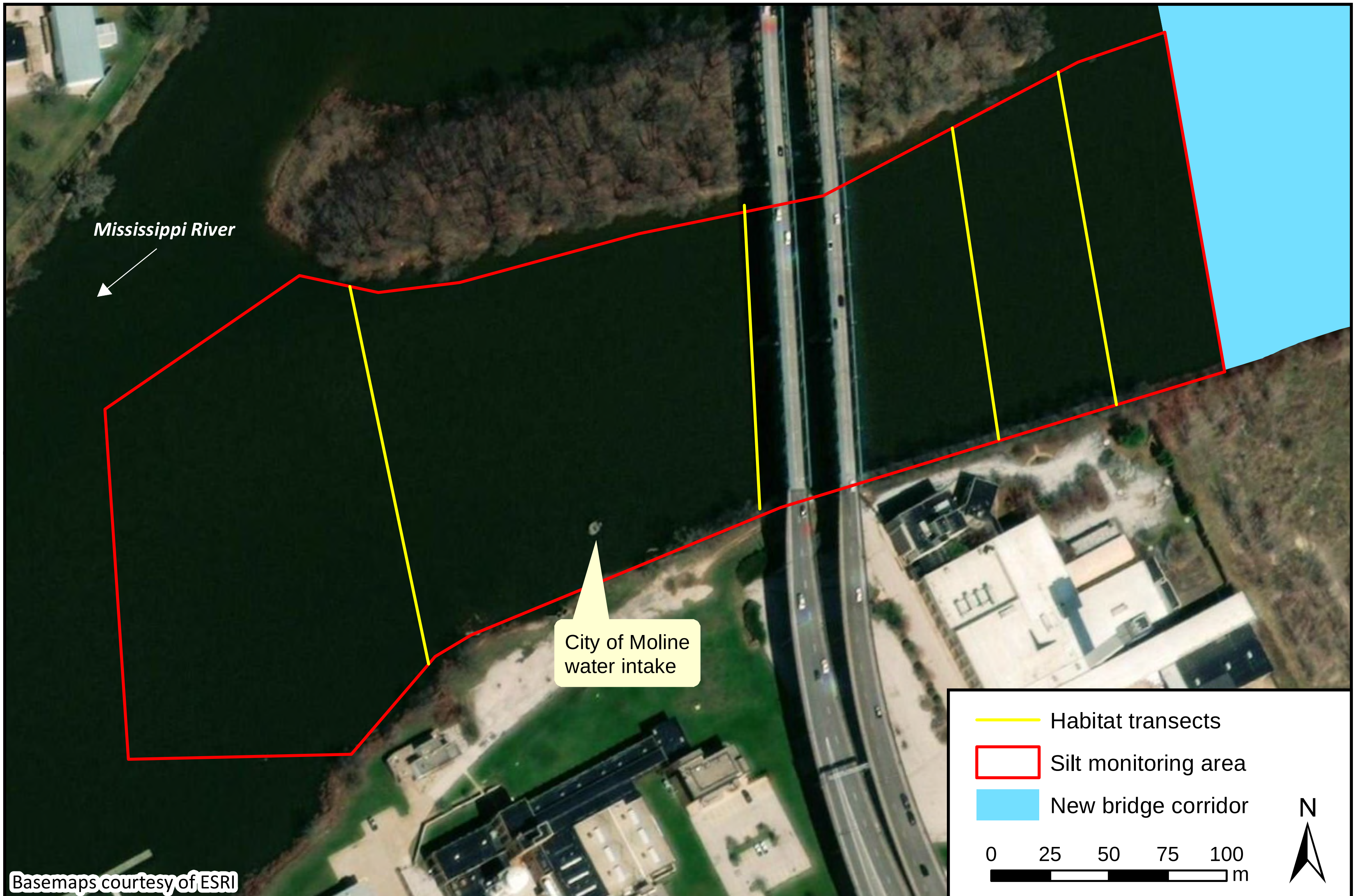

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Figure 2-6. Sylvan Slough silt monitoring area and transect locations, 2017 - 2018.

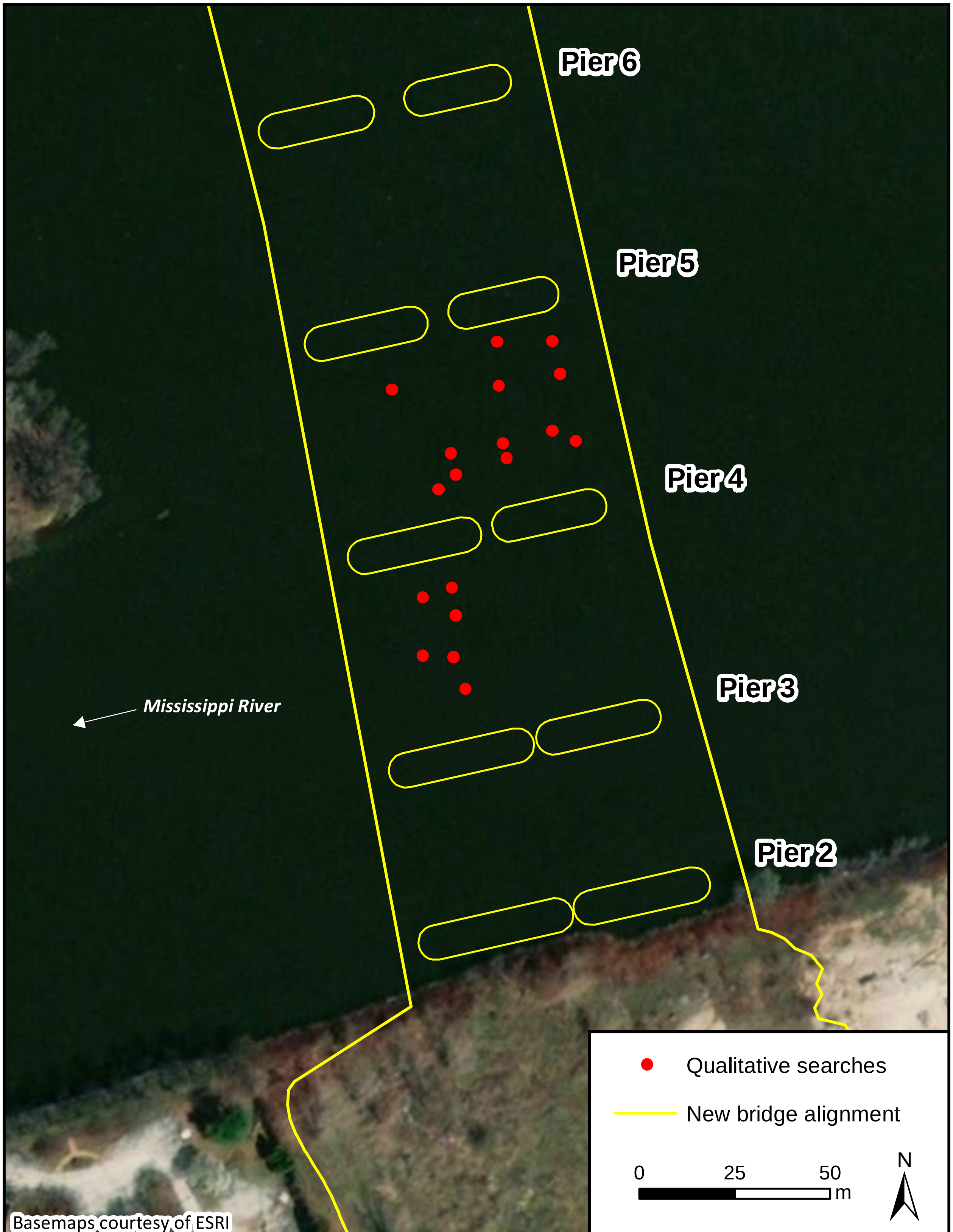

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Figure 2-7. Qualitative search locations in the new bridge construction area, October 2018.

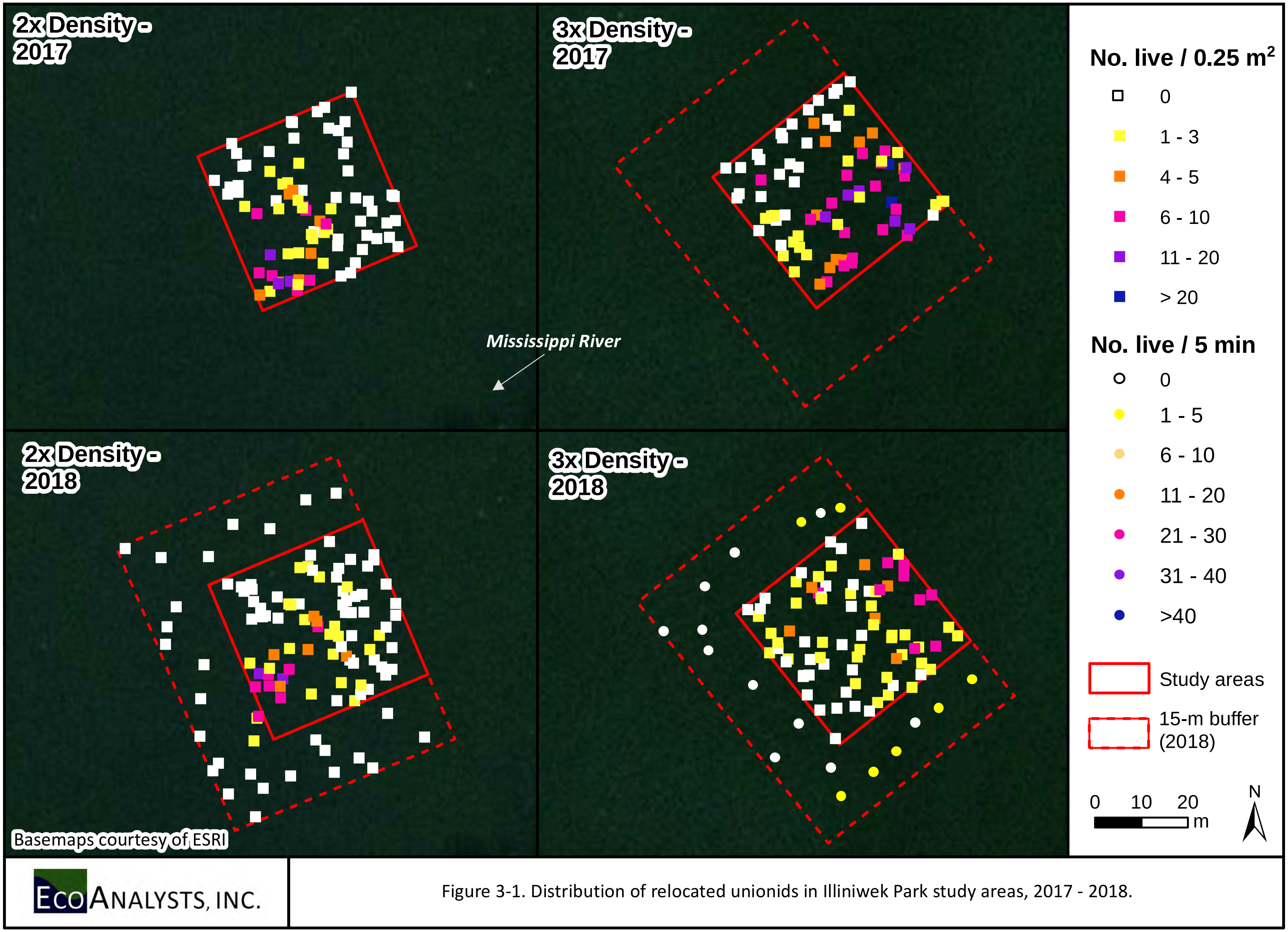

Figure 3-1. Distribution of relocated unionids in Illiniwek Park study areas, 2017 - 2018.

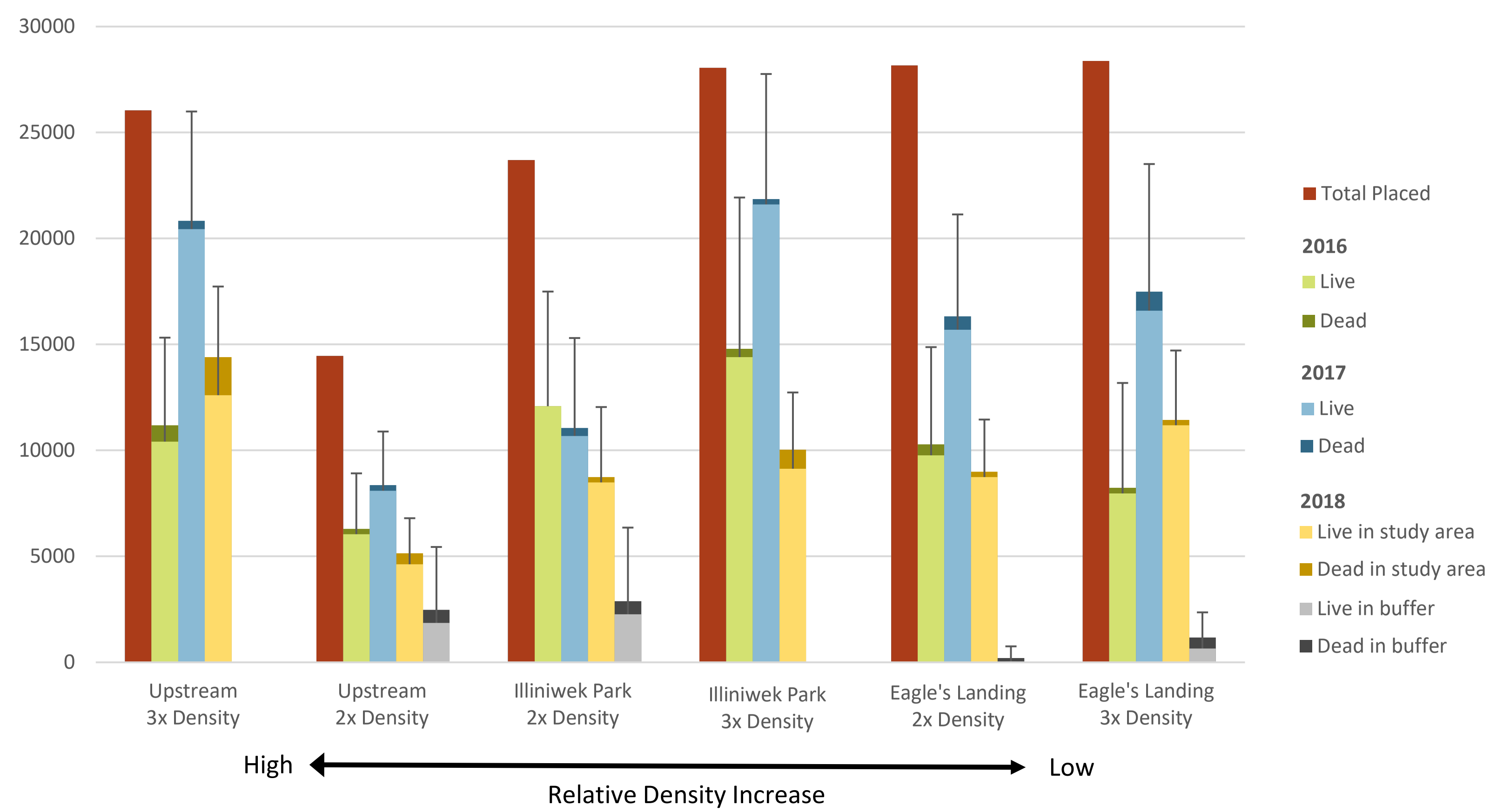

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Figure 3-2. Unionids placed and recaptured in density study areas, 2016 - 2018.

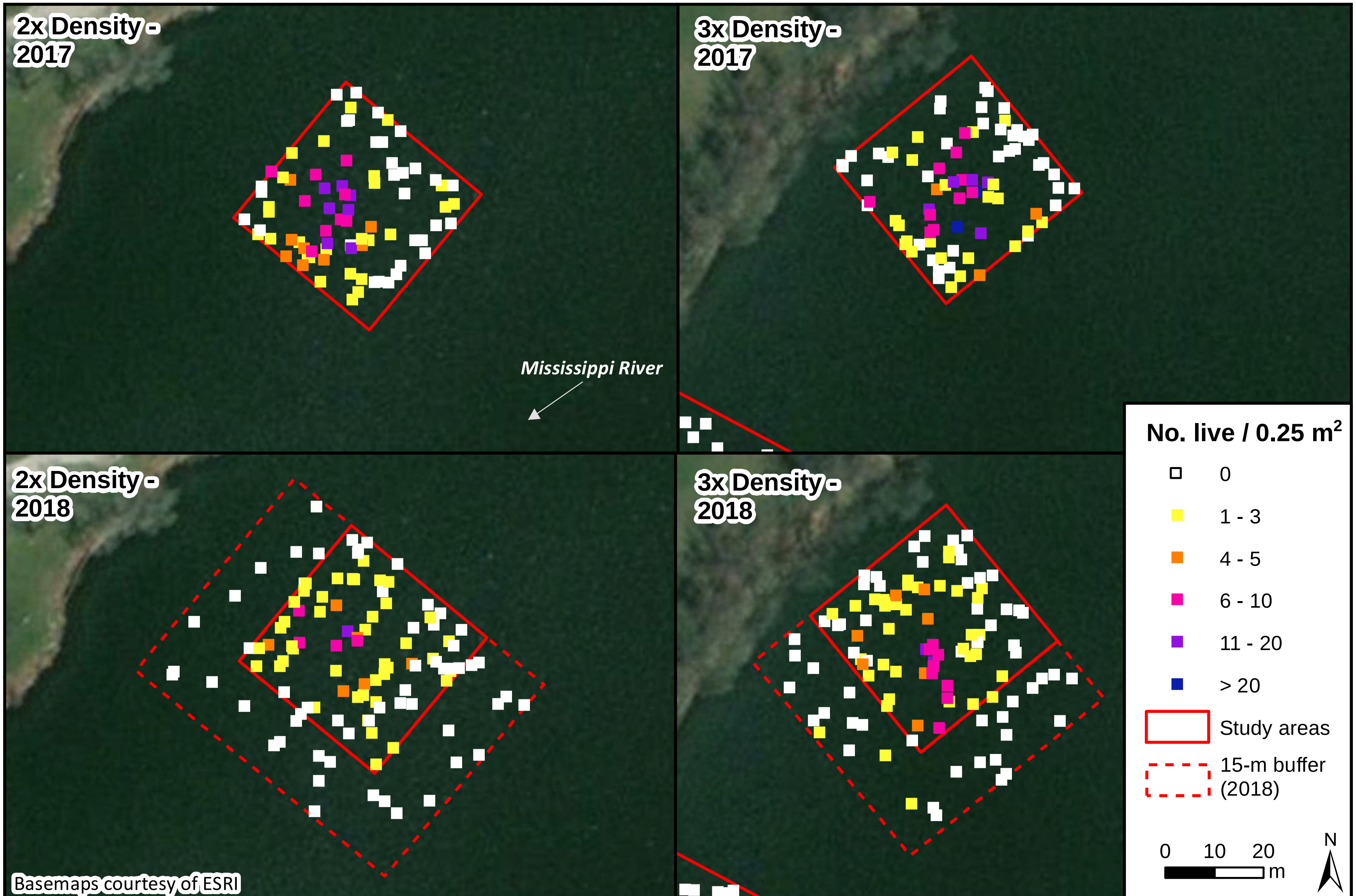

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Figure 3-3. Distribution of relocated unionids in Eagle's Landing study areas, 2017 - 2018.

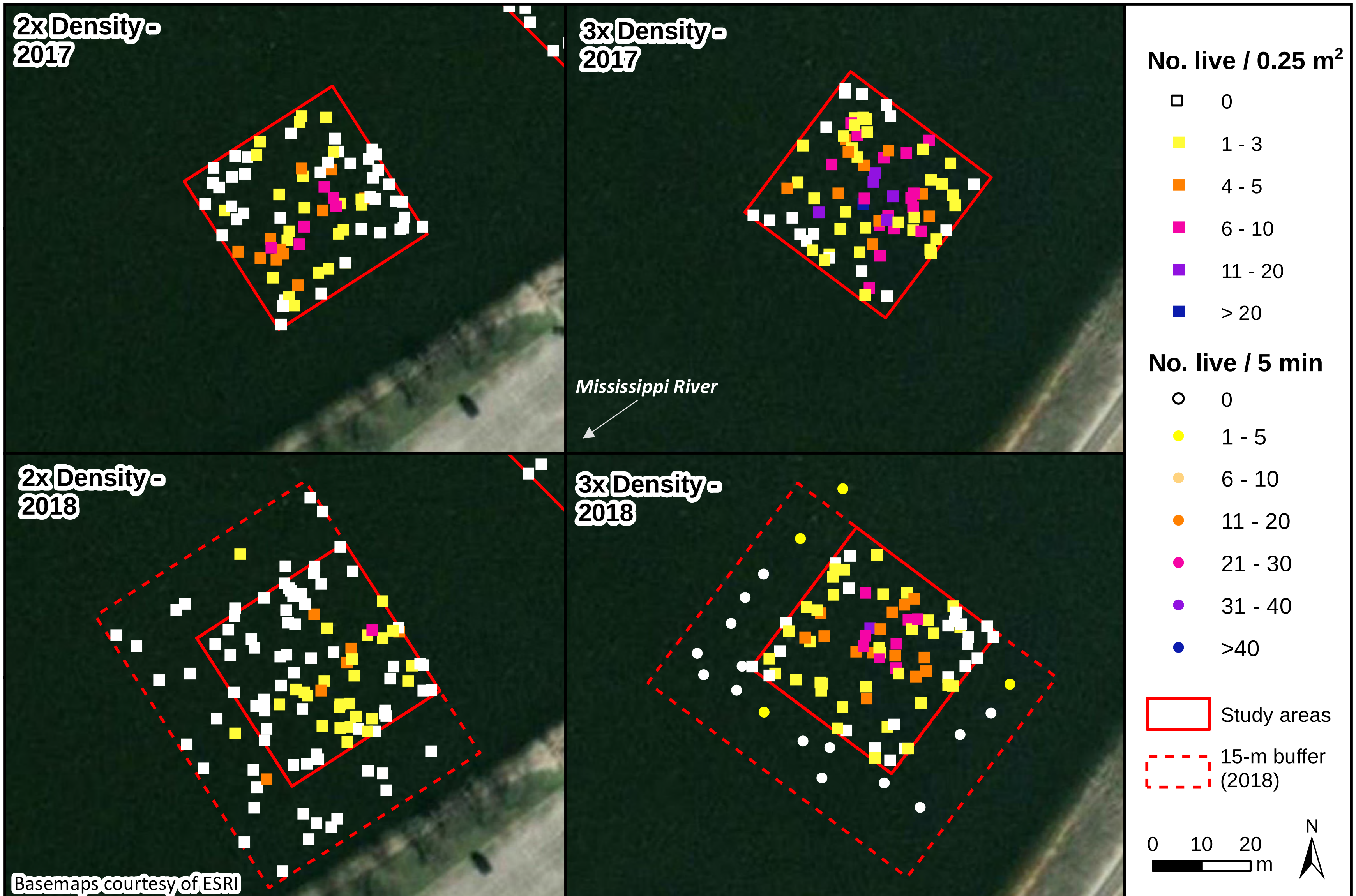

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Figure 3-4. Distribution of relocated unionids in Upstream study areas, 2017 - 2018.

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Figure 3-5. Substrate composition along transects in Sylvan Slough, 2017 - 2018.

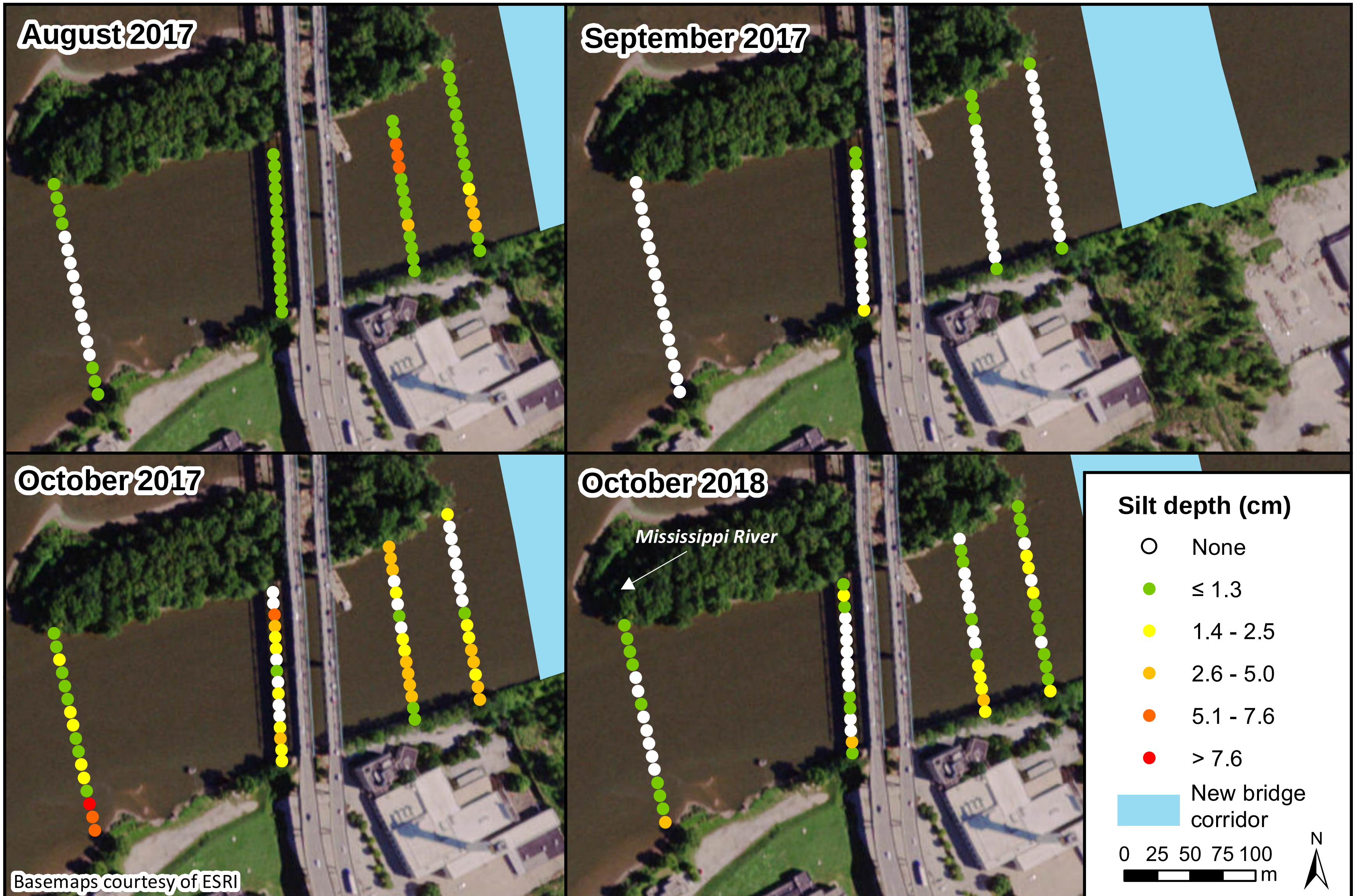

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Figure 3-6. Depth of silt on top of substrate along transects in Sylvan Slough, 2017 - 2018.

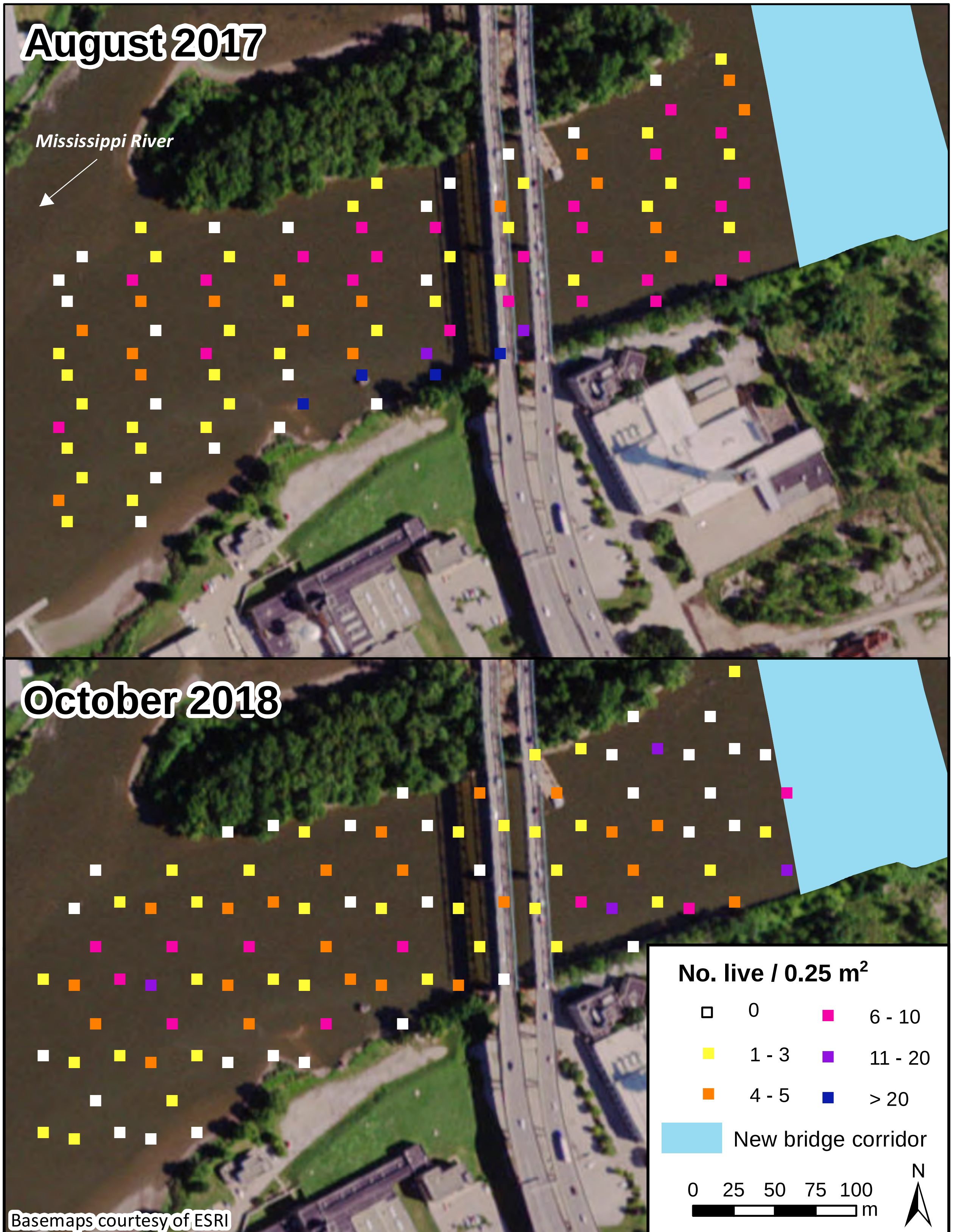

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Figure 3-7. Live unionids collected in Sylvan Slough quantitative samples, 2017 - 2018.

Table 3-1. Habitat characteristics in Illiniwek Park density study areas, 2016 - 2018.

	Discharge (cfs)		Depth (m)		Average % substrate constituents										
	Min.	Max.	Min.	Max.	Bedrock	Boulder	Cobble	Gravel	Sand	Silt	Clay	Shell	Detritus	Wood	Vege-tation
Control															
July 2016	82,000	82,000	0.9	1.5	0.0	0.0	0.0	0.0	0.1	27.1	72.9	0.0	0.0	0.0	0.0
August 2017	74,800	86,500	1.2	1.5	0.0	0.0	0.0	0.0	0.0	40.3	59.3	0.0	0.5	0.0	0.0
Sept. - Oct. 2018	125,000	125,000	1.5	1.8	0.0	0.0	0.0	0.0	0.0	1.7	94.4	3.3	0.0	0.7	0.0
2x Density															
July 2016	87,000	87,000	1.8	3.4	0.0	0.3	0.6	0.5	31.4	31.5	8.6	25.9	0.0	1.3	0.0
November 2016	104,000	104,000	2.4	3.7	0.8	0.0	0.6	0.8	59.8	11.3	3.0	23.9	0.0	0.0	0.0
August 2017	61,800	74,800	1.5	2.7	1.1	1.4	7.3	0.0	31.6	6.6	5.0	46.9	0.0	0.0	0.0
Sept. - Oct. 2018	122,000	176,000	2.4	4.0	0.0	1.2	4.8	5.4	44.0	0.8	0.0	41.2	0.0	2.6	0.0
3x Density															
July 2016	85,000	85,000	1.2	2.4	0.0	0.0	0.0	0.0	0.1	26.8	72.8	0.1	0.0	0.2	0.0
November 2016	104,000	104,000	1.2	1.8	0.0	0.0	0.0	0.0	0.0	46.3	47.3	6.5	0.0	0.0	0.0
August 2017	86,500	93,800	0.9	1.8	0.0	0.0	0.0	0.0	0.0	0.5	96.1	0.0	3.1	0.3	0.0
Sept. - Oct. 2018	111,000	121,000	1.5	2.4	0.0	0.0	0.0	0.0	0.0	2.8	90.3	5.1	0.0	1.9	0.0

Table 3-2. Unionid assemblage characteristics in the Illiniwek Park Control area, 2016 - 2018.

	July 2016	2017	2018
Total live unionids	215	220	208
Live species	14	11	11
ES_100	10	9	9
Most abundant species	*A. plicata* (50.7%) *O. reflexa* (31.6%) *F. flava* (7.4%)	*A. plicata* (55.0%) *O. reflexa* (29.1%) *F. flava* (4.1%) *P. ohiensis* (4.1%)	*A. plicata* (46.2%) *O. reflexa* (29.3%) *L. fragilis* (12.0%)
Total density (no./m^2 ± 2SE)	10.8 ± 1.9 ^{A}	11.0 ± 2.0 ^{A}	10.4 ± 1.4 ^{A}
Adult density (no./m^2 ± 2SE)	4.6 ± 1.1 ^{A}	3.9 ± 1.0 ^{A}	3.8 ± 0.8 ^{A}
Juvenile density (no./m^2 ± 2SE)	6.2 ± 1.5 ^{A}	7.2 ± 1.7 ^{A}	6.6 ± 1.2 ^{A}
% ≤5 years old	57.7	65.0	63.5
% mortality	2.3	6.8	10.3
FD density (no./m^2 ± 2SE)	0.3 ± 0.2 ^{A}	0.8 ± 0.4 ^{B}	1.2 ± 0.5 ^{B}

Nomenclature follows Williams et al. (2017)

Different letters within a row denote a significant difference among years ($p < 0.05$)

Table 3-3. Unionid assemblage characteristics in the Illiniwek Park 2x Density area, 2016 - 2018.

	Resident Unionids				Relocated Unionids		
	July 2016	Nov. 2016	2017	2018	Nov. 2016	2017	2018
Total live unionids	399	127	406	601	94	166	131
Live species	18	15	20	18	12	14	14
ES_100	13	14	15	13	12	13	13
Most abundant species	*C. pustulosa* (27.3%) *A. plicata* (23.3%) *O. reflexa* (21.3%)	*A. plicata* (26.0%) *O. reflexa* (25.2%) *C. pustulosa* (19.7%)	*O. reflexa* (27.3%) *A. plicata* (23.2%) *C. pustulosa* (20.9%)	*O. reflexa* (22.0%) *L. fragilis* (20.1%) *A. plicata* (18.5%)	*C. pustulosa* (33.0%) *O. reflexa* (16.0%) *A. plicata* (13.8%) *L. recta* (13.8%)	*C. pustulosa* (31.9%) *O. reflexa* (21.1%) *A. plicata* (13.9%)	*C. pustulosa* (28.2%) *O. reflexa* (21.4%) *A. plicata* (15.3%)
Total density (no./m^2 ± 2SE)	20.0 ± 2.5 ^{A}	12.7 ± 3.4 ^{B}	20.3 ± 2.4 ^{A}	30.1 ± 3.0 ^{C}	9.4 ± 4.2 *	8.3 ± 3.2 *	6.6 ± 2.5 *
Adult density (no./m^2 ± 2SE)	10.9 ± 1.9 ^{A}	6.1 ± 1.8 ^{B}	10.0 ± 1.7 ^{A}	11.8 ± 1.7 ^{A}	7.7 ± 3.5 *	7.4 ± 2.9 *	6.1 ± 2.3 *
Juvenile density (no./m^2 ± 2SE)	9.1 ± 1.7 ^{A}	6.6 ± 2.6 ^{B}	10.3 ± 1.6 ^{A}	18.3 ± 2.3 ^{C}	1.7 ± 0.9 *	0.9 ± 0.6 †	0.5 ± 0.4 †
% ≤5 years old	45.4	52.0	50.7	60.9	18.1	10.8	6.9
Average length (mm)	-	-	-	-	63.3 ± 6.2 *†	59.3 ± 4.0 *	64.4 ± 4.3 †
% mortality	0.7	19.1	3.8	3.7	0.0	2.9	3.0
FD density (no./m^2 ± 2SE)	0.2 ± 0.2 ^{A}	3.0 ± 1.1 ^{B}	0.8 ± 0.4 ^{C}	1.2 ± 0.5 ^{C}	0.0 ± 0.0 *	0.3 ± 0.3 *	0.2 ± 0.2 *

Nomenclature follows Williams et al. (2017)

Different letters or symbols within a row denote a significant difference among years ($p < 0.05$)

Table 3-4. Unionid assemblage characteristics in the Illiniwek Park 3x Density area, 2016 - 2018.

	Resident Unionids				Relocated Unionids		
	July 2016	Nov. 2016	2017	2018	Nov. 2016	2017	2018
Total live unionids	576	125	400	442	112	335	142
Live species	16	12	16	17	12	15	11
ES_100	10	11	11	11	12	13	11
Most abundant species	*A. plicata* (40.8%) *O. reflexa* (36.6%) *C. pustulosa* (4.7%) *L. fragilis* (4.7%)	*O. reflexa* (36.8%) *A. plicata* (36.0%) *C. pustulosa* (7.2%)	*A. plicata* (38.5%) *O. reflexa* (38.0%) *F. flava* (4.3%)	*O. reflexa* (40.7%) *A. plicata* (32.4%) *L. fragilis* (6.1%)	*C. pustulosa* (38.4%) *O. reflexa* (16.1%) *A. plicata* (13.4%)	*C. pustulosa* (31.0%) *O. reflexa* (17.0%) *A. plicata* (17.0%) *L. recta* (7.5%)	*C. pustulosa* (33.8%) *O. reflexa* (22.5%) *A. plicata* (12.7%)
Total density (no./m^2 ± 2SE)	28.8 ± 4.9^{A}	12.5 ± 3.4^{B}	20.0 ± 2.8^{C}	22.1 ± 2.9^{AC}	$11.2 \pm 5.5^{*}$	$16.8 \pm 4.5^{\dagger}$	$7.1 \pm 2.0^{*}$
Adult density (no./m^2 ± 2SE)	13.6 ± 3.0^{A}	4.8 ± 1.9^{B}	11.4 ± 1.8^{A}	12.5 ± 2.1^{A}	$9.4 \pm 4.8^{*}$	$14.7 \pm 4.0^{\dagger}$	$6.4 \pm 1.9^{*}$
Juvenile density (no./m^2 ± 2SE)	15.3 ± 2.6^{A}	7.7 ± 2.3^{B}	8.7 ± 1.7^{B}	9.6 ± 1.5^{B}	$1.8 \pm 1.4^{*\dagger}$	$2.1 \pm 0.8^{*}$	$0.7 \pm 0.4^{\dagger}$
% ≤5 years old	53.0	61.6	43.3	43.4	16.1	12.2	9.9
Average length (mm)	-	-	-	-	$56.9 \pm 5.5^{*}$	$61.0 \pm 3.0^{*}$	$62.7 \pm 5.0^{*}$
% mortality	2.2	9.4	5.9	7.9	2.6	1.2	8.4
FD density (no./m^2 ± 2SE)	0.7 ± 0.4^{A}	1.3 ± 0.7^{BC}	1.3 ± 0.6^{B}	1.9 ± 0.6^{C}	$0.3 \pm 0.3^{*}$	$0.2 \pm 0.2^{*}$	$0.7 \pm 0.4^{*}$

Nomenclature follows Williams et al. (2017)

Different letters or symbols within a row denote a significant difference among years ($p < 0.05$)

Table 3-5. Unionids placed in density study areas, 2016 - 2017.

Species	Illiniwek Park		Eagle's Landing		Upstream	
	2x Density	3x Density	2x Density	3x Density	2x Density	3x Density
<u>Amblemini</u>						
Amblema plicata	3,763	4,449	4,484	4,410	2,344	4,250
<u>Pleurobemini</u>						
Fusconaia flava	557	698	694	737	496	635
Pleurobema sintoxia	6	5	6	9	5	5
<u>Quadrulini</u>						
Cyclonaias (=Quadrula) nodulata	68	56	47	44	47	43
Cyclonaias (=Quadrula) pustulosa	8,621	10,133	10,089	10,287	5,213	9,401
Megalonaias nervosa	567	728	705	743	401	620
Quadrula quadrula	691	815	807	787	272	749
Theliderma (=Quadrula) metanevra	567	605	647	675	436	597
<u>Lampsilini</u>						
Actinonaias ligamentina	9	13	9	21	7	21
Ellipsaria lineolata	477	525	583	583	306	431
Lampsilis cardium	1,059	1,266	1,301	1,337	740	1,287
Lampsilis siliquoidea	-	1	-	-	-	-
Lampsilis teres	-	1	-	-	-	-
Leptodea fragilis	165	184	192	183	116	184
Ligumia recta	1,516	1,736	1,787	1,695	829	1,738
Obliquaria reflexa	4,950	5,989	6,018	6,133	2,898	5,383
Obovaria olivaria	331	406	359	353	115	339
Potamilus alatus	104	91	102	91	68	97
Potamilus ohiensis	2	6	4	2	-	3
Toxolasma parvum	3	-	1	2	-	1
Truncilla donaciformis	4	14	14	13	9	10
Truncilla truncata	74	121	101	84	32	88
<u>Anodontini</u>						
Arcidens confragosus	68	103	73	74	53	59
Lasmigona complanata	91	100	132	111	68	102
Pyganodon grandis	1	4	7	3	2	5
Strophitus undulatus	-	2	2	-	-	-
Utterbackia imbecillis	-	2	-	1	-	-
Total placed in 2016	23,694	24,837	25,124	25,252	14,457	24,750
Total placed in 2017	-	3,216	3,040	3,126	-	1,298
Total to date	23,694	28,053	28,164	28,378	14,457	26,048
No. species placed	23	26	24	24	21	23

Nomenclature follows Williams et al. (2017). Species names used in previous I-74 reports are provided in parentheses.

Table 3-6. Estimated number of relocated unionids occurring in density study areas, 2016 - 2018.

	Illiniwek Park		Eagle's Landing		Upstream	
	2x Density	3x Density	2x Density	3x Density	2x Density	3x Density
Unionids placed, 2016	23,694	24,837	25,124	25,252	14,457	24,750
Estimated % increase in density	99.6	86.2	40.9	28.4	103.1	192.5
Expected density (no./m^2)	18.4	19.3	19.5	19.6	11.2	19.2
2016 density of relocated unionids (no./m^2 ± 2SE)	9.4 ± 4.2	11.2 ± 5.5	7.6 ± 3.6	6.2 ± 3.9	4.7 ± 1.9	8.1 ± 3.2
2016 est. no. of relocated unionids live	12,088	14,403	9,774	7,973	6,044	10,417
2016 est. no. of relocated unionids dead	0	386	514	257	257	772
2016 est. no. relocated unionids accounted for	12,088	14,789	10,288	8,230	6,301	11,188
% of no. placed	51.0	59.5	40.9	32.6	43.6	45.2
Total unionids placed, 2016 - 2017	23,694	28,053	28,164	28,378	14,457	26,048
Estimated % increase in density	99.6	97.4	45.8	31.9	103.1	202.6
Expected density (no./m^2)	18.4	21.8	21.9	22.1	11.2	20.3
2017 density of relocated unionids (no./m^2 ± 2SE)	8.3 ± 3.2	16.8 ± 4.5	12.2 ± 3.6	12.9 ± 4.6	6.3 ± 2.0	15.9 ± 4.0
2017 est. no. of relocated unionids live	10,674	21,605	15,689	16,589	8,102	20,447
2017 est. no. of relocated unionids dead	386	257	643	900	257	386
2017 est. no. of relocated unionids accounted for	11,060	21,862	16,332	17,490	8,359	20,833
% of no. placed	46.7	77.9	58.0	61.6	57.8	80.0
2018 density of relocated unionids (no./m^2 ± 2SE) in area	6.6 ± 2.5	7.1 ± 2.0	6.8 ± 1.9	8.7 ± 2.5	3.6 ± 1.3	9.8 ± 2.4
2018 est. no. of relocated unionids live in area	8,488	9,131	8,745	11,188	4,630	12,603
2018 est. no. of relocated unionids dead in area	257	900	257	257	514	1,800
2018 est. no. of relocated unionids accounted for in area	8,745	10,031	9,002	11,445	5,144	14,403
2018 density of relocated unionids (no./m2 ± 2SE) in buffer	1.1 ± 1.6	n/a	0.0 ± 0.0	0.5 ± 0.5	0.9 ± 1.4	n/a
2018 est. no. of relocated unionids live in buffer	2,266	n/a	0	650	1,854	n/a
2018 est. no. of relocated unionids dead in buffer	618	n/a	206	520	618	n/a
2018 est. no. of relocated unionids accounted for in buffer	2,884	n/a	206	1,170	2,472	n/a
2018 est. no relocated unionids accounted for, area + buffer	11,629	10,031	9,208	12,615	7,616	14,403
% of no. placed	49.1	35.8	32.7	44.5	52.7	55.3

Table 3-7. Unionids collected in buffers outside density study areas, 2018.

	Illiniwek Park		Eagle's Landing		Upstream	
	2x Density	3x Density	2x Density	3x Density	2x Density	3x Density
Sample effort	7.5 m^2	90 min	7.5 m^2	7.5 m^2	7.5 m^2	90 min
Total no. live	8	8	0	4	7	9
Live species	6	2	0	3	4	4
Total density (no./m^2 ± 2SE)	1.1 ± 1.6	-	0.0 ± 0.0	0.5 ± 0.5	0.9 ± 1.4	-
Catch per unit effort (no. live/hr)	-	5.3	-	-	-	6.0
FD density (no./m^2 ± 2SE)	0.3 ± 0.4	-	0.1 ± 0.3	0.4 ± 0.8	0.3 ± 0.5	-
% mortality	-	11.1	-	-	-	40.0
Buffer area (m^2)	2,060	2,060	2,060	1,300	2,060	2,060
Est. relocated unionids in buffer	2,266	-	0	650	1,854	-

Table 3-8. Habitat characteristics in Eagle's Landing density study areas, 2016 - 2018.

	Discharge (cfs)		Depth (m)		Average % substrate constituents										
	Min.	Max.	Min.	Max.	Bedrock	Boulder	Cobble	Gravel	Sand	Silt	Clay	Shell	Detritus	Wood	Vege-tation
<u>Control area</u>															
July 2016	62,000	67,000	0.3	2.7	0.0	0.0	18.3	2.9	20.4	21.2	0.4	36.9	0.0	0.0	0.0
August 2017	76,200	76,900	0.3	2.7	0.0	2.1	8.1	5.4	41.4	7.2	4.4	31.2	0.0	0.1	0.0
Sept. - Oct. 2018	121,000	122,000	0.6	3.4	0.0	2.1	10.2	3.4	32.3	0.9	2.8	44.1	0.0	4.4	0.0
<u>2x Density</u>															
July 2016	56,000	62,000	0.3	2.7	0.0	0.0	1.4	0.0	1.9	58.4	0.0	38.3	0.0	0.0	0.0
November 2016	104,000	104,000	1.2	3.7	0.0	0.0	2.0	0.0	44.5	17.3	16.8	19.3	0.3	0.0	0.0
August 2017	76,200	76,600	0.6	2.7	0.0	0.0	7.8	0.3	40.7	7.3	10.0	34.0	0.0	0.0	0.0
Sept. - Oct. 2018	114,000	114,000	1.8	3.0	0.0	0.7	0.9	1.4	42.1	10.8	14.2	28.7	0.0	1.3	0.0
<u>3x Density</u>															
July 2016	67,000	87,000	0.6	2.1	0.0	0.3	7.5	0.3	24.5	21.5	8.4	37.2	0.0	0.4	0.0
November 2016	104,000	104,000	1.5	2.7	0.0	0.0	1.5	4.3	34.5	9.5	16.0	28.5	5.8	0.0	0.0
August 2017	74,900	76,900	0.6	2.1	0.0	0.8	1.3	0.3	31.1	11.6	11.4	42.5	0.0	1.0	0.0
Sept. - Oct. 2018	151,000	156,000	1.5	3.0	0.0	0.5	1.4	0.4	18.9	2.3	22.4	51.0	0.0	3.1	0.0

Table 3-9. Unionid assemblage characteristics in the Eagle's Landing Control area, 2016 - 2018.

	July 2016	2017	2018
Total live unionids	1,559	731	756
Live species	21	20	20
ES_100	13	14	15
Most abundant species	*U. imbecillis* (23.6%)	*C. pustulosa* (21.1%)	*L. fragilis* (17.3%)
	C. pustulosa (13.1%)	*O. reflexa* (15.9%)	*O. reflexa* (15.9%)
	O. reflexa (12.4%)	*A. plicata* (15.2%)	*C. pustulosa* (14.7%)
Total density (no./m^2 ± 2SE)	78.0 ± 16.6 A	36.6 ± 7.0 B	37.8 ± 7.7 B
Adult density (no./m^2 ± 2SE)	16.7 ± 3.9 A	21.6 ± 4.3 A	17.5 ± 3.5 A
Juvenile density (no./m^2 ± 2SE)	61.3 ± 13.4 A	15.0 ± 3.6 B	20.4 ± 4.6 B
% ≤5 years old	78.6	40.9	53.8
% mortality	4.5	3.3	7.2
FD density (no./m^2 ± 2SE)	3.7 ± 1.2 A	1.3 ± 0.6 B	3.0 ± 1.0 A

Nomenclature follows Williams et al. (2017)

Different letters or symbols within a row denote a significant difference among years ($p < 0.05$)

Table 3-10. Unionid assemblage characteristics in the Eagle's Landing 2x Density area, 2016 - 2018.

	Resident Unionids				Relocated Unionids		
	July 2016	Nov. 2016	2017	2018	Nov. 2016	2017	2018
Total live unionids	1,229	242	486	485	76	244	135
Live species	20	16	21	20	14	14	12
ES_100	12	14	13	14	16	12	12
Most abundant species	*O. reflexa* (29.5%)	*O. reflexa* (27.3%)	*O. reflexa* (28.4%)	*O. reflexa* (23.9%)	*C. pustulosa* (27.6%)	*C. pustulosa* (31.6%)	*C. pustulosa* (30.4%)
	U. imbecillis (16.1%)	*C. pustulosa* (16.1%)	*C. pustulosa* (20.8%)	*C. pustulosa* (21.2%)	*O. reflexa* (21.1%)	*O. reflexa* (21.7%)	*A. plicata* (15.6%)
	C. pustulosa (12.6%)	*A. plicata* (12.0%)	*A. plicata* (15.4%)	*A. plicata* (12.2%)	*A. plicata* (15.8%)	*A. plicata* (18.9%)	*O. reflexa* (14.8%)
Total density (no./m^2 ± 2SE)	61.5 ± 10.2 ^{A}	24.2 ± 5.0 ^{B}	24.3 ± 3.3 ^{B}	24.3 ± 3.4 ^{B}	7.6 ± 3.6 *	12.2 ± 3.6 *	6.8 ± 1.9 *
Adult density (no./m^2 ± 2SE)	15.0 ± 3.1 ^{A}	8.2 ± 2.5 ^{B}	10.2 ± 1.5 ^{AB}	9.8 ± 1.9 ^{B}	6.4 ± 2.9 *	11.6 ± 3.3 *	6.2 ± 1.8 *
Juvenile density (no./m^2 ± 2SE)	46.5 ± 7.9 ^{A}	16.0 ± 3.4 ^{B}	14.2 ± 2.3 ^{B}	14.5 ± 2.4 ^{B}	1.2 ± 0.9 *	0.7 ± 0.5 *	0.6 ± 0.4 *
% ≤5 years old	75.7	66.1	58.2	59.8	15.8	5.3	8.9
Average length (mm)	-	-	-	-	62.4 ± 7.1 *	60.2 ± 3.2 *	70.3 ± 5.4 †
% mortality	5.8	14.2	5.4	6.9	5.0	3.9	2.2
FD density (no./m^2 ± 2SE)	3.8 ± 0.8 ^{A}	4.0 ± 2.0 ^{A}	1.4 ± 0.5 ^{B}	1.8 ± 0.8 ^{B}	0.4 ± 0.4 *	0.5 ± 0.3 *	0.2 ± 0.2 *

Nomenclature follows Williams et al. (2017)

Different letters or symbols within a row denote a significant difference among years ($p < 0.05$)

Table 3-11. Unionid assemblage characteristics in the Eagle's Landing 3x Density area, 2016 - 2018.

	Resident Unionids				Relocated Unionids		
	July 2016	Nov. 2016	2017	2018	Nov. 2016	2017	2018
Total live unionids	1,835	361	939	1,045	62	257	174
Live species	24	19	23	21	11	13	13
ES_100	13	15	13	14	11	11	12
Most abundant species	*U. imbecillis* (18.3%)	*C. pustulosa* (16.1%)	*C. pustulosa* (23.1%)	*C. pustulosa* (21.6%)	*A. plicata* (22.6%)	*C. pustulosa* (32.7%)	*C. pustulosa* (25.7%)
	O. reflexa (15.9%)	*A. plicata* (15.5%)	*O. reflexa* (16.2%)	*A. plicata* (14.5%)	*C. pustulosa* (21.0%)	*O. reflexa* (20.6%)	*O. reflexa* (18.3%)
	C. pustulosa (15.0%)	*O. reflexa* (14.4%)	*A. plicata* (16.1%)	*L. fragilis* (14.0%)	*O. reflexa* (12.9%)	*A. plicata* (19.1%)	*A. plicata* (16.6%)
Total density (no./m^2 ± 2SE)	91.8 ± 19.8^{A}	36.1 ± 8.7^{B}	47.0 ± 7.9^{BC}	52.3 ± 7.3^{C}	$6.2 \pm 3.9^{*}$	$12.9 \pm 4.6^{*}$	$8.7 \pm 2.5^{*}$
Adult density (no./m^2 ± 2SE)	22.5 ± 4.5^{A}	13.8 ± 3.6^{B}	26.5 ± 4.3^{C}	24.3 ± 3.6^{AC}	$5.2 \pm 3.0^{*}$	$11.5 \pm 4.3^{*}$	$7.7 \pm 2.3^{*}$
Juvenile density (no./m^2 ± 2SE)	69.3 ± 17.5^{A}	22.3 ± 6.4^{BC}	20.5 ± 5.2^{B}	28.0 ± 4.4^{C}	$1.0 \pm 1.0^{*}$	$1.4 \pm 0.6^{*}$	$1.1 \pm 0.4^{*}$
% ≤5 years old	75.5	61.8	43.6	53.5	16.1	10.9	12.0
Average length (mm)	-	-	-	-	$64.2 \pm 7.4^{*\dagger}$	$59.1 \pm 3.3^{*}$	$67.7 \pm 4.4^{\dagger}$
% mortality	4.0	8.4	7.8	2.5	3.1	5.2	2.2
FD density (no./m^2 ± 2SE)	3.8 ± 1.1^{A}	3.3 ± 1.0^{A}	4.0 ± 1.1^{A}	1.4 ± 0.6^{B}	$0.2 \pm 0.3^{*}$	$0.7 \pm 0.4^{\dagger}$	$0.2 \pm 0.2^{*}$

Nomenclature follows Williams et al. (2017)

Different letters or symbols within a row denote a significant difference among years ($p < 0.05$)

Table 3-12. Habitat characteristics in Upstream density study areas, 2016 - 2018.

	Discharge (cfs)		Depth (m)		Average % substrate constituents										
	Min.	Max.	Min.	Max.	Bedrock	Boulder	Cobble	Gravel	Sand	Silt	Clay	Shell	Detritus	Wood	Vege-tation
Control area															
July 2016	56,000	79,000	0.3	3.4	1.8	0.0	1.6	1.9	19.9	34.4	1.5	37.0	0.0	1.9	0.0
August 2017	92,000	92,000	1.5	3.7	23.8	0.0	6.8	0.0	37.3	6.9	5.4	18.1	0.0	1.8	0.0
Sept. - Oct. 2018	124,000	124,000	2.4	4.0	5.1	5.3	9.3	6.3	44.3	1.2	1.0	27.6	0.0	0.0	0.0
2x Density															
July 2016	79,000	87,000	1.5	4.0	3.8	0.9	0.6	0.0	30.3	33.5	6.9	21.6	0.0	2.5	0.0
November 2016	106,000	106,000	2.7	4.0	2.5	0.0	0.8	3.3	63.5	8.5	0.8	20.5	0.3	0.0	0.0
August 2017	76,600	86,700	1.8	4.0	0.0	2.2	0.8	0.0	38.4	16.3	3.9	29.3	7.8	0.9	0.0
Sept. - Oct. 2018	132,000	132,000	3.0	4.6	6.0	1.1	4.2	5.4	51.9	0.8	0.0	29.9	0.0	0.8	0.0
3x Density															
July 2016	57,000	57,000	0.6	3.0	6.1	0.1	0.7	0.0	11.7	43.8	17.4	19.6	0.0	0.5	0.1
November 2016	106,000	106,000	1.2	3.7	3.5	0.0	1.0	1.0	21.3	29.0	18.5	24.8	1.0	0.0	0.0
August 2017	87,600	93,800	0.6	3.0	1.8	2.0	5.1	0.1	14.6	14.6	37.6	22.9	0.0	1.4	0.0
Sept. - Oct. 2018	158,000	176,000	1.5	4.3	4.1	0.0	3.2	4.7	28.4	7.4	31.8	19.4	0.0	1.0	0.0

Table 3-13. Unionid assemblage characteristics in the Upstream Control area, 2016 - 2018.

	July 2016	2017	2018
Total live unionids	355	274	413
Live species	16	16	19
ES_100	12	12	14
Most abundant species	*O. reflexa* (25.4%) *A. plicata* (23.9%) *C. pustulosa* (22.8%)	*C. pustulosa* (34.3%) *O. reflexa* (24.1%) *A. plicata* (20.1%)	*C. pustulosa* (29.8%) *O. reflexa* (22.3%) *A. plicata* (11.4%)
Total density (no./m^2 ± 2SE)	17.8 ± 2.6 ^{A}	13.7 ± 3.1 ^{B}	20.7 ± 2.9 ^{A}
Adult density (no./m^2 ± 2SE)	8.5 ± 1.4 ^{A}	7.0 ± 1.5 ^{B}	11.6 ± 2.1 ^{C}
Juvenile density (no./m^2 ± 2SE)	9.3 ± 1.7 ^{A}	6.7 ± 2.0 ^{B}	9.1 ± 1.5 ^{A}
% ≤5 years old	52.1	48.9	44.1
% mortality	13.2	7.4	18.7
FD density (no./m^2 ± 2SE)	2.7 ± 1.0 ^{A}	1.1 ± 0.6 ^{B}	4.8 ± 1.3 ^{C}

Nomenclature follows Williams et al. (2017)

Different letters or symbols within a row denote a significant difference among years ($p < 0.05$)

Table 3-14. Unionid assemblage characteristics in the Upstream 2x Density area, 2016 - 2018.

	Resident Unionids				Relocated Unionids		
	July 2016	Nov. 2016	2017	2018	Nov. 2016	2017	2018
Total	235	88	184	274	47	125	71
Live species	15	15	14	18	10	11	8
ES_100	12	16	12	14	14	10	9
Most abundant species	*C. pustulosa* (26.8%)	*C. pustulosa* (29.5%)	*C. pustulosa* (29.9%)	*C. pustulosa* (28.8%)	*C. pustulosa* (40.4%)	*C. pustulosa* (37.6%)	*C. pustulosa* (31.0%)
	O. reflexa (24.7%)	*O. reflexa* (21.6%)	*O. reflexa* (25.0%)	*O. reflexa* (20.8%)	*A. plicata* (17.0%)	*O. reflexa* (22.4%)	*O. reflexa* (26.8%)
	A. plicata (19.6%)	*A. plicata* (14.8%)	*A. plicata* (20.7%)	*A. plicata* (20.1%)	*L. recta* (12.8%)	*A. plicata* (21.6%)	*A. plicata* (14.1%)
Total density (no./m^2 ± 2SE)	11.8 ± 2.2 ^{A}	8.8 ± 2.5 ^{A}	9.2 ± 1.9 ^{A}	13.7 ± 2.9 ^{A}	4.7 ± 1.9 *	6.3 ± 2.0 *	3.6 ± 1.3 *
Adult density (no./m^2 ± 2SE)	7.1 ± 1.6 ^{A}	2.3 ± 1.1 ^{B}	4.5 ± 1.2 ^{C}	8.6 ± 1.9 ^{A}	3.6 ± 1.8 *	5.6 ± 1.8 *	3.5 ± 1.3 *
Juvenile density (no./m^2 ± 2SE)	4.7 ± 1.4 ^{A}	6.5 ± 2.1 ^{A}	4.7 ± 1.4 ^{A}	5.1 ± 1.4 ^{A}	1.1 ± 0.8 *	0.7 ± 0.4 *	0.1 ± 0.2 †
% ≤5 years old	40.0	73.9	51.1	37.2	23.4	10.4	2.8
Average length (mm)	-	-	-	-	61.1 ± 8.3 *	57.4 ± 4.4 *	56.7 ± 5.5 *
% mortality	17.0	24.1	9.4	17.2	4.1	3.1	9.0
FD density (no./m^2 ± 2SE)	2.4 ± 0.9 ^{A}	2.8 ± 1.1 ^{A}	1.0 ± 0.4 ^{B}	2.9 ± 0.8 ^{A}	0.2 ± 0.3 *	0.2 ± 0.2 *	0.4 ± 0.3 *

Nomenclature follows Williams et al. (2017)

Different letters or symbols within a row denote a significant difference among years ($p < 0.05$)

Table 3-15. Unionid assemblage characteristics in the Upstream 3x Density area, 2016 - 2018.

	Resident Unionids				Relocated Unionids		
	July 2016	Nov. 2016	2017	2018	Nov. 2016	2017	2018
Total live unionids	221	108	282	367	81	318	176
Live species	15	14	17	19	11	14	12
ES_100	13	14	12	17	11	12	11
Most abundant species	*O. reflexa* (36.7%)	*O. reflexa* (27.8%)	*O. reflexa* (31.2%)	*O. reflexa* (28.6%)	*A. plicata* (28.4%)	*C. pustulosa* (34.0%)	*C. pustulosa* (32.3%)
	C. pustulosa (19.0%)	*C. pustulosa* (25.9%)	*C. pustulosa* (27.3%)	*C. pustulosa* (18.3%)	*C. pustulosa* (19.8%)	*A. plicata* (19.5%)	*A. plicata* (16.4%)
	A. plicata (14.9%)	*A. plicata* (15.7%)	*A. plicata* (18.8%)	*A. plicata* (12.0%)	*L. recta* (13.6%)	*O. reflexa* (15.1%)	*O. reflexa* (15.9%)
Total density (no./m^2 ± 2SE)	11.1 ± 2.4 ^{A}	10.8 ± 3.4 ^{AB}	14.1 ± 2.6 ^{B}	18.4 ± 3.2 ^{C}	8.1 ± 3.2 *	15.9 ± 4.0 †	9.8 ± 2.4 *
Adult density (no./m^2 ± 2SE)	4.5 ± 1.2 ^{A}	5.8 ± 2.0 ^{A}	8.1 ± 1.6 ^{B}	8.9 ± 1.7 ^{B}	7.4 ± 2.9 *	15.0 ± 3.8 †	8.8 ± 2.3 *
Juvenile density (no./m^2 ± 2SE)	6.6 ± 1.7 ^{A}	5.0 ± 1.8 ^{A}	6.1 ± 1.5 ^{A}	9.5 ± 2.1 ^{B}	0.7 ± 0.6 *	1.0 ± 0.5 *	1.0 ± 0.5 *
% ≤5 years old	59.3	46.3	42.9	51.8	8.6	6.0	9.7
Average length (mm)	-	-	-	-	70.2 ± 6.8 *	61.2 ± 3.1 †	66.4 ± 4.1 *
% mortality	31.8	35.7	6.3	5.9	6.9	1.9	12.2
FD density (no./m^2 ± 2SE)	5.2 ± 1.4 ^{A}	6.0 ± 2.3 ^{A}	1.0 ± 0.5 ^{B}	1.2 ± 0.5 ^{B}	0.6 ± 0.5 *†	0.3 ± 0.3 *	1.4 ± 0.6 †

Nomenclature follows Williams et al. (2017)

Different letters or symbols within a row denote a significant difference among years ($p < 0.05$)

Table 3-16. Recapture rates, mortality, and metrics of growth and reproduction for T&E species placed in grids.

Grid/Species	No. Placed	2017 Live	2017 Dead	2018 Live	2018 Dead	Avg. Length (mm) Initial Placement	Avg. Length (mm) August 2017	Avg. Length (mm) October 2018	2018 % Gravid Females [1]	2018 Est. No. Remaining [2]
Illiniwek *L. higginsii*										
Lampsilis higginsii	268	230 (85.8%)	0 (0.0%)	35 (13.1%)	0 (0.0%)	74.2 ± 1.6 ^{A}	77.1 ± 1.4 ^{B}	80.4 ± 3.0 ^{B}	47.4	225 (153-297)
Illiniwek *P. cyphyus*										
Plethobasus cyphyus	53	25 (47.2%)	0 (0.0%)	3 (5.7%)	1 (1.9%)	84.7 ± 3.0 ^{A}	89.6 ± 3.0 ^{A}	83.3 ± 5.9 ^{A}	n/a	19 (0-39)
Eurynia (=Elliptio) dilatata	1	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	73.0	-	-	n/a	-
Cyclonaias tuberculata	1	1 (100.0%)	0 (0.0%)	1 (100.0%)	0 (0.0%)	74.0	74.0	74.0	n/a	1
Eagle's Landing *L. higginsii*										
Lampsilis higginsii	248	217 (87.5%)	1 (0.4%)	33 (13.3%)	0 (0.0%)	75.9 ± 1.6 ^{A}	79.2 ± 1.5 ^{B}	82.8 ± 3.7 ^{C}	76.9	206 (92-321)
Eagle's Landing *P. cyphyus*										
Plethobasus cyphyus	61	57 (93.4%)	0 (0.0%)	9 (14.8%)	0 (0.0%)	84.5 ± 2.2 ^{A}	85.6 ± 2.0 ^{A}	88.9 ± 3.9 ^{A}	n/a	56 (2-111)
Eurynia (=Elliptio) dilatata	1	0	0 (0.0%)	0 (0.0%)	0 (0.0%)	84.0	-	-	n/a	-
Upstream *L. higginsii*										
Lampsilis higginsii	236	180 (76.3%)	1 (0.4%)	33 (14.0%)	1 (0.4%)	73.5 ± 2.0 ^{A}	77.6 ± 1.9 ^{B}	84.3 ± 3.7 ^{C}	50.0	206 (89-324)

Nomenclature follows Williams et al. (2017). Species names used in previous I-74 reports are provided in parentheses.

[1] Number of females identified as charging or gravid divided by total number of females recaptured live

[2] Estimated number of relocated individuals (±95% confidence interval) remaining in grid, calculated from 2018 observed density

Table 3-17. Recapture and mortality of PIT-tagged *M. monodonta*, 2015 - 2018.

		October 2015		April 2016		2017		2018		
Site	Initial No. Placed	Recap. Live	Recap. Dead	Recap. Live	Recap. Dead	Recap. Live	Recap. Dead	Recap. Live	Recap. Dead	Detected, Status Unknown [1]
Sylvan Slough										
Live individuals (2015)	3	3 (100%)	-	3 (100%)	-	3 (100%)	-	3 (100%)	-	-
Dead shells (2015)	2	n/a	2 (100%)	n/a	2 (100%)	n/a	2 (100%)	n/a	2 (100%)	-
Live individuals (2016-2017)	25	n/a	n/a	n/a	n/a	17 (68%)	2 (8%)	15 (60%)	3 (12%)	2 (8%)
Arsenal Up										
Live individuals (2015)	3	1 (33%)	-	0 (0%)	-	3 (100%)	-	2 (67%)	-	-
Dead shells (2015)	2	n/a	0 (0%)	n/a	0 (0%)	n/a	2 (100%)	n/a	0 (0%)	-
Arsenal Dn										
Live individuals (2015)	4	1 (25%)	-	1 (25%)	-	0 (0%)	1 (25%)	0 (0%)	-	-
Dead shells (2015)	1	n/a	1 (100%)	n/a	1 (100%)	n/a	1 (100%)	n/a	0 (0%)	-

[1] Reader detected PIT tag, but diver unable to locate the tagged individual

Table 3-18. Unionids collected in Sylvan Slough quantitative samples, 2014 - 2018.

Species	2018		2017		2014 [1]	
	No. Live	%	No. Live	%	No. Live	%
Amblemini						
Amblema plicata	32	11.6	55	12.4	86	15.2
Pleurobemini						
Fusconaia flava	9	3.3	18	4.0	9	1.6
Plethobasus cyphyus	1	0.4	-	-	1	0.2
Pleurobema sintoxia	1	0.4	-	-	-	-
Quadrulini						
Cyclonaias (=Quadrula) nodulata	2	0.7	1	0.2	1	0.2
Cyclonaias (=Quadrula) pustulosa	90	32.7	169	38.0	184	32.5
Megalonaias nervosa	5	1.8	8	1.8	7	1.2
Quadrula quadrula	17	6.2	21	4.7	10	1.8
Theliderma (=Quadrula) metanevra	11	4.0	15	3.4	23	4.1
Lampsilini						
Actinonaias ligamentina	-	-	1	0.2	-	-
Ellipsaria lineolata	4	1.5	5	1.1	6	1.1
Lampsilis cardium	20	7.3	11	2.5	20	3.5
Lampsilis higginsii	5	1.8	-	-	1	0.2
Leptodea fragilis	6	2.2	12	2.7	28	4.9
Ligumia recta	18	6.5	20	4.5	26	4.6
Obliquaria reflexa	48	17.5	94	21.1	125	22.1
Obovaria olivaria	-	-	1	0.2	7	1.2
Potamilus alatus	3	1.1	-	-	3	0.5
Potamilus ohiensis	-	-	1	0.2	2	0.4
Toxolasma parvum	-	-	1	0.2	3	0.5
Truncilla donaciformis	-	-	4	0.9	12	2.1
Truncilla truncata	3	1.1	4	0.9	3	0.5
Anodontini						
Arcidens confragosus	-	-	1	0.2	-	-
Lasmigona complanata	-	-	1	0.2	2	0.4
Pyganodon grandis	-	-	1	0.2	1	0.2
Utterbackia imbecillis	-	-	1	0.2	6	1.1
Total	275	100.0	445	100.0	566	100.0
Live species	17		22		23	
Total density (no./m^2 ± 2SE)	11.0 ± 2.3 ^{A}		17.8 ± 4.2 ^{B}		23.1 ± 4.3 ^{C}	
Adult density (no./m^2 ± 2SE)	7.1 ± 1.8 ^{A}		8.4 ± 1.8 ^{A}		12.9 ± 2.7 ^{B}	
Juvenile density (no./m^2 ± 2SE)	3.9 ± 1.0 ^{A}		9.4 ± 2.7 ^{B}		10.2 ± 2.2 ^{B}	
% ≤5 years old	35.6		52.8		44.2	
% mortality	12.7		9.7		27.2	
FD density (no./m^2 ± 2SE)	1.6 ± 0.6 ^{A}		1.9 ± 0.6 ^{A}		8.6 ± 2.2 ^{B}	

[1] ESI (2014); metrics calculated using the 98 samples that fell within the 2017 - 2018 silt monitoring area.

Table 3-19. Unionids collected in the new I-74 bridge construction area, 2018.

Species	No. Live	%
Amblemini		
Amblema plicata	12	21.8
Pleurobemini		
Fusconaia flava	1	1.8
Quadrulini		
Cyclonaias (=Quadrula) pustulosa	7	12.7
Megalonaias nervosa	5	9.1
Lampsilini		
Ellipsaria lineolata	3	5.5
Lampsilis cardium	12	21.8
Lampsilis higginsii	1	1.8
Ligumia recta	7	12.7
Obliquaria reflexa	4	7.3
Obovaria olivaria	2	3.6
Potamilus alatus	1	1.8
Total	55	100.0
Live species	11	
% ≤5 years old	1.8	
% mortality	8.3	
Catch per unit effort (no. live/hr)	36.7	

Nomenclature follows Williams et al. (2017). Species names used in previous I-74 reports are provided in parentheses.

ATTACHMENT G

I-74 BRIDGE REPLACEMENT PROJECT ILLINOIS DEPARTMENT OF NATURAL RESOURCES CONSERVATION PLAN

Illinois Department of Natural Resources
CONSERVATION PLAN

(Application for an Incidental Take Authorization)

Per 520 ILCS 10/5.5 and 17 Ill. Adm. Code 1080

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

PROJECT APPLICANT: **Illinois and Iowa Departments of Transportation and Federal Highway Administration**

PROJECT NAME: **Interstate 74 (I-74) Bridge Replacement Project**

COUNTY: **Rock Island**

AREA OF IMPACT: **The Action Area is limited to the construction and demolition footprint of the existing and proposed bridge, as well as a 50-foot buffer on both the upstream and downstream sides of the existing and proposed bridges within the Mississippi River (see Figures 1, 2, and 3 attached). The following sites were identified as potential mussel relocation areas and are, therefore, included in the action area (Figure 4):**

- **LeClaire Channel – Iowa Bank of Pool 14; River Mile (RM) 494**
- **Illiniwek Park – Illinois Bank of Pool 15; RM 494**
- **Eagle's Landing – Iowa Bank of Pool 15; RM 490-491**
- **Upstream Site – Illinois Bank of Pool 15; RM 486.5-488.5; Upstream of proposed bridge**
- **Sylvan Slough – Illinois Bank of Pool 15; RM 484.5-485.5; Downstream of the existing bridge**
- **Lateral Dike (Spectaclecase only) – Illinois Bank of Pool 15**
- **Arsenal Power Dam (Spectaclecase only) – Arsenal Island downstream of the Arsenal power dam**

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

1. **A description of the impact likely to result from the proposed taking**

A) Identification of the **area to be affected** by the proposed action - The Iowa and Illinois Departments of Transportation (Iowa DOT and Illinois DOT) and the Federal Highway Administration (FHWA) are proposing to replace the I-74 bridge across the Mississippi River between Bettendorf, Iowa and Moline, Illinois (Figure 1). In Illinois, the bridge project is located in Sections 28, 29, 32 and 33, Township 18N, Range 01W in Rock Island County (Figure 1). The I-74 bridge and associated right-of-way, which includes the action area, is owned by the State of Illinois.

The existing I-74 bridge crosses Pool 15 of the Mississippi River near RM 486 (Figure 1). The project will involve removal of the existing suspension bridge and construction of a new basket handle twin arch bridge just upstream of the current location (Figure 1).

B) **Biological data** on the affected Species – A Biological Assessment (BA) that included a Conservation Plan for Illinois state-listed mussel species was submitted to IDNR on May 5, 2016. On July 16, 2016, the IDNR issued an Incidental Take Authorization (ITA) for the following federal and state-listed mussel species previously identified within the Action Area (see Attachment A for biological data for these species):

- Higgins-eye pearlymussel (*Lampsilis higginsi)*
- Spectaclecase mussel (*Cumberlandia monodonta)*
- Sheepnose mussel (*Plethobasus cyphyus)*
- Butterfly (*Ellipsaria lineolata)*
- Ebonyshell (*Fusconia ebena)*
- Black Sandshell (*Ligumia recta)*

Mussel relocation was conducted within the proposed bridge corridor from August 1, 2016 through October 25, 2016 (see mussel removal areas on Figure 3). During the relocation, two additional state-listed mussel species were captured that were not included in the 2016 ITA. The Iowa and Illinois DOTs and the FHWA are requesting incidental take authorization for the following additional mussel species for the project:

- Purple wartyback (*Cyclonaia tuberculata)*
- Spike (*Elliptio dilatata)*

Biological data for these two species are also included in Attachment A.

C) **Description of project activities** that will result in taking - Project activities include:

- Construction of basket handle twin arch bridge (includes drilled pier shafts into riverbed)
- Construction of two storm sewer outfalls
- Demolition of existing suspension bridge
- Dredging to facilitate construction and demolition
- Installation of coffer dams
- Installation of anchored silt curtain
- Relocation of mussels prior to construction and demolition activities

The new bridge will consist of 14 concrete piers supporting the deck and will be approximately 3,372 feet in length (Figure 2). A detailed discussion of the proposed construction components and activities, including construction staging areas and dredge activities and project components in the river, is included in Attachment B. Project plans are included in Attachment C. Table 1 below provides a summary of the proposed project schedule. Construction and/or demolition activities will occur year-round.

Table 1. Proposed Project Schedule

Project Phase	Proposed Schedule
Mussel Relocation (Pre-Construction)	July through September 2016 - COMPLETED
Installation of Silt Curtain (Pre-Construction)	Summer 2017
Storm Sewer Outfall Projects	August to October 2017 (Outfall M6) Fall 2017 or April-July 2018 (Outfall M1B)
Construction of the Proposed Bridge	September 2017 through November 2020 (Eastbound lanes complete November 2019; Westbound lanes complete November 2020)

Mussel Relocation (Pre-Demolition)	Fall 2020
Demolition of the Existing Bridge	November 2020 through Fall 2021

The existing bridge will remain open to traffic during construction of the new bridge and will be demolished once construction of the new bridge is complete. Demolition will include removal of the bridge deck and all existing piers, with the exception of Pier K located in Sylvan Slough (Figure 2). This pier will remain to minimize effects to the existing Sylvan Slough mussel bed and federal and state-listed mussel species found at that location. A detailed discussion of demolition activities and staging is included in Attachment B. Demolition activities will occur year-round.

The project will also include construction of two storm sewer outfalls to the Mississippi River in Moline, Illinois (Figure 2). The city of Moline's existing storm sewer systems that drain the I-74 bridge and a portion of the city have a history of surcharging (i.e., the volume of stormwater exceeds the capacity of the drain), resulting in flooding at 3rd, 6th, and 7th avenues in Moline. The two proposed outfalls will be constructed to manage drainage from mainline roads and bridges as well as side roads, and are expected to remove some of the water from the existing flood-prone areas. Specifics of the storm sewer outfall projects are discussed in Attachment B and site plans are found in Attachment C.

D) Explanation of the anticipated **adverse effects on listed species**; how will the applicant's proposed actions impact each of the species' life cycle stages.

A discussion of direct and indirect effects to federal and state-listed mussel species as a result of the project is included in Attachment D. Potential adverse effects to mussel species include mortality, disturbance and stress to the animals as a result of relocation and construction/demolition activities, temporary disruption to reproduction, and temporary displacement of host fish (see Attachment D). Take estimates for both federal and state-listed mussel species are included in Attachment E).

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

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

The action area is limited to the construction and demolition footprints of the existing and proposed bridges as well as a 50-foot buffer on both the upstream and downstream sides of the existing and proposed bridges within the Mississippi River. A discussion of project activities, including dimensions of project infrastructure to be placed in the river and impacts to mussel habitat, is found in Attachment B. Approximately 6.2 acres of suitable mussel habitat will be dredged between Piers 1 through 5 on the Illinois side of the river following relocation of mussels (see Attachment D). In addition, approximately 0.69 acre of suitable mussel habitat will be permanently altered by the placement of piers on the Illinois side of the river (see Attachment C for site plans). Take estimates for the Higgins eye pearlymussel, spectaclecase mussel, sheepnose mussel, butterfly, ebonyshell, black sandshell, purple wartyback, and spike are included in Attachment E.

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

During construction, 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 Engineer's Section 404 permit, the water quality certification of Illinois Environmental Protection Agency (EPA), and the requirements within the National Pollutant Discharge Ellimination System (NPDES) construction permit. It is anticipated the areas affected by dredging will return to pre-construction conditions in time and mussels will recolonize the area.

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

Project-specific Special Provisions were developed by the Iowa DOT to avoid and minimize effects to mussel species (Attachment F). Restrictions will be implemented for project staging to reduce effects to mussels. Silt curtains will be installed (see Attachment B for details). Pier K in Sylvan Slough will not be removed during demolition to avoid and minimize impacts to the spectaclecase mussel (see Attachment D for details).

The following conservation measures will be implemented to avoid and minimize potential effects to mussel species: Prior to construction activities, mussels will be relocated from the action area of the proposed bridge (see Attachment G for details of the relocation plan); and, a second round of mussel relocation will occur prior to demolition of the existing bridge.

In an effort to avoid and/or minimize impacts to mussels downstream, floating silt curtains will be installed prior to construction to retain sediment created by construction. The need for and placement of silt curtains prior to demolition activities will be determined prior to commencement of those activities and will be based on the effectiveness of the silt curtain during construction.

In addition to the placement of silt curtains and relocation efforts described above, the Special Provisions include:

- Near the Illinois riverbank, construction is restricted in sensitive areas, including Sylvan Slough, and extending upstream of both bridge corridors (see Attachment F).
- Barges and water craft used for construction activities shall be inspected for the presence of zebra mussels (*Dreissena polymorpha)* prior to placing the barges into the Mississippi River and shall be completely out of water for 10 days to ensure proper drying and reduce potential infestation by zebra mussels.
- The contractor will be responsible for implementing measures to prevent debris from falling into the river. Debris will not be allowed to collect at the bottom of the river. The contractor will remove any debris from the water or river bed as soon as practicable during the same work day in order to prevent the accumulation of potentially polluted materials. Construction inspectors will be present during construction and demolition activities to ensure compliance with DOT Special Provisions (Attachment F).

The Special Provisions (Attachment F) also address measures to avoid and minimize effects to water quality which also protect mussel species. Attachment G outlines the relocation plan for mussel species.

A comprehensive conservation strategy to serve as mitigation for potential impacts as a result of the I-74 project was developed cooperatively with U.S. Fish and Wildlife Service (USFWS), IDNR, and Iowa DNR. The Intergovernmental Agreement (IGA) was executed on May 10, 2016. As a result of that agreement, the following mitigation measures were agreed to by the DOTs for implementation:

- A large-scale study of Pool 15 will occur in three phases to map habitat and mussel distribution consisting of compilation and mapping of existing data, quantitative sampling to map the distribution of existing mussel beds in channel border habitat, and provide calibration for larger scale sampling, and poolwide sampling to determine density and population estimates.
- A study will be conducted to investigate the effects of increasing resident mussel density at varying rates resulting from the I-74 Bridge Project mussel relocation. A subset of relocated mussels will be placed at varying densities within the three general (not spectaclecase) relocation sites. The sites will be monitored to determine whether different densities persist or if the beds return to pre-relocation numbers. Monitoring will occur annually for the first two years and in the 4th, 7th, and 10th years following mussel relocation. Data from this study will provide valuable information on the potential carrying capacity of mussel beds and inform future relocation efforts.
- A two-year mussel education and outreach staff position to serve as the point of contact, to develop education materials, to conduct classroom and public interpretive outreach, to perform media and community education, and to develop and coordinate a social media presence. The staff will educate on both the ecology of mussels and bridge construction/demolition techniques. A document may be developed through this position to address best management practices for future bridge projects that have the potential to impact mussel resources.
- A five-year effort to inoculate host fish with mussel glochidia and perform free release of 10,000 inoculated fish annually near the project impact in cooperation with the Genoa National Fish Hatchery's Native Mussel Recovery Program. This effort will assist with repopulation of impacted areas and offset the impacts from bridge construction and demolition. The resource agencies will determine which mussel species and host fish species will be stocked based on the data collected from the mussel relocation and the impacts to mussel beds within the action area.

D) plans for **monitoring** the effects of the proposed actions on endangered or threatened species, such as species and habitat monitoring before and after construction, include a plan for follow-up reporting to IDNR.

Post-construction monitoring activities will be conducted to determine the success of mussel recolonization of the action area, and the success of relocations and survival of mussel species (see Attachment H for details of the monitoring plan). Other monitoring studies may be implemented in coordination with the USFWS and IDNR.

E) **adaptive management practices** that will be used to deal with changed or unforeseen circumstances that affect an endangered or threatened species. Consider environmental variables such as flooding, drought, and species dynamics as well as other catastrophes. Management practices should include contingencies and specific triggers. Note: Not foreseeing any changes does not quality as an adaptive management plan.

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 be postponed, which may cause the overall timeframe of the relocation to be extended. 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 transplanted 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 **adequate funding** exists to support and implement all mitigation activities described in the conservation plan. This may be in the form of bonds, certificates of insurance, escrow accounts or other financial instruments adequate to carry out all aspects of the conservation plan.

All proposed mitigation will be completed as part of, and not separate from, the construction of the project and in many cases will also be conditions of other permits (e.g., NPDES). Therefore, funding for the mitigation will be included in the funding for the overall project. Iowa DOT, Illinois DOT, and FHWA commit to funding construction of the project, and by extension, funding of the mitigation.

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

The proposed action was selected after carefully evaluating several alternatives, including a No Action alternative, in the Final Environmental Impact Statement (FEIS) published by FHWA on January 8, 2009 (http://www.iowadot.gov/ole/nepaprojects/nepaprojectseis.aspx?I-74 Quad Cities Corridor Study#feis). Various roadway and multimodal improvements were developed and tested at a conceptual level to allow identification of a complete set of reasonable and representative build alternatives for more detailed consideration. The options included:

- Reuse of the Mississippi River bridges
- Multiple location and lane configuration options for a new river crossing
- Interchange location and design options
- Multimodal improvements

Ten river crossing alignment options, representing both easterly and westerly alignment shifts, initially were developed. Two new alignment locations were carried forward for detailed analysis considered in the Central Section, along with variations for the interchanges and local road configurations. The remaining alignment locations, as well as reuse of the existing Mississippi River bridges, were analyzed but ultimately dismissed because they did not meet the purpose and need of the project. Multimodal improvements were incorporated into the design where appropriate.

A No-Action Alternative was also considered and was defined as no new major construction along the I-74 corridor. Selection of the No Action alternative would have meant that no mussels would have been impacted by the project because a new bridge would not have been constructed; however, this alternative did not meet the purpose and need of the I-74 bridge replacement project, which was to improve capacity, travel reliability, and safety of the I-74 corridor.

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

Attachment E includes methods used to calculate total take by species and tables that provide details of the take estimates for federal and state-listed species. The Mississippi River, and specifically, Sylvan Slough, provides suitable habitat for the federal and state-listed mussels within the action area. Table 2 presents a comparison between the number of federal and state-listed mussels estimated to be successfully relocated from the construction action area prior to construction (based on take estimates provided in Attachment E) and the total number of each species relocated during the 2016 relocation effort. Individuals were relocated per the methods described in the relocation plan (see Attachment G).

Table 2. Comparison of Relocation Estimates and 2016 Relocation Results for Federal and State-listed Threatened and Endangered Mussel Species – I-74 Bridge Replacement Project

Species	Estimated Number of Individuals Successfully Relocated from the Action Area	Total Number of Individuals Captured during the 2016 Relocation Effort
Higgins eye pearlymussel	741	747
Spectaclecase Mussel	0	23
Sheepnose Mussel	186	106
Butterfly	3,679	2,640
Ebonyshell	0	0
Black Sandshell	12,516	8,741
Purple Wartyback	91	1
Spike	91	2
Total	17,304	12,260

In addition, it is estimated approximately 726 Higgins eye pearlymussels, 184 sheepnose mussels, 347 spectaclecase mussels, 2,521 butterfly, 10,939 black sandshell, 135 purple wartyback, and 135 spike will be successfully relocated from the demolition action area prior to demolition activities. Individuals will be relocated per the methods described in the relocation plan (see Attachment G).

The risk of "incidental take" as a result of project activities does exist (see Attachments D and E). Expected mortality for each species (and percent mortality of that species) within the Illinois portion of the action area resulting from both construction and demolition is listed below:

- Higgins eye pearlymussel 1,860 (55.8%)
- Sheepnose mussel 489 (56.5%)
- Butterfly 8,525 (57.8%)
- Black sandshell 29,709 (55.8%)
- Spectaclecase mussel 60 (14.8%)
- Purple wartyback 202 (47.2%)
- Spike 202 (47.2%)

No live ebonyshell were found during surveys of the action area; therefore, no take of this species is anticipated, although take coverage is sought for this species in the event the species found during relocation efforts. The action area is not the only location in Illinois where the affected species are found. In addition to Sylvan Slough, these species are found in other locations along the Illinois portion of the Mississippi River as well as in some inland rivers. Therefore, the incidental take of Higgins eye pearlymussels, sheepnose mussels, spectaclecase mussels, butterfly, black sandshell, purple wartyback, and spike will not reduce the likelihood of the survival of these species in the wild in Illinois.

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

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

By ______________________
Kevin Marchek
Region 2 Engineer
Illinois Department of Transportation

By ______________________
Tammy Nicholson, Director
Office of Location and Environment
Iowa Department of Transportation

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

The IDNR is responsible for the review of this Conservation Plan and for subsequent issuance of the Incidental Take Authorization.

The Iowa DOT will be responsible for relocation of Higgins eye, spectaclecase, sheepnose, butterfly, ebonyshell (if found), black sandshell, purple wartyback, and spike mussels from the action area to specified relocation areas (see Table 1 for estimated schedule of relocation activities). Post-construction monitoring activities will be conducted to determine the success of mussel re-colonization of the action area, and the success of relocations and survival of mussel species. Other monitoring studies may be implemented in coordination with the USFWS and the IDNR. Annual progress reports will be provided to the IDNR in January each year of the permit and will include, but may not be limited to, a summary of any mussel relocations, the results of any monitoring studies performed, or a discussion of adaptive management strategies that may be implemented.

The Iowa DOT is responsible for the construction sites, the placement and function of the erosion and sediment control, all items in the Incidental Take Authorization and coordination with the IDNR and the USFWS.

The Iowa DOT is responsible for obtaining biological clearance from IDNR, coordination and implementing recommendations to the contractor related to and constructing the project and addressing commitments listed under the Incidental Take Authorization permit.

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

Ecological Specialists, Inc. (ESI), on behalf of the Iowa DOT, has the authority to conduct the mussel relocation and follow-up monitoring under Federal TES Permit TE206781-6. In addition, prior to the 2016 mussel relocation, ESI obtained the required Illinois T&E permit (Permit No. 16-027).

The Iowa DOT has the legal responsibility for the implementation and oversight of the mussel relocations under the Illinois Endangered Species Act. All federal and state laws, regulations, permits, and commitments will be adhered to.

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

Project activities will require a Clean Water Act Section 404 permit from the U.S. Army corps of Engineers (USACE Rock Island District), Rivers and Harbors Act Section 10 Permit (USACE Rock Island District), and a water quality certification from Illinois EPA. Iowa DOT, Illinois DOT, and FHWA will obtain any necessary federal, state, and local permits and comply with all permit conditions.

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

None.

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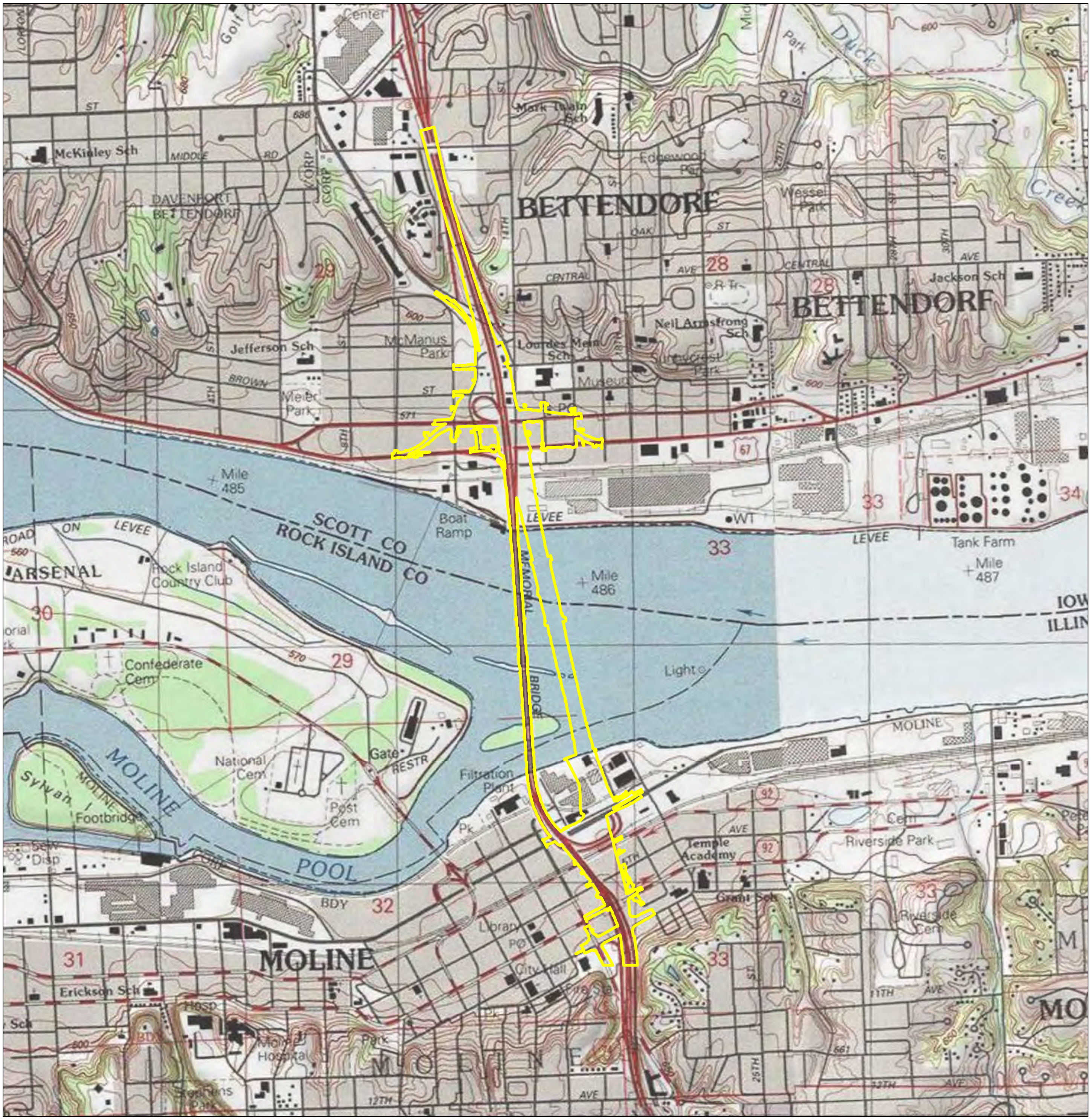

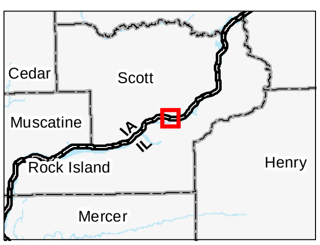

Legend

Project Area

Notes
1. Coordinate System: NAD 1983 StatePlane Iowa South FIPS 1402 Feet
2. Data Sources Include: Stantec, IDOT
3. Background: USGS 7.5' Topographic Quadrangles

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

Figure No.
1

Title
Project Location

Client/Project
Iowa Department of Transportation
I-74 Bridge Replacement Project
Biological Assessment

Project Location 193703186
T. of Bettendorf, Scott Co., IA; T. of Moline, Rock Island Co., IL
Prepared by KAS on 2015-12-14
Technical Review by JD on 2016-01-07
Independent Review by SP on 2016-04-29

0 1,000 2,000 Feet
1:24,000 (at original document size of 8.5x11)

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Stantec

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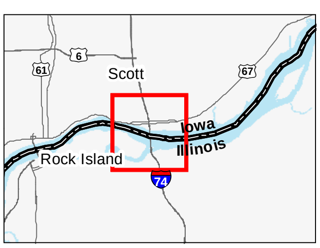


Legend

- Action Area – Aquatic Resources
- Action Area – Terrestrial Resources
- Pier K
- Storm Sewer Outfall

National Hydrography Dataset

- Perennial Stream
- Intermittent Stream
- Ephemeral Stream
- Waterbody

Figure No.
2

Title
Action Area Overview

Client/Project
Iowa Department of Transportation
I-74 Bridge Replacement Project
Biological Assessment

Project Location 193703186
T. of Bettendorf, Scott Co., IA; T. of Moline, Rock Island Co., IL

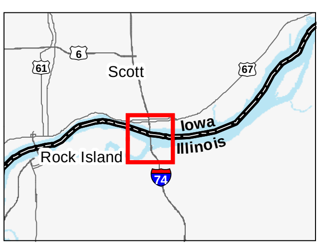
Prepared by KAS on 2015-12-14
Technical Review by JD on 2016-01-07
Independent Review by SP on 2016-04-29

0 800 1,600 Feet
1:19,200 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 StatePlane Iowa South FIPS 1402 Feet
2. Data Sources Include: Stantec, IDOT, NADS, USGS
3. Orthophotography: NAIP 2015

Stantec

R:\gis\other_PCs\193703186_I-74_BiologicalAssessment\03_data\gis_cad\gis\mxds\Fig3_I74_BiologicalAssessment.mxd Revised: 2016-04-29 By: jdelprete



Legend

- Mussel Removal Area (Construction)
- Potential Dredging Area (Construction)

National Hydrography Dataset

- Perennial Stream
- Intermittent Stream
- Ephemeral Stream
- Waterbody

Notes
1. Coordinate System: NAD 1983 StatePlane Iowa South FIPS 1402 Feet
2. Data Sources Include: Stantec, IDOT, NADS, USGS
3. Orthophotography: NAIP 2015

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Figure No.
3

Title
Mussel Removal Areas and Potential Dredging Area

Client/Project
Iowa Department of Transportation
I-74 Bridge Replacement Project
Biological Assessment

Project Location
T. of Bettendorf, Scott Co., IA;
T. of Moline,
Rock Island Co., IL

193703186
Prepared by JD on 2016-04-28
Technical Review by MP on 2016-04-28
Independent Review by SP on 2016-04-29

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1:12,000 (at original document size of 8.5x11)

Stantec

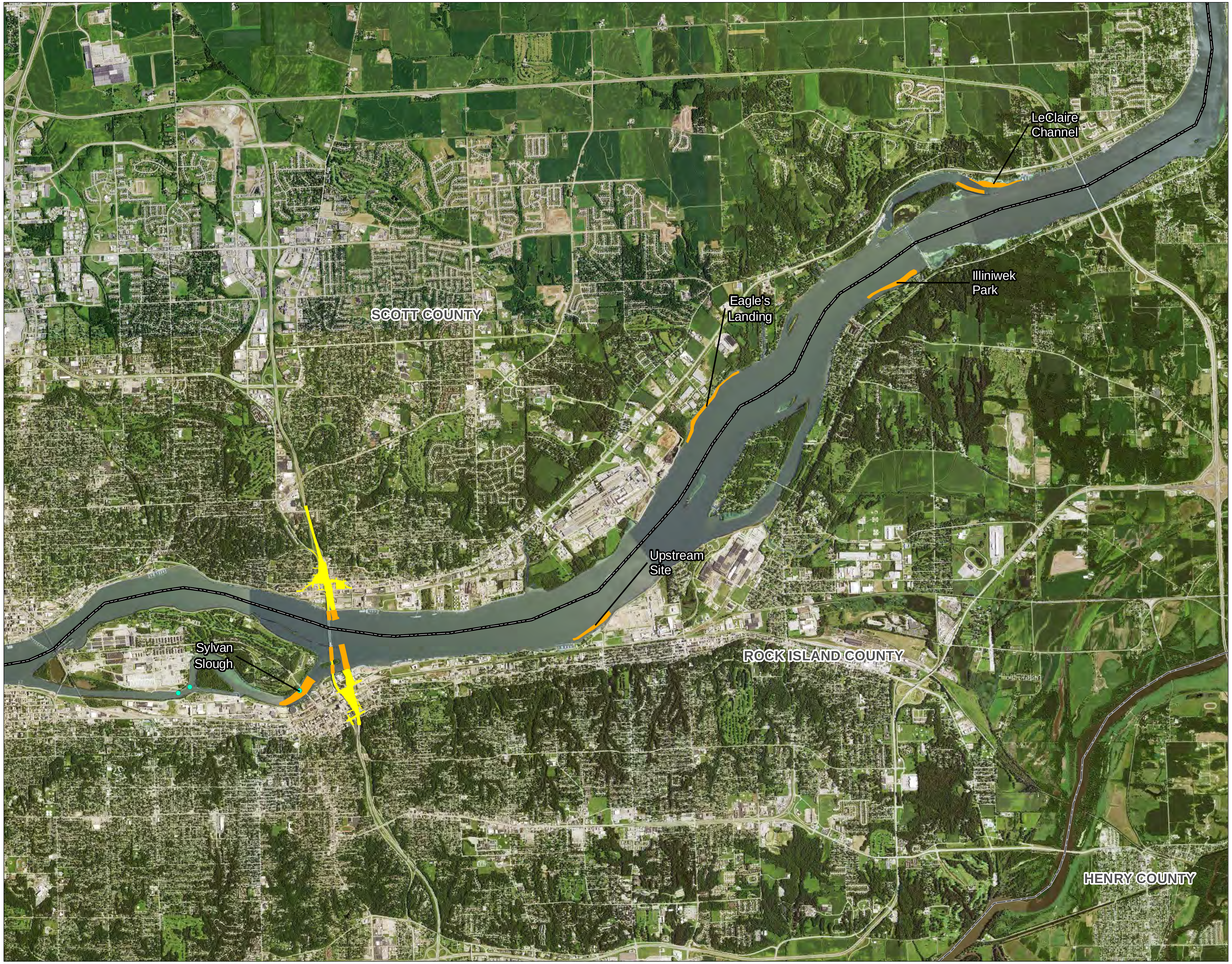

Figure No.
4

Title
Action Area - Aquatic Resource

Client/Project
Iowa Department of Transportation
I-74 Bridge Replacement Project
Biological Assessment

Project Location
T. of Bettendorf, Scott Co., IA;
T. of Moline,
Rock Island Co., IL

193703186
Prepared by KAS on 2016-01-20
Technical Review by JD on 2016-01-20
Independent Review by SP on 2016-04-29

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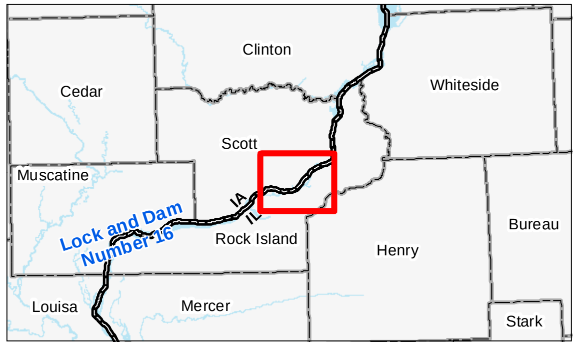
1:63,360 (At original document size of 11x17)

N

Legend
- Spectaclecase Relocation Point
- Action Area - Aquatic Resources
- Action Area – Terrestrial Resources
- Waterbody



Notes
1. Coordinate System: NAD 1983 StatePlane Iowa South FIPS 1402 Feet
2. Data Sources Include: Stantec, IDOT, NADS, USGS
3. Orthophotography: NAIP 2015

Stantec

Page 1 of 1

ATTACHMENT A

BIOLOGICAL DATA

BIOLOGICAL DATA – FEDERAL AND STATE-LISTED MUSSEL SPECIES

Higgins Eye Pearlymussel

Current Status

The Higgins eye pearlymussel was listed as endangered by the USFWS on June 14, 1976 (41 FR 24062-24067). A USFWS Higgins Eye Mussel Recovery Plan was first developed and signed on July 29, 1983 (USFWS 1983a). Revision of the plan began in 1994 in response to concern that the large flood of 1993 may have significantly impacted Higgins eye. The most recent version of the plan is the Higgins eye pearlymussel (*Lampsilis higginsii*) Recovery Plan: First Revision signed on May 12, 2004 (USFWS 2004).

The Higgins eye pearlymussel is also currently listed as endangered by State of Illinois. Listed species in Illinois are protected under the Illinois Endangered Species Protection Act (ESPA; 520 ILCS 10) and regulatory authority lies with the Illinois DNR.

The 1983 recovery plan listed seven locations as primary habitats and nine locations as potential secondary habitats (USFWS 1983a). The revised recovery plan lists 10 Essential Habitat Areas (EHA), 6 of which are in the Mississippi River between river miles 489 and 656 (USFWS 2004):

- Whiskey Rock (Pool 9; Lansing, Iowa)
- Harpers Slough (Pool 10; near Harpers Ferry, Iowa)
- Prairie du Chien, Wisconsin (Pool 10; main and east channel)
- McMillan Island (Pool 10; Guttenberg, Iowa)
- Cordova, Illinois (Pool 14)
- Sylvan Slough (Pool 15; Moline, Illinois) – located within the I-74 action area

EHAs are those areas that the USFWS and its partners have found to be of utmost importance to the conservation of the Higgins eye pearlymussel (USFWS 2004). Since publication of the revised recovery plan (USFWS 2004), four new EHAs were added in consultation with the recovery team:

- Lansing, Iowa (Pool 9; RM 660-661)
- Cassville, Wisconsin (Pool 11, RM 606-608)
- Hanson's Slough (Pool 14, RM 509.1-510.1)
- Buffalo, Iowa (Pool 16, RM 470-471)

The revised recovery plan describes two main objectives that indicate the USFWS's current management direction (USFWS 2004):

1. Preserving the Higgins eye pearlymussel and its Essential Habitat Areas.
2. Enhancing the abundance and viability of the Higgins eye pearlymussel in areas where it currently exists and restoring populations within its historical range.

Species Description

The Higgins eye pearlymussel is a medium-sized (reaching approximately 4 inches in length) freshwater mussel with smooth, yellow, yellowish green or brown with green rays that are obscure on some individuals (USFWS 1983). The species is sexually dimorphic. Baker (1928) provided the following description of the shell morphology:

"The shell is oval or elliptical, somewhat inflated, solid, with a gaping anterior base. The beaks are placed forward of the center of the dorsal margin, much elevated, swollen, their sculpture consisting of a few feeble ridges slightly looped; anterior end broadly rounded; posterior end truncated in the female, bluntly pointed in the male; ventral and dorsal margins slightly curved, almost parallel; posterior ridge rounded, but well-marked; surface shining, marked by irregular growth lines which are better developed at rest periods where they are usually dark colored; epidermis olive or yellowish green with faint green rays. Hinge massive; pseudocardinals erect, triangular or pyramidal, divergent, serrated, two in the left and one in the right valve, with sometimes indications of additional denticles on either side of the single right pseudocardinal; interdentium narrow, flat; laterals short, thick, slightly curved, almost smooth, cavity of the beaks deep, containing the dorsal muscle scars, anterior adductor scar deeply excavated, posterior scar distinct; nacre silvery-white, iridescent, often tinged with pink."

The Higgins eye feeds by filtering food particles from the water column. The specific food habits of the species are unknown, but other juvenile and adult freshwater mussels have been documented to feed on detritus, diatoms, phytoplankton, and zooplankton (Churchill and Lewis 1924). The diet of Higgins eye glochidia (larvae), like other freshwater mussels, is comprised of fish body fluids (once encysted).

The major reasons for listing Higgins eye were the decrease in both abundance and range of the species. The initial recovery plan (USFWS 1983a) indicated the Higgins eye was never abundant and Coker (1919) indicated that the species was becoming increasingly rare even at the end of the 1800s. The fact that there were few records of live specimens from the early 1900s until the enactment of the ESA in 1973 was a major factor in its listing in 1976.

<u>Habitat</u>
The Higgins eye has been characterized as a large river mussel species (USFWS 2004). Higgins eye may be primarily adapted to large river habitats with moderate current, such as the East channel of the Mississippi River near Prairie du Chien, Wisconsin (USFWS 2004). Davis and Hart (1995) indicated that it was found in the more "riverine" portion of Pool 7 (near La Crescent, Minnesota) and in the tailwater reaches of other Mississippi River navigation pools. Higgins eye has also been found in beds bordering main or side channels and may prefer areas of high turbulence and oxygen content (Fuller 1978).

Little information is available about the specific habitat requirements of Higgins eye. The Higgins eye has been found in various substrates from sand to boulders but not in areas of unstable shifting coarse sands. Fuller (1978) indicates Higgins eye may be found in 8-15 feet of water in mud with a mixture of gravel and stones. Cawley (1996) indicated that Higgins eye were most common in sand/gravel substrate. Miller and Payne (1996) considered substratum that was free of plants and consisted of stable, gravelly sand as suitable. The species is not associated with firmly packed clay, flocculent silt, organic material, bedrock, concrete or unstable moving sand (Wilcox et al. 1993). Habitat associations or requirements for the juvenile stage are unknown.

<u>Life History</u>
The reproductive cycle of the Higgins eye is similar to that of other native freshwater mussels. Males release sperm into the water column; the sperm are then taken in by the females through their siphons during feeding and respiration. The females retain the fertilized eggs in their gills until the glochidia fully develop. The glochidia are released into the water and within a few days they must attach to the appropriate species of fish, which they parasitize for a short time while they develop

into juvenile mussels. Female Higgins eye are bradytitic (i.e., long-term breeders that retain the developing larvae within their marsupia throughout most of the year, except during early summer). The breeding season is between May and September (Baker, 1928) and glochidial release has been reported during June and July (Waller and Holland-Bartels 1988) and May and September (Surber 1912). Reproduction is attempted annually.

Early studies indicated that sauger (*Sander canadensis)* and freshwater drum (*Aplodinotus grunniens)* were glochidial fish hosts (Surber 1912; Wilson 1916; Coker et al. 1921) based on examination of natural infections; however, field identifications were not robust. In laboratory studies, Waller and Holland-Bartels (1988) indicated that four species of fish were suitable hosts: largemouth bass (*Micropterus salmoides),* smallmouth bass (*Micropterus dolomieu)*, walleye (*Sander vitreus)* and yellow perch (*Perca flavescens).* There was some transformation of glochidia to juveniles on green sunfish (*Lepomis cyanellus)*, whereas two species, bluegill (*Lepomis macrochirus)* and fathead minnow (*Pimephales promelas)* were unsuitable hosts. Hove and Kapuscinski (2002) have confirmed sauger as a suitable host and identified largemouth bass and black crappie (*Pomoxis nigromaculatus)* as additional host species.

<u>Status in the Action Area</u>
Since 1980, live Higgins eye pearlymussels have been found in parts of the following rivers: the Upper Mississippi River north of Lock and Dam 19 at Keokuk, Iowa, and in three tributaries of the Mississippi River - the St. Croix River between Minnesota and Wisconsin, the Wisconsin River in Wisconsin, and the lower Rock River between Illinois and Iowa. The species' current range is about 50 percent of its historic distribution which extended as far south as St. Louis, Missouri, and in several additional tributaries of the Mississippi River (USFWS 2004). Since 2000, reintroductions have occurred in the Mississippi River, Wisconsin River, Rock River, Iowa River, Cedar River, and the Wapsipinicon River (ESI, personal communication).

The Sylvan Slough EHA, located in Pool 15 of the Mississippi River in Rock Island County, Illinois (Figure 2), is found within the action area for the Project.

A survey of the action area conducted in August and September 2014 found live Higgins eye in all four survey areas; however, this species comprised <1% of the sample in each of the survey areas (ESI 2014). One live specimen was also found at an existing bridge pier adjacent to the navigation channel (ESI 2014).

Spectaclecase Mussel

<u>Current Status</u>
The spectaclecase mussel was listed as endangered by the USFWS on April 12, 2012 (50 FR 14914-14949). A recovery outline for the species was completed in 2014 (Butler 2002a).

The spectaclecase mussel is also currently listed as endangered by the State of Illinois. Listed species in Illinois are protected under the Illinois Endangered Species Protection Act (ESPA; 520 ILCS 10) and regulatory authority lies with the Illinois DNR.

<u>Species Description</u>
The spectaclecase mussel has an oblong, elongate, and compressed shell that can be up to approximately 8 inches in length with rounded anterior and posterior ends. The surface of the shell is smooth to somewhat rough and is brown in young shells, becoming dark brown to black and rayless with age (Cummings and Mayer 1992).

Habitat

This species inhabits large rivers with swiftly flowing water and are found among boulders in patches of sand, cobble, or gravel in areas of reduced current (Cummings and Mayer 1992).

Life History

The reproductive cycle of the spectaclecase is similar to that of the Higgins eye pearlymussel (see above). Males expel clouds of sperm into the water column, which are drawn in by females through their incurrent siphons. Fertilization takes place internally, and the resulting zygotes develop into specialized larvae (glochidia) within the gills. The spectaclecase utilizes all four gills as marsupia for its glochidia. It is thought to be a short-term brooder, with glochidial release occurring from early April to late May in Missouri streams (Baird 2000 as cited in USFWS 2007). As stated in USFWS (2007), both Howard (1915) and Gordon and Smith (1990) reported it as producing two broods, one in spring or early summer and the other in the fall, also based on Meramec River specimens. Baird (2000 as cited in USFWS 2007), however, found no evidence of two spawns in a given year.

Glochidia are released in the form of conglutinates, which are analogous to cold capsules (i.e., gelatinous containers with numerous glochidia within). Conglutinates typically contain not only glochidia, but embryos and undeveloped ova as well. Based on eight Missouri specimens, the number of conglutinates released per individual varied from 53 – 88, with a mean of 64.5 (Baird 2000 as cited in USFWS 2007).

USFWS (2007) indicates spectaclecase glochidia "are the smallest known for any North American mussel; they measure approximately 0.0024 inches in both length and height (Baird 2000 as cited in USFWS 2007). Tens to hundreds of thousands of the hookless glochidia may occur in each conglutinate. Total fecundity (including glochidia and ova) in Baird's (2000 as cited in USFWS 2007) Missouri study varied from 1.93 – 9.57 million per female. In mussels, fecundity is related positively to body size and inversely related to glochidia size (Bauer 1994 as cited in USFWS 2007). The reproductive potential of *C. monodonta* is therefore phenomenal. However, the fact that extant populations are generally skewed towards larger adults strongly indicates that survival rates to the adult stage must conversely be extraordinarily low" (USFWS 2007).

Researchers in Wisconsin have observed females in the lab and under boulders in the St. Croix River simultaneously releasing their conglutinates (David Heath, WDNR, pers. com.). The conglutinates are entrained along a transparent, sticky mucous strand up to several feet in length (M.C. Barnhart, Southwest Missouri State University, pers. comm., 2002). Baird (2000 as cited in USFWS 2007) observed the release of loose glochidia and small fragments of conglutinates. Based on his observations, he hypothesized that conglutinates may typically contain mostly immature glochidia, and that conglutinates primarily with immature glochidia may be aborted when disturbed (USFWS 2007).

As stated in USFWS 2007, the host(s) for the *C. monodonta* is unknown, although over 60 species of potential fishes, amphibians, and crayfish have been tested in the lab during host suitability studies (Knudsen and Hove 1997; Lee and Hove 1997; Hove et al. 1998; Baird 2000; and Henley and Neves 2006). Two of 690 wild-collected fish checked by Baird (2000 as cited in USFWS 2007) had spectaclecase glochidia attached to their gills: the bigeye chub (*Hybopsis amblops*) and pealip redhorse (*Moxostoma macrolepidotum pisolabrum)*. However, these fish are not confirmed as hosts, because the encysted glochidia had not grown measurably and glochidial transformation was not observed (Baird 2000 as cited in USFWS 2007).

Status in the Action Area

Historically, the spectaclecase was found in at least 44 streams of the Mississippi, Ohio and Missouri River basins in 14 states; however, it has been extirpated from 3 states and today is found in only 20 streams.[1] The spectaclecase mussel's current range includes Iowa and Illinois. With few exceptions, spectaclecase populations are fragmented and restricted to short stream reaches.[2]

A survey of the action area conducted in August and September 2014 by ESI (2014) found live spectaclecase in three of the four survey areas. Fourteen were found at the existing bridge pier (Pier K) within Sylvan Slough (Survey Area A). Two individuals were found in Survey Area B, one of which was found at the north end of a small island, the other was found at an existing pier. Approximately 15 additional spectaclecase were collected at this existing pier in 2015 (ESI 2015). One individual was found near the Iowa bank of the river (Survey Area D) at an existing pier closest to the bank (ESI 2014).

Sheepnose Mussel

Current Status

The sheepnose mussel was listed as endangered by the USFWS on April 12, 2012 (50 CFR 17). A status assessment for this species was prepared in 2002 (Butler 2002b).

The sheepnose mussel is currently listed as endangered by the State of Illinois. Listed species in Illinois are protected under the Illinois ESPA and regulatory authority lies with the Illinois DNR.

Species Description

The sheepnose mussel has thick, oval, or oblong, somewhat elongate, and slightly inflated shell that can be up to 5 inches in length with a rounded anterior end and bluntly pointed posterior end. The surface of the shell is smooth except for a row of knobs or tubercles on the center of the valve (Cummings and Mayer 1992). The periostracum is often a distinctive yellowish color but may also be dark brown.

Habitat

This species inhabits medium to large rivers in shallow areas with moderate to swift current that flows over gravel or mixed sand and gravel (Cummings and Mayer 1992). However, they have also been found in areas of mud, cobble, and boulders, and in large rivers they may be found in deep runs.[3]

Life History

The reproductive cycle of the spectaclecase is similar to that of the Higgins eye pearlymussel (see above). Sheepnose glochidia are expelled in jellylike masses of mucus called conglutinates. Sheepnose conglutinates are narrow, red or pink, and discharged in an unbroken line that look like small worms. When a fish eats a conglutinate, glochidia are exposed to and attach to the fish's gills. The only confirmed wild host for sheepnose glochidia is the sauger, although recent laboratory studies have successfully transformed sheepnose glochidia on fathead minnow, creek chub (*Semotilus atrromaculatus*), central stoneroller (*Campostoma anomalum*) and brook stickleback (*Culaea inconstans*).

If glochidia successfully attach to a host fish, they mature into juvenile mussels within a few weeks, and then drop off. If they land on suitable habitat, juveniles grow and mature into adult mussels.

[1] http://www.fws.gov/midwest/endangered/clams/spectaclecase/SpectaclecaseFactSheetMarch2012.html
[2] ibid
[3] http://www.fws.gov/midwest/endangered/clams/sheepnose/SheepnoseFactSheetMarch2012.html

Using fish as hosts allows the sheepnose to move upstream and populate habitats it could not otherwise reach. Sheepnose mussels are reported to live as long as 30 years.

Status in the Action Area
The USFWS indicates the sheepnose is a freshwater mussel found across the Midwest and Southeast; however, it has been eliminated from two-thirds of the total number of streams from which it was historically known. Today, the sheepnose is found in several states, including Iowa and Illinois.[4]

A survey of the action area conducted in August and September 2014 by ESI (2014) found one live sheepnose in Sylvan Slough (Survey Area A), representing approximately 0.1% of the total sample (ESI 2014).

Butterfly

Current Status
The butterfly is currently listed as threatened in Illinois.[5]

Species Description
Cummings and Mayer (1992) indicate the butterfly is approximately 4 inches in length; the shell of the butterfly is somewhat triangular, thick, solid, and compressed. The anterior end is broadly rounded; the posterior end is pointed. The shell is smooth, yellow or yellowish green, with scattered brown rays that are usually broken into V-shaped or irregular rectangular blotches. Old shells have faint brown rays or are rayless. The beak cavity is shallow to moderately deep.

Habitat
The species inhabits large rivers with sand or gravel substrates (Cummings and Mayer 1992).

Life History
The reproductive cycle of the butterfly is similar to that of other native freshwater mussels (see Life History discussion of the Higgins eye pearlymussel above). The freshwater drum (*Aplodinotus grunniens)* is a known host of glochidia of the butterfly mussel.

Status in the Action Area
A survey of the action area conducted in August and September 2014 by ESI (2014) found this species in all four survey areas, three of which are found on the Illinois side of the river (ESI 2014). This species was most abundant in Area C where it made up approximately 2% of the total sample (ESI 2014).

Ebonyshell

Current Status
The ebonyshell is listed as threatened in the state of Illinois.[6]

Species Description

Cummings and Mayer (1992) indicate the ebonyshell can measure up to 4 inches in length; the

[4] http://www.fws.gov/midwest/endangered/clams/sheepnose/index.html
[5] http://www.dnr.illinois.gov/ESPB/Documents/ET_by_County.pdf
[6] ibid.

shell of this species is solid and heavy, rounded or oval and inflated with rounded anterior end. The posterior end is rounded or bluntly pointed. The shell is smooth with elevated ridges that indicate periods of growth. The beak cavity of this species is very deep.

Habitat Requirements

This species is known to inhabit large rivers with sand or gravel substrates (Cummings and May 1992).

Life History
The reproductive cycle of the ebonyshell is similar to that of other native freshwater mussels (see Life History discussion of the Higgins eye pearlymussel above). The skipjack herring is the primary host fish for the ebonyshell.

Status in the Action Area
One weathered, dead shell and no live specimens of the Illinois state-threatened ebonyshell were found during the 2014 survey (ESI 2014).

Black Sandshell

Current Status
The black sandshell is listed as threatened in the state of Illinois.[7]

Species Description
Cummings and Mayer (1992) indicate the black sandshell is approximately 8 inches in length; the shell of this species is elongate, solid, and moderately compressed with a rounded anterior end. The posterior end is pointed in males and saber-shaped in females. The shell is smooth and shiny and is dark green, brown, or black with green rays visible on some individuals. The beak cavity is shallow.

Habitat Requirements

This species inhabits medium to large rivers in riffles or raceways in gravel or firm sand (Cummings and Mayer 1992).

Life History
The reproductive cycle of the black sandshell is similar to that of other native freshwater mussels (see Life History discussion of the Higgins eye pearlymussel above). The American eel and the bluegill are likely host species for the black sandshell.

Status in the Action Area
A survey of the action area conducted in August and September 2014 by ESI (2014) found this species in all four survey areas, three of which are found on the Illinois side of the river (ESI 2014). In addition, this species was also found within the navigation channel (ESI 2014).

[7] http://www.dnr.illinois.gov/ESPB/Documents/ET_by_County.pdf

Purple Wartyback

Current Status
The purple wartyback is listed as threatened in the state of Illinois.[8]

Species Description
Cummings and Mayer (1992) indicate the purple wartyback is approximately 5 inches in length; the shell of this species is rounded with a fairly prominent wing. The beak is covered with fine, wavy sculpturing with no green stripe on the umbo and purple nacre. Young shells are yellowish brown to greenish brown becoming dark brown in older shells. The shell, except the anterior quarter, is covered with tubercles that form small ridges on the dorsal wing. The beak cavity is very deep.

Habitat
This species inhabits medium to large rivers in gravel or mixed sand and gravel (Cummings and Mayer 1992).

Life History
The reproductive cycle of the black sandshell is similar to that of other native freshwater mussels (see Life History discussion of the Higgins eye pearlymussel above). Known fish hosts for the purple wartyback include: the black bullhead (*Ameiurus melas*), yellow bullhead (*Ameiurus natalis*), flathead catfish (*Pylodictis olivaris*) and the channel catfish (*Ictalurus punctatus*) (Hove 1997; Hove and Kurth 1997 as cited in Watters et al. 2009).

Status in the Action Area
This species was not found during the survey of the action area conducted in August and September 2014 by ESI (2014); however, one individual was captured during the 2016 relocation (ESI, personal communication).

Spike

Current Status
The spike is listed as threatened in the state of Illinois.[9]

Species Description
Cummings and Mayer (1992) indicate the spike is approximately 5 inches in length; the shell of this species is thick and elongate. Shells are greenish brown with faint green rays visible on small shells; the shell is dark brown to black in adults. The nacre is almost often purples. The beak cavity is very shallow.

Habitat
This species inhabits small to large streams and occasionally lakes in mud or gravel (Cummings and Mayer 1992).

Life History
The reproductive cycle of the spike is similar to that of other native freshwater mussels (see Life History discussion of the Higgins eye pearlymussel above). Watters et al. 2009 indicates a range of

[8] Ibid.
[9] http://www.dnr.illinois.gov/ESPB/Documents/ET_by_County.pdf

known host fish for the spike including sauger, gizzard shad ((*Dorosoma cepedianum*), flathead catfish, and white crappie (*Pomoxis annularis)*.

Status in the Action Area
This species was not found during the survey of the action area conducted in August and September 2014 by ESI (2014); however, two individuals were captured during the 2016 relocation (ESI, personal communication).

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ATTACHMENT B

PROJECT DETAILS

Proposed Construction Components and Activities

Construction Staging Areas and Dredge Activities

Because the navigation channel must be maintained and remain open to river traffic during both construction and demolition activities, it is assumed two staging areas will be used: one on the Iowa shore and a second on the Illinois shore. Staging will occur primarily within the river and will consist of barges moored (i.e. attached by cable or cable) to shore or anchored into the riverbed. The exact location of the staging areas is not yet known because the construction contractor will be responsible for choosing the location of the staging areas. However, the Iowa DOT, by means of project-specific Special Provisions (see Attachment F), will restrict contractors from selecting staging areas within certain areas of the river (see map in Attachment F). Specifically, construction staging will be prohibited within Sylvan Slough and upstream of the proposed bridge corridor (see map in Attachment F).

Workers will be transported to and from the construction/demolition areas daily via either a small watercraft or work barge; materials transport will occur via work barge on an as-needed basis. It is assumed that transport vehicles will travel the most direct route between the staging areas and the construction/demolition areas, and that dredging of the river bottom to accommodate transport of materials and workers will not occur.

Dredging may be required to allow for barge access to the staging areas; however, staging areas will be chosen the contractor so the need for and limits of dredging are not known at this time. Should dredging be required outside of the dredging limits shown on Figure 3, the Iowa DOT will coordinate with the USFWS and IDNR prior to dredging activities to determine what, if any, impacts mussels would occur. Dredged material will not be placed back into the river; however, areas disturbed by dredging will be backfilled with special revetment (i.e., boulders) (see Attachment F). If dredged material is deposited on the shore before being hauled away, silt fences, perimeter and slope sediment control devices, or low silt berms will be required to limit the re-entry of sediment into the river. In addition, the material will be placed in a confined area that is not classified as a wetland (Attachment F).

Dredging may also be required to allow barge access to construction and demolition areas (Figure 3). Dredging, if required, will occur after relocation of mussel species (see discussion below) and prior to construction and/or demolition activities. It is assumed dredging will occur once for each phase of the project. However, should additional dredging be required as a result of unforeseen circumstances (e.g., major flood event that deposits significant material in the work space), the contractor will contact the Iowa DOT which will meet and confer with the USFWS prior to additional dredging activities.

To be conservative, it is assumed that dredging for construction and demolition activities will occur in all areas with water depths of less than 6 feet (as depicted on Figure 3); however, this is likely an overestimate. Based on this depth, approximately 271,145 square feet (6.2 acres) located between Piers 1 through 5 (Illinois side of the river) may require dredging of the river bottom prior to construction. The exact limits of dredging required for demolition activities will not be known until closer to demolition. Iowa DOT will meet and confer with the USFWS and IDNR to discuss the dredging effort and potential effects to mussels prior to demolition activities.

Project Components Within the River

Silt Curtain

In an effort to protect the City of Moline's drinking water intake structure on the Illinois bank, floating silt curtains will be installed prior to construction of the bridge to retain sediment created by construction (see map in Attachment F showing silt curtain locations). In addition to protecting the water intake structure, effects of sedimentation on mussel species will also be avoided and/or minimized by the silt curtain. On the Illinois side of the river, three silt curtains will be placed downstream of the proposed bridge corridor to protect the water intake structure and Sylvan Slough (Attachment F).

Silt curtains will be deployed via work barge or boat. The placement of the silt curtains will occur prior to any potential dredging activities that may be required on the Illinois side of the river; however, no dredging is currently anticipated as a result of the silt curtain placement. The top of the curtain would be equipped with floating expanded polystyrene float material and navigation markers. The bottom of the curtain would be weighted down by anchors that will be placed approximately every 25 feet and will have a dimension of approximately 3 feet by 3 feet. The curtains would remain in place for the duration of construction; following construction, any accumulated debris at the river bottom and surface would be removed before curtain removal.

The need for and placement of silt curtains prior to demolition activities will be determined prior to commencement of those activities and will be based on the effectiveness of the silt curtains during the construction phase of the project.

Bridge Piers

The proposed bridge consists of 14 piers in the river; each pier consisting of up to 10 columns with a 7-foot diameter (see Attachment C for project plans). Piers will be placed in the river bed with spans between piers ranging from 148 feet to 203 feet (Attachment C). Piers will be approximately 30-feet wide with varying lengths ranging from 119 feet, 8 inches (Pier 2) to 86 feet, 8 inches (Pier 9) (Attachment C). Footings for two arch foundations will be placed on either side of the navigation channel (Attachment C). The total footprint of the proposed bridge piers within the river is approximately 36,900 square feet.

Foundations for the approach spans (Spans 1-11 and 14-15 [see Attachment C]) will consist of shafts drilled into the bedrock. The shafts will be drilled using barge mounted drill rigs wherever adequate water depths are present. If the water depth is not sufficient to accommodate a barge, construction of temporary supports, consisting of a steel structure, would occur in the water to support the drilling work. The supports would require socketing (i.e., to be embedded) into the bedrock. This work will occur within a 16.4-foot (5-meter) buffer of all proposed pier locations.

For the main span substructure footings, a cofferdam will be required at each of the six locations (two outer footings and an interior footing at Piers 12 and 13). Due to very shallow overburden (e.g., silt, rock, sand, etc.), the sheeting for the cofferdams will be embedded (i.e., pounded/driven) into bedrock in order to provide a seal and obtain adequate strength and stability at the toe.

Spoil from pier columns will be placed on barges and taken off site. No fill material will be left in the river.

Storm Sewer Outfall

Construction of two storm sewer outfall structures is proposed as part of the project (Figure 2; Attachment C). Outfall M6 and a 72-inch storm sewer that runs along existing Ramp RD-H (the ramp from River Drive to westbound I-74) that drains the I-74 roadway from the river bank to 19th Street will be constructed in August to October 2017 (Attachment C). Construction at this location is expected to take approximately three weeks.

Outfall M1B and the proposed 36-inch storm sewer will be constructed in fall 2017 or April to July of 2018. Construction at this location is also expected to take approximately three weeks, though this structure is slightly smaller than M6 and may be constructed in less than three weeks.

Construction staging for the storm sewer outfalls would occur on land. Construction would consist of an open cut for installation of the pipe at each location. Cofferdams will be required at each outfall into the river unless river levels are exceptionally low. The exact dimensions of the cofferdams, if required, will be determined by the contractor at the time of construction. However, a conservative estimate indicates the dimensions of the coffer dam at Outfall M6 will be approximately 17 feet x 40 feet (680 square feet) and the dimensions at Outfall M1B will be slightly smaller at 13 feet x 40 feet (520 square feet).

Proposed Demolition Activities

Demolition of the existing bridge is anticipated to occur in late 2020 and be completed by fall of 2021. Demolition activities include demolition of the bridge railing and concrete deck, and demolition of the existing bridge piers (except Pier K within Sylvan Slough (Figure 2)).

The removal of the bridge railing and concrete deck will occur from above with equipment working on the existing bridge deck. The deck will be deconstructed from the top of the deck and materials will be lowered onto barges staged below the bridge.

The suspended portion of the bridge over the navigation channel will be demolished via explosive demolition and dropped into the channel during the winter months when the lock and dam system is closed for the winter, likely January through early March each year. Piers will be demolished so they fall into the tightest pile possible. Subsequent removal of the demolished bridge material from the river bottom within the navigation channel will be accomplished using barge mounted cranes to lift this material onto barges for removal.

In order to reduce impacts to mussels and to the existing mussel bed within Sylvan Slough, explosive demolition of the existing structure will not be permitted on the Illinois side of the river, and no materials will be dropped into the river at this location. Pier K, located within Sylvan Slough (Figure 2), provides habitat for mussel species, including the spectaclecase mussel, and will not be removed. During demolition activities, the contractor will be restricted from impacting the river bottom within a 16.4-foot (5-meter) buffer of Pier K.

The remaining piers and anchor spans will be removed using barge mounted cranes. The specific method used for pier removal will be chosen by the contractor; however, it is anticipated the piers will be removed mechanically by either cutting the pier off at the base and using cranes to lift the material onto work barges for removal or pushing the pier or portions of the pier directly onto the work barge for transport. No material will be dropped into the river as a result of these activities; however, the exact methods used to ensure materials are not dropped into the water as a result of demolition will be at the discretion of the contractor. Construction inspectors will be present at all times during construction and demolition activities to ensure compliance with DOT Special Provisions (Attachment F). Demolition of individual piers is anticipated to take approximately 1 day per pier.

ATTACHMENT C

PROJECT PLANS/DRAWINGS

Lunda did not include because of file size restrictions

ATTACHMENT D

DIRECT/INDIRECT EFFECTS TO MUSSEL SPECIES

DIRECT AND INDIRECT EFFECTS BY SPECIES

Higgins Eye Pearlymussel

Direct and Indirect Effects

Relocation

Prior to construction activities, all mussels, will be relocated from a 32.8-foot (10-meter) buffer around Piers 1 through 5 (Illinois side of the river) (Figure 3). Mussels will also be relocated from the proposed storm sewer outfall project areas (see Attachment B). Due to the number of mussels to be relocated, the relocation effort is anticipated to take approximately 60 days. Therefore, mussels will be relocated from the removal areas between July and August 2016 (the year prior to the start of construction). The relocation plan is found in Appendix G. Take estimates by species and activity are summarized below and in Attachment E.

The mussel removal areas will be searched by divers until at least 90% of all mussels ≥1 inch in length are collected. Although the area will be extensively searched, it is estimated that up to 10% of mussels >1 inch in length could be missed resulting in mortality up to 86 adult Higgins eye pearlymussels. In addition, mortality of 51 adults is expected during relocation, and 207 individuals less than 1 inch (25 millimeters (mm)) in size would likely be missed during the relocation efforts for a total of 344 Higgins eye pearlymussels (see Attachment E). These calculations include mortality as a result of relocation for the storm sewer outfall projects. It is estimated that approximately 741 Higgins eye pearlymussels will be successfully relocated from the action area prior to construction and would be considered harassed.

Prior to construction activities, an anchored silt curtain will be placed downstream of the proposed bridge corridor to minimize sedimentation downstream of construction. The need for and placement of silt curtains prior to demolition activities will be determined prior to commencement of those activities and will be based on the effectiveness of the silt curtains used during construction activities. Prior to placement of the silt curtain anchors, a diver will be present to move any mussels that may be present at the proposed anchor locations. Relocation of individuals would consist of moving them a short distance away from the proposed anchor locations. Mussels would not be removed from the water for relocation as a result of the proposed silt curtain; therefore, effects of this activity are expected to be minor.

Mussel relocation will also occur prior to demolition of the existing bridge following the general relocation plan identified in Attachment H. It is assumed that mussels will be relocated from existing riprap around the existing bridge piers, with the exception of Pier K in Sylvan Slough. Given that demolition is not anticipated to begin until November 2020, a more specific relocation plan will be developed prior to demolition activities and in coordination with the USFWS.

Construction

Direct effects of construction include mortality of individuals left behind following the relocation efforts (see discussion above). Take estimates for construction activities and the silt curtain placement are summarized in this section and detailed in Attachment E. It is estimated that mortality of up to 1,131 Higgins eye pearlymussels that remain in the potential dredging area on the Illinois side of the river (Figure 3) could occur, as well as 8 individuals left behind at Piers 6 through 8. Approximately 44 individuals of this species (Illinois side of the river) will not be removed in water deeper than 8 feet may be disturbed (i.e., harass) (Appendix E). Temporary effects to the riverbed, and subsequent effects to mussel species, as a result of placement of the silt curtain anchors is expected to be discountable.

Fish hosts may be temporarily displaced from the area due to increased activity associated with construction; however, no host fish habitat will be permanently destroyed. Though effects to fish hosts are expected temporary and minor, construction and relocation activities may indirectly result in the loss of up to one year of reproduction due to stress and/or disturbance to mussels. At water depths greater than 6 feet, the effects to mussels as a result of propeller wash due to construction barges are expected to be discountable. Construction of coffer dams for the storm sewer outfall projects may result in noise or sound waves that may disturb fish or mussel species. It is expected these effects will be short-term (i.e., when sheet pile is driven into the riverbed) and may have a minimum effect on fish species and/or mussels that have not been relocated.

Indirect effects to this species as a result of construction activities also include the potential for increased sedimentation. These effects are expected to be minimized by the installation of an anchored silt curtain that will be placed downstream from the proposed bridge corridor prior to construction of the bridge (Attachment F). The need for and placement of silt curtains prior to demolition activities will be determined prior to commencement of those activities and will be based on the effectiveness of the silt curtains used during construction.

Hydraulic modeling (HDR 2015) was conducted to determine if changes to water velocity would occur as a result of construction of the new bridge piers upstream of Sylvan Slough (Piers 2, 3, and 4; see plan in Attachment C). Specifically, the Iowa DOT wanted to determine if scour would occur at the proposed bridge piers that could result in increased sedimentation downstream of the existing bridge which includes Sylvan Slough. The results of the modeling indicate the differences in velocity are limited to wake zones associated with the piers and extend as far as 300 feet downstream of the piers; however, the velocity upstream of the piers is insufficient to move medium sand when compared to critical velocity (the minimum velocity needed to pick up medium sand grains and move them) (HDR 2015). Therefore, the results of the modeling indicate scour will not occur at the proposed bridge piers and would not result in increased sedimentation downstream of the new bridge.

Dredging will result in a change to the substrate, though the extent and duration of these changes are not entirely known. Little information exists specifically regarding the return of substrate to pre-dredging conditions (ESI, personal communication). The post-dredging substrate will likely remain unstable for some time after dredging, as organic matter, biofilms, etc. require time to return to the substrate. Several studies have reported recolonization of dredged areas by mussels, which may be an indicator of substrate recovery. Eckblad (1999) surveyed sites in the Upper Mississippi River that had been dredged ≤5 years previously, and collected mussels from 4 of the 12 sites; a total of 14 species was observed at all sites dredged in the past 5 years. Mussels were also recovered from nearly half of sites that had been dredged ≤10 years previously and ≥15 years previously (Eckblad 1999). Recolonization does appear to include listed species; live Higgins eye pearlymussels were found by Miller and Payne (1992) near Prairie du Chien, Wisconsin, in an area dredged 8 years earlier, and by Fuller (1980) in the St. Croix River (Minnesota) near a frequently dredged channel (USFWS 2000).

Ecological Specialists, Inc. has been monitoring a small dredged area in Pool 19 of the Mississippi River since 2014 to determine the rate of recovery of mussels relative to a nearby undisturbed reference area (Heidi Dunn, personal communication). The dredge area was divided into two segments, one of which was dredged in 2012, while the other was dredged in November 2013. Care was taken to restore bottom contours after dredging. The dredged area recolonized quickly with juveniles; juvenile density in October 2015 (2 years after the last dredging event) was 12.7 m^2 (95% CI: 8.2 to 17.2). Although adult density remains low (1.8 ± 0.8 unionids/m^2), it has steadily increased across all sampling events, suggesting more mussels are becoming established in the dredged area. In addition, the average length of mapleleaf (*Quadrula quadrula)* juveniles (the most abundant species) has increased across all sample events, suggesting that the juveniles that initially colonized the area are remaining in the area and growing (ESI, unpublished data). Results of this project thus far suggest that mussels may begin to move into disturbed areas in as little as a few years, though additional time will likely be needed for the community to return to pre-dredging conditions (Heidi Dunn, personal communication).

Several factors may contribute to the time it takes for mussels to recolonize dredged areas within the action area, including post-dredging contours and how closely they match pre-dredging conditions. Dredged areas near the bridge may also be repopulated via downstream movement of mussels from known upstream aggregations (e.g. the upstream relocation area identified in ESI 2015). In addition, some mussels are present downstream of the bridge in Sylvan Slough that could provide a source of glochidia/juveniles to be dispersed via host fish movement (ESI, personal communication).

Demolition

Direct effects of demolition include mortality to individuals left behind following the relocation efforts; however, the specifics of the relocation effort prior to demolition will be determined closer to that phase of the project. Mortality of individuals that remain may result from dredging activities that will occur within the action area to accommodate demolition of the existing bridge (Figure 2). Mortality of individuals could also occur as a result of demolition of the existing piers. It is estimated that total mortality of the Higgins eye pearlymussel as a result of demolition activities could include up to 397 individuals located within the action area for demolition (Figure 2). Methods used in the take estimate are included in Attachment E.

Indirect effects to mussels as a result of demolition activities are similar to those discussed above for construction and include changes to substrate as a result of dredging within the action area and sedimentation. Fish hosts may be temporarily displaced from the area due to increased activity associated with demolition; however, no host fish habitat will be permanently destroyed. Though effects to fish hosts are temporary, demolition and relocation activities may indirectly result in the loss of up to one year of reproduction due to stress and/or disturbance to mussels.

Spectaclecase Mussel

<u>Direct and Indirect Effects</u>

Relocation

Prior to demolition activities, all mussels, will be relocated from a portion of the action area of the existing bridge (Figure 2) using collection and handling methods described in the relocation plan (Attachment H). It is assumed that mussels will be relocated from existing riprap around the existing bridge piers, with the exception of Pier K in Sylvan Slough. Given that demolition is not anticipated to begin until November 2020, a relocation plan that will include the spatial extent of the mussel removal area will be developed prior to demolition activities and in coordination with the USFWS and IDNR.

Relocation efforts prior to demolition could result in mortality of up to approximately 59 individual spectaclecase mussels on the Illinois side of the river (see Attachment E). Based on a 90% relocation effort, approximately 347 individuals will be successfully relocated from the action area prior to demolition and would be disturbed (i.e., harass) (Attachment E). Mussels will not be relocated from Pier K (Figure 2).

Construction
No direct effects to this species as a result of construction are expected because of the specific habitat requirements of this species which differ from the Higgins eye pearlymussel. Take estimates provided in Attachment E indicate no take of this species as a result of construction.

Demolition
The direct effects to this species as a result of demolition include mortality as a result of relocation, dredging and pier removal (see Attachment B). Given the specific habitat requirements of the spectaclecase (rocks, boulders, etc.), removal of the existing piers may have a greater effect on this species when compared to other mussel species. To avoid and minimize effects to this species, Pier K (located within Sylvan Slough; Figure 2), which provides habitat for the spectaclecase mussel, will not be removed as a result of demolition of the existing bridge, and no mussels will be relocated from this pier. During demolition activities, the contractor will be restricted from impacting the river bottom within a 16.4-foot (5-meter) buffer of Pier K. Total mortality to this species as a result of demolition activities of other existing piers is estimated to be up to approximately 59 individuals as a result of relocation efforts; approximately 347 individuals will be successfully relocated prior to demolition activities and would be disturbed (i.e., harass) (see Attachment E).

Sheepnose Mussel

Direct and Indirect Effects

Relocation
Relocation activities will be the same as those described for the Higgins eye pearlymussel above. Although the area will be extensively searched, it is estimated that up to 10% of mussels >1 inch in length could be missed resulting in mortality of 21 adult sheepnose mussels. In addition, mortality of 10 adults is expected during relocation, and 53 individuals less than 1 inch (25 mm) in size would likely be missed during the relocation efforts for a total of 84 individuals (see Appendix E). These calculations include take as a result of the storm sewer outfall projects. Approximately 186 individuals will be successfully relocated from the action area prior to construction and would be disturbed (i.e., harass) (Appendix E).

Construction
The direct effects to this species as a result of construction are expected to be the same as those described above for the Higgins eye pearlymussel, and include mortality as a result of construction activities, including dredging, pier placement and construction of the storm sewer outfalls (see Attachments B and E).

It is estimated that mortality of up to 283 individuals that remain in the potential dredging area located outside of the mussel removal area on the Illinois side of the river (Figure 3) will occur, as well as 2 individuals left behind at the Pier 6 through 8 locations. It is estimated that up to 11 individuals (Illinois) will be left behind in water deeper than 8 feet and would be disturbed (i.e., harass) (Appendix E).

Demolition
The direct effects to this species as a result of demolition are expected to be the same as those described above for the Higgins eye pearlymussel, and include mortality as a result of dredging

and pier removal (Attachment B). Total mortality to this species as a result of demolition activities is estimated to be up to 115 individuals (Attachment E).

Butterfly, Ebonyshell, Black Sandshell, Purple Wartyback, and Spike

Direct and Indirect Effects

Relocation
Relocation activities will be the same as those described above for the Higgins eye pearlymussel. Take estimates by species are summarized in Appendix E.

Construction
The direct effects to these state-listed species as a result of construction are expected to be the same as those described above for the Higgins eye pearlymussel, and include mortality as a result of construction activities, including dredging, pier placement and construction of the storm sewer outfalls (Attachments B and E). Given that one weathered, dead shell and no live specimens of the Illinois state-threatened ebonyshell were found (ESI 2014), effects to this species are expected to discountable. This species is not included in the takes estimates found in Appendix E because take of this species is unlikely to occur.

Demolition
The direct effects to this species as a result of demolition are expected to be the same as those described above for the Higgins eye pearlymussel, and include mortality as a result of dredging and pier removal (see Attachment B). Take estimates by species are summarized in Appendix E. Given that one weathered, dead shell and no live specimens of the Illinois state-threatened ebonyshell were found (ESI 2014), effects to this species are expected to be discountable.

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ATTACHMENT E

TAKE ESTIMATES

Take Estimates

Methods

Methods used to calculate take estimate for all federal and state-listed mussel species are described in this section. This attachment also provides tables that summarize the take estimate by species.

Total Mussels

ESI calculated the estimated number of total mussels, including common species, found within the action area on the Illinois side of the river using the following methods:

- Using a shapefile of the action area provided by the Iowa DOT, ESI used "Calculate Geometry" in ArcGIS to obtain the area (in square meters) of the action area on the Illinois side of the river.
- Using a shapefile of the 2014 quadrat survey locations to calculate average mussel density (number of mussels per square meter) within the action area, an average density was calculated using data collected from each quadrat location.
- None of the survey quadrats fell within the action area of the storm sewer outfalls; therefore, average density of the outfall area was calculated by selecting all Area A (ESI 2014) quadrat points within 50 feet of the bank, and excluding points on the downstream end that were on a mud flat and not consistent with habitat within the outfall area.
- Average densities were multiplied by the area to get an estimated total number of animals within the action area on the Illinois side of the river.
- For the purposes of estimating take as a result of placement of the silt curtain anchors, an approximate 66-foot (20-meter) buffer was placed around the curtain to calculate the average density of mussels.

ESI then calculated a take estimate for individual species using the following methods:

- Using quantitative data from the 2014 survey, ESI calculated the relative abundance of each species and multiplied that by the estimated total number mussels to obtain an estimated number of each species. Data collected from Area A were used for the existing bridge and storm sewer outfall locations on the Illinois bank; data collected from Area B were used for the riverward section of the existing bridge; and, data from Areas A, B, and C were combined to calculate an estimated take from the proposed bridge corridor on the Illinois bank.

- The 2014 quantitative data were also used to calculate the proportion of mussels ≤1 inch in size for each of the surveyed areas. The proportion of mussels ≤1 inch was multiplied by the estimated number mussels of each species to split out the mussels ≥1 inch in size from those that are small and may be missed during the relocation effort. The overall proportion of individuals ≤1 inch in size, rather than the species-specific proportions of juveniles, was used because there were several species for which small individuals were not collected. The intent was to account for the fact that there are likely small individuals of those species present even if they were not found during the survey.

  In some areas, there were some species that were not collected in quantitative samples, but were collected in qualitative samples. For those species, the assumption was made that the relative abundance is equal to half the relative abundance of the least common species found in the quantitative samples.

Spectaclecase Mussels

Take estimates for the spectaclecase mussel were calculated differently than all other species. Given that this species is primarily found adjacent to existing bridge piers, and suitable habitat is not present in the proposed bridge alignment, the assumption was made that this species would only occur near piers in the existing bridge alignment within the action area. A shapefile was created of the existing bridge piers using plans provided by the Iowa DOT, an approximately 16.4-foot (5-meter) buffer was added around each pier (treating each pair of piers as a single unit), the area of the piers themselves was subtracted out of the total area, and the resulting buffer was clipped to the survey areas to eliminate any buffer areas that ended up on land. The Calculate Geometry feature was used to obtain the area of each resulting 16.4-foot (5-meter) pier buffer. The buffered pier area was multiplied by the average density in the action area to estimate the number of mussels in the pier areas. That number was then multiplied by the relative abundance of spectaclecase mussels collected in qualitative samples (ESI 2014) to get an estimate of the number of spectaclecase mussels around the piers.

Take Estimates by Species

Detailed results of the take calculations for federal and state-listed mussel species is found at the end of this attachment. The total take estimates as a result of construction and demolition activities (with the exception of the silt curtain placement) for each of the federal and state-listed mussel species are summarized in the table below. Construction estimates include estimated take as a result of the storm sewer outfall projects.

Species	**Take Estimate – Illinois**		**Species Total**
	Construction	Demolition	
Higgins eye pearlymussel	2,219	1,115	**3,334**
Spectaclecase Mussel	0	406	**406**
Sheepnose Mussel	557	298	**855**
Butterfly[1]	11,045	3,707	**14,752**
Ebonyshell[1]	0	0	**0**
Black Sandshell[1]	37,567	15,694	**53,261**
Purple Wartyback[1]	225	204	**429**
Spike[1]	225	204	**429**

[1]State-listed species – Illinois
[2]No live specimens found during 2015 survey; one weathered dead shell collected

The following table summarizes the results of take calculations for federal and state-listed mussel species as a result of silt curtain anchor placement.

Species	**Take Estimate – Illinois**	**Species Total**
Higgins eye pearlymussel	3	**3**
Spectaclecase Mussel	0	**0**
Sheepnose Mussel	1	**1**
Butterfly[1]	12	**13**
Ebonyshell[1,2]	0	**0**
Black Sandshell[1]	51	**51**
Purple Wartyback[1]	1	**1**
Spike[1]	1	**1**

[1]State-listed species – Illinois
[2]No live specimens found during 2015 survey; one weathered dead shell collected

Table 1. Estimated take of unionids within the outfall Action Area.

Species	Total Est. No. Live [1]	Est. No. Live >25mm	Est. No. Live ≤25mm [2]	90% relocated: Adults left behind [3]	Relocated [4]	Relocation Mortality [3]	Total mortality[3]	Total successfully relocated[4]
Plethobasus cyphyus	**7**	**5**	**2**	**0**	**4**	**0**	**3**	**4**
Ellipsaria lineolata	**52**	**38**	**15**	**4**	**34**	**2**	**20**	**32**
Lampsilis higginsii	**20**	**14**	**6**	**1**	**13**	**1**	**8**	**12**
Ligumia recta	**190**	**137**	**53**	**14**	**123**	**6**	**73**	**117**

[1] Estimated total number of animals = area of Action Area segment (193 m^2) * average density in Action Area segment (23.4/m^2). Estimated number of each species = relative abundance of each species in 2014 quantitative samples (Area A within 50 m of bank) * estimated total number of animals in Action Area segment.

[2] Considered "harmed," as animals this small will likely be missed in relocation. Calculated by multiplying overall proportion of individuals ≤25mm (2014 data) by estimated number of each species in Action Area segment.

[3] Considered "harmed:" No. ≤25mm + some individuals will be missed during relocation (10%) + some individuals may not survive relocation (5% of relocated mussels).

[4] Individuals successfully relocated; considered "harassed."

Table 2. Estimated take of unionids at IL Piers 1-5 plus 10 m buffers.

Species	Total Est. No. Live [1]	Est. No. Live >25mm	Est. No. Live ≤25mm [2]	90% relocated: Adults left behind [3]	90% relocated: Relocated	90% relocated: Relocation Mortality [3]	90% relocated: Total mortality[3]	90% relocated: Total successfully relocated[4]	Total in IL bank AA	Total no. live in area not relocated	Left behind in direct impact areas (Piers 6-8)	Left behind in direct impact areas (<8 ft [dredging])[5]	Left behind in secondary impact areas [6]
Elliptio dilatata [7]	**132**	**107**	**25**	**11**	**96**	**5**	**41**	**91**	**225**	**93**	**1**	**92**	**6**
Plethobasus cyphyus	**263**	**213**	**50**	**21**	**192**	**10**	**81**	**182**	**550**	**286**	**2**	**283**	**11**
Cyclonaias tuberculata [7]	**132**	**107**	**25**	**11**	**96**	**5**	**41**	**91**	**225**	**93**	**1**	**92**	**6**
Ellipsaria lineolata	**5,268**	**4,265**	**1,003**	**427**	**3,839**	**192**	**1,621**	**3,647**	**10,993**	**5,725**	**40**	**5,657**	**219**
Lampsilis higginsii	**1,054**	**853**	**201**	**85**	**768**	**38**	**324**	**729**	**2,199**	**1,145**	**8**	**1,131**	**44**
Ligumia recta	**17,911**	**14,501**	**3,409**	**1,450**	**13,051**	**653**	**5,512**	**12,399**	**37,377**	**19,466**	**134**	**19,235**	**746**

[1] Estimated total number of animals = area of Action Area segment (12,146 m^2) * average density in Action Area segment (31.9/m^2). Estimated number of each species = relative abundance of each species in 2014 quantitative samples (Areas A, B, and C combined) * estimated total number of animals in Action Area segment.

[2] Considered "harmed," as animals this small will likely be missed in relocation. Calculated by multiplying overall proportion of individuals ≤25mm (2014 data) by estimated number of each species in Action Area segment.

[3] Considered "harmed:" No. ≤25mm + some individuals will be missed during relocation (10%) + some individuals may not survive relocation (5% of relocated mussels).

[4] Individuals successfully relocated; considered "harassed."

[5] Based on 2009 bathymetric data from the Corps of Engineers.

[6] Secondary impact areas = portions of the Illinois bank Action Area (bank to edge of Pier 8) that will not be directly affected by pier construction or dredging (depths >8 ft).

[7] Species not collected in 2014 survey; assigned half the relative abundance of the least common species collected in 2014 survey.

Table 3. Estimated take of unionids within the old bridge Action Area, total Illinois segment.

Species	Total Est. No. Live [1]	Est. No. Live >25mm	Est. No. Live ≤25mm [2]	90% relocated: Adults left behind [3]	90% relocated: Relocated [4]	90% relocated: Relocation Mortality [3]	90% relocated: Total mortality[3]	90% relocated: Total successfully relocated[4]
Cumberlandia monodonta [5]	**406**	**406**	**0**	**41**	**365**	**18**	**59**	**347**
Elliptio dilatata [6]	**204**	**158**	**46**	**16**	**142**	**7**	**69**	**135**
Plethobasus cyphyus	**298**	**215**	**84**	**21**	**193**	**10**	**115**	**184**
Cyclonaias tuberculata [6]	**204**	**158**	**46**	**16**	**142**	**7**	**69**	**135**
Ellipsaria lineolata	**3,707**	**2,949**	**758**	**295**	**2,654**	**133**	**1,186**	**2,521**
Lampsilis higginsii	**1,115**	**849**	**266**	**85**	**764**	**38**	**389**	**726**
Ligumia recta	**15,694**	**12,794**	**2,899**	**1,279**	**11,515**	**576**	**4,755**	**10,939**

[1] Estimated total number of animals = IL old bridge bank + IL old bridge RW. Estimated number of each species = IL old bridge bank + IL old bridge RW

[2] Considered "harmed," as animals this small will likely be missed in relocation. IL old bridge bank + IL old bridge RW

[3] Considered "harmed:" No. ≤25mm + some individuals will be missed during relocation (10%) + some individuals may not survive relocation (5% of relocated mussels).

[4] Individuals successfully relocated; considered "harassed."

[5] Calculated as IL old bridge bank + IL old bridge RW

[6] Species not collected in 2014 survey; assigned half the relative abundance of the least common species collected in 2014 survey.

[7] Species not collected in quantitative samples; assigned half the relative abundance of the least common species in quantitative samples.

ATTACHMENT F

IOWA DOT SPECIAL PROVISIONS

SP- 150XXX
(New)

SPECIAL PROVISIONS
FOR
ENVIRONMENTAL PROTECTION

Scott and Rock Island Counties

Effective Date
[Insert Effective Date]

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150XXX.01 DESCRIPTION

A. The work under this contract is located in an environmentally sensitive area within or near the Mississippi River (the River). The Contractor's work area shall be restricted to the minimum to construct the project and to accomplish related work. Contractor shall make every reasonable effort to execute the construction in a manner so as to minimize any adverse impact of the construction or work on fish, mussels, wildlife, or natural areas.

B. Areas disturbed by excavation for construction of haul roads, docks and other permanent or temporary structures, shall be restored to original contours as noted in contract documents. Areas required for equipment movement, offices, stockpiling, service repairs, and storage shall be kept to a minimum and shall be restricted to the boundaries noted in the plans and contract documents***.***

150.XXX.02 WORK ZONE REQUIREMENTS

A. The I-74 corridor project area crosses the Mississippi River which is an environmentally sensitive resource. All construction activity in the Mississippi River, along its riverbank, and within the area that drains into the Mississippi River should be considered work in an environmentally sensitive area. Work on the Illinois side of the river should be considered work in a particularly sensitive area.

B. Any construction related conditions deemed to be potentially damaging to environmentally sensitive resources by the Engineer shall be rectified immediately or construction will cease until such time as the condition is rectified. At the discretion of the Engineer, construction activities may resume once provisions to rectify the situation are made. The Contractor shall confine equipment and operations to the project right-of-way shown in the contract documents. These designated construction zones shall be protected with temporary sediment control measures in accordance with the details in the contract documents. No work shall commence on this contract until temporary erosion control and sediment control measures identified in the plans have been installed.

C. Any erosion control and sediment control measures implemented, on land or water, shall remain in place and maintained until construction in the area is completed.

D. No tributaries, oxbows or other backwater areas will be "cut off" or blocked from normal flow conditions. Recreational boat traffic closures may be necessary in the area of Sylvan Slough due to construction activities. The contractor is required to secure necessary permits and clearances for closure of any portion of the River.

E. Any sediment control measures implemented, on land or water, shall remain in place and maintained until construction in the area is completed. For areas on the river bank, sediment control measures shall remain in place and be maintained until the area has been stabilized with temporary or permanent seeding. All earthwork operations on shore will be carried out in such a manner to ensure no sediment runoff and soil erosion will enter the river.

F. Temporary sediment control measures removed or damaged due to construction activities or high water levels shall be replaced or repaired, where possible, within the emergency mobilization time of 8 hours or within standard mobilization time of 72 hours. If it is not possible to meet the designated time frames, sediment controls shall be replaced prior to recommencing work that would cause turbidity issues in the water.

G. The clearing of vegetation will be limited to that which is absolutely necessary for construction and operation of the project. All areas disturbed by construction activities and not covered with riprap shall be re-seeded with native grass mix according to Article 2601.03.C,5, of the Standard Specifications, unless otherwise specified in the contract documents. All re-vegetated areas shall be monitored to make certain they succeed.

H. Removal and replacement of any revetment stone placed as part of the project should yield a structure with no significant change in gradation. Any damaged stone shall be replaced with new stone to ensure proper gradation.

I. Any and all barges and other water craft used for construction activities, shall be inspected for the presence of zebra mussels prior to placing the barges into the Mississippi River. Barges shall be completely out of the water for 10 days with all compartments opened that could potentially contain water and therefore harbor adult, larval or juvenile zebra mussel. This will ensure proper drying of the barge(s) and reduction of potential infestation. If the barge is obtained from a local source, United States Fish and Wildlife Service, Illinois Department of Natural Resources and Iowa Department of Natural Resources staff must still be contacted to discuss previous locations at which the barge has been used.

J. The U.S. Army Corps of Engineers (USACE) shall be notified if temporary work is constructed and when it is removed from the river. All temporary construction required shall be removed from the River in its entirety once it is no longer needed for construction of the project. If dredging is needed around the temporary slips to convey barges and the discharge will be placed back into the Mississippi River, the USACE shall be notified of the location of dredging, amount to be dredged, and any required Section 401 water quality testing prior to any discharge of dredged material. Should dredged or excavated material be deposited on the shore before being hauled away, silt fences, perimeter and slope sediment control devices, or low silt berms shall be required to limit the reentry of sediments into the river. In addition, the materials shall be placed in a confined area, not classified as a wetland. All temporary construction required shall be removed from the Mississippi River in its entirety once it is no longer needed for construction of the project.

K. Temporary construction in the River may include an appropriate combination of barges, temporary slips, temporary supports (falsework), and temporary cofferdams. **An elevated earthen/sand/rock work platform (causeway or equipment pad) shall not be used for any**

construction; fills in the River for temporary crossings, causeway, or equipment pad structures are not permitted.

L. A plan for all temporary construction needed shall be submitted to and approved by the USACE and the Office of Location and Environment (OLE) prior to installation. The plan must include but is not limited to the location identified on an aerial photo, the dimensions, construction methods, duration of use and measures that will be used to control turbidity and/or sedimentation. The Contractor shall submit the plan for all temporary construction to the Engineer prior to commencing work. Once approved by the USACE and/or the OLE, the Engineer will notify the Contractor of approval.

M. The substantial girder lengths may require the girders be constructed in segments; therefore, temporary supports may be required. These supports could essentially consist of temporary piers necessary to support girder segments prior to final assembly. Any temporary support work outside of the navigation channel shall be restricted to the work area identified in Special Provision for Mussel Conservation. Temporary supports shall be promptly removed from the River following final girder assembly.

N. If dredging is needed to convey barges the discharge will not be placed back into the River. The USACE shall be notified of the location of dredging, amount to be dredged, and any Section 401 water quality testing required by the Iowa Department of Natural Resources prior to any discharge of dredged material. Should dredged or excavated material be deposited on the shore before being hauled away, silt fences, perimeter and slope sediment control devices, or low silt berms shall be required to limit the reentry of sediments into the river. In addition, the materials shall be placed in a confined area, not classified as a wetland.

O. Prior to commencement of hydraulic dredging, the applicant shall perform a modified elutriate test procedure to predict the effluent quality or the total concentration of contaminants in the effluent. This test simulates the processes occurring during confined disposal and provides information on the dissolved and particulate contaminant concentrations. Results of the elutriate test shall be forwarded to the Iowa Department of Natural Resources and Illinois Department of Natural Resources when available. Should test results prove unsatisfactory, the Iowa Department of Natural Resources or Illinois Department of Natural Resources may amend this Certification to assure that effluent water quality requirements are met. Please note that if mechanical dredging is performed, the testing will not be required.

P. Native materials removed from cofferdams may be replaced in the cofferdam. Other than replacing native materials, any fill materials introduced into the River must be clean (meaning less than 10% fines that would pass through a #200 sieve). Areas disturbed by dredging shall be backfilled with special revetment. Dredging and backfill is included in project BRFIM-074-1(197)5—05-82 and project BRFIM-074-1(198)5—05-82.

Q. The Contractor shall remove any debris from the water or the river bed as soon as practicable during the same work day in order to prevent the accumulation of unsightly, deleterious, and /or potentially polluted materials, as directed by the Engineer. The Contractor shall also implement measures to prevent debris from falling into the river. Should debris enter the river, it shall be retrieved immediately. Debris will not be allowed to collect on the bottom of the river.

R. No materials, including cleared and grubbed vegetation or construction debris, shall be disposed of in such a way that it could enter a wetland or waterway.

S. The contractor shall perform his work in such a way to ensure that no wet or dried concrete shall enter the River, any waterway or wetlands. If concrete does enter these areas the Contractor shall be solely responsible for any remediation necessary. Wash concrete trucks out in such a manner that wash water cannot enter the River, waterway, or wetlands. If a designated area is constructed or identified, that location shall be included in the temporary construction plans.

T. Care shall be taken to prevent materials spilled or stored on site from washing into any wetland or waterway as a result of cleanup activities, natural runoff, or flooding, and that, during construction, any materials, which are accidentally spilled into these areas, will be retrieved.

U. No fuels, lubricants, form oil, or similar products shall be stored in an area that has not been protected by a berm or other spill materials within the project area. All handling and storage of these materials must be done in such a manner as to comply with federal Spill Prevention Control and Countermeasure regulations and protect all water bodies from accidental spills and leaks.

V. The contractor shall perform his work in such a way as to prevent materials spilled or stored on site from washing into the River or any wetland or waterway as a result of cleanup activities, natural runoff, or flooding. If, during construction, any materials are accidentally spilled into these areas, the materials will be retrieved and/or remediated immediately.

W. Spill protection material (i.e., spill kit) shall be readily available at the project site, and on work barges, to contain and absorb accidental spills of fluids from construction equipment. Personnel trained in the implementation of the spill kit shall be readily available onsite to respond to accidental spills.

X. The Iowa Department of Natural Resources regulates open burning and administers regulations that pertain to fugitive dust and opacity (visible emissions). In general “open burning” is prohibited except for the special exemptions listed in the state open burning rules. The open burning rules are contained in 567 IAC rule 23.2(455B). In addition there are a number of definitions in 567 Chapter 20 that are applicable to open burning. The IAC is available on-line at www.legis.state.ia.us/IAChtml. In general, owners or operators must take reasonable precautions to prevent fugitive dust from becoming airborne and crossing the property line. These regulations are contained in 567 IAC paragraph 23.3(2)”c”, and can be found at the website above. In general, visible emissions in excess of 40 percent opacity are not allowed unless specifically exempted under rule. The rules for opacity are under paragraph 567 IAC 23.3(2)”d”, and can be found at the website above.

150XXX.03 PROTECTED SPECIES

A. Sylvan Slough, downstream of the project area, has been identified by the US Fish and Wildlife service as an Essential Habitat Area for the federally endangered Higgins eye pearly mussels. In addition, Sylvan Slough is inhabited by two other federally endangered mussels, spectacle case mussel and sheepnose mussel. Please refer to Special Provision for Mussel Conservation for more information on protecting threatened and endangered species.

B. Attention is directed to the Migratory Bird Treaty Act (15 USC 703-711) 50 CFR Part 21 and 50 CFR Part 10 that protect migratory birds, their occupied nests, and their eggs from disturbance or destruction. Activities that are likely to result in disturbance or destruction of migratory birds include but are not limited to clearing and grubbing, as well as structure cleaning, painting, demolition or reconstruction where bird nests are present. To protect migratory birds, do not conduct construction activities where active nests are present between the dates April 1 and July 15 inclusive or until the birds have fledged and left the structure. If evidence of migratory bird nesting is discovered after beginning work or in the event that migratory bird nests become established, immediately stop work and notify the Engineer.

C. Removal of trees is prohibited between the dates of April 1 to September 30 inclusive to avoid Indiana bat and northern long-eared bat habitat.

D. Removal of trees is prohibited between the dates of December 15 to February 20 to protect bald eagles.

E. If during the course of construction, any discoveries of protected plant or animals are made in the project area, the Contractor should notify the Engineer immediately.

150XXX.04 CLEAN WATER ACT COMPLIANCE

A. A Clean Water Act Section 404 Permit has been obtained by the Contracting Authority that authorizes all construction-related activities affecting waters of the U.S. The 404 Permit contains numerous special conditions, all of which may not have been included in this Special Provision. Failure to follow the provisions of the 404 Permit or this Special Provision may result in enforcement actions being initiated by the USACE. Enforcement actions may include an order to immediately cease all construction activity and/or fines.

B. It will be the Contractor's responsibility to ensure that the day-to-day operations of the project comply with this Special Provision. The Engineer will be available throughout the project to offer guidance to the Contractor regarding compliance with this Special Provision and the Clean Water Act.

C. Included with the Clean Water Act Section 404 Permit are Section 401 Water Quality Certifications from Iowa Department of Natural Resources and the Illinois Department of Natural Resources, which contain numerous special conditions are included by reference in this Special Provision.

D. It is the goal of Iowa's and Illinois' Water Quality Standards that all uses of the Mississippi River be maintained and protected. The dredging will cease if the water quality standards of either the State of Iowa or the State of Illinois are violated.

150XXX.05 PAYMENT

A. No separate payment will be made for costs incurred due to compliance with this Special Provision.

B. No additional time will be provided to the contract unless approved in writing by the Engineer.

SPECIAL PROVISIONS
FOR
MUSSEL CONSERVATION

Scott and Rock Island Counties
BRFIM-074-1(197)5—05-82
BRFIM-074-1(198)5—05-82

Effective Date
[Insert Effective Date]

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150XXX.01 DESCRIPTION

A. The work under this contract is located in an environmentally sensitive area within the Mississippi River (the River). This work has the potential to impact state and federally threatened and endangered mussels living in the River. In environmentally sensitive areas of the River the Contractor's work area shall be restricted to the areas shown on Figure 1 to construct the project and to accomplish related work. Contractor shall make every reasonable effort to execute the construction in a manner so as to minimize any adverse impact of the construction or work on fish, mussels, wildlife, or natural areas. Contractor's work is not restricted outside of the work areas identified on Figure 1 and the restricted areas on Figure 2.

B. Areas required for equipment movement, stockpiling, service repairs, and storage shall be kept to a minimum and shall be restricted to occur within the boundaries noted in Figure 1 in the River and outside of the areas noted on Figure 2 on the Illinois and Iowa banks of the River.

150XXX.02 WORK ZONE REQUIREMENTS

A. The project area crosses the Mississippi River which is an environmentally sensitive resource. All construction activity in the Mississippi River, along its riverbank, and within the area that drains into the Mississippi River should be considered work in an environmentally sensitive area. Work on the Illinois side of the river should be considered work in a particularly sensitive area. The specific project area addressed in this Special Provision is within the River. All of these areas are environmentally sensitive resources.

B. Any construction related conditions deemed to be potentially damaging to environmentally sensitive resources by the Engineer shall be rectified immediately or construction will cease until such time as the condition is rectified. At the discretion of the Engineer, construction activities may resume once provisions to rectify the situation are made.

C. The Contractor shall confine equipment and operations in the River to the project areas shown in Figure 1. These designated construction zones shall be protected with temporary sediment control measures in accordance with the details in the contract documents. No work shall commence on this contract until temporary sediment control measures identified in the plans have been installed.

D. Concurrently with construction, prior to work in the water, silt curtains shall be deployed as depicted in Figure 1 and as detailed in projects BRFIM-074-1(197)5—05-82 and BRFIM-074-1(198)5—05-82. Any additional sediment control measures will be employed as needed, and at the Engineer's discretion, to protect waters of the U.S., threatened and endangered mussels and the City of Moline drinking water intake.

E. Construction in the River will require access to the River via the Iowa or Illinois bank. Figure 2 identifies areas that are restricted from being used as River access due to endangered mussel inhabitation. No river access will be allowed within the restricted areas identified on Figure 2.

F. Areas disturbed by dredging shall be backfilled with special revetment.

G. It is the goal of Iowa's and Illinois' Water Quality Standards that all uses of the River be maintained and protected. The dredging will cease if the water quality standards of either the State of Iowa or the State of Illinois are violated.

150XXX-03 PROTECTED SPECIES

A. Sylvan Slough, downstream of the project area, has been identified by the US Fish and Wildlife service as an Essential Habitat Area for the federally endangered Higgins eye pearly mussels. In addition, Sylvan Slough is inhabited by two other federally endangered mussels: spectacle case mussel and sheepnose mussel.

B. If during the course of construction, any discoveries of additional protected plant or animals are made in the project area, the Contractor shall notify the Engineer immediately.

C. It will be the Contractor's responsibility to ensure that the day-to-day operations of the project comply with this Special Provision. The Engineer will be available throughout the project to offer guidance to the Contractor regarding compliance with this Special Provision. Any environmental monitoring, required by the US Fish and Wildlife Service, of environmentally sensitive areas or areas where mussels could be present will be performed by the contracting authority or its designee and coordinated with the contractor through the Engineer.

150XXX.04 MATERIALS

A. Backfill for areas disturbed by dredging (special revetment) is included in project BRFIM-074-1(197)—05-82 and project BRFIM-074-1(198)—05-82.

B. Silt curtain is included in project BRFIM-074-1(197)5—05-82 and project BRFIM-074-1(198)—05-82.

150XXX.05 PAYMENT

A. Except as specified in the Material Section above, no separate payment will be made for costs incurred due to compliance with this Special Provision.

B. No additional time will be provided to the contract unless approved in writing by the Engineer.

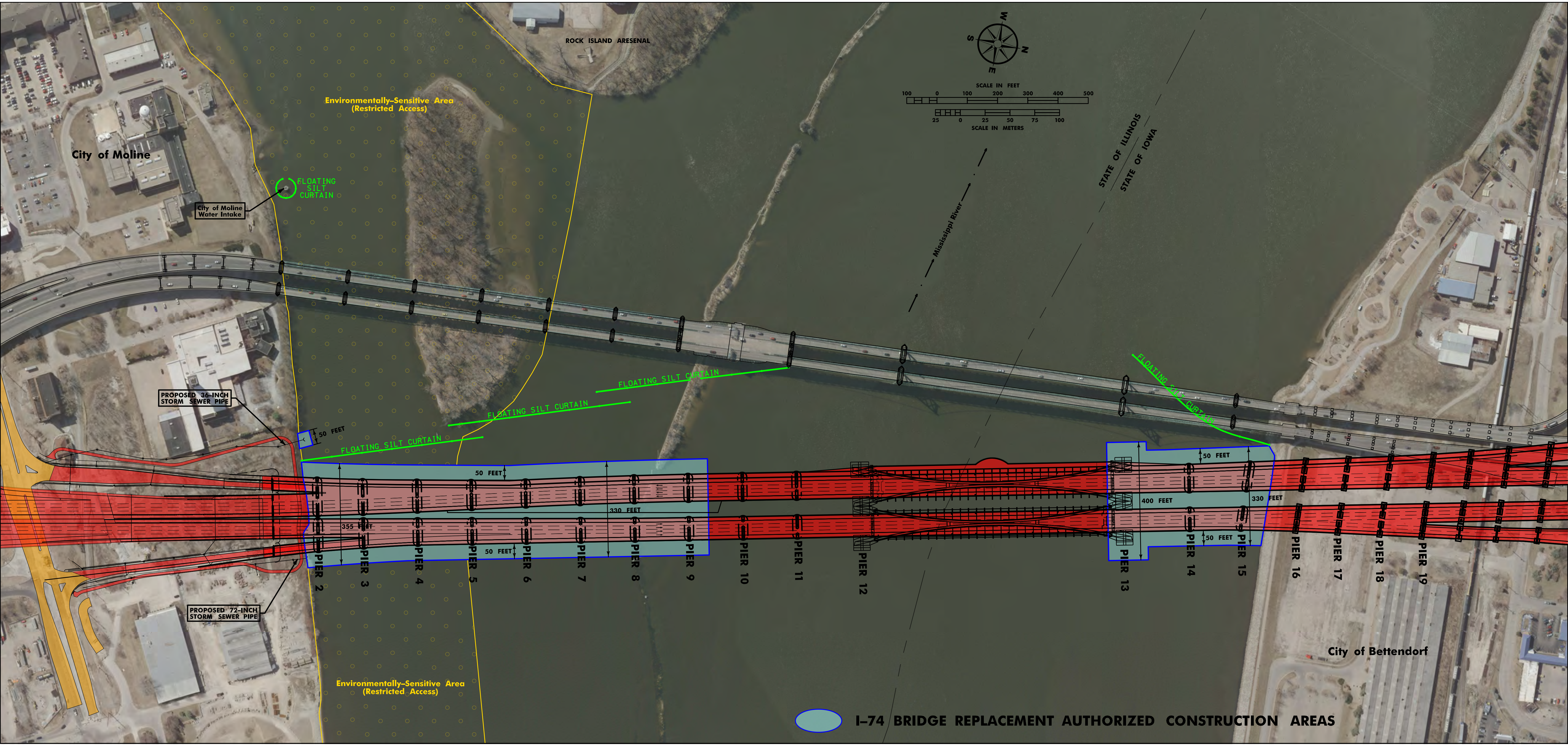


Figure 1. Construction area map, I-74 over the Mississippi River.

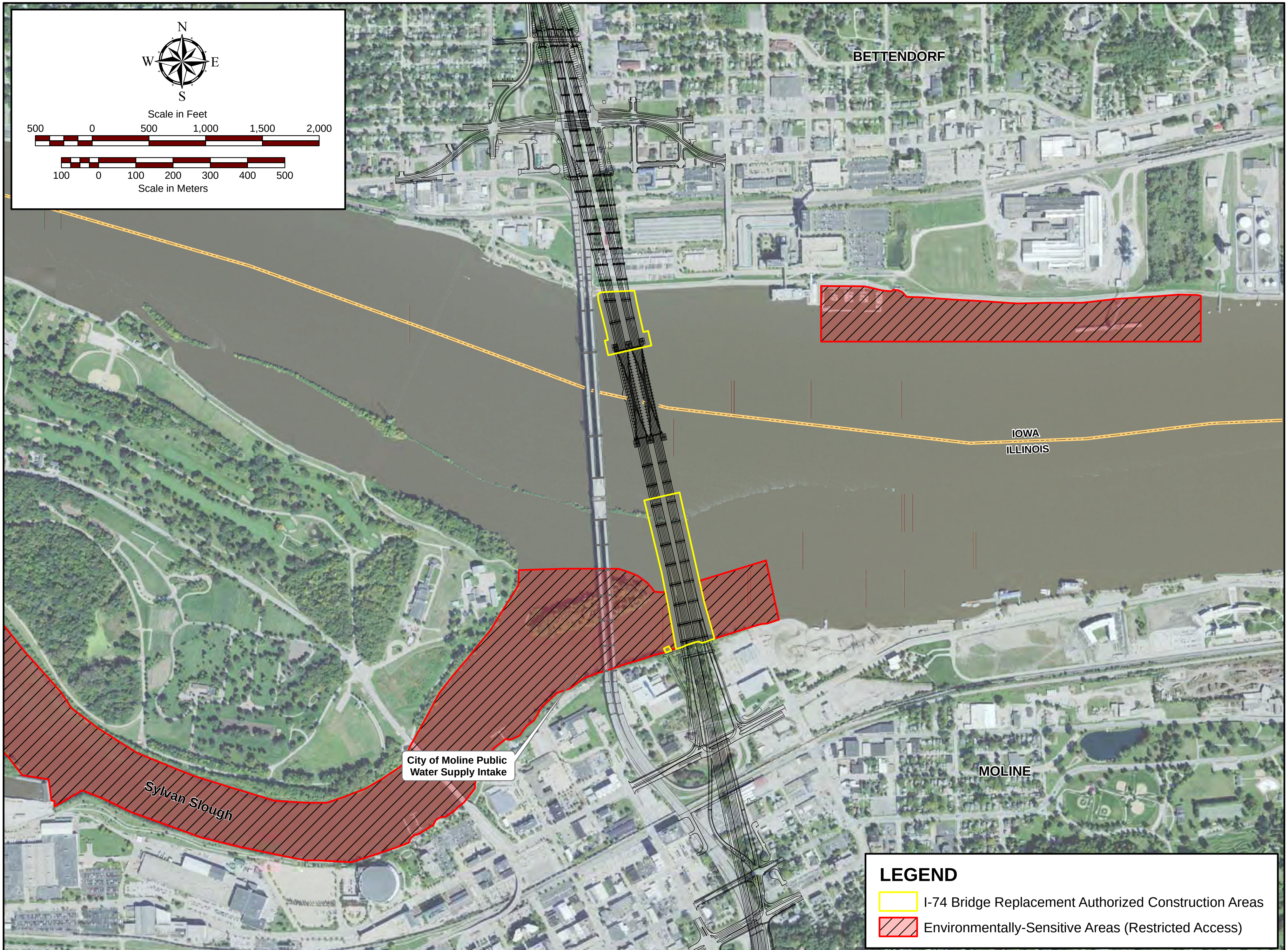


Figure 2. Project constraints map, I-74 over the Mississippi River.

ATTACHMENT G

RELOCATION PLAN

I-74 Relocation Plan

New bridge - Illinois bank

Eleven piers will be constructed on the Illinois bank. Mussel density was high near the bank, averaging 31.9 mussels/m^2 from the Illinois bank to halfway between Piers 5 and 6. Density decreased sharply to 0.4 mussels/m^2 riverward of this point. Much of the area from the bank to Pier 5 is <6 ft deep (based on bathymetry data from the Corps of Engineers) and may need to be dredged to allow barge access. Although these mussels may be affected by construction, to reduce the relocation effort to a more manageable level, mussels will only be relocated from around the first 5 piers on the Illinois bank, plus 10-m buffers around each pier footprint. Each pier + buffer area will therefore be approximately 90 m long and 30 m wide. Based on the estimated density, approximately 387,447 mussels could occur in the pier construction zones. The construction area and buffer zone will be delineated with lines and buoys, and will be divided into 3 m x 10 m (10 ft x 30 ft) cells. A diver will search each cell by hand, disturbing the top 10 cm of substrate, and collecting all mussels encountered. The number of mussels collected in each cell will be recorded. To ensure that at least 90% of mussels are removed, additional searches of each cell will be conducted until the final search yields <10% of the cumulative number of mussels collected in that cell.

Collected mussels will be brought to the surface, counted, and placed in mesh bags suspended in flowing water or in holding tanks equipped with well pumps and aerators to refresh the water before being transported to the processing area by boat (proposed processing location is on the Illinois bank, under and adjacent to the existing bridge). Mussels may be briefly (<5 min) exposed to air during transport, but will be replaced in flowing river water or holding tanks while awaiting processing. Common species will be identified, categorized as adult (>5 years old) or juvenile (≤5 years old), and etched with a slash on the anterior edge of the shell. State-listed species will be identified, measured (length in mm), aged (external annuli count), and etched with a slash on the anterior edge of the shell. Federally listed species will be identified, measured (length, width, and height in mm), aged, and marked with a unique ID number; *Lampsilis higginsii* and *Plethobasus cyphyus* will be marked with a Dremel tool, while PIT tags will be affixed to *Cumberlandia monodonta* (if encountered). Exposure to air will be limited to 5 min or less during processing.

Common and state-listed species will be placed in quadrants doubling and tripling resident density at 3 of the recipient sites (Illiniwek Park, Eagle's Landing, and Upstream). Each mussel's placement location will be randomly selected by rolling dice or drawing a number from a hat. *Lampsilis higginsii* and *P. cyphyus* will be placed in grids at the same 3 recipient sites; the site and grid cell will be randomly selected for each mussel. *Cumberlandia monodonta* will be placed at previously selected *C. monodonta* recipient sites (ESI, 2015). Monitoring of previously relocated *C. monodonta* suggests that the Sylvan Slough recipient site is most suitable for placement of additional individuals; therefore, any *C. monodonta* encountered in this relocation will be placed at the Sylvan Slough site. Processed mussels will be transported by boat to their respective placement locations. Mussels will be sorted into bags by placement location; bags will be placed in a holding tank in the transport boat to minimize exposure to air. Common and state-listed species will be distributed throughout their respective placement locations from the surface. *Lampsilis higginsii* and *P. cyphyus* will be hand-placed in their respective grid cells, and *C. monodonta* will be hand-placed at the Sylvan Slough site near the previously relocated individuals. The transport boat will make frequent trips to the recipient sites to minimize the total holding time.

New bridge - Iowa bank

Three piers will be constructed on the Iowa bank. Mussel density along the Iowa bank averaged 2.1 mussels/m^2. Substrate in the proposed pier construction areas (determined during the 2014 survey; ESI, 2014) was primarily bedrock or sand, and most mussels were found in small patches of sand, silt, and clay. Additionally, most of the area between the piers is >8 ft deep and should not be affected by construction equipment. We therefore propose to relocate mussels from the new pier construction areas within a 5-m buffer around each proposed pier footprint. The 2 shoreward piers plus buffers are approximately 80 m long x 20 m wide, while the riverward pier plus buffer is approximately 100 m long x 40 m wide. Based on this density, approximately 14,350 mussels could occur in the pier construction zones. The construction area and buffer zone will be delineated with lines and buoys. Divers will conduct an initial reconnaissance within each delineated pier polygon to determine areas with suitable habitat (i.e., heterogeneous mix of silt, sand, clay, gravel). Collecting effort will be concentrated within suitable habitat areas. At least one dive day of effort per pier will be spent relocating mussels from each of the 3 piers in the Iowa bank channel border. One day should be sufficient to collect the majority of mussels at each pier; however, if density is greater than anticipated, a second dive day may be required. A dive day will consist of 6-8 hours of diving with one diver in the water.

Collected mussels will be transported to the processing area and processed as described above. Placement locations for federally listed species will be the same as those used for the Illinois bank (randomized grid cells for *L. higginsii* and *P. cyphyus*, Sylvan Slough site for *C. monodonta*). A denser assemblage of mussels (8/m^2) was found within 70 m of the Iowa bank between the new bridge corridor and the existing casino boat upstream. Common and state-listed mussels collected from the Iowa piers will be distributed from the surface throughout this area.

Existing bridge

Although detailed plans have not yet been developed, it is assumed that mussels will need to be relocated from at least a portion of the existing bridge action area prior to demolition. Approximately 308,800 mussels may occur in the Illinois portion of the action area, and an additional 3,500 may occur in the Iowa portion. Collection areas will be divided into cells and searched until at least 90% of mussels have been removed, as described above.

Collected mussels will be transported to the processing area and processed as described above. Placement of federally listed species will likely follow the methods proposed for relocation in the new bridge corridor (grids for *L. higginsii* and *P. cyphyus,* previously identified recipient sites for *C. monodonta*); the site(s) to be used will be determined at a later date. Common and state-listed species will be distributed among portions of the Illiniwek Park, Eagle's Landing, or Upstream sites that were not used in the new bridge relocation, or at the Buffalo and/or Fairport sites.

ATTACHMENT H

MONITORING PLAN

I-74 Mussel Relocation and Monitoring

1) Density Study at Recipient Sites

Relocation of unionids from the I-74 bridge footprint provides an opportunity to investigate the effects of increasing resident unionid density at varying rates in recipient sites. Anecdotal evidence suggests that unionid communities often return to pre-relocation densities over time, and that increasing density by a large percentage may be detrimental. To examine the effects of density increases in resident unionid communities, a subset of unionids relocated from the I-74 bridge will be placed in recipient sites in varying numbers, and will be monitored over time.

The proposed density study will take place in 3 different recipient sites to determine if different unionid beds may have different carrying capacities, and to allow results to be replicated. Each recipient site will be divided into 4 quadrants of approximately equal area. One quadrant will be reserved for monitoring of federally endangered species (described below). The remaining 3 quadrants will be used for the density study. Prior to the relocation effort, 80 quantitative samples will be conducted in each of the 3 quadrants at the 3 recipient sites (240 samples at each site; 720 total samples) to estimate density with 15-20% precision. Samples will be randomly distributed in each quadrant.

During the relocation effort, mussels will be placed at the recipient sites in varying densities. One quadrant will serve as a control; no mussels will be placed in this quadrant. Mussel density will be doubled in the second quadrant, and tripled in the third quadrant. The number of mussels that can be placed in each quadrant is presented in Table 1. Mussel placement in the recipient site quadrants will be randomized. Each potential placement site (2 quadrants each at 3 recipient sites) will be assigned a unique number from 1 to 6. The number of the placement site for each relocated mussel will be selected using dice or by drawing numbers (1-6) from a hat.

Monitoring will be conducted in subsequent years to quantify changes in density over time. Random quantitative samples will be collected as in the initial sampling event. Sampling will occur annually for 2 years following the relocation (2017 and 2018), and at Years 5, 10, and 15 (2021, 2026, 2031).

2) Construction Area Monitoring

Sampling will be conducted in the new bridge footprint to quantify the effects of construction on unionids and to determine the rate at which unionids recolonize the construction area. Baseline quantitative data will be collected prior to construction (spring 2016) to allow for statistical comparison with future data. Quantitative samples will be used to determine unionid density and community metrics within the new bridge Action Area. To achieve a confidence interval within 20-25% of the mean, 100 samples will be collected in the Illinois portion of the action area. Samples will be arranged in a three random start design (Strayer and Smith, 2003) for statistical validity. Due to high variability in the Iowa action area, and because depths are great enough that construction barges should not directly impact the substrate, samples in the Iowa action area will be concentrated around the shoreward pier. Twenty (20) quantitative samples will be collected in and adjacent to the pier footprint, and 30 samples will be collected outside the pier footprint. Data will be used to evaluate unionid species composition, community metrics, and density in the action areas.

Additional sampling will be conducted immediately after construction is complete (2017) to determine if unionids not relocated from the bridge area were impacted by construction. Quantitative samples will be collected as described above, and differences in community characteristics before and after construction will be noted. In addition, qualitative timed searches may be conducted around the new bridge piers to more effectively sample these areas and determine if unionid mortality may have occurred due to construction.

Monitoring the new bridge footprint with both quantitative and qualitative sampling will continue annually for the first 3 years following construction (2017, 2018, and 2019) and in Years 5, 10, and 15 (2021, 2026, and 2031). Continued monitoring will seek to describe unionid community changes, particularly mortality, and to document recolonization of unionids in the construction area.

3) <u>Recipient Site Monitoring</u>

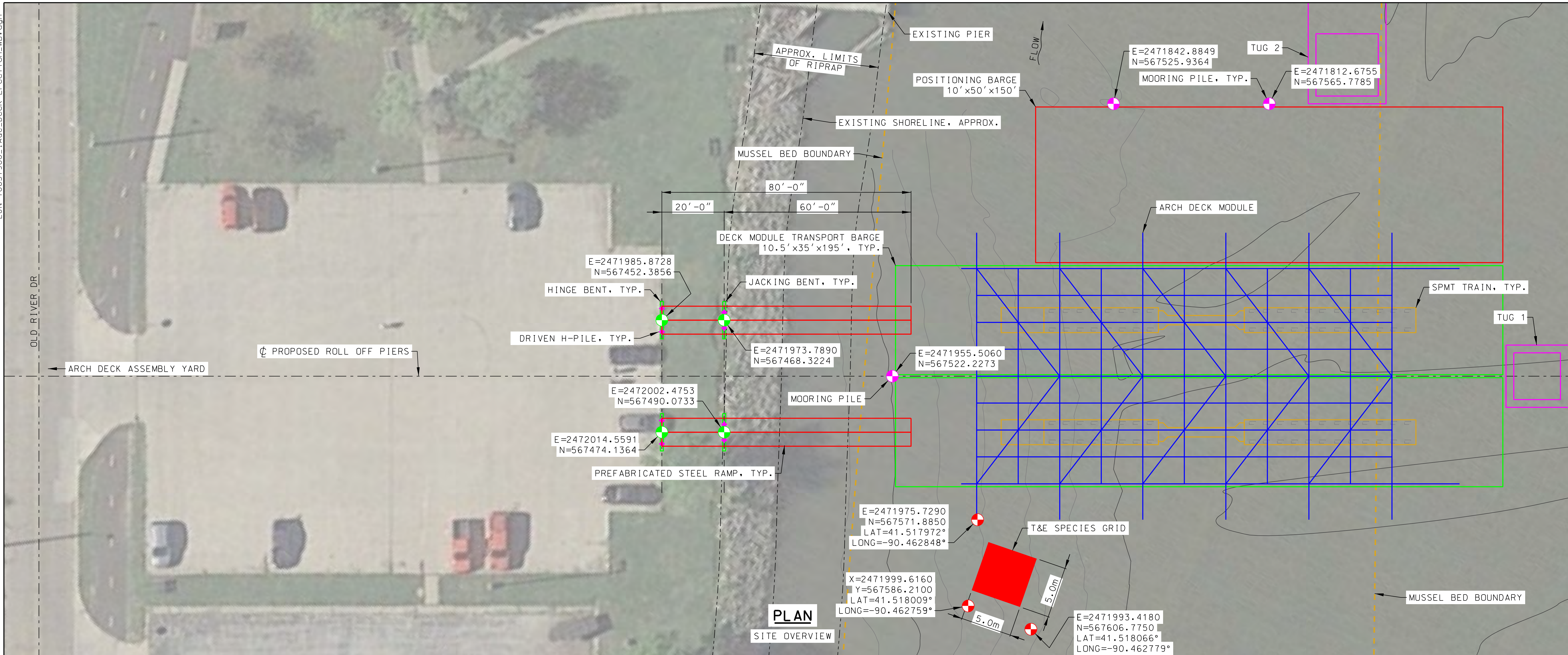
Monitoring of federally endangered unionid species will be conducted to evaluate the health of unionids after relocation and to ensure that take estimates are not being exceeded. *Lampsilis higginsii* and *Plethobasus cyphyus* will be moved to general recipient sites identified in previous surveys; recipient sites and handling/monitoring procedures for *Cumberlandia monodonta* will be different due to this species' specific habitat requirements and are described below. All *P. cyphyus* and approximately 1000 *L. higginsii* will be placed in grids at 3 of the recipient sites. At each site, one 5 x 5 m grid will be established for placement of *P. cyphyus,* and two 5 x 5 m grids will be established for *L. higginsii.* Grids will be divided into 4 cells each. Relocated individuals will be marked with unique ID numbers, and will be measured (length, width, and height in mm), aged (external annuli count), and sexed (*L. higginsii*). Marked individuals will be hand-placed in grid cells at a rate not to exceed 50% of the existing density, and the grid cell in which each individual is placed will be recorded. Grids will be monitored to quantify survival, movement, and growth of relocated individuals. Each grid cell will be thoroughly searched by a diver, and any marked individuals found in grid cells will be processed as described above. Monitoring will be conducted annually for the first 2 years after relocation (2017 and 2018), and then at Years 5, 10, and 15 (2021, 2026, and 2031).

Cumberlandia monodonta is typically found in boulder or large rock substrate; therefore, the general recipient sites are not suitable for placement of this species. Several *C. monodonta* have been experimentally relocated to 3 sites harboring existing populations, and are currently being monitored using PIT tags. Any *C. monodonta* collected in the relocation effort will be measured and aged, and PIT tags will be affixed to the outer shell in the same manner as those individuals that have already been relocated (ESI, 2015). Tagged individuals will be hand-placed in 1 of the 3 recipient sites currently in use for this species. These sites will continue to be monitored to record survival of relocated *C. monodonta.*

Monitoring entails a diver passing a PIT tag reader over the substrate at the recipient sites while the topside crew directs the diver and informs him of any detections. If a tagged shell is detected, the diver will search the substrate by hand to locate the tagged mussel and determine if it is alive or dead. General notes about the position of mussels in the substrate, presence of resident (untagged) individuals, and habitat will also be recorded.

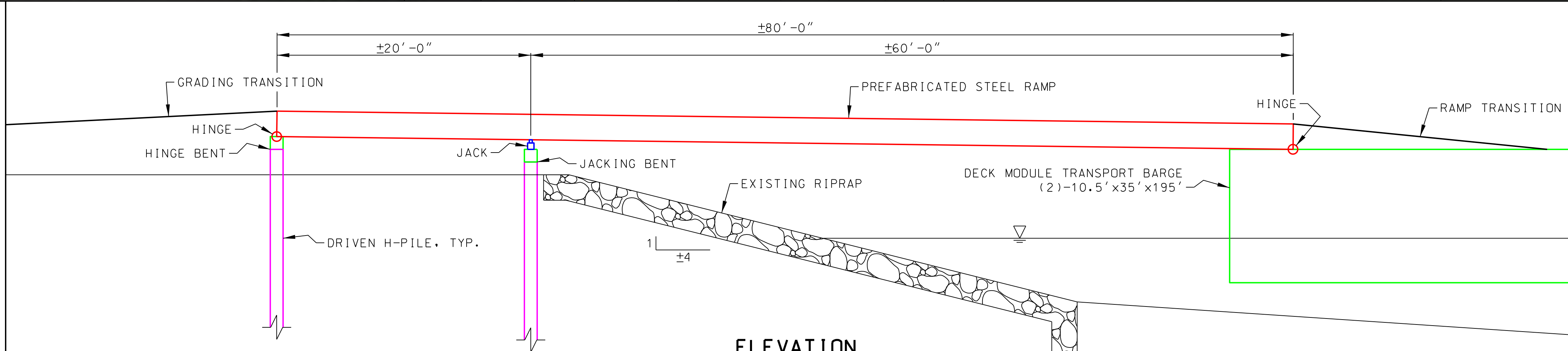
ATTACHMENT H

TEMPORARY ROLL OFF PIERS WITH MOORING PILE PLAN SHEET



NOTES:

1) DO NOT SCALE DRAWINGS.
2) GENERAL CONFIGURATION SHOWN IS APPROXIMATE.
3) REQUIRES APPROXIMATELY (12) STEEL HP OR PIPE PILE TO DRIVEN OUTSIDE TOP OF RIPRAP.
4) REQUIRES APPROXIMATELY (3) STEEL PIPE PILE TO BE PRE-BORED OUT TO APPROXIMATELY 200' FROM EXISTING SHORELINE.
5) REQUIRES SOME MINOR DISPLACEMENT OF EXISTING RIPRAP AND SHORELINE ABOVE WATERLINE TO FACILITATE PILE DRIVING AND BENT CONSTRUCTION.
6) T&E SPECIES GRID LAID OUT ACCORDING TO GPS COORDINATES PROVIDED BY KRISTEN LUNDH OF US FWS ON 12/23/2019, WHICH CORRESPOND TO FIGURE 2-4 OF THE "TECHNICAL REPORT, PROJECT NO. 18-018, APRIL 2019 - YEAR 2 MONITORING OF UNIONIDS RELOCATED FROM THE NEW INTERSTATE 74 BRIDGE CROSSING, MISSISSIPPI RIVER POOL 15," BY ECOANALYSTS, INC.
7) MUSSEL BED BOUNDARY BASED UPON INFORMATION SHOWN IN YEAR 2 MONITORING OF UNIONIDS RELOCATED FROM THE NEW INTERSTATE 74 BRIDGE CROSSING, MISSISSIPPI RIVER POOL 15 DATED APRIL 2019 FROM ECO ANALYSTS, INC.



LUNDA CONSTRUCTION CO.

Lunda Job: 10657900				
Designed By: BJG	Design Ck'd:	1/14/2020	PLAN FOR PERMITTING ONLY	BJG
Drawn By: BJG	Plans Ck'd:			
		Date	Revision	By

Job Title: IOWA DOT - HIGHWAY DIVISION
PN: IM-NHS-074-1(197 & 198)5--03-82
I-74 OVER MISSISSIPPI RIVER
BETWEEN BETTENDORF, IA AND MOLINE, IL
SCOTT & ROCK ISLAND COUNTIES

Page Title: ROLL OFF PIERS
JACK-UP RAMPS - W/ MOORING PILES

Design No.: 617 & 717 Sheet: 1 OF 1
Date: 1/14/2020

ATTACHMENT I

MAP OF POOL 15 ARCH DECK YARD LOCATIONS CONSIDERED


Riverdale
Campbells Island
Option 6 - Campbell's Island Marina
Winnebago Island
Option 4 - Boat Restoration Facility
Option 3 - Green Bridge Co. Property
Option 5 - C&W Trucking & Sons Property
Rock Island
Rock Island Arsenal
Option 8 - Riverview LLC Property
Option 7 - Ben Butterworth Pier Parking Lot
Option 2 - Lunda Staging Area
Option 1 - Lunda Yard
Sylvan Island
Moline

ATTACHMENT J

ARCH DECK YARD BACKGROUND & PROPOSED LAUNCHING OPTIONS

LUNDA CONSTRUCTION CO.

Arch Deck Yard Background & Proposed Launching Options

I-74 Mississippi River Bridges & Approaches IM-NHS-074-1 (197 & 198)

12/18/2019

Background

Starting in late 2018 Lunda began to look for options to mitigate the I-74 schedule. One of the options discussed with the Department was preassembling the Arch decks and lifting the deck modules into place.

There are many challenges with preassembling the Arch deck including the sheer size and weight of the deck modules. Lunda's engineers broke the Arch deck into six pieces which weigh between 387,000 to 589,000 lbs. The six deck modules are 100' wide and vary from 81' to 160' long. Lunda is limited to constructing the modules within Pool 15 since the deck modules are too large to fit through the locks. See the attached drawing titled *WB Deck Erection Module C.G.S & Weights* for more information.

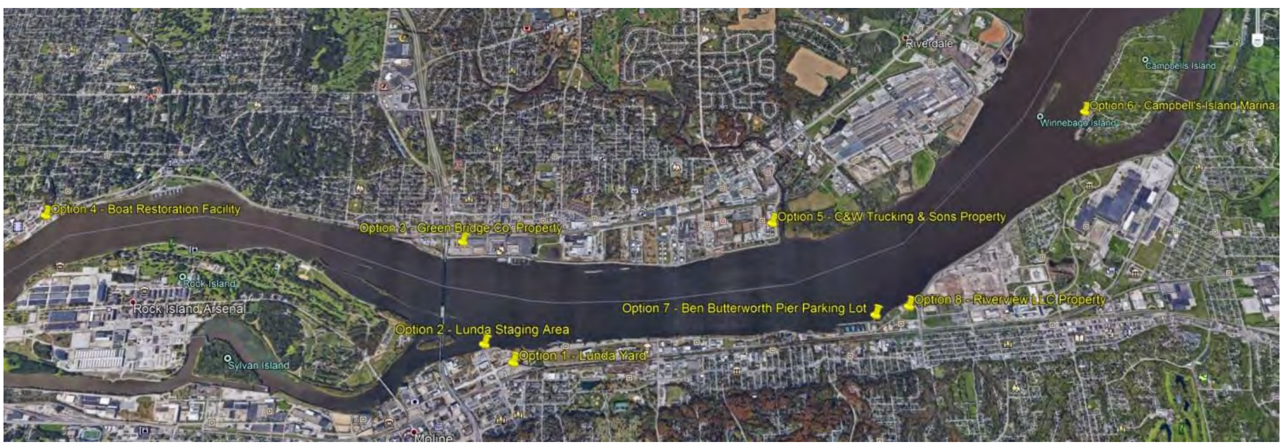
Lunda conducted a thorough review of the Pool 15 area for potential sites. The Arch deck yard site needed to have many characteristics which made finding a suitable location challenging. First, the proposed yard needed to be large enough to construct and store all the deck modules. Second, the area would need to be able to support the heavy weight of the deck modules. Third, the area would need to be clear from utility interferences such as overhead power lines. Fourth, the proposed staging area needed have clear access to the Mississippi River as the modules cannot traverse over elevation changes of more than a few feet. Next, the proposed yard site would need to have good trucking access for the deliveries from Lunda's steel fabricator ISC. The site would then need to be available for a long enough time to support both the WB and EB Arch deck construction. Finally, the launch site near the proposed yard location would need to be deep enough for the barges and tugs. As Lunda found out during our investigation, Pool 15 has many limitations including the levee system, shallow water, low lying areas, public parks, access constraints and existing commercial development.

Arch Deck Yard Considered Locations

Lunda considered several locations throughout Pool 15 for the proposed Arch deck yard. The following table lists the locations considered.

Description	Location
Lunda Yard	Moline, IL
Lunda Staging Area	Moline, IL
Green Bridge Company Property	Bettendorf, IA
Boat Restoration Facility	Davenport, IA
C&W Trucking & Sons Property	Bettendorf, IA
Campbell's Island Marina	Campbell's Island, IL
Ben Butterworth Pier Parking Lot	Moline, IL
Riverview LLC Property	Moline, IL

The following is a map of Pool 15 with the considered locations:



Location Option 1: Lunda Yard on the Riverstone Property Moline, IL

The first location considered was the Lunda's yard located at 2360 Rive Drive in Moline, IL. The following is an aerial picture from Google Maps:

Lunda's yard circled in red is located to the East of 23rd Street between River Drive and the railroad tracks. This option was ruled out because the Arch deck modules were too large to be transported from Lunda's yard across the street through the Riverstone property and out to the Mississippi River.

Location Option 2: Lunda Staging Area Riverstone Property Moline, IL

The second location considered was Lunda's yard on the Riverstone property near the Mississippi River. The following is an aerial picture from Google Maps:

The area circled in red is the space that Lunda has leased from Riverstone and is Lunda's main staging area to the I-74 Bridge. This location was also ruled out. A wide enough path to the dockwall could not be created without interfering with Riverstone's commercial aggregate operations. Riverstone would not relinquish any more room to Lunda. This area is also used for the staging of staff, equipment and materials for the project and is the main lifeline to the bridges. This space could not be taken away to construct the Arch deck modules or it would have interrupted the construction of the rest of the bridge.

Location Option 3: Green Bridge Company Property Bettendorf, IA

The third location considered was in Iowa just to the east of the newly construction I-74 bridge. The following is an aerial picture from Google Maps:

The area circled in red was considered for a possible Arch deck yard location. The space is limited at this location. Another major drawback to this location is transporting the assembled modules over the top of the Bettendorf Levee and out to the water. The top of the levee is approximately 12 feet above the property baseline, nearly 17 feet above normal pool and over 100 feet wide at the base. The Riverfront Trail shown in the picture above is located on top of the levee. Lunda's work would have been in the Levee Buffer Zone and would have required a 408 permit and approval by the City of Bettendorf.

An elaborate jacking scheme would have been required to get the assembled modules from shore to barge; one system to raise the modules from grade to top of levee, and then another to lower them from top of the levee to barge deck. Alternatively, the modules could have been assembled above top of levee elevation, and then transferred to shore towers on the barge deck, eliminating the vertical jacking steps, but requiring all the assembly and transport work to occur at height. Regardless of vertical jacking, this location would have required a temporary bridge spanning the levee and capable of carrying the assembled modules and transporters, or a shorter temporary bridge and significant foundation work within the footprint of the levee. Based on our experience with obtaining the Work in Levee Zone permits for the existing I-74 contract, Lunda had concerns that this system would even be approved by the necessary permitting authorities.

Location Option 4 – Boat Restoration Facility Davenport, IA

The next location considered was in Iowa downstream of the existing I-74 bridge. The following is an aerial picture from Google Maps:

The area circled in red was considered for a potential site. The area was not large enough to support Lunda's operations and would have disrupted the existing commercial business.

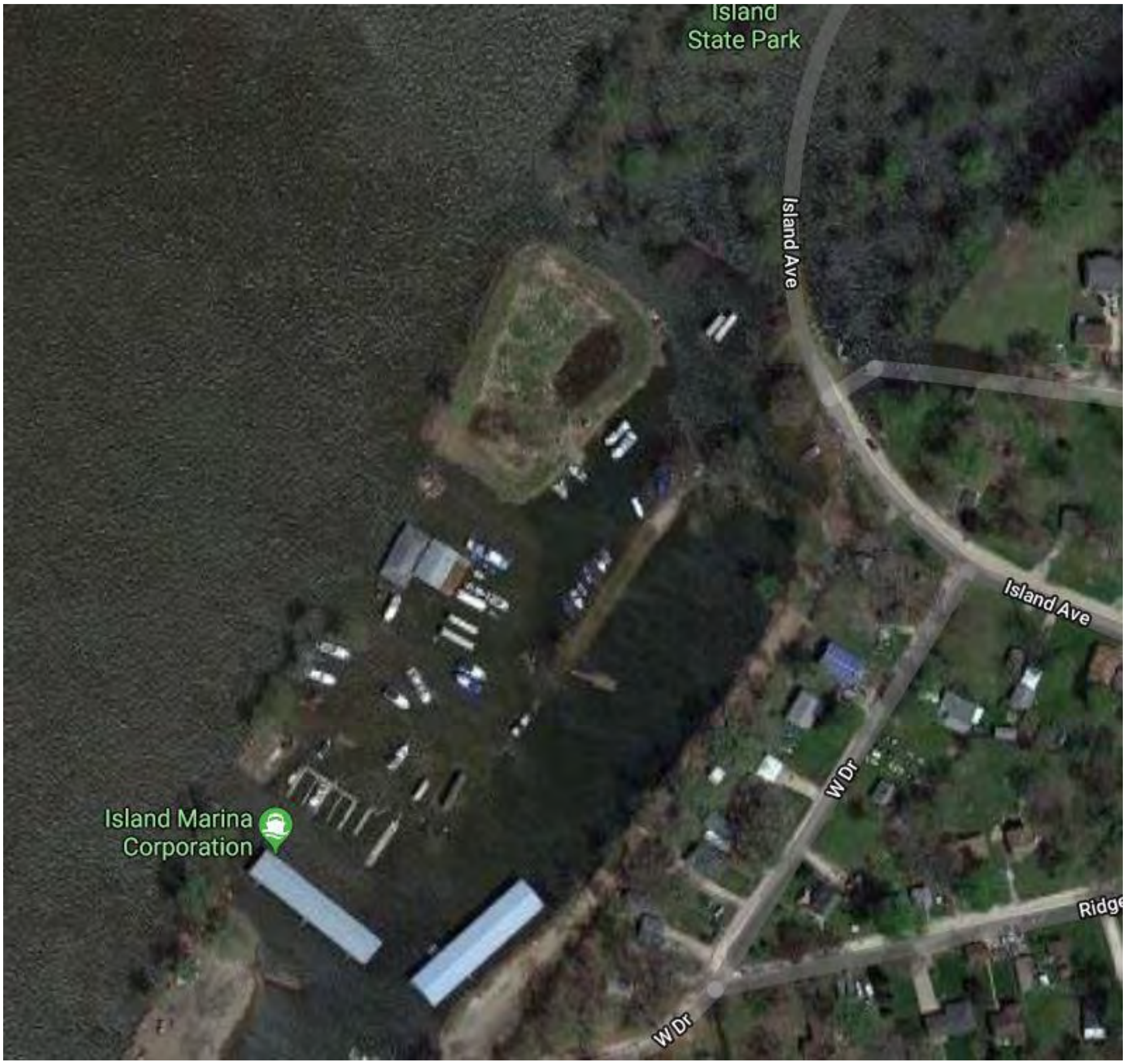
Location Option 5 – C&W Trucking & Sons Property Bettendorf, IA

The next location considered was upstream of the existing I-74 bridge on the Iowa side of the Mississippi river. The following is an aerial picture from Google Maps:

The area in red was the potential location for the Arch deck yard. This location was ruled out because Lunda's operations would have disrupted the existing commercial business, blocked traffic on Elm Street and there were issues with transporting the deck modules over the top of the existing levee as described in Location Option 3.

Location Option 6 – Campbell's Island Marina, IL

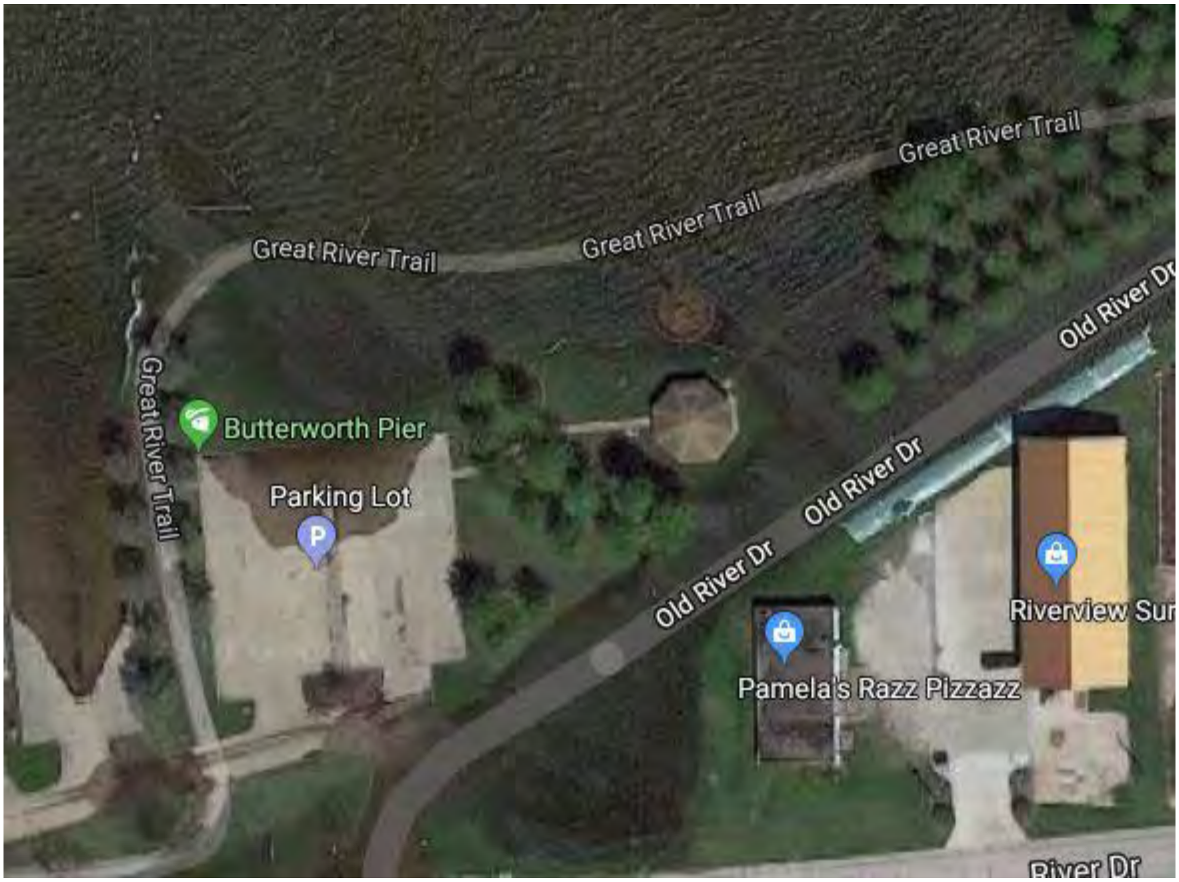
The next location considered was in Illinois upstream of the I-74 Bridge at Campbell's Island near the Island Marina. The following is an aerial picture from Google Maps:



This location was quickly ruled out because there was not enough room to build the deck modules and there were issues with delivering the Arch deck girders from the supplier to this site.

Location Option 7 – Ben Butterworth Pier Parking Lot Moline, IL

The next option considered Ben Butterworth Pier Parking lot. The following is an aerial picture from Google Maps:



There was not enough room at this location to preassemble the Arch deck modules and transport them down to the I-74 Bridge. Lunda also considered transporting the deck modules from what would be the eventual Arch deck yard over to this location. However, there are several issues with this proposed solution. The attached drawing *Roll Off Piers At Ben Butterworth Pier* shows the impacts with this potential route. The road is not wide enough to transport the modules down to Butterworth Pier landing. Lunda would have had to fill in the roadway to create a level surface for the Self Propelled Modular Transporters (SPMTs) to safely take the modules down to the landing. Two existing park buildings would have had be removed and replaced. The bike path would have had to be replaced. Numerous trees and utility poles would have also had to been taken down and replaced.

Location Option 8 – Riverview LLC Property Moline, IL

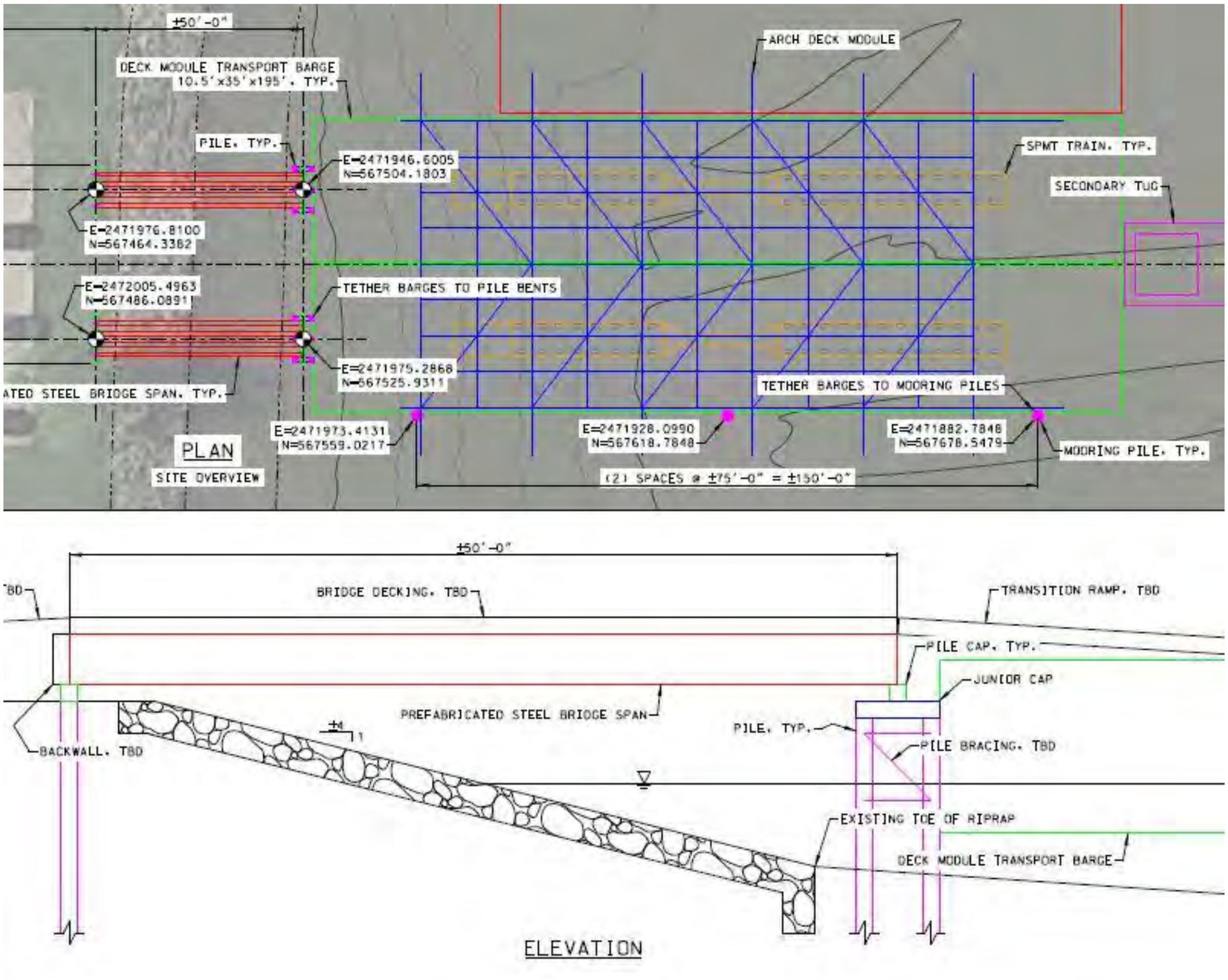
Lunda ultimately chose the location near Ben Butterworth Park owned by the Riverview LLC. The location had an area large enough to build all the Arch deck modules, good access for steel deliveries, no utility interference, straightforward access to the Mississippi River and water deep enough for the barges to transport the modules down to the I-74 Bridge. The following is an aerial picture of the Arch deck yard. Lunda was unaware that the DNR had relocated mussels to the potential launch site until November 2019.

Arch Deck Module Launching Options

The following pages discuss potential options to transport the Arch deck modules from Lunda's yard onto the water.

Launching Option A – Roll Off Pier Pile Bents Outside Toe of Riprap

Lunda has used Self Propelled Modular Transporters (SPMT) on two past projects. One of these projects was a signature arch bridge across the Mississippi River in Hastings, MN. Lunda constructed the arch on land, used SPMTs to transport the arch onto waiting barges and then utilized tug boats to move the arch into position. Lunda has proposed using a similar concept for the I-74 project. Lunda would construct the deck modules in the yard and then use the SPMTs to transport the modules across Old River Drive to the roll off pier and then on to the barges. The following is an aerial picture of the proposed launching location from Google Maps followed by a snapshot of the proposed plan for this option:

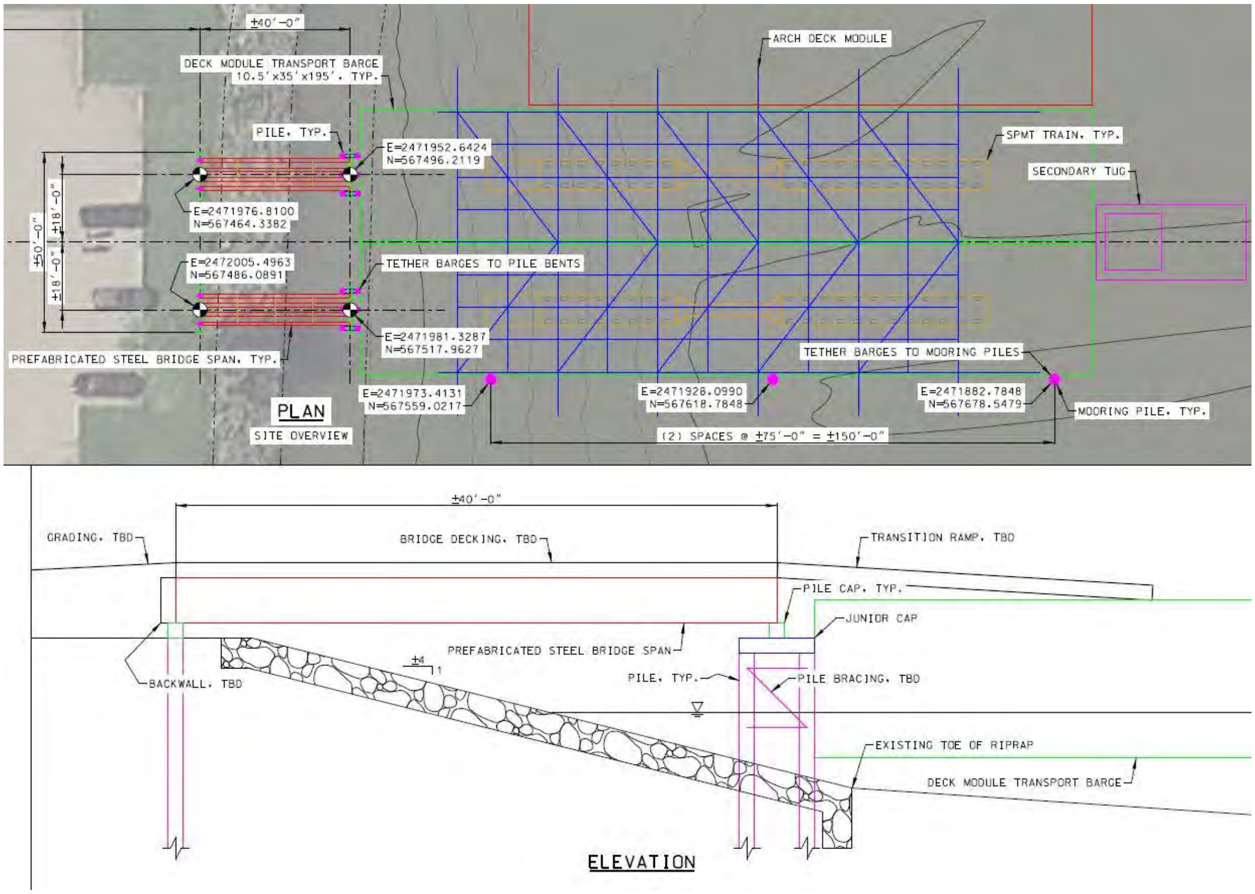


This proposed option would build the roll of piers with pile bents outside the toe of the rip rap. Each pile bent would consist of six H piles. With the two bents a total of twelve piles would be driven in the water. Each H pile is 14 inches wide. Bathometric surveys confirm there is approximately 6' of water depth at the toe of rip rap at normal pool level. The barges will draft three feet and would not touch the bottom of the river even while being loaded. The pile bents can be built from either land or from the water. The pile bents would take approximately two weeks to build.

Three 24-inch diameter mooring piles are also proposed with this option to safely hold the barges in position while the Arch deck modules are loaded onto the barges. Barges would also be necessary for the installation of the mooring pile. The barges would need to spud down to hold position during the mooring pile installation process. Once the mooring piles are complete this would eliminate random spudding moving forward because the barges will always tie up to the mooring pile. The mooring pile can be installed by driving the casings down with a vibratory hammer or drilling the casings into the river bed. This launching option does not requiring dredging. See the drawing titled *Roll Off Piers Pile Bents Outside Toe of Riprap* for more information on this proposed option. The impacted area with this alterative is 16 SF for the twelve piles and 10 SF for the three mooring piles for a total of 26 SF.

Launching Option B – Roll Off Pier Pile Bents Inside Toe of Riprap

Option B is very similar to Option A except the pile bents would be built in the rip rap. A total of twelve piles would also be driven with this option in the water. Lunda would then transport the modules via the SPMTs across Old River Drive to the roll off pier and on to the barges. The following is an aerial picture of the proposed launching location from Google Maps followed by a snapshot of the proposed plan for this option:

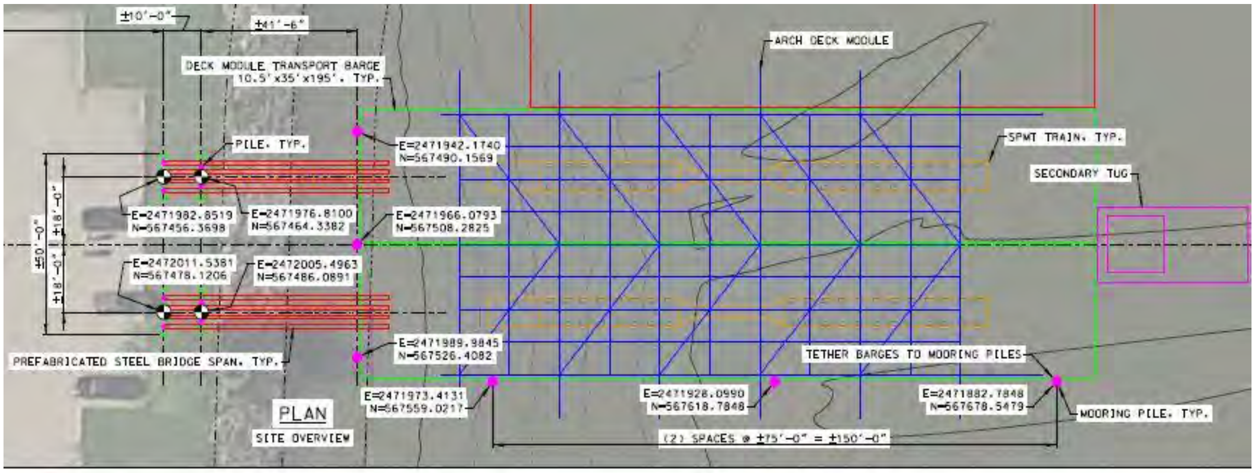


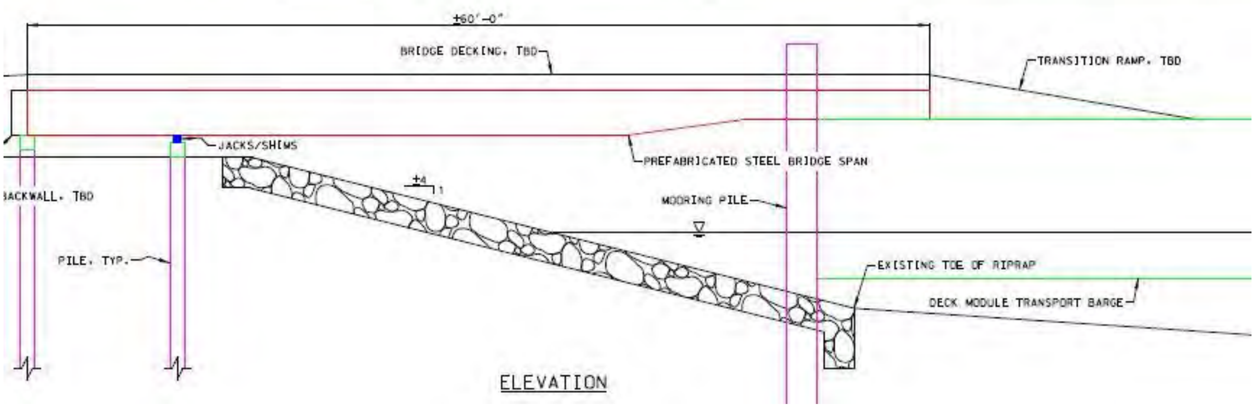
This proposed option would build the roll of piers with pile bents inside the toe of the rip rap which may be less environmentally intrusive. The barges would not touch the bottom of the river even while being loaded. The pile bents can be built from either land or from the water. The rip rap would need to be moved out of the way with an excavator prior to the piles being placed. The pile bent would take approximately two weeks to build.

Just like Launching Option A three 24-inch diameter mooring piles are also proposed to safely hold the barges in position. This option does not requiring dredging and moves the pile bent to inside the rip rap which may be a more environmentally sound alternative. See the drawing titled *Roll Off Piers Pile Bents Inside Toe of Riprap* for more information on this proposed option. The impacted area with this alterative is 16 SF for the twelve piles and 10 SF for the three mooring piles for a total of 26 SF.

Launching Option C – Roll Off Piers Mooring Piles Inside the Toe of Riprap

With this option Lunda would still transport the deck modules via Self Propelled Modular Transporter (SPMT) across Old River Drive to the roll off pier and on to the barges. The following is an aerial picture of the proposed launching location from Google Maps followed by a snapshot of the proposed plan for this option:

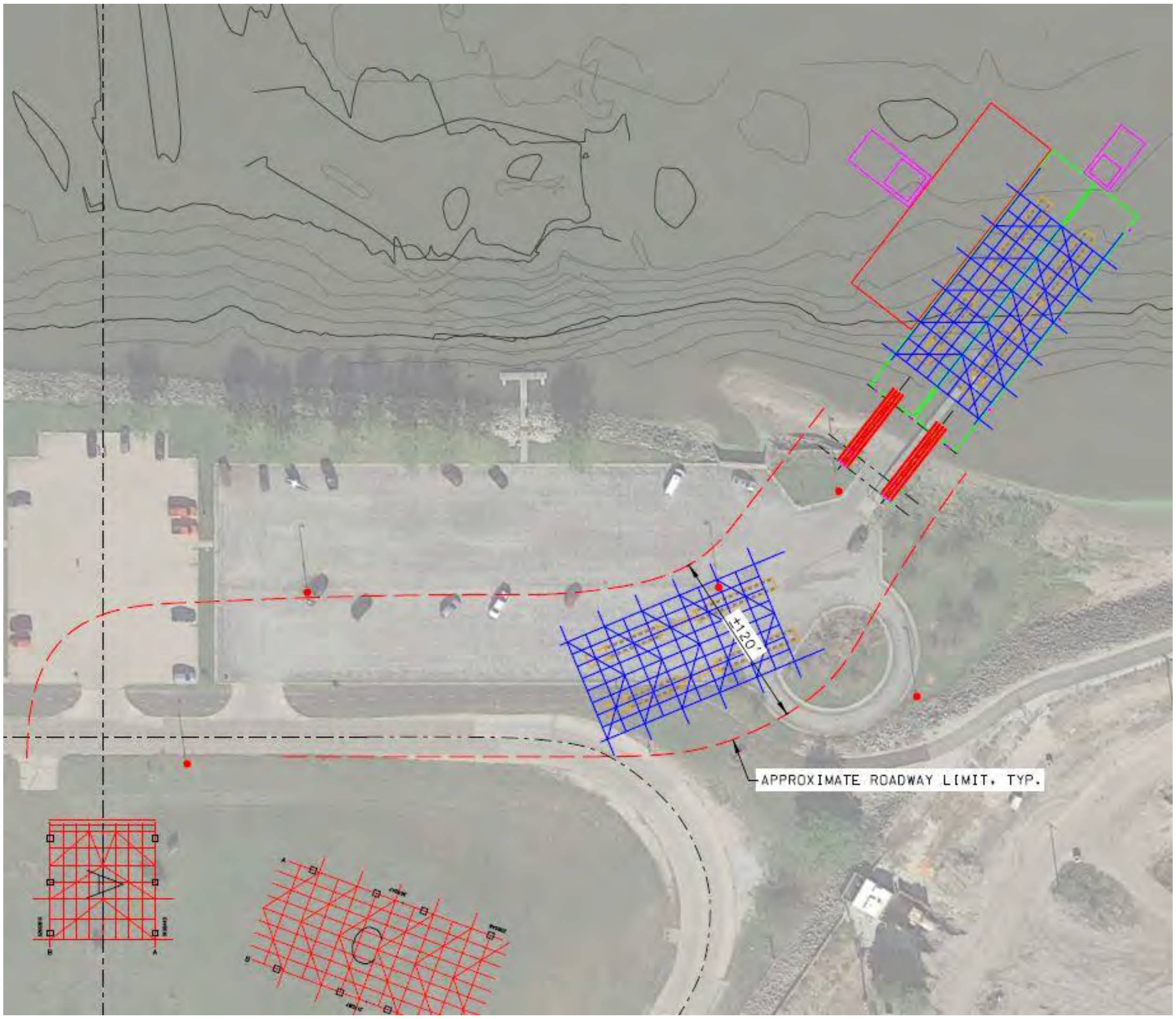




This proposed option would build a cantilevered launching system for the SPMTs to use. A pile array would not be built, but six mooring pile would still need to be installed. Three mooring piling would be installed in the rip rap and the remaining three piles would be the same as the Options A and B. An excavator would need to move the rip rap out of the way prior to installation of the mooring pile. This option does not requiring dredging. See the drawing titled *Roll Off Piers Pile Bents Inside Toe of Riprap* for more information on this proposed option. The impacted area with this alterative is 19 SF for the six mooring piles.

Launching Option D – Boat Ramp with Roll Off Pier

The next option utilizes the current Arch deck yard location but would transport the modules down the existing boat ramp circled in red. The following is an aerial picture from Google Maps followed by a snapshot of the plan for this location:



There are issues with this proposed option. Lunda recently performed a bathometric survey by the existing boat ramp and the area would need to be dredged to provide enough clearance for the barges. Lunda would then need to build a temporary pier at this location utilizing one of the designs detailed in Launching Options A-C. Since the proposed roll off pier is within 200' of the existing levee Lunda expects that a 408 permit would be required. Having to dredge and being close to the levee are obstacles that would need to be overcome with this option. See the drawing titled *Roll Off Piers At Boat Ramp* for more information on this proposed option. The dredging impact with this alternative is approximately 150' wide by 200' long for 30,000 SF.

Launching Option E - Canal

The next option utilizes the current Arch deck yard location but would transport the modules into a newly excavated canal shown in red below. The following is an aerial picture from Google Maps:

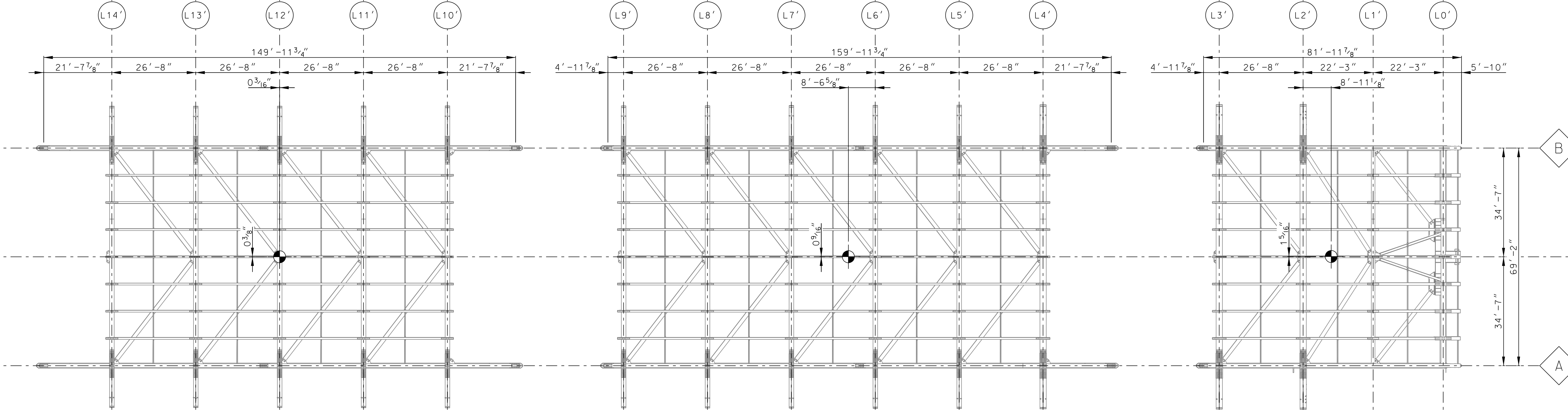
An area that is 100’ long by 205’ wide by 15’ deep would have to be excavated to accommodate the three barges necessary for this option. Two barges support the deck module and the third is a positioning barge. Because of the poor soil conditions, sheeting would not be able to be used. Lunda believes the slopes from the canal would have to be cut back at a 1.5:1. The canal option would require a significant excavation. The parking lots would be destroyed and have to be replaced. The utility impacts are unknown at this time. Lunda would still need to build a roll off pier with this option. No mooring pile in the river would be necessary with this option. Our experience has shown that permitting canals is difficult and time consuming. Lunda is unsure if this option would be approved by the permitting authorities. This option is also very expensive with having to haul out the excavated material, replace the excavated material and then rebuild the two parking lots.

Summary

As previously described Lunda explored multiple locations throughout Pool 15 to find a suitable place to build the Arch deck modules and ultimately selected the site near Ben Butterworth Park. Lunda has also presented several options to transport the Arch deck modules from the yard onto barges. Lunda has tried to minimize environmental impacts by proposing to build pile piers instead of dredging or creating a dockwall using filled material in the Mississippi River. Launching Option A is Lunda's preferred alternative followed by Options B then C. Having the pile pier just outside the rip rap helps maintain barge clearance from the bottom of the river and adds stability to the barges from the Mississippi River crosscurrents while being loaded. While Launching Option A is our preferred alternative, we do understand that Launching Options B and C may potentially reduce potential impacts to the mussel bed by moving some of the support system into the rip rap.

Lunda has explored other methods to help eliminate the mooring pile shown in Launching Options A-C such as tying the barges back to the shore with the cables. However, our experienced boat pilots do not recommend utilizing cables to hold barge position because of safety concerns. It is imperative that the barges maintain their position as hundreds of thousands of pounds of equipment and materials are loaded onto them.

To meet the schedule for the I-74 project Lunda needs to build the pile bents by March 2020. The proposed bents will be in place until summer 2021 since they will be used for both the WB and EB Arch deck construction. The pile bents will then be removed. There will be a gap in between the WB Arch deck placement and EB Arch deck placement of approximately one year where there will be no activity at the pile bents. Lunda does not plan on storing barges at that location during this timeframe.



MODULE C - ERECTED 3RD

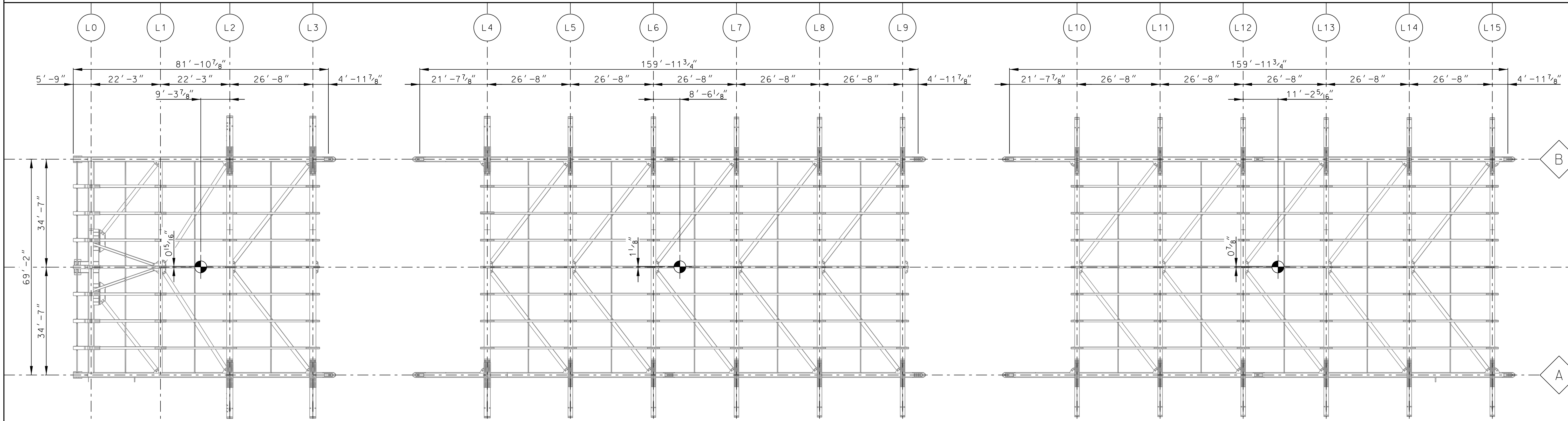
STEEL WEIGHT = 407 KIP
FORMWORK WEIGHT = 74 KIP
TOTAL WEIGHT = 481 KIP

MODULE B - ERECTED 2ND

STEEL WEIGHT = 497 KIP
FORMWORK WEIGHT = 92 KIP
TOTAL WEIGHT = 589 KIP

MODULE A - ERECTED 1ST

STEEL WEIGHT = 337 KIP
FORMWORK WEIGHT = 49 KIP
TOTAL WEIGHT = 387 KIP



MODULE F - ERECTED 5TH

STEEL WEIGHT = 341 KIP
FORMWORK WEIGHT = 49 KIP
TOTAL WEIGHT = 390 KIP

MODULE E - ERECTED 6TH

STEEL WEIGHT = 497 KIP
FORMWORK WEIGHT = 92 KIP
TOTAL WEIGHT = 589 KIP

MODULE D - ERECTED 4TH

STEEL WEIGHT = 476 KIP
FORMWORK WEIGHT = 92 KIP
TOTAL WEIGHT = 569 KIP

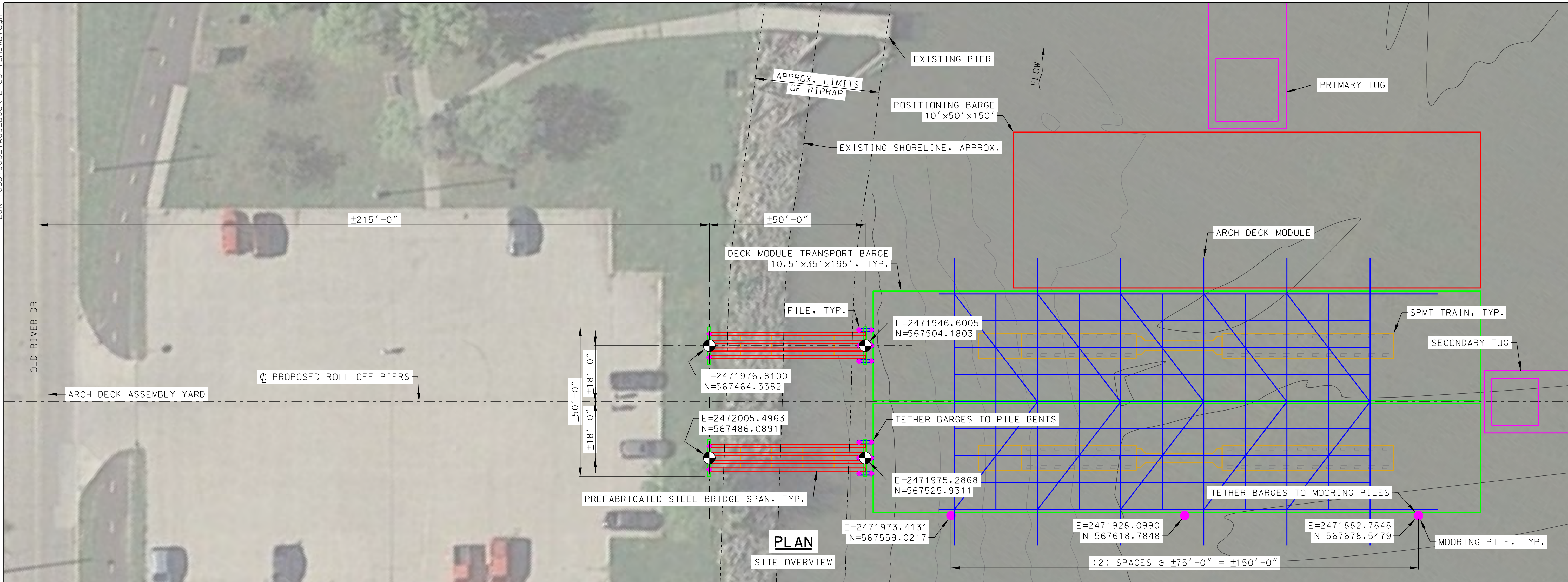
LUNDA CONSTRUCTION CO.

Lunda Job: 10657900	#	Date	Revision	By
Designed By: BJG / Design Ck'd:	0	11/25/2019	RELEASED FOR REFERENCE	BJG
Drawn By: BJG / Plans Ck'd:			310	

Job Title:
IOWA DOT - HIGHWAY DIVISION
PN: IM-NHS-074-1(197 & 198)5--03-82
I-74 OVER MISSISSIPPI RIVER
BETWEEN BETTENDORF, IA AND MOLINE, IL
SCOTT & ROCK ISLAND COUNTIES

Page Title:
WB DECK ERECTION
MODULE C.G.S & WEIGHTS

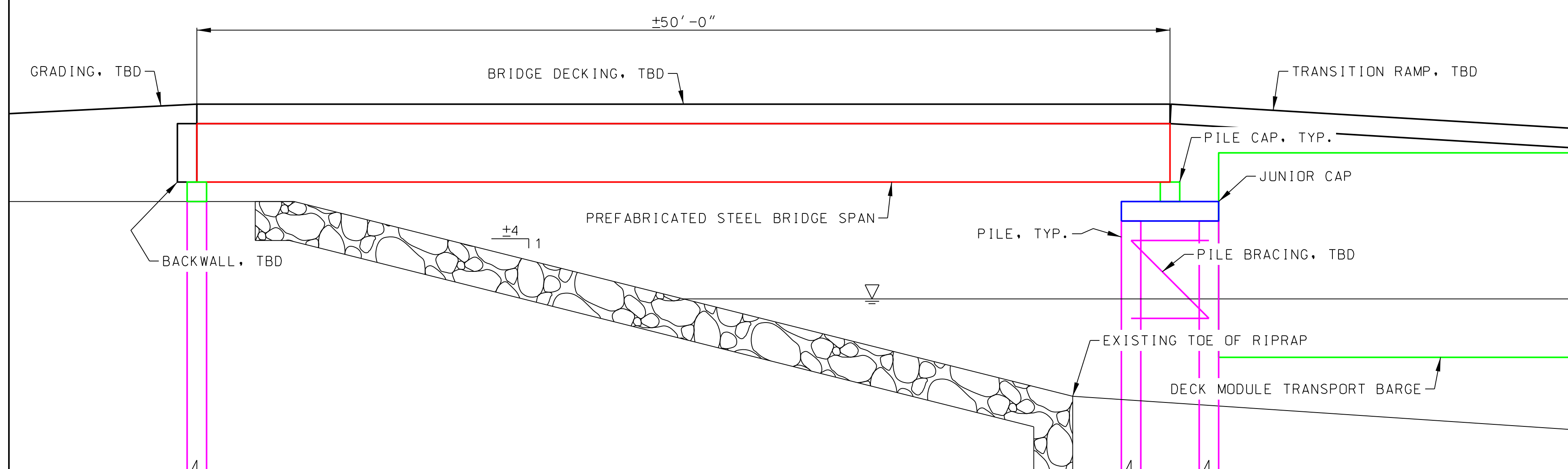
Design No.: 617 | Sheet: 1 OF 1
Date: 12/6/2019



PLAN
SITE OVERVIEW

NOTES:

1) DO NOT SCALE DRAWINGS.
2) GENERAL CONFIGURATION SHOWN IS APPROXIMATE.
3) REQUIRES APPROXIMATELY (12) STEEL HP OR PIPE PILE TO BE DRIVEN OUTSIDE TOE OF RIPRAP.
4) REQUIRES APPROXIMATELY (8) STEEL HP OR PIPE PILE TO DRIVEN OUTSIDE TOP OF RIPRAP.
5) REQUIRES APPROXIMATELY (3) STEEL PIPE PILE TO BE PRE-BORED OUT TO APPROXIMATELY 200' FROM EXISTING SHORELINE.
6) REQUIRES LITTLE TO NO DISPLACEMENT OF EXISTING RIPRAP.



ELEVATION

LUNDA CONSTRUCTION CO.

Lunda Job: 10657900	△	12/5/2019	PRELIMINARY PLAN - NOT FOR CONSTRUCTION	BJG
Designed By: BJG / Design Ck'd:				
Drawn By: BJG / Plans Ck'd:			311	
	#	Date	Revision	By

Job Title:
IOWA DOT - HIGHWAY DIVISION
PN: IM-NHS-074-1(197 & 198)5--03-82
I-74 OVER MISSISSIPPI RIVER
BETWEEN BETTENDORF, IA AND MOLINE, IL
SCOTT & ROCK ISLAND COUNTIES

Page Title:
ROLL OFF PIERS
PILE BENTS OUTSIDE TOE OF RIPRAP

Design No.: 617 & 717 | Sheet: 1 OF 1
Date: 12/5/2019

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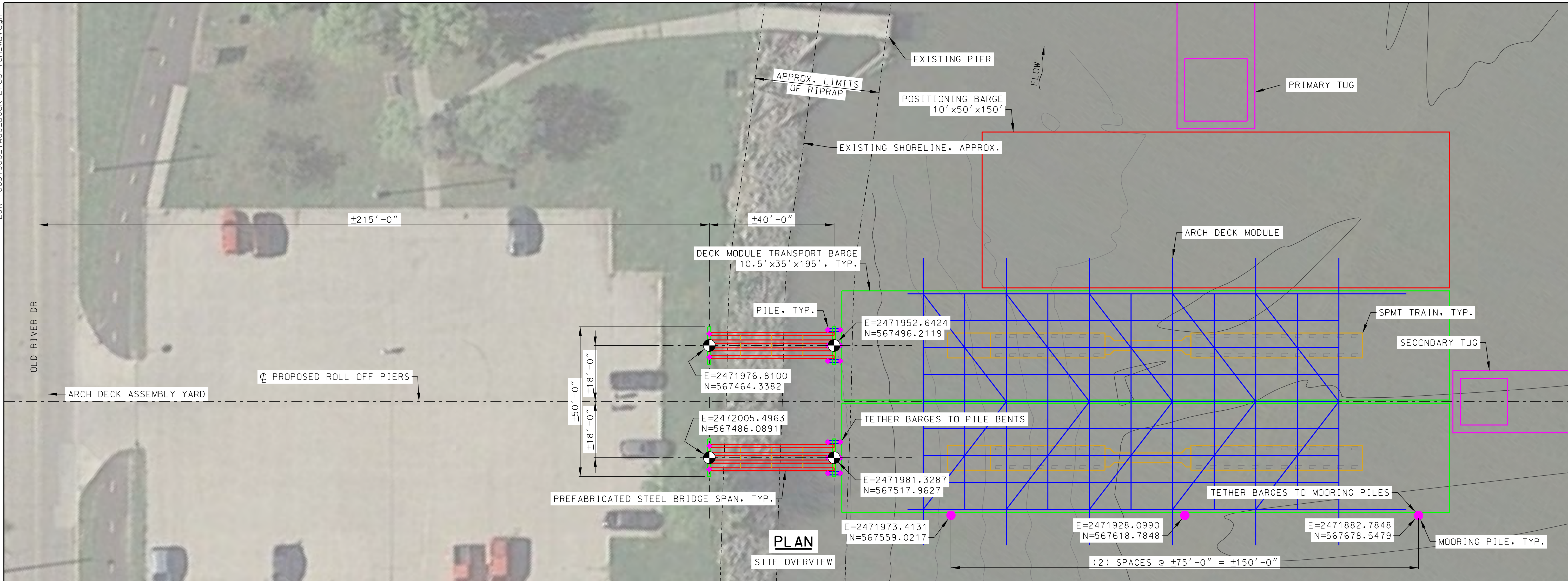
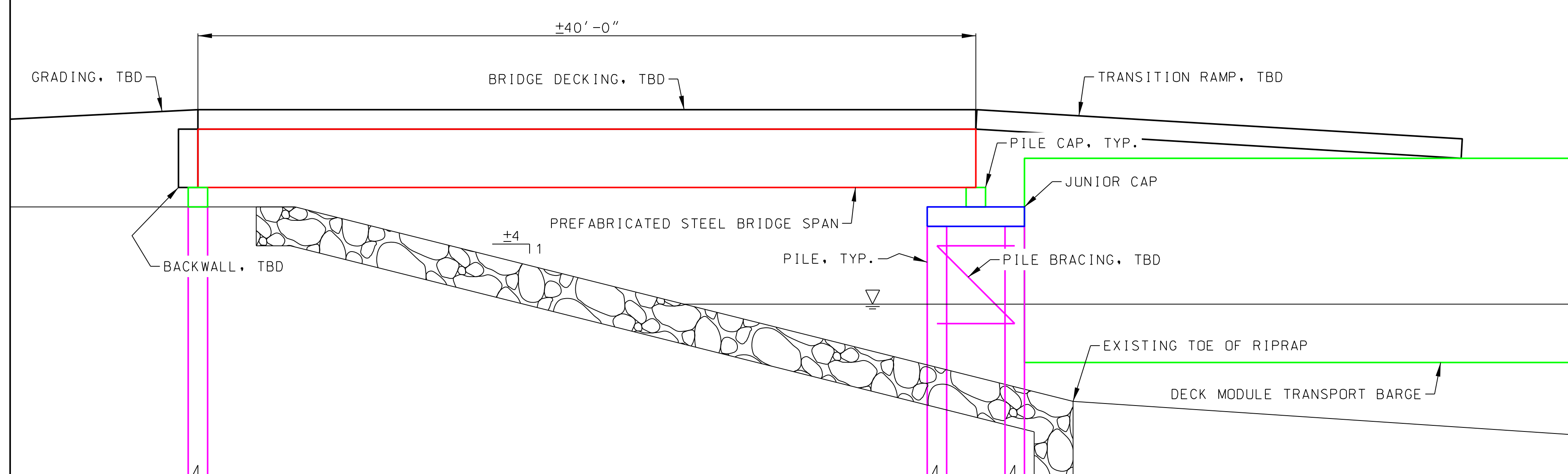


NOTES:

1) DO NOT SCALE DRAWINGS.
2) GENERAL CONFIGURATION SHOWN IS APPROXIMATE.
3) REQUIRES APPROXIMATELY (12) STEEL HP OR PIPE PILE TO BE DRIVEN INSIDE TOE OF RIPRAP.
4) REQUIRES APPROXIMATELY (8) STEEL HP OR PIPE PILE TO DRIVEN OUTSIDE TOP OF RIPRAP.
5) REQUIRES APPROXIMATELY (3) STEEL PIPE PILE TO BE PRE-BORED OUT TO APPROXIMATELY 200' FROM EXISTING SHORELINE.
6) REQUIRES SOME MINOR DISPLACEMENT OF EXISTING RIPRAP TO FACILITATE PILE DRIVING.



ELEVATION

LUNDA CONSTRUCTION CO.

Lunda Job: 10657900	B	12/5/2019	PRELIMINARY PLAN - NOT FOR CONSTRUCTION	BJG
Designed By: BJG	Design Ck'd:			
Drawn By: BJG	Plans Ck'd:		312	
	#	Date	Revision	By

Job Title: IOWA DOT - HIGHWAY DIVISION
PN: IM-NHS-074-1(197 & 198)5--03-82
I-74 OVER MISSISSIPPI RIVER
BETWEEN BETTENDORF, IA AND MOLINE, IL
SCOTT & ROCK ISLAND COUNTIES

Page Title: ROLL OFF PIERS
PILE BENTS INSIDE TOE OF RIPRAP

Design No.: 617 & 717 Sheet: 1 OF 1
Date: 12/5/2019

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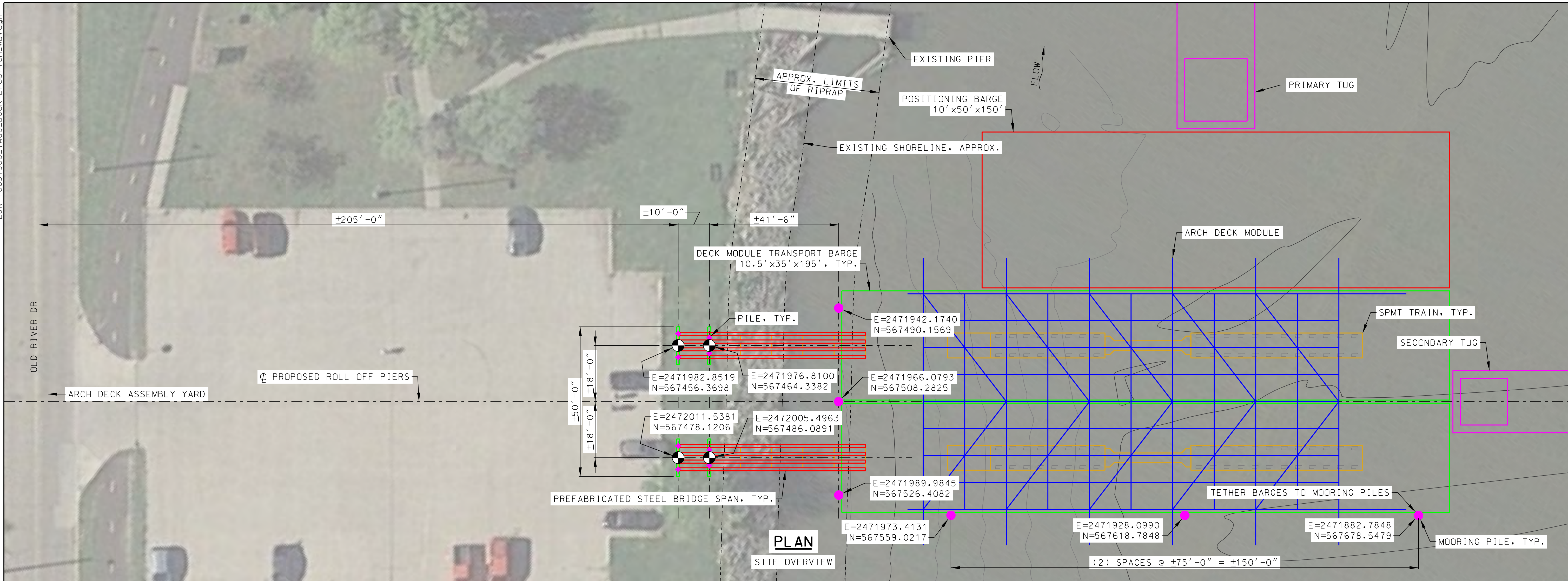
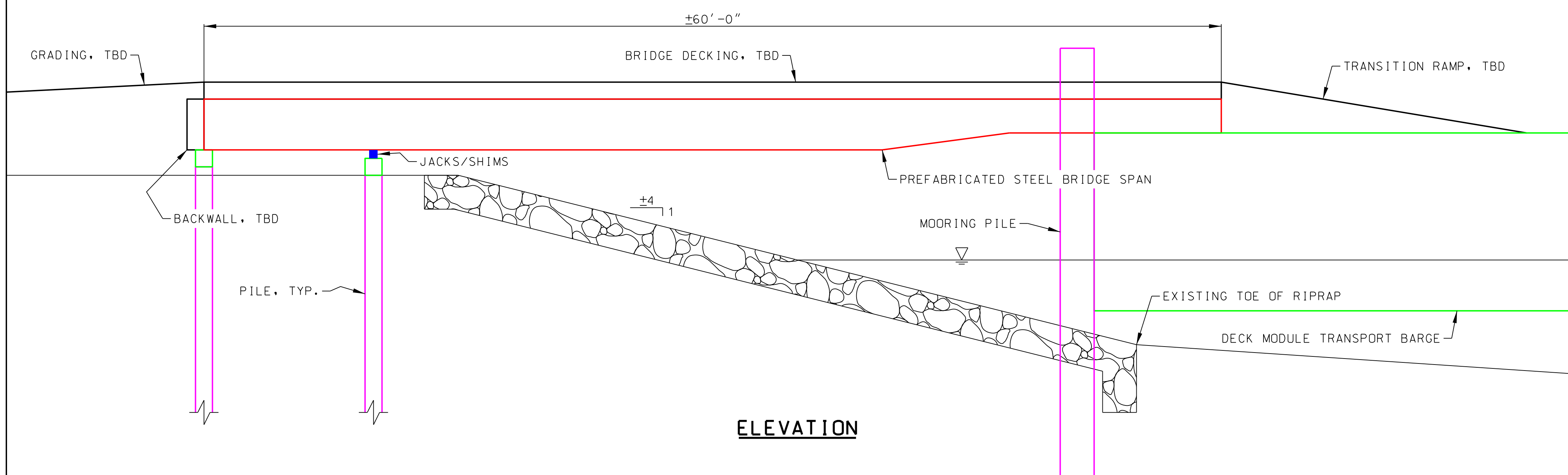


NOTES:

1) DO NOT SCALE DRAWINGS.
2) GENERAL CONFIGURATION SHOWN IS APPROXIMATE.
3) REQUIRES APPROXIMATELY (12) STEEL HP OR PIPE PILE TO DRIVEN OUTSIDE TOP OF RIPRAP.
4) REQUIRES APPROXIMATELY (3) STEEL PIPE PILE TO BE PRE-BORED NEAR TOE OF RIPRAP.
5) REQUIRES APPROXIMATELY (3) STEEL PIPE PILE TO BE PRE-BORED OUT TO APPROXIMATELY 200' FROM EXISTING SHORELINE.
6) REQUIRES SOME MINOR DISPLACEMENT OF EXISTING RIPRAP TO FACILITATE PRE-BORING AND PILE INSTALLATION.
7) MAY REQUIRE SOME DISPLACEMENT OF EXISTING EMBANKMENT TO ACCOMMODATE ELEVATIONS AND SECTION DEPTHS.



LUNDA CONSTRUCTION CO.

Lunda Job: 10657900	△	12/5/2019	PRELIMINARY PLAN - NOT FOR CONSTRUCTION	BJG
Designed By: BJG / Design Ck'd:				
Drawn By: BJG / Plans Ck'd:			313	
	#	Date	Revision	By

Job Title: IOWA DOT - HIGHWAY DIVISION
PN: IM-NHS-074-1(197 & 198)5--03-82
I-74 OVER MISSISSIPPI RIVER
BETWEEN BETTENDORF, IA AND MOLINE, IL
SCOTT & ROCK ISLAND COUNTIES

Page Title: ROLL OFF PIERS
MOORING PILES INSIDE TOE OF RIPRAP

Design No.: 617 & 717 | Sheet: 1 OF 1
Date: 12/5/2019

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