

I. Introduction

The Corps of Engineers, St. Paul District, proposes to construct two channel training structures in Lower Pool 2 of the Upper Mississippi River to improve navigability and safety, and to reduce channel maintenance requirements.

Freshwater mussel surveys conducted in the proposed project footprint were used to estimate that project construction would kill approximately $85,000 \pm 25,750$ individual mussels, including individuals representing four species of conservation concern in the State of Minnesota. Freshwater mussels fill important ecological roles including nutrient cycling, substrate stabilization, and as a food source for fish and mammals. In accordance with Corps' planning guidance and CMMP guidance, the Corps has incorporated mitigation measures that would ensure that the project does not have more than a negligible adverse effect on this ecological resource. Project effects were first minimized by selecting narrow rock mounds for the channel training structures to reduce the project footprint. Unavoidable impacts of the selected TSP would be offset by relocating the mussels currently within the footprint of the proposed structures prior to project construction. This would involve divers collecting as many mussels from the footprints as possible, and moving the mussels to a location or locations that would augment nearby existing populations.

II. Objectives

Objectives are identified below, with major associated tasks identified for each objective. Tasks and methodologies are detailed further in Chapter III.

(1) Collect and remove unionids within the impacted footprint.

- a. Finalize structure footprint locations and delineate for relocation. (USACE)
- b. Divers to search and remove all unionids encountered. Following established methodology, it is anticipated that the relocation would result in >90% of all mussels being successfully removed. (Contract)
- c. The USFWS will be consulted with for any federally listed species collected and a plan for T&E relocation will be finalized prior to relocation efforts. (USACE)

(2) Verify nearby stable, suitable areas for relocation.

- a. Use previous mussel surveys, bathymetry, aerial imagery, etc. to delineate at least 10 acres of potentially suitable habitat in Lower Pool 2. (USACE)
- b. Verify site suitability by diver reconnaissance exploration prior to placement. (Contract)

(3) Augment existing unionid populations in Lower Pool 2.

- a. Mark relocated mussels via rotary tool or other identifiable marker and document release location (Contract)

- b. Mussels may be relocated by scattering from the surface by relocation crew. Federally listed species if encountered will be uniquely marked and hand placed in the substrate at relocation sites. (Contract)
- c. Conduct two surveys to assess the relocation: (1) survey a subset of relocation sites immediately after the relocation, and (2) survey all relocation sites one-year following relocation to assess survival. (USACE)

III. Relocation Description

Collection

Relocation would be scheduled to occur as close prior to construction as feasible, no more than one year prior to proposed construction. Relocation activities would only take place when the water temperature exceeds 40°F and air temperature exceeds 32°F but is below 95°F.

Relocation efforts will follow established guidelines provided by Dunn, et al. (1997, attached). Divers will thoroughly search each of the impact areas, removing all unionids encountered. . Divers will place two parallel collecting lines (i.e., weighted rope) along the edge of the footprint spaced approximately 1m apart and will crawl along the line and collect unionids within an arms-reach within the lines (approximately 1m), disturbing all substrate and debris and placing unionids in a mesh collecting bag. Divers will traverse the line a second time to ensure double coverage and that the majority of unionids have been collected. One line will then be moved another one-meter and parallel to one line, and the process alternated (lines leap frogging each other) and repeated until the entire area is thoroughly searched twice. (Due to the large area and varying orientation of the proposed structure to the river flow, alternate strategies such as grids may be proposed to better ensure that the entire area is searched with double coverage.)

All collected unionids will be placed into mesh bags and retrieved by the surface dive tenders. Bags will be labeled with the area, time searched, date, and diver. A relocation team (malacologist and technician) will retrieve bags of unionids from the dive team. Unionids will be sorted into species and zebra mussels removed. All common species will be counted, recorded, and marked with a slash hitting the edge of the periostracum on the anterior, ventral side. Threatened and endangered species (T&E species) will each be marked with a unique number using a dremel tool to etch the periostracum. These individuals will also be measured and aged.

Unionids will be transported between the collection and relocation areas by boat in a flow through live well containing river water. Animals will only be exposed to air briefly (<5min) during processing.

If Federally-listed species are found during relocation efforts, the Corps and USFWS should be immediately notified. The Corps would conduct the necessary Endangered Species Act

Coordination with the U.S. Fish and Wildlife Service prior to and during relocation efforts with a plan agreed upon as to the treatment of T&E species.

Relocation Site Selection

Potential relocation sites will be delineated by Corps biologists. Ideally, the areas will have stable substrate, be free of threats such as future development, and have species-rich and reproducing unionid communities. Corps biologists will use recent and historic surveys conducted near the project area to identify likely existing mussel beds. Areas that have been surveyed multiple times and have demonstrated a stable mussel community will be given the highest priority.

The proposed site locations will be provided to the contractor. The contractor will perform spot dives at each of the sites to verify suitability prior to placement of new mussels. Factors considered should include substrate composition, substrate consolidation, flow, and presence of unionids, preferably represented by both older specimens and recent recruits. Areas should have sufficient current velocity to prevent deposition of fine material, but low enough to allow substrate stability (Vaughn 1997). Areas should be avoided that may require future channel maintenance activities or impose regulatory constraints to industry or governmental agencies.

Relocation

After divers have verified the suitability of the relocation area(s), the areas will be marked at the surface in 100m intervals to assist the relocation crew with unionid distribution. Animals will be spread from the boat as it is driven slowly through the area, with the goal of scattering them evenly throughout the site(s). An area (or areas) may be designated for rare species, so as to aggregate them within the most suitable habitat available, and to assist in monitoring their survival.

Relocated mussels would be spread over an area such that the density in the relocation areas would be increased by approximately 10 mussels/m². Density in high-quality mussel beds in the Upper Mississippi River has been recorded as exceeding 100 mussels/m² (e.g. Prairie du Chien, WI) as recently as the mid-1980s. Existing mussel densities within Lower Pool 2 range from 0 to approximately 10/m².

If federally listed species are relocated, a specific area delineated by divers within the general relocation prior to relocation will be identified for hand placement of T&E individuals. Federally listed individuals will be uniquely marked, measured for length, aged, sex and gravidity determined, and hand placed in the substrate by divers in either a grid marked by blocks, PVC, or a similar fashion. The General Relocation Area will be marked at 100m intervals and the T&E relocation grid marked to assist the relocation crew with unionid distribution and future monitoring.

Federally T&E species will be hand placed in their natural position in the grid cells, with two unionids placed per cell. A diver will dig a small hole, and bury approximately 2/3 of the unionid.

A malacologist/diver will place all unionids, such that they are properly positioned. Once all four cells of each grid are filled, the PVC frames will be flipped downstream to create a new row of cells. Habitat will be inspected to insure its suitability for unionids. If habitat is unsuitable, a new grid will be established within the T&E area. For each grid row, cells will be marked with pins and a reference cell sampled as above.

During and after all collected unionids are relocated, the position of lines and weights delineating the areas will be recorded with GPS and the lines and weights will be removed. Similarly, the position of T&E grids will be recorded with GPS.

Monitoring – Relocation Sites

The Corps will conduct monitoring with qualified malacologists of relocation areas immediately post relocation (at a subset of relocation sites), and one year following relocation. The first monitoring effort will focus on ensuring that mussels generally survived relocation and were able to burrow into the substrate at the relocation sites. The second monitoring effort will focus on verifying survival through the first year. Results would be incorporated into the overall relocation report. Details for each event follow:

In Year 0 (the same calendar year the relocation is completed), 2 of the approximately 10 relocation sites will be inspected to assess the acclimation to the site. Divers would perform a visual inspection to the extent possible to qualitatively assess whether it appears that the majority of relocated mussels have burrowed into the substrate. 100 relocated (marked) mussels will be collected from the substrate, taken to the water surface, and assessed for mortality.

In Year 1 (the calendar year directly following the relocation), each relocation site would be inspected to assess mortality. At each relocation site, a diver would perform a qualitative search until 100 relocated (marked) mussels have been collected. All mussels collected would be identified and determined to be living or dead. The relocation would be determined to be successful if the overall average mortality of all relocation sites is below 15 percent. If relocation failure is revealed by the Year 1 relocation site survey, the Corps will investigate potential measures for remedying the failure and loss of ecological function, in coordination with the Minnesota Department of Natural Resources.

Monitoring – Potential Project Indirect Impacts

The Corps will conduct monitoring with qualified malacologists of pre-project, and five years post-project in an area where some indirect project impacts could occur, but are not expected to occur (See Exhibit 4). Each monitoring effort would consist of (1) A minimum of 40 0.25 m² quadrat samples randomly placed within the area identified on Exhibit 2 to estimate density, and (2) One five minute spot dive at each of 10 (or more) of the 0.25 m² quadrat sample sites will be sampled, plus an additional ten (or more) 5-minute spot dives in areas that are high-probability areas for

unionids, as determined by the malacologist in the field. A report describing the results would be prepared and shared with interested parties.

References

- Dunn, H. L., B. E. Sietman, and D. E. Kelner. 2000. Evaluation of recent unionid (*Bivalvia*) relocations and suggestions for future relocations and reintroductions, p. 169–183. In: R. A. Tankersley, D. I. Warmolts, G. T. Watters, B. J. Armitage, D. Johnson and R. S. Butler (eds.). *Freshwater Mollusk Symposia Proceedings*. Ohio Biological Survey, Columbus.
- Dunn, H.L., and B.E. Seitman. 1997. Guidelines used in four geographically diverse unionid relocations. Pp. 176-183 in: K.S. Cummings, A.C. Buchanan, C.A. Mayer, and T.J. Naimo, eds. *Conservation and management of freshwater mussels II: initiatives for the future*. Proceedings of a UMRCC symposium, October 1995, St. Louis, Missouri. Upper Mississippi River Conservation Committee, Rock Island, Illinois.

Exhibit 1:

List of Minnesota State Endangered, Threatened and Special Concern Unionid Species

Species in **Red are also Federally-Endangered.*

Endangered

<i>Arcidens confragosus</i>	rock pocketbook
<i>Cumberlandia monodonta</i>	spectaclecase
<i>Cyclonaias tuberculata</i>	purple wartyback
<i>Elliptio crassidens</i>	elephant-ear
<i>Epioblasma triquetra</i>	snuffbox
<i>Fusconaia ebena</i>	ebonyshell
<i>Lampsilis higginsii</i>	Higgins eye
<i>Lampsilis teres</i>	yellow sandshell
<i>Megaloniais nervosa</i>	washboard
<i>Plethobasus cyphus</i>	sheepnose
<i>Quadrula fragosa</i>	winged mapleleaf
<i>Simpsonaias ambigua</i>	salamander mussel
<i>Tritogonia verrucosa</i>	pistolgrip

Threatened

<i>Actinonaias ligamentina</i>	mucket
<i>Alasmidonta marginata</i>	elktoe
<i>Ellipsaria lineolata</i>	butterfly
<i>Elliptio dilatata</i>	spike
<i>Lasmigona costata</i>	fluted-shell
<i>Ligumia subrostrata</i>	pondmussel
<i>Quadrula metanevra</i>	monkeyface
<i>Quadrula nodulata</i>	wartyback
<i>Truncilla donaciformis</i>	fawnsfoot
<i>Venustaconcha ellipsiformis</i>	ellipse

Special Concern

<i>Anodonta suborbiculata</i>	flat floater
<i>Elliptio complanata</i>	eastern elliptio
<i>Lasmigona compressa</i>	creek heelsplitter
<i>Ligumia recta</i>	black sandshell
<i>Pleurobema sintoxia</i>	round pigtoe

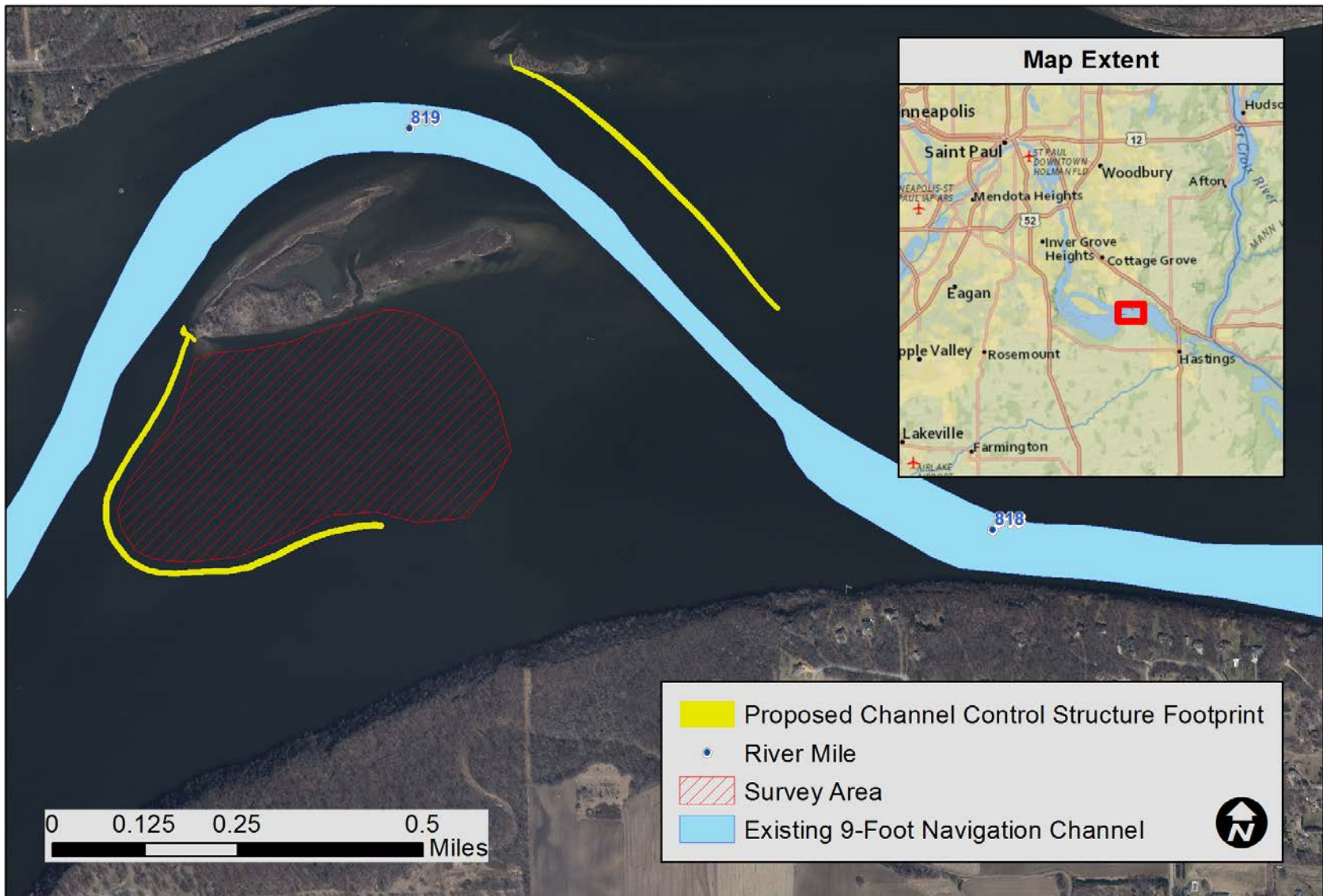


Exhibit 2. Project location, showing proposed channel training structure footprints.

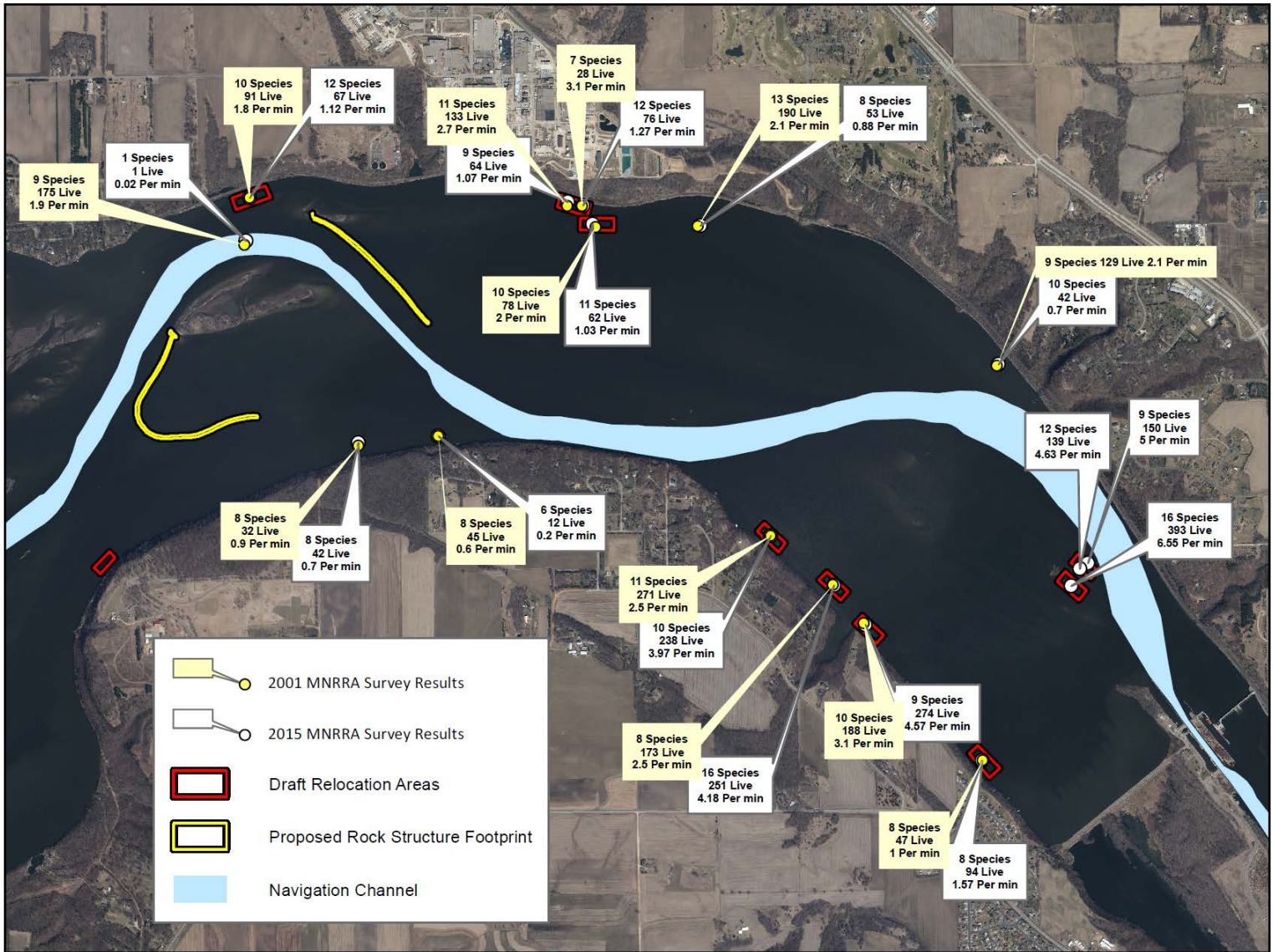


Exhibit 3. Corps-identified potential unionid relocation areas

Exhibit 4. Project Mussel Surveys, Effects, and Relocation Areas, shown with existing bathymetry