UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY ENVIRONMENTAL IMPACT STATEMENT

SITE-SPECIFIC HABITAT ASSESSMENT

I. DESCRIPTION OF PROJECT

A. Overall Study Description. The Upper Mississippi River - Illinois Waterway System Navigation Study ("Navigation Study") is a feasibility study addressing the need for navigation improvements for the Upper Mississippi River - Illinois Waterway (UMR-IWW) System for the years 2000-2050. The study encompasses 29 locks on the Upper Mississippi and 8 locks on the Illinois Waterway (Figure 1). Specifically, the principal problem being addressed is the potential for significant traffic delays on the system over the 50-year planning horizon, resulting in economic losses to the nation. The study will determine whether navigation improvement measures are justified and, if so, the nature of and appropriate sequencing of these measures over the 50-year planning horizon.

The environmental impacts of the measures under consideration are being addressed on a system-wide basis (traffic impacts on specified resources of concern) and a site-specific basis (localized impacts within the immediate vicinity of a lock and dam). This report covers the latter. Overall objectives of the environmental component and pertinent Corps of Engineers guidance and Federal regulations may be found in the Navigation Study Project Study Plan (June 1997).

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B. Site-Specific Analyses. The objective of the analyses is to conduct initial assessments of impacts at each of the locks and dams (L/Ds) being evaluated for potential construction of navigation improvements. These are Mississippi L/Ds 11-25 and Illinois Waterway L/Ds at Lockport, Brandon Road, Dresden Island, Marseilles, Starved Rock, Peoria and La Grange. The primary purpose is to assist the study team in formulating a recommended plan by providing quantitative measure or qualitative evaluation of environmental impacts and estimated habitat replacement costs. Detailed analysis of site-specific impacts, based on any recommended/authorized measures, will not be possible until detailed design information for those measures is available.

Based on information from other study work groups and planning efforts during both the reconnaissance and feasibility phases of the Navigation Study, it was determined that seven lock and dam sites (on the lower portion of the system) have the greatest potential to be recommended for navigation improvements. These sites (L/Ds 20-25 on the Mississippi and Peoria and La Grange on the Illinois) were assessed in greater detail, using quantitative habitat assessment methods. The remaining sites were assessed in a qualitative manner, utilizing in part results obtained at the lower sites. While the upper site assessments are included here, the bulk of this report deals with the detailed quantitative assessments.

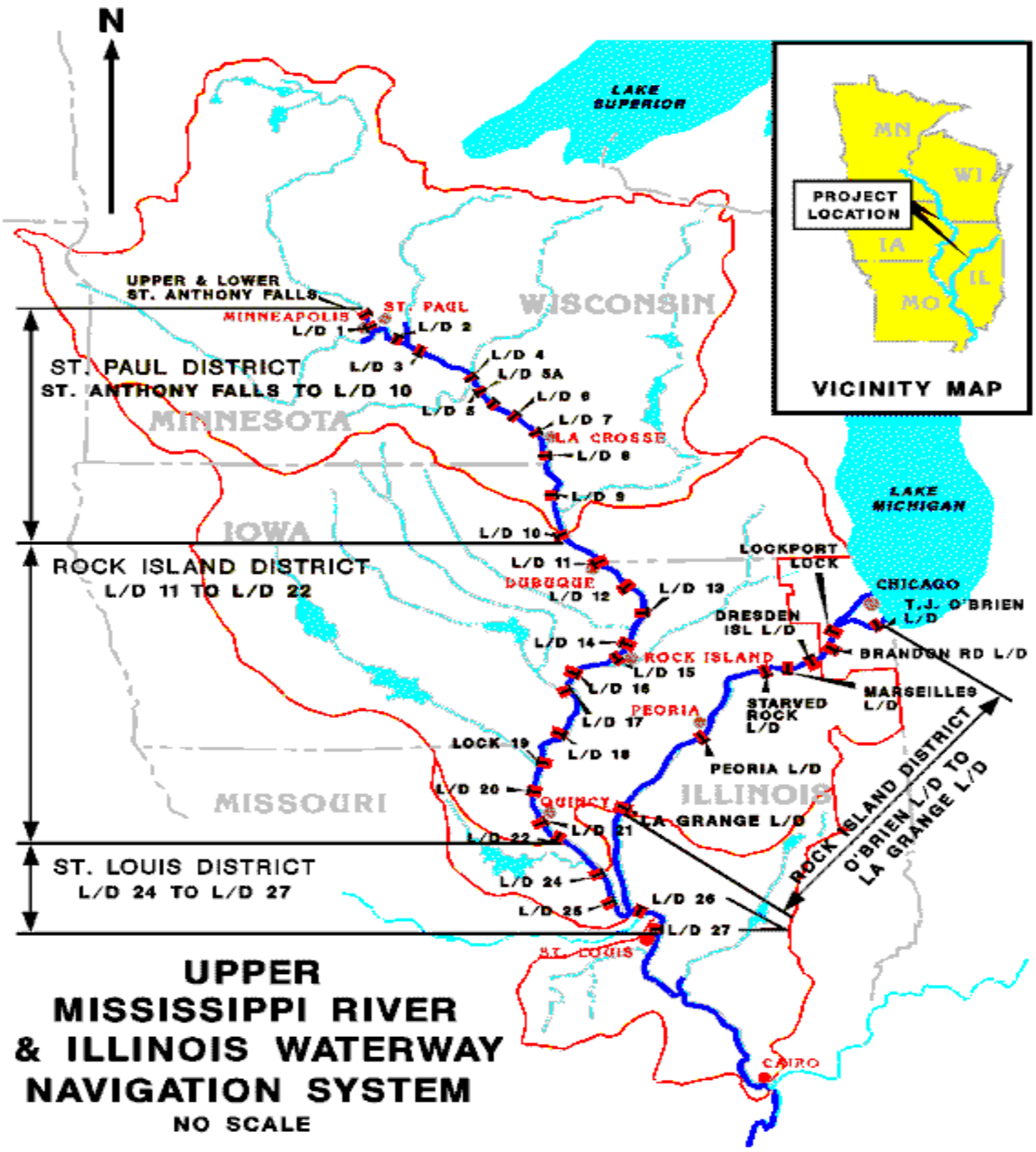

Figure 1. Study Area.

C. Study Area Description. The broad geographic area of the study encompasses the states of Minnesota, Wisconsin, Illinois, Iowa and Missouri. The lower sites studied in most detail border Illinois and Missouri. At each lock and dam, an area within a one-mile radius of the center-point of the dam was delineated as the analysis area for the site-specific studies. Site maps were prepared that incorporated Geographic Information Systems (GIS) coverages of land cover/land use, aerial photography, National Wetlands Inventory (NWI) data, and overlain locations of proposed engineering measures (see

Appendix A). Sections III and IV of this report more thoroughly describe the individual sites. The following paragraphs explain the potential changes common to all sites and how they are depicted on the maps.

1. Areas Affected by Lock Changes. The composite extent of these areas is bounded by a solid red line. A selected alternative would consist of some portion of this area. Generally, lock changes would entail downstream extensions of existing lock chambers and extension/construction of guidewalls both upstream and downstream. Total upstream length (from the centerline of the dam) is typically 1,500 feet, and downstream length is 2,900 feet. Total width of a given lock location would be 250 feet. Locations 2 and 3 utilize the existing and auxiliary chambers, respectively, while Location 4 is through the gated section of the dam, with the red line indicating its farthest riverward extent for this location (see Figure 2 for lock locations). Location 4 would require replacement of lost flow, and this would most likely be in the form of additional gates near or adjacent to the storage yard area at the end of the gated section (except at L/D 20; see Sections I.D. and IV.B. for further explanation; L/Ds 24 and 25 could have a replacement gate placed in the existing auxiliary lock). For the few sites where a Location 1 is still being evaluated, this would entail constructing an entirely new 1,200-foot chamber.

2. Areas Affected by Construction/Landside Impacts. These areas are delineated by a green line and/or cross-hatching. Included here would be construction staging areas and any shoreline excavation that would be required for lock construction or channel realignment. Extent of these areas is based on a projected need of 8 to12 acres for staging. A concrete batch plant, if necessary, would require an additional 1 to 2 acres.

3. Areas Affected by Channel Changes. Channel realignments are shown in dark blue. Line segments indicate the boundaries of a given channel, while cross-hatched areas represent new channel excavation. The extent and alignment of these new channels was determined by considering documented problems with tow approaches and how these approaches could be made more efficient. Some alignments may serve more than one location, while others are specifically tied to a given location. Where necessary, this is indicated by numbers that correspond to a given lock location.

4. Dredged Material Placement Sites. Possible placement sites are indicated by magenta cross-hatching. Size of these areas was determined by assuming that material would be stacked to a height of 12 feet, which equates to 19,400 cubic yards/acre. Location was guided by several factors. These include the reach limits of dredging equipment (~1 mile) and the assumption that agricultural fields would be the preferred placement sites. Truck hauling is assumed for distant sites. Size of these sites can be determined with relative certainty based on estimated quantities of material. Geographic location is much less certain, and the currently mapped locations should be considered as "best guesses" for current planning purposes. Final location of these sites depends on a variety of factors that would be formally evaluated during the detailed site-specific assessment phase.

D. Description of Engineering Measures to Reduce Traffic Congestion.

1. Large-Scale Measures. These measures entail extending the existing lock or constructing a second lock elsewhere at the existing lock and dam site. The primary benefit of large-scale measures is to provide a lock chamber long enough (1,200 feet in length) to eliminate the necessity of double lockages, thus creating significant time savings. The Navigation Study team evaluated an array of alternative lock placement sites, different design types, and lock sizes. A lengthy qualitative and quantitative screening process reduced this matrix considerably, and the survivors underwent further detailed analysis and screening. For purposes of the site-specific assessments, only lock location was evaluated in terms of potential impacts. Variation in lock size or construction type was not considered to have any appreciable environmental consequences (only 600-foot x 110-foot and 1,200-foot x 110-foot locks were carried forward for detailed analysis). Three construction types were considered, as described below (see also Table 1). Type A was eliminated due to cost.

TABLE 1: Locations and Types Surviving After Lock Type Screening

Lock and Dam Site	Location Number and Viable Types					
	1	2[1]	3	4	5	6
L/D 11		B, C	B, C			
L/D 12		B, C	B, C	B, C		
L/D 13		B, C	B, C	B, C		
L/D 14		B, C		B, C		
L/D 15		B, C	B, C			
L/D 16		B, C	B, C	B, C		
L/D 17	C	B, C	B, C	B, C		
L/D 18		B, C	B, C	B, C		
L/D 19			B, C			
L/D 20		B, C	B, C	B, C		
L/D 21		B, C	B, C	B, C		
L/D 22		B, C	B, C	B, C		
L/D 24		B, C	B, C	B, C		
L/D 25	C	B, C	B, C	B, C		
Peoria	C	B, C				
La Grange	C	B, C				

[1] There are no new 600-foot lock alternatives at Location 2. Therefore, the Location 2 column is blank for the 600-foot lock case (the 1,200-foot lock case is shown). All other columns are the same for both lock sizes.

a. Type A. A "Type A" conceptual lock design is a lock designed according to current design standards and traditional construction methods for locks. It would be

constructed within a dewatered cofferdam, as were all the existing locks and dams on the Mississippi River and Illinois Waterway. This lock type would typically have concrete gravity or U-frame walls, a side port filling and emptying system, and a downstream miter gate and either an upstream miter gate or a lift gate. A Type A lock would be expected to have the highest performance levels and durability, but also the highest first cost. Construction risks would be low for this type of lock.

b. Type B. A "Type B" conceptual lock design is a lower cost lock utilizing construction techniques proven in marine construction that heretofore have not commonly been used in lock construction. Use of these construction techniques, float-in and lift-in, would be innovative in the lock construction arena. A Type B lock would present slight reductions in performance but similar durability compared to a Type A lock. A Type B lock would present the highest risks to construct of the three types.

c. Type C. A "Type C" conceptual lock design is the lowest first cost design, cellular sheet pile construction with precast concrete lockwall panels, that still is safe with predictable performance. This lock type would be expected to be less durable and less reliable than Type A and B locks. To accomplish the cost savings, certain design standards were relaxed with resulting tradeoffs in performance (sill depths, filling and emptying, etc.). A Type C lock would typically present low to moderate risks to construct.

Six lock locations were initially considered: Location 1, landside of the existing lock; Location 2, extension of the existing lock; Location 3, in the auxiliary lock chamber; Location 4, in the gated section of the dam; Location 5, in the overflow section of the dam; and Location 6, landside on the opposite shoreline (Figure 2).

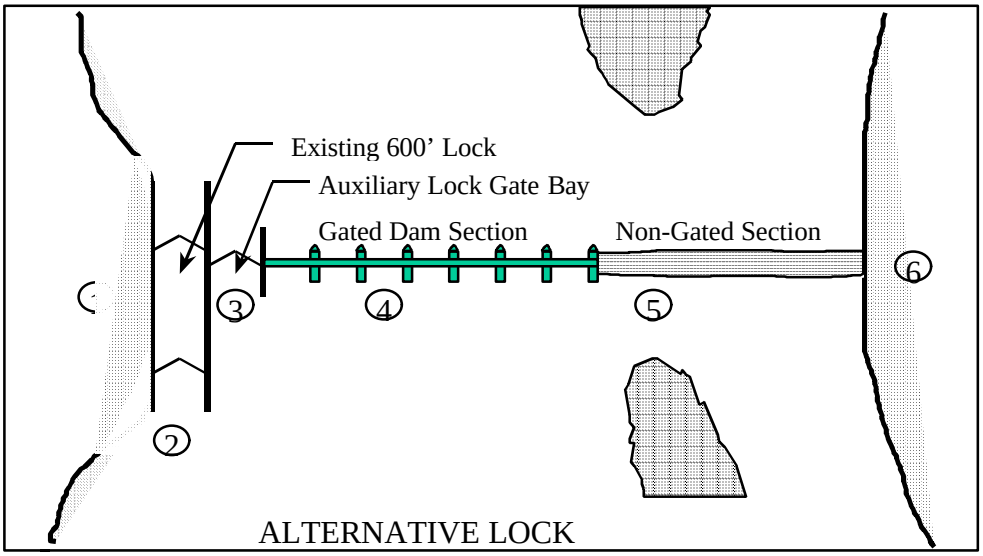

Figure 2. Alternative New Lock Locations at a Typical Existing Lock and Dam Site.

The initial screening process quickly eliminated all Locations 5 and 6 due to unfeasibility of engineering, construction or operation, as well as serious environmental impacts. Nearly all of the Location 1 locks were also screened out for similar reasons; exceptions are at Locks 17, 25, Peoria and La Grange. The majority of potential locations for new lock construction are at Locations 2, 3, and 4 (Table 1). The particular siting of these possible lock locations, at each lock and dam, was depicted on the planning maps used in the site-specific habitat evaluations. In addition to potential new lock construction, an option carried forward for Locks 17 and 20 was that of providing for navigable pass through the dam. This would allow tows to bypass the lock and traverse the dam via wicket gates during certain periods of high flow. These gates would require new construction and placement, with attendant channel changes, and were evaluated as a separate large-scale measure.

2. Small-Scale Measures. These measures are broadly defined as any navigation improvement that is less costly than constructing a new lock. They are divided into structural (requiring some amount of construction) and non-structural (essentially operational or policy changes). The small-scale measures are aimed at reducing the total time to complete the lockage process, particularly those elements that require the most time, such as approach/exit and breaking, remaking and reconfiguring tows. It is possible that a recommended set of measures could include a combination of large- and small-scale measures.

After initial identification of a "universe" of possible small-scale measures, a similar evaluation and screening process was conducted to narrow the list of possible measures. From an initial list of 92 measures, qualitative and quantitative screening resulted in 8 measures being carried forward for detailed consideration. Two of these measures, adjacent mooring facilities and approach improvements, are structural in nature and have the greatest potential for environmental impacts. In addition, the use of switchboats and industry self help are likely to require guidewall extensions or remote moorings, which may have some environmental impacts. None of the small-scale measures were evaluated using HEP, although the approach channel improvements and guidewall extensions would be nearly identical in nature if implemented as small-scale measures and thus the HEP results could be applicable. The remaining measures were evaluated qualitatively based on proposed location (e.g., mooring cells or other remote remake sites) or other potential impact, where applicable. Further descriptions of the large- and small-scale engineering measures and screening processes are found in the Navigation Study Engineering Appendix (Engineering Work Group, Draft 1998) and are summarized below.

a. <u>Switchboats with Extended Guidewalls</u>. Switchboats in the 1,800 to 2,000 hp range were determined to be able to safely extract the unpowered first cut of double lockages out along an extended guidewall. This process represents the major additional time savings, since it provides a faster extraction than the existing tow haulage and allows the next waiting tow (traveling in the same direction) to use the lock while the first tow remakes its couplings. Switchboats can also assist tows in approaching the locks in adverse conditions and by moving ice and debris from around the chamber. Moving the cuts farther down along the extended guidewall can also reduce chambering times for

downbound tows by allowing faster releases of water from the chamber due to the reduced potential to snap a line. To fully implement this measure, the guidewalls must be extended roughly 600 feet (providing 1,200 feet total) using either cellular sheet pile construction or spud barges.

b. Switchboats with Remote Mooring Facilities. Somewhat larger switchboats, in the 2,200 to 2,400 hp range, were determined to be necessary to safely extract the unpowered first cut and push it to a remote mooring under all flow conditions. Adequate mooring sites out of the approach path are required to fully implement the measure. In addition, due to safety concerns, switchboats would not be used to back cuts upriver, above the dam. Instead, a short guidewall extension, roughly 300 feet long, would be provided allowing the switchboat to extract the cut, tie it off, uncouple from the cut, move to the downstream end, recouple, and then push upstream to the remote mooring. This allows both exchanges and turnbacks lockage types to use the chamber while the previous tow is remaking. Switchboats can also assist tows in approaching the locks in adverse conditions and by moving ice and debris from around the chamber. Using switchboats in combination with remote remake areas can also reduce downbound chambering times by allowing faster releases of water from the chamber.

c. Industry Self Help. Already put in place on occasion, this measure relies on navigation industry tows to help one another extract unpowered cuts without the assistance of lock personnel or equipment when there is significant congestion at a lock. When used, a towboat would not just wait in line for its turn to lock; instead, it would act similar to a switchboat, removing an unpowered cut from the lock and taking it away from the guidewall for recoupling along a waiting tow traveling in the opposite direction. This procedure leaves the lock open for the next waiting tow. It also eliminates the need to use tow haulage equipment and provides for faster extraction. The addition of guidewall extensions and/or mooring cells would make this a safer and more efficient option.

d. Congestion Tolls. Tolls could be collected to alter the distribution of towboat traffic on the system, reducing delays at the locks. This measure could be implemented only if a current Federal law is changed that prohibits charging of tolls for watercraft passing through locks. If implemented, tolls would be collected from tows, and possibly from recreational craft, using congested locks. It assumes that a fee could be charged at locks experiencing significant delay or that a licensing fee would be charged for use of the system. The goal would be to shift potential traffic away from congested locks to alternative modes of transportation or other portions of the inland waterway system.

e. Lockage Time Charges. This measure seeks to charge all vessels based on the length of time the lock is in use. While similar to congestion tolls, these charges would be set at a lower level in an effort to create an incentive to improve efficiency rather than reduce the use of a congested lock. However, tows would not be charged for lockage elements that they can not control, such as gate opening, closing, and chamber filling and emptying time.

f. Adjacent Mooring Facilities. New mooring facilities above or below the lock could consist of mooring cells or buoys attached to a mooring line. These structures, which provide waiting areas where tows can be tied off, can improve efficiency in two ways. They can provide a waiting area closer to the lock where a tow can safely wait clear of a narrow approach, allowing a tow exiting in the opposite direction to pass. By waiting closer, the exchange approach and exit times can be reduced. In addition, when used with a switchboat or an industry self-help process (as described earlier), properly placed, adequate moorings provide a place where tows can remake, making the lock available sooner for the next tow waiting in either direction.

g. Power Ratchet on Tows. This device uses a 4-horsepower gas engine to power a hydraulic drive system, which operates a specially designed wrench head to engage the barge (steamboat) ratchets. The device would be stationed on a center barge at the break couplings. It would improve efficiency and cut down on a double lockage time by increasing the speed of the recoupling process. It may also improve safety and generally requires less physical labor than the current way the barges are reconnected after a double lockage.

h. Channel Improvements. This measure includes a variety of possible modifications including dike fields, submerged dikes, vane dikes, dredging, bank filling, bank excavation and channel relocation, all designed to control channel currents and improve the path of a tow as it enters a lock. Such improvements have been found to significantly reduce approach times and make conditions safer, depending upon the location, combination of improvements, and river conditions at the time.