Final Report:
Unionid Survey for the A-Mill Artist Lofts Hydroelectric Project, Mississippi River, Hennepin County, Minnesota

Prepared for:

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1.0 Introduction

Minneapolis Leased Housing Associates IV, Limited Partnership is working to obtain licensing for the A-Mill Artist Lofts Hydroelectric Project, located on the left descending bank (LDB) of the Mississippi River at the Upper St. Anthony Falls dam (river mile 853.8). The project will involve rehabilitating existing hydroelectric facilities at this location, including an intake along the LDB and a tailrace that will discharge into a back channel below the Upper St. Anthony Falls dam (Figure 1-1).

Unionids (freshwater mussels) are known to occur in the Upper and Lower St. Anthony Falls Pools of the Mississippi River. A total of 18 species have been reported from the Upper St. Anthony Falls Pool, including the Minnesota threatened species *Truncilla donaciformis* and species of special concern *Pleurobema sintoxia* and *Ligumia recta* (Table 1-1). Sixteen species have been reported from the Lower St. Anthony Falls Pool, but 4 of these species have not been collected in the past 30 years. Kelner and Davis (2002) conducted surveys at 2 locations near the proposed hydroelectric project: in the side channel upstream of the hydroelectric intake site at river mile 854.1, and along the LDB in the Lower St. Anthony Falls Pool at river mile 853.5. Species richness at both sites was relatively low. Nine species were collected live from the upstream site, and 2 additional species were collected as dead shells. Only 4 species were collected live from the downstream site, though an additional 5 species were collected as dead shells. No Minnesota listed species were collected live at either site (see Table 1-1).

Operation of the hydroelectric facility has the potential to alter local hydraulics both upstream and downstream of the facility, which may result in changes to habitat characteristics such as current velocity or patterns of sediment scour and deposition. Such characteristics are important in defining habitat for unionids, and any changes in these characteristics have the potential to affect unionid distribution and abundance. Therefore, a Level I mussel survey was conducted to determine whether unionids occur in the areas that could potentially be impacted by operation of the hydroelectric facility.

2.0 Methods

Methods for the Level I mussel survey were developed following the Minnesota Freshwater Mussel Survey and Relocation Protocol (MN survey protocol; MNDNR & USFWS, 2013). The upstream survey area extended from the intake up to the Route 65/3rd Avenue bridge and covered an area of approximately 19,200 m^2 (Figure 2-1). The MN survey protocol calls for at least 20 minutes of qualitative search time per 2000 m^2 of impact area. Thus, the upstream survey area was divided into 10 cells, each roughly 2000 m^2 in area (see Figure 2-1). The downstream survey area extended from the discharge 250 m downstream to the Stone Arch Bridge. This area was initially divided into 7 cells, but an additional cell (RC) was added in the field to ensure that the entire potential impact area would be adequately searched (see Figure 2-1). Due to the narrow channel width, Cells 1 through 5 were all <1000 m^2 in area. The final area of the downstream site was approximately 8800 m^2. Each cell in both the upstream and downstream areas was searched qualitatively for 20 minutes, with 2 exceptions: Cells 9 and 10 in the upstream survey area were not searched due to their proximity to an existing hydroelectric intake, and Cell 1 in the downstream area was only searched for 10 min due to its small area and shallow depth. Qualitative searches entailed a diver/snorkeler searching the substrate visually and tactually, collecting all unionids and shells encountered. The 20-min search period was divided into 5-min intervals to enable better coverage of the area. The starting point of each search was recorded with a Trimble GeoXH GPS unit (Appendix A). Depth and substrate composition were also recorded at the start of each search.

All unionids encountered in qualitative searches were identified to species and counted. At least one individual of each species collected was photographed (Appendix B). Dead shells were identified and categorized as either fresh (FD; nacre shiny, hinge line flexible, periostracum in similar condition as live unionids, likely died within the past few months), weathered (WD; nacre chalky, hinge line brittle, valves may or may not be attached, likely died months to years ago), or subfossil (SF; single valves, generally no or discolored periostracum, shells very chalky, likely dead decades to centuries). At least one shell of each species encountered (if available) was retained as a voucher. All unionids were relocated to an area of suitable habitat along the LDB at the Hennepin Avenue bridge (approx. 500 m upstream of the upstream survey area).

Fieldwork for the Level I survey was conducted on August 19-20, 2014. Results of the Level I survey were discussed with the Minnesota Department of Natural Resources (MNDNR) to determine if a Level II survey was necessary. Based on the results of the Level I survey, MNDNR determined that a Level II survey was not necessary at this site.

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3.0 Results and Discussion

3.1 Upstream Survey Area

Mississippi River flow ranged from 7520 cubic feet per second (cfs) to 7900 cfs during sampling. A hydroelectric facility (unrelated to this project) currently operates on Hennepin Island; the intake for this facility is located at the downstream riverward corner of the survey area. Except for a channel leading to this intake, the downstream edge of the survey area was restricted by a mooring cell/sheetpile barrier. Current velocity was slow near the bank and increased with distance riverward and toward the intake. Depth was relatively shallow throughout the area, ranging from 0.6 m near the bank to 2.1 m riverward (Figure 3-1). Substrate was primarily sand and silt. Silt was more common in the shoreward half of the area, while the riverward half was almost exclusively sand. Small amounts of cobble and gravel were also present in the upstream shoreward corner (see Figure 3-1).

A total of 16 live unionids of 7 species were collected in the upstream survey area (Table 3-1). *Fusconaia flava* (31.3%) and *Pyganodon grandis* (25.0%) were the two most common species collected. Three additional species were collected as dead shell material only (see Table 3-1). Unionids were present in 6 of the 8 sampling cells, but were most abundant in the shoreward 2 cells (Figure 3-2). Catch per unit effort (CPUE) was very low, averaging 0.1 mussels/minute (6.0 mussels/hour) over the whole survey area. The low abundance of unionids, particularly in the riverward half of the area, is likely due to a lack of suitable habitat. Substrate was a mixture of sand and silt in the shoreward half of the area, and loose sand riverward. These substrate types may not be stable enough for unionids to successfully colonize, and excessive siltation may smother unionids.

Species composition in this area was similar to that observed by Kelner and Davis (2002) just upstream. They collected 9 live species, and 2 additional species were collected as dead shells. Seven live species were collected in the present study, 5 of which were also collected by Kelner and Davis. All 3 species collected as dead shells in the present study were collected live by Kelner and Davis. The cumulative species curve developed for this area suggests that a few additional species may reside in the area (Figure 3-3); however, given the low abundance of unionids, any additional species are likely only present in low numbers.

Unionid abundance in the upstream survey area was low, and CPUE was only 0.1 mussels/minute. All of the unionid species collected are considered “common” to “abundant” in the Upper St. Anthony Falls Pool (see Table 1-1). A few more common species may occur in the area, but are likely only present in low numbers. All unionids collected in this survey were relocated upstream to an area of suitable habitat, and, given the lack of suitable habitat in the area, few unionids likely remain in the survey area. Therefore, few unionids are likely to be affected by any hydraulic changes resulting from operation of the hydroelectric facility.

3.2 Downstream Survey Area

The downstream survey area primarily fell within a narrow back channel along the LDB. The existing hydroelectric facility on Hennepin Island discharges into a separate back channel to the west of the survey area; this channel was not

included in the present survey. The old hydroelectric outlet at the head of the back channel appeared to be discharging a very small volume of water. A small amount of river water passes through the old hydroelectric facility to prevent stagnation; along with groundwater inputs, this appears to be the source of the discharge. Current velocity was low throughout the survey area, except for brief surges where flow was reversed. These surges are likely due to lockage through the Upper St. Anthony Falls Lock. Due to the small pool size between the Upper and Lower St. Anthony Falls dams, discharging water from the upper lock to pass a boat through appears to cause a brief increase in water levels in the lower pool, forcing water upstream into the back channel. Depth was shallow, ranging from 0.3 m to 0.9 m (Figure 3-4). Substrate was variable throughout the area. The upstream-most end was rockier, consisting primarily of boulder, cobble, and gravel. The edges of the back channel also contained some cobble and gravel, but substrate in the center of the channel was primarily sand, silt, and woody debris. Sand and silt were also the primary substrate constituents at the downstream end of the area (see Figure 3-4).

Only 8 live unionids of 4 species were collected in the downstream survey area, most of which were *P. grandis* (see Table 3-1). One additional species was collected as a weathered dead shell. Most unionids were collected from Cells 4 and 5 at the downstream end of the narrow back channel (Figure 3-5). CPUE was extremely low, averaging only 0.05 mussels/minute (2.8 mussels/hour). As in the upstream survey area, unionids are likely limited by a lack of suitable habitat in this area. The loose sand/silt substrate found throughout most of the area may not be stable enough for unionids, and the low and variable current velocity in this back channel habitat may result in decreased dissolved oxygen, preventing most unionid species from colonizing the area.

Although Kelner and Davis (2002) reported similar species richness and CPUE from their nearby survey site at RM 853.5, species composition differed from the present study (see Table 1-1). Kelner and Davis collected 4 live species from their RM 853.5 site, but of those, only *P. grandis* was collected in the present survey. The other 3 species reported by Kelner and Davis were not collected live or dead in the present survey, while the other live species collected in the present survey were not found live by Kelner and Davis. The cumulative species curve for the downstream survey area suggests that most of the species that occur at this site were likely found during the survey; a few additional species may be present but likely only occur in low numbers (Figure 3-6).

Unionid abundance in the downstream survey area was very low, and CPUE was only 0.05 mussels/minute (2.8 mussels/hour). The 3 species collected in this area are all considered “rare” in the Lower St. Anthony Falls Pool. However, this designation may simply be due to low overall unionid abundance in this pool, as all of these species are relatively common in the Mississippi River both upstream and downstream of this site (Kelner, 2011). All unionids collected were relocated upstream to an area of suitable habitat, and few unionids likely remain in the survey area due to the lack of suitable habitat. Therefore, few unionids are likely to be affected by any hydraulic changes resulting from operation of the hydroelectric facility.

4.0 Literature Cited

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Figure 1-1. Location of the A-Mill Hydroelectric project and associated mussel survey areas, Mississippi River mile 853.8.

Figure 2-1. Mussel relocation area and division of upstream and downstream survey areas into sampling cells, August 2014.

Figure 3-1. Substrate composition and depth in the upstream survey area, August 2014.

Figure 3-2. Live unionids collected in qualitative searches in the upstream survey area, August 2014.

Figure 3-3. Cumulative species curve, upstream survey area, August 2014.

Figure 3-4. Substrate composition and depth in the downstream survey area, August 2014.

Figure 3-5. Live unionids collected in qualitative searches in the downstream survey area, August 2014.

Figure 3-6. Cumulative species curve, downstream survey area, August 2014.

Table 1-1. Unionid species reported from the Upper and Lower St. Anthony Falls Pools, Mississippi River

Table 3-1. Unionids collected in the vicinity of the A-Mill Hydroelectric project, August 2014