US Army Corps of Engineers
St. Paul District

Environmental Management Program
Restoring & Monitoring
ON THE
Upper Mississippi River System

Guttenberg Waterfowl Ponds Habitat Rehabilitation and Enhancement Project Evaluation Report

Upper Mississippi River Environmental Management Program

St. Paul District
U.S. Army Corps of Engineers
St. Paul, Minnesota

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Guttenberg Waterfowl Ponds

Habitat Rehabilitation and Enhancement Project Evaluation Report

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1.0 Introduction

1.1 UMRS EMP

The Upper Mississippi River System Environmental Management Program (UMRS-EMP) is a Federal-State partnership to manage, restore and monitor the UMRS ecosystem. The UMRS-EMP was authorized by Congress in Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662) and reauthorized in 1999. Subsequent amendments have helped shape the two major components of EMP – the Habitat Rehabilitation and Enhancement Projects (HREPs) and the Long Term Resource Monitoring Program (LTRMP) (USACE, 2010). Together, HREPs and LTRMP are designed to improve the environmental health of the UMRS and increase our understanding of its natural resources (USACE, 2010).

The EMP was the first program in the Nation to combine ecosystem restoration with scientific monitoring and research efforts on a large river system (USACE, 2010). The EMP has served the Nation well for 25 years on the UMRS, completing 56 habitat projects benefiting approximately 100,000 acres of aquatic and floodplain habitat and contributing significantly to our scientific understanding of this complex system through monitoring and research (USACE, 2010). As of October 2011, nine additional projects were under active construction and another 25 were in various planning and design stages. These projects range in size from small bank stabilization efforts that might cost less than a million dollars, to larger island or water level management projects that may exceed 15 million dollars. Most projects consist of several different restoration actions.

In addition to its achievements on the UMRS, the EMP has served as a model for other aquatic ecosystem efforts both nationally and internationally (USACE, 2010). The program has matured and adapted to changing conditions and new scientific insights and continues to be an efficient and effective means of ensuring that the UMRS remains both a nationally significant ecosystem and nationally significant navigation system (USACE, 2010).

1.2 Habitat Rehabilitation and Enhancement Projects

Habitat Rehabilitation and Enhancement Project (HREP) construction is one element of the UMRS-EMP. The projects provide site-specific ecosystem restoration, and are intended and designed to counteract the adverse ecological effects of impoundment and river regulation through a variety of modifications, including flow introductions, modification of channel training structures, dredging, island construction, and water level management. Interagency, multi-discipline teams including personnel from the Minnesota Department of Natural Resources (MDNR), the Wisconsin Department of Natural Resources (WDNR) the United States Fish and Wildlife Service (USFWS), and the United States Army Corps of Engineers (USACE) worked together to plan and design these projects, which are located on the navigable portion of the Upper Mississippi River and its navigable tributaries.

1.3 Purpose of Habitat Project Evaluation Reports

The purpose of this evaluation report is to summarize the project history and the effectiveness of the project in meeting stated restoration objectives. Another purpose is adaptive management, to derive lessons learned from the project experience for application to future restoration projects and river management.

1.4 Project Team

Project team members for this evaluation report included representatives from the Corps of Engineers, the U.S. Fish and Wildlife Service, and the Wisconsin, Iowa, and Minnesota Departments of Natural Resources, and are listed below. Many of these team members were also involved in the planning and construction phases of this project.

Much of the information in this report has been gathered from the project team members and others familiar with the project. This was accomplished through the use of a questionnaire (Appendix A), and subsequent review of this report by the project team.

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2.0 Project Background

2.1 Project Documents

Much of the information presented here is summarized from other documents, most of which are listed in Table 1. These documents are available from the St. Paul District on request.

Table 1. Project Documents

Guttenberg Waterfowl Ponds Definite Project Report/ Environmental Document (DPR)	July 1988
Bussey Lake Definite Project Report/ Environmental Document	May 1990
Guttenberg Waterfowl Ponds	September 1997

Operation and Maintenance document	
Bussey Lake Operation and Maintenance document	September 1997
Bussey Lake Project Completion Report	September 2004

2.2 Project Area

The project is located in Clayton County, Iowa, directly east of the city of Guttenberg. The project area is within the floodplain of the Mississippi River, immediately downstream from Lock and Dam 10 at river mile 615 (Figure 1). It lies within the Upper Mississippi River National Wildlife and Fish Refuge.

The project area encompasses approximately 200 acres of backwaters and islands. The project area was an abandoned fish rearing pond complex, formerly part of the Guttenberg National Fish Hatchery. Three former fish rearing ponds were modified to serve as moist soil units for waterfowl management. The ponds were 9.0, 13.7, and 12.5 acres in area, totaling 35 acres of moist soil units. The ponds are bordered by Cassville Slough on the east and Dead Slough on the west (Figures 2 and 3). Directly below the pond complex is a 30-acre pond named Big Lake, which remains wet throughout the year and attracts waterfowl with desirable aquatic plant species.

Directly upstream of Lock and Dam 10, the Upper Mississippi River National Wildlife and Fish Refuge maintains the 12 Mile Island Closed Area. This 1,679-acre area is closed to all hunting of migratory birds and includes a no motor use and voluntary avoidance policy from October 15 through the end of the state duck hunting season. The Guttenberg Ponds Sanctuary encompasses 252 acres surrounding the ponds and prohibits entry from October 1 to the end of the state duck hunting season. These two adjacent areas together constitute a large refuge for migratory waterfowl.

Figure 1. Project Location

Figure 2. Original Project Plan View

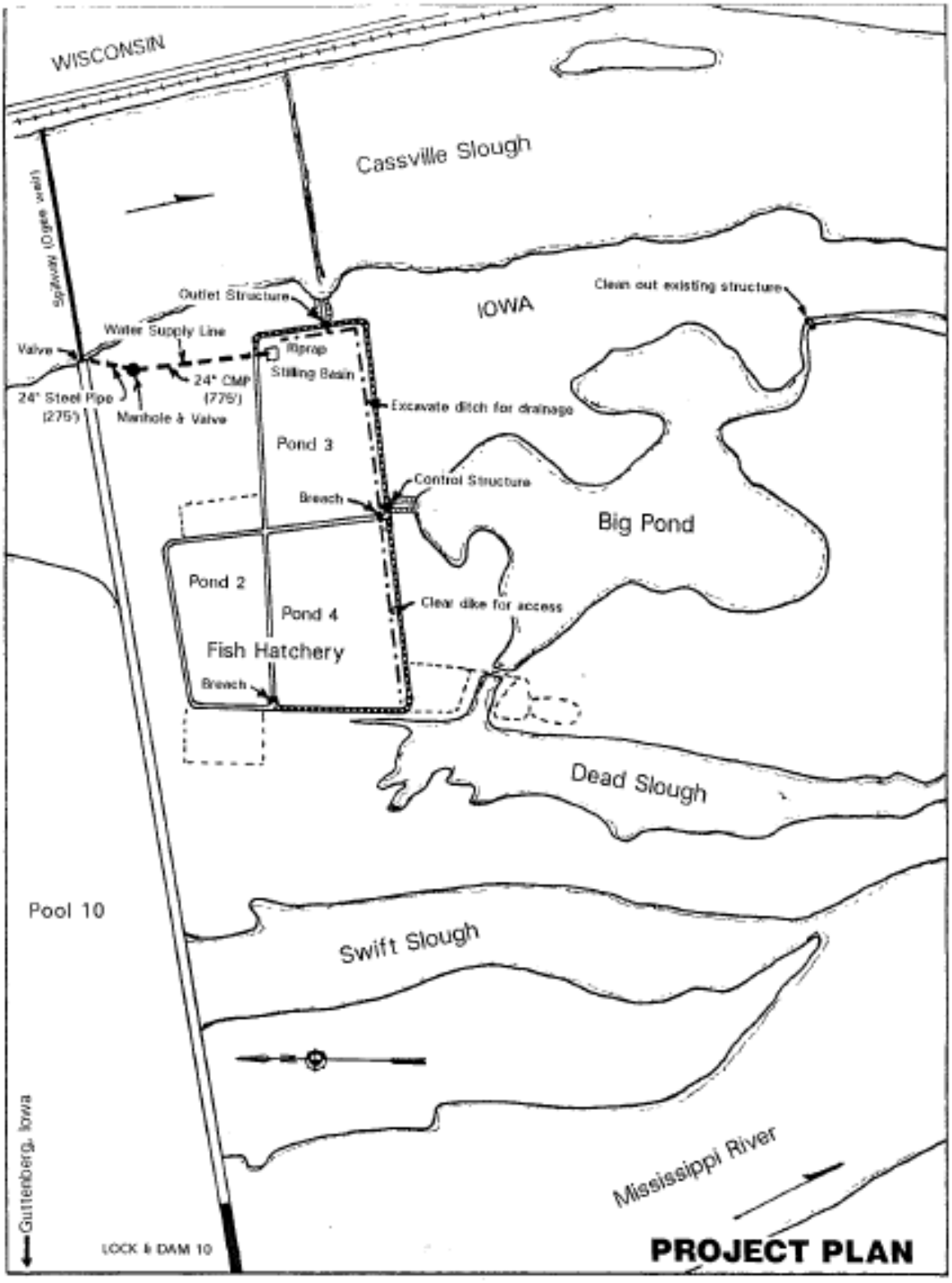
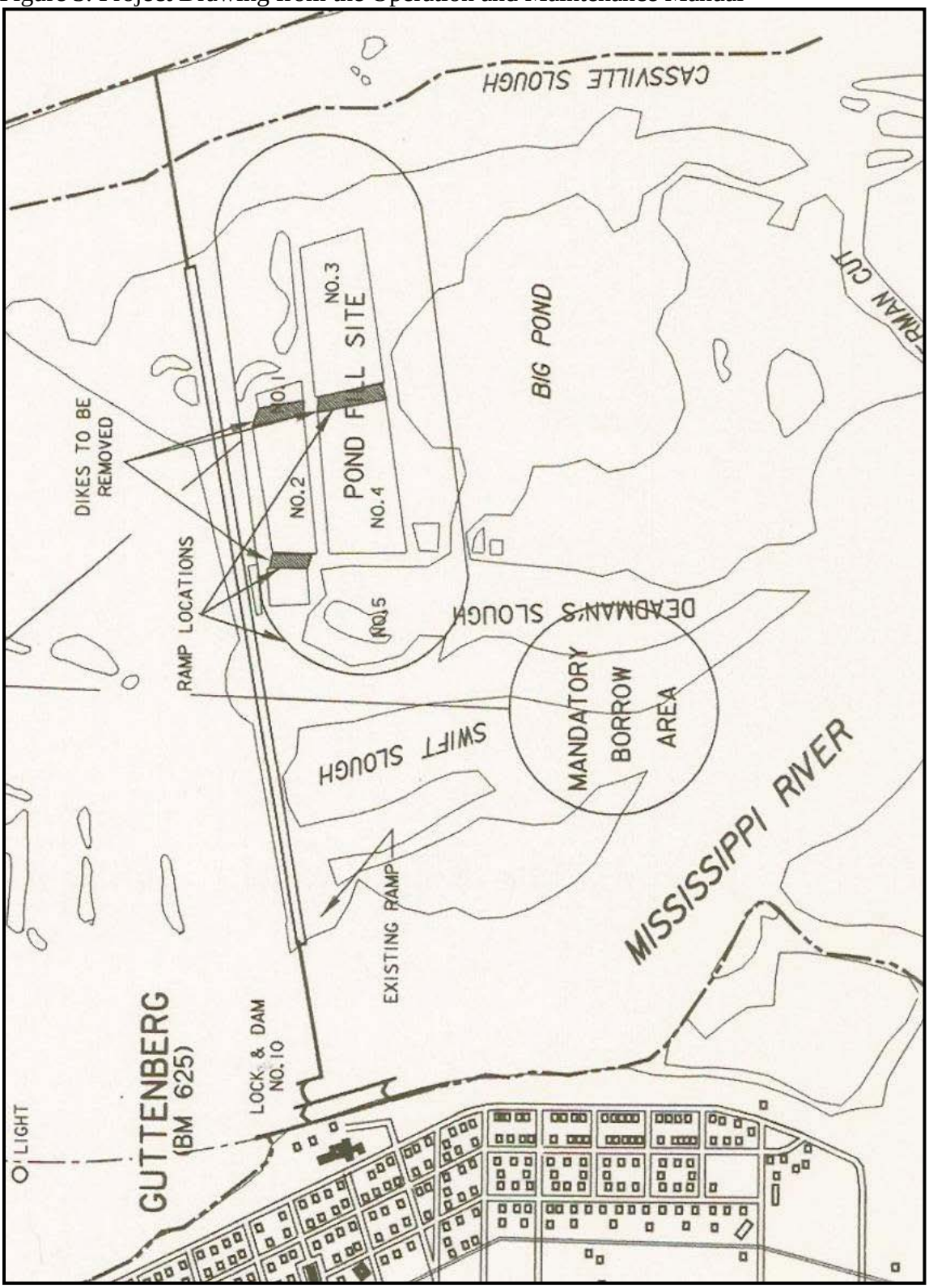


Figure 3. Project Drawing from the Operation and Maintenance Manual



2.3 Pre-Project Habitat Conditions and Changes

The project area included constructed dikes around the ponds that had grown over with woody vegetation. The interior of the ponds had shallow aquatic and wetland habitat. In some years, the ponds were well-vegetated; in other years, high water limited the amount of aquatic vegetation in the ponds. Managers were not able to control water levels in the ponds prior to completion of this project.

Before the HREP project, the ponds supported relatively good vegetation, including many native wetland species. Vegetation in the ponds varied from year to year, influenced by water levels. In 1972, the ponds supported (in declining order of coverage) rice cut grass, cocklebur, spike rush, arrowhead, loosestrife, wild millet, smartweed, burreed, *Cyperus spp.*, prairie cord grass, fleabane, and bulrush. When water levels were conducive, the ponds held additional wetland plants such as cattail, barnyard millet and coontail. By 1988, woody vegetation had invaded the pond dikes including 15- to 25-foot tall trees of American elm, silver maple, and mulberry. Woody vegetation interfered with the management goal of enhancing waterfowl habitat. Managers wanted better control of water levels to increase vegetation diversity, provide for fall waterfowl feeding, staging, and to control woody growth on the dikes.

2.4 Fish and Wildlife in the Project Area

Wildlife species using the general area include those common to Upper Mississippi River backwater areas. Adjacent areas are used extensively by wading birds for feeding, by waterfowl for nesting and brood sites, and by furbearers for den and feeding areas. Wildlife using the area includes several species of frogs, snapping turtles, painted turtles, osprey, bald eagles, and red shouldered hawks. The Definite Project Report (DPR) stated that all species of waterfowl that use the Mississippi Flyway use this site. Blue winged teal, mallard, and coot are especially common in the project area. Great blue herons, common egrets, muskrat, mink, beaver, and otter also make use of the area. Although minnows and rough fish were sometimes present in low numbers in the ponds, sport fish were uncommon because of low and fluctuating water levels and because access points (water control structures) were usually clogged with debris. Fish species common to Big Pond and nearby backwaters include bluegill, crappie, largemouth bass, carp, bullhead, and bowfin.

2.4.1 Threatened and Endangered Species in the Project Area

State and federally- listed threatened or endangered species potentially present in the area at the time of the DPR included the bald eagle, osprey, peregrine falcon, and Higgins' eye pearly mussel. The DPR concluded that there would be no significant negative effects to these species and that there would be no effect to federally threatened and endangered species.

Since the completion of the DPR, the bald eagle and the peregrine falcon have been removed from the federal threatened and endangered species list. Federally- listed threatened or endangered species currently documented in Clay County include the Higgins' eye pearly mussel (*Lampsilis higginsii*), the Iowa Pleistocene snail (*Discus macclintocki*), and the northern monkshood (*Aconitum noveboracense*). The federally listed Prairie bush-clover (*Lespedeza leptostachya*) and the Western Prairie Fringed Orchid (*Platanthera praeclara*) could potentially be found in Clayton County, but there are no documented occurrences. At the time of this evaluation report, the only species currently on the federal threatened and endangered species list that is likely to be found in or near the project area is the Higgins' eye pearly mussel. The Iowa Pleistocene snail is found only on algific talus slopes, and the northern monkshood is found on shaded and partially shaded cliffs and talus slopes, therefore these species would not be found at this site. The immediate project area does not provide suitable habitat for the Higgins' eye pearly mussel due to lack of channel habitat, shallow and fluctuating water levels, and it is unlikely that it would be affected by continued operation.

Two species of mussel that could potentially be found near the project areas have been listed as candidate species by the US Fish and Wildlife Service: the sheepnose (*Plethobasus cyphyus*) and the spectaclecase (*Cumberlandia monodonta*). Similar to the Higgins' eye mussel, it is unlikely that these species would be found in the immediate project area and it is unlikely that the continued operation of the project would have any effect on them.

2.5 Cultural Resources

The Guttenberg Fish Ponds were significant historical structures and were listed on the National Register of Historical Places. The HREP project required substantial coordination with the Iowa State Historic Preservation Office to mitigate the impacts caused by the project to the historic site. The Corps was required to create an illustrated informational booklet for the public to communicate "the features of the fish rearing ponds and the part this property played in the development of the national fish hatchery and navigation/conservation movements" (Advisory Council on Historic Preservation, 1992). The Corps historian, John Anfinson, wrote a booklet titled "Commerce and Conservation on the Upper Mississippi River," which was well-received by many agencies. After publishing, the booklet was available to the public at the US FWS office in Guttenberg. Anfinson also wrote a longer article, which was published in the Annals of Iowa in fall 1993. In addition to the ponds themselves, there were two archeological sites within the project boundaries. One site was to be flagged to avoid impacts; the other site was to be monitored during excavation by a professional archeologist.

3.0 Project Purpose

The project purpose was to provide food for migrating waterfowl by renovating existing abandoned fish ponds and operating them as moist soil management units. The project enables water level control of the ponds and provides a more efficient means of operation. The project is operated as a seasonally flooded impoundment.

3.1 Specific Project Objectives

The Definite Project Report (DPR) contained no clearly stated project objectives. The general purpose was to provide staging areas for migrating waterfowl, but no specific objectives or quantitative performance criteria were proposed for evaluating the success of the project. The Corps did not complete a pre- and forecasted with-project Habitat Evaluation Procedures (HEP) analysis to quantify expected increases in habitat value.

Quantifying the pre-project waterfowl use of the ponds is difficult because only one survey was documented. In an unpublished U.S. Fish and Wildlife Service (USFWS) Refuge document from 1972, J. P. Smith estimated duck densities at 8 to 25 birds per acre. Using the fall use days for mallards (22.5 days) and the total moist soil area (35.2 acres), the mean number of fall duck use days was calculated to be 6,570 to 19,733 days. These numbers were considered low by Smith, and a review of several studies indicated that waterfowl use could increase three to five times through better management of the moist soil units.

The DPR estimated that after project implementation, peak waterfowl use of the ponds would increase by three to five times the pre-project level. Using the pre-project estimates of 8 to 25 birds per acre and 6,570 to 19,733 fall duck use days, post-project densities were predicted to range from 24 to 125 ducks per acre, and duck use days were predicted to range from 19,710 to 98,665 days. The DPR went on to state that while these ranges are large, it was expected that the actual use would be in the upper half of these estimates.

4.0 Project Description

4.1 Project Features and Implementation History

The project currently consists of two moist soil units, each approximately 25 acres in size, ringed by earthen dikes. A gated water line brings water to the units from Lock and Dam 10, and water control structures allow the units to be drawn down when needed. The water level in the two units can be managed independently. The bottom elevation of the units varies, creating a diversity of vegetation.

Initial construction of the HREP took place in conjunction with the Lock and Dam 10 abutment raise. The plan selected in the DPR, shown on Figure 2, included ditching and breaching of dikes to provide drainage to a simple corrugated metal pipe drop outlet structure on the east side of the pond complex, discharging into Cassville Slough, just downstream of the Lock and Dam 10 spillway. A gated, 24-inch water supply line with a single knife valve was constructed from the Lock and Dam 10 spillway to the ponds. This supply line was designed to provide 80 acre-feet of water to the ponds in 6 days to raise the pond water level 3 feet. An additional control structure was added to provide a water supply to Big Pond Slough via the ponds. Construction of this phase began in October 1989 and was completed in October 1990 at a cost of $318,000.

Shortly after construction of the first phase, planning for the Bussey Lake habitat project recommended dredging to improve aquatic habitat in Bussey Lake, a backwater area just upstream of Lock and Dam No. 10. The Bussey Lake HREP project was constructed in conjunction with the Guttenberg Ponds HREP. Approximately 115,000 cubic yards of dredged material from Bussey Lake were used to elevate and level the bottoms of the three existing moist soil units totaling 35 acres in size. Another 145,000 cubic yards of material was used to create one new moist soil unit, 15 acres in size, located immediately west of the system (Pond 5 on Figure 3).

The bottom elevation of the ponds was raised 2 to 3 feet to an elevation 608 feet above mean sea level (msl). Interior dikes were removed so that the ponds could be operated as two units. Pond 1 (Area 1 on Figure 4) consists of the former Ponds 3 and 4. Pond 2 (Area 2 on Figure 4) consists of the former Ponds 1 and 2 and the new Pond 5. The original pond dikes had top elevations of 620.0 ft and were considered stable, not requiring any modification for the project. Woody vegetation was cleared from the dikes to make future inspection and maintenance easier. The new Pond 5 dike was constructed to top elevation of 615.0 to prevent overtopping by high water during the June to November period when water levels in the ponds are being managed for habitat purposes.

The dredging of Bussey Lake and the construction of the new moist soil unit (Pond 5) began in July 1992 and was completed in October 1992 when Pond 5 was filled to its design elevation. Final grading and seeding of the pond dikes was delayed until October 1994 because of persistent high water. The cost of building the pond was included in the Bussey Lake project.

Three outlet structures allow water to be drained from the two ponds. One stop log/culvert system allows drainage of water from the ponds into Cassville Slough (Outlet 1 in Area 1 on Figure 4). A second outlet allows water to be drained into Deadman's Slough (Outlet 2 in Area 2 on Figure 4). A third outlet structure (Outlet 3 in Area 1 on Figure 4) provides the ability to discharge water into the Big Pond area below the waterfowl pond dikes to assist in alleviating dissolved oxygen (D.O.) depletion problems. The outlet structures serve a number of functions. They must control the rate of flow out of the ponds, control the elevation of water within the ponds, keep the river from backing into the ponds, and minimize the potential for carp to enter the ponds. The features that perform these functions are stop logs, a slide gate, and a carp exclusion rack.

Under the revised design in which the ponds would be managed as two units, it was desired to be able to independently manage water levels in the two units. The original water supply line provided water to Pond 1 and a branch water supply line was installed to provide water to Pond 2 (Figure 4). A junction box was constructed at the intersection of the two lines and slide gates installed to allow independent control of water to the two ponds. A knife valve in a manhole located along the intake pipe approximately 100 feet downstream of the Lock and Dam 10 spillway controls the water entering the ponds. Installation of the branch water supply line and new water control structures began in

January 1995 and was completed in November 1995 at a cost of $655,000. Table 2 shows the project timeline.

Table 2. Project Timeline

1939-1941	Construction of original fish ponds as part of the conservation movement.
1961	Three small additional ponds built
1971	Property transferred to Upper Mississippi River National Wildlife and Fish Refuge
1973	Fish ponds abandoned
1987	Guttenberg HREP and Bussey Lake HREP planning initiated
1988	Guttenberg DPR complete
1990	Construction of Guttenberg HREP completed
1990	Fish ponds converted to moist soil units for waterfowl habitat improvement *dikes were breached in two places *original outlets removed from ponds 2, 3, and 4 *drainage ditch excavated inside the walls of ponds 3 and 4 *repairs to the dike *removal of trees from the outer dikes Resulted in seasonal water control
1990	Bussey Lake Stage 1A DPR complete
1992-1994	Bussey Lake dredge material used to raise existing MSU
	Bussey Lake dredge material used to construct additional MSU
1995	Bussey Lake Stage 2: Guttenberg Ponds Work *installed water branch supply line *installed water control structures
1996	Guttenberg Ponds dike breach: installed overflow section on Pond 2 dike
1997	Guttenberg Ponds and Bussey Lake O&M manuals complete
2001	Second overflow section added to Pond 2 after 2001 flood
2003	Outlet #3 repaired
2004	Bussey Lake HREP Evaluation Report Completed
2011	Guttenberg Ponds HREP Evaluation Report Completed

Figure 4. Final Project Plan View (prepared by Sharonne Baylor, FWS, June 2009)

4.2 Project Construction Costs

The Guttenberg Ponds HREP project was constructed in conjunction with the Bussey Lake HREP. Several tasks that were necessary to complete the Guttenberg project were included in contracts for Bussey Lake work. Table 3 below lists costs associated with the Guttenberg Ponds project, including the Bussey Lake Contracts. Costs for the Bussey Lake project that were not associated with the Guttenberg Ponds project are not included in the table below.

Table 3. Construction Costs

Project Name	Tasks	Completion Date	Contractor	Cost
Lock and Dam 10 Spillway Abutment Raise and Guttenberg Pond Construction	1) water supply line 2) restoration of pond outlet structures	October 1990	Taylor Construction, Inc.	$318,000
Bussey Lake Stage 1	1) structure removal 2) dike survey, 3) stump removal 4) pond survey	October 1994	J.F. Brennan Co., Inc.	$27,135
Bussey Lake Stage 2	1) install branch water supply line 2) install new water control structures	November 1995	Taylor Construction, Inc.	$389,170
Guttenberg Waterfowl Ponds Dike Breach	1) install overflow section	October 1996	Weymiller Marine, Inc.	$29,000
Total Project Cost Excluding Bussey Lake Costs				$763,305

5.0 Operation and Maintenance

5.1 Project Features Requiring Operation and Maintenance

Realizing the benefits of moist soil units require active management. Because of this, the Guttenberg Ponds project requires more operation and maintenance effort than most HREPs. The project includes several features that require operation and maintenance. Dikes require vegetation management to control the growth of woody species and burrowing muskrats that can compromise the integrity of the structures. Each soil management unit receives water through a water supply line. A junction box was constructed at the intersection of the two lines. Slide gates were installed in the junction box to allow independent control of water to the two units. The original knife valve remains in place above the junction box to provide the ability to completely shut off water to the system if necessary.

The operating plan for these ponds includes filling the ponds with water in late August, with release of water in June of the next year. Prior to the HREP project, the ponds were

operated by releasing water in June only 1 out of 7 years. With the bottom elevations raised to 608 feet msl, it was expected that the ponds would be drained in June approximately 5 out of 7 years (USACE 1990). Pond water levels are managed by operating the water supply lines and outlet structures. The DPR mentions potential problems with achieving sufficient substrate drying due to soil particle size. This has sometimes been a problem in certain portions of the project area, depending on rainfall and main channel water level.

5.2 Operation and Maintenance Responsibilities

The U.S. Fish and Wildlife Service accepted the operation and maintenance responsibility for the project in agreements signed by the USFWS and the Corps dated 12 January 1989 and 20 February 1992. The USFWS has given the operation and maintenance responsibility to the McGregor Refuge District Manager.

5.3 Operation and Maintenance Tasks and Schedule

The Guttenberg Ponds Operation and Maintenance Manual states: “The typical management plan would be to have the ponds dewatered by the end of June. The ponds would be left dry during July-August to promote the growth of desired plant species. In late August-early September, the ponds would be reflooded with 12-18 inches of water to provide feeding habitat for migratory water birds. The ponds would either be drained or left flooded over the winter depending upon management goals at the time.”

The tasks associated with the project are listed in the Guttenberg Waterfowl Ponds O&M manual, page 10:

- Operate the moist soil units for the benefit of migratory water birds and other fish and wildlife.
- Operate and maintain structure gates in accordance with manufacturer’s instructions.
- Annual inspection.
- Keep trees and brush off overflow spillway.
- Keep trees and brush off dikes.

5.4 History of Major Disturbances and Repairs

Overtopping by high water in 1993 and 1996 resulted in erosion in the Pond 2 dike where it crosses Deadman's Slough (near Outlet 2 on Figure 4). Settlement in this area creates a low spot where water crossing the dike eroded the sand sediments with which the dike was constructed. To alleviate this problem, a rock overflow section was placed in this section of the dike in October 1996 at a cost of $29,000. Another floodwater overflow spillway was added to Pond 2 after the 2001 flood. Outlet 3 was repaired by the Corps after flooding in 2003 at a cost of $19,800. Table 4 provides the history of major disturbances.

Table 4. History of Major Disturbances

1997	Flood
April 2001	Second largest flood event on record.
Fall 2003	US Army Corps of Engineers Physical Support Branch repaired Outlet No. 3.

5.5 Operation and Maintenance History

The USFWS managers state that while they intend to manage the water level in the ponds according to the schedule described in section 5.3, circumstances sometimes prevent them from doing so. For example, high water levels on the main channel can preclude drawing down the ponds. The two units were constructed to be managed separately, but have not been managed differently to date. Although Outlet 3 was added to allow water control to raise D.O. levels in Big Lake, the project has not been utilized to improve conditions in Big Lake. The U.S. Fish and Wildlife Service has not monitored D.O. levels in Big Lake, and has not actively managed the Guttenberg Ponds water level to affect habitat in the area outside the moist soil units. The USFWS uses both mechanical removal and herbicide to control woody vegetation on the dikes around the ponds.

5.6 Operation and Maintenance Cost

Annual operation and maintenance costs estimated during the preparation of the DPR were cumulatively $3,500 (1990 dollars). Actual costs of operation and maintenance by the USFWS are listed in Table 5 below (USFWS 2010). Costs before FY03 are not well documented. There are no records of O & M costs between 1998 and 2002.

Table 5. USFWS Operation and Maintenance Costs.

Year	Years in O&M	Estimated Annual Cost w/ Inflation	Actual FWS Costs	Activities
1997	1	$1,841	$0	Not documented.
1998	2	$1,871	$6,480	Operate water control structures, mow, control woody vegetation
FY 2003	7	$2,112	$3,386	Operate water control structures, mow, control of woody vegetation, experimental seeding of wild millet, repair Outlet No. 3.
FY 2004	8	$2,169	$20,188	Operate water control structures, inspect repair work, clean structures, inspect dikes, repair Outlet No. 3.
FY 2005	9	$2,243	$ 620	Operate water control structures, inspect dikes, cleaned structures, invasives control.
FY 2006	10	$2,315	$1,104	Operate water control structures, inspect dikes, vegetation data collection.
FY 2007	11	$2,383	$2,700	Operate water control structures, inspections.
FY 2008	12	$2,472	$677	Operate water control structures, inspections.
FY 2009	13	$2,546	$5,200	Operate water control structures, inspections.
FY 2010	14	$2,622	$2,300	Operate water control structures, inspections.

6.0 Project Monitoring

6.1 Monitoring Plan

A specific monitoring plan was not developed for the project; however, the DPR did include the following discussion of monitoring tasks: “The following information would be collected in order to evaluate the performance of the project and to allow effective changes in the operating schedule, if needed: pond versus tailwater elevations; timing and duration of drawdown; extent of plant germination; vegetation composition and vigor; reflooding schedule (depths); vegetation response to reflooding; and wildlife use before, during, and after flooding. This information would be recorded each year for 3 years to determine if the project is functioning as desired. Data collection in 1988 would provide 1 year of pre-construction information. However, because construction may occur during the fall migration period, disturbance may invalidate the 1988 waterfowl counts. Because of the high variability in the magnitude of the fall waterfowl flight (due to weather, continental population levels, local hunting pressure, etc.) and duration of stay at stopover areas (due to physiological condition of individual birds, food availability, etc.), project evaluations should not be based on data from only one year. Evaluation of the project effects would be performed qualitatively because of the limited quantitative information available for comparison. The evaluation would be based on the empirical knowledge of local wildlife managers familiar with the site and on expected outputs

determined from published data." Table 6 provides information on the monitoring activities that occurred.

Table 6. Project Monitoring Activities

Year	Monitoring Activities	Agency
1972	Duck densities and use days	USFWS
2006	Vegetation Survey	USFWS
2009	Duck densities and use days	USFWS
2010	Duck densities and use days	USFWS

6.2 Present Habitat Conditions

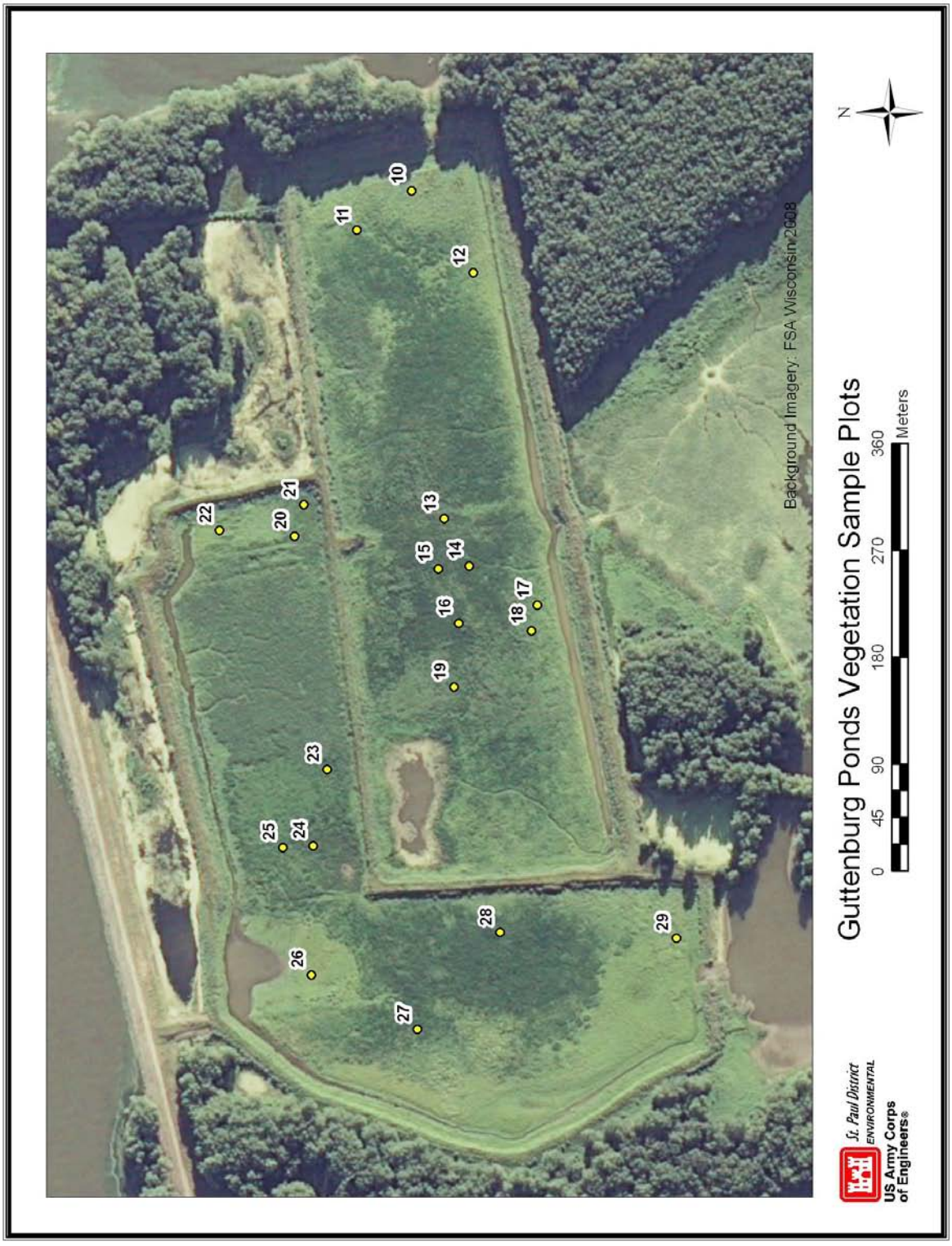
The project has resulted in the creation of about 50 acres of actively-managed moist soil habitat. The units support a variety of common wetland plant species. There are relatively few invasive plant species on the site. In general, the habitat provides a satisfactory feeding and resting area for migratory waterfowl.

In 2006 the U.S. Fish and Wildlife Service conducted a vegetation survey of the moist soil units. Twenty 10 m by 10 m plots were placed randomly in the moist soil units (Figure 5). Most plants present were identified to species and approximate cover was noted. Since plant abundance was recorded as an approximate cover (e.g. 25% to 50% cover), the exact abundance of each species cannot be calculated. However, Table 7 presents the documented plant species in approximate order of abundance. Eight species made up about 75% of the total vegetation cover. Woody vegetation on the dikes has been controlled by burning, mowing, and herbicide application.

The vegetation survey indicates that the site supports a high quality shallow marsh plant community. In particular, bur-reed, hop sedge, arrowhead, river bulrush, false nettle, and American lotus are found in minimally disturbed wetlands. The site also contains many annuals and pioneer perennials, but this is common in river marshes that are subject to frequent disturbance by flood events. Several of the plant species provide food for waterfowl, including bur-reed, awned barnyard grass, redroot flatsedge, rice cutgrass, rosemallow, river bulrush, and arrowhead.

The site has a low density of invasive species. Purple loosestrife was not documented in 2003, even though it was present in 1972. Reed canary grass has invaded the ponds and is approximately the eighth most abundant plant species. It was found in 4 out of 20 sampling sites, and had a 5-15% cover at three sites and 51-75% at one site. It is possible that the ponds will become more dominated by reed canary grass over time, but controlling this species is difficult in a floodplain where river flows carry new seeds into the site each year.

Figure 5. Vegetation Plot Locations



The USFWS vegetation survey included a calculation of the Floristic Quality Index for each of the twenty sites. FQI values are calculated based on estimates of each species' conservatism—the species' tolerance to disturbance and its fidelity to a particular pre-Euro-American settlement community type. There are no established assessment criteria or numerical standards that provide guidance on interpreting the significance of FQI scores. Criteria of this type would need to be specific to each plant community due to variation in natural disturbance regimes, which affects the conservatism of the community. FQI values are best used to compare the relative quality of a set of sites, but using the scores to determine one site's quality is not useful at this time. Therefore, the FQI scores will not be evaluated in this report. The Minnesota Pollution Control Agency is currently developing community-specific assessment criteria that will provide quantitative measures of site integrity. In the future, these criteria may be used to assess site quality using FQI scores.

Table 7: List of Species in Approximate Order of Cover

Common Name	Species	Appx. Cover
Broadfruit bur-reed	Sparganium eurycarpum	>20%
Rough barnyard grass	Echinochloa muricata	10-20%
Redroot flatsedge	Cyperus erythrorhizos	10-20%
Common spikerush	Eleocharis palustris	5-10%
Rice cutgrass	Leersia oryzoides	5-10%
Halberdleaf rosemallow	Hibiscus laevis	5-10%
Seedbox	Ludwigia alternifolia	1-5%
River bulrush	Scirpus fluviatilis	1-5%
Reed canary grass	Phalaris arundinacea	1-5%
Smallspike false nettle	Boehmeria cylindrica	1-5%
Needle spikerush	Eleocharis acicularis	1-5%
Broadleaf arrowhead	Sagittaria latifolia	1-5%
Sessilefruit arrowhead	Sagittaria rigida	1-5%
American lotus	Nelumbo lutea	1-5%
Lanceleaf fogfruit	Phyla lanceolata	1-5%
Aster	Aster spp.	<1%
Hop sedge	Carex lupulina	<1%
Ponygrass	Eragrostis hynoides	<1%
Old witchgrass	Panicum capillare	<1%
Hardstem bulrush	Scirpus acutus	<1%
Velvetleaf	Abutilon theophrasti	<1%
Silver maple	Acer saccharinum	<1%
Slim amaranth	Amaranthus hybridus	<1%
Common buttonbush	Cephalanthus occidentalis	<1%
Ditch stonecrop	Penthorum sedoides	<1%
Eastern cottonwood	Polygonum lapathifolium	<1%
Curlytop knotweed	Populus deltoides	<1%
Woolgrass	Scirpus cyperinus	<1%
Riverbank grape	Vitis riparia	<1%

Waterfowl use of the area during autumn migration increased after the project. The 1972 pre-project survey estimated that the ponds supported 6,570 to 19,733 duck use days, and post-project densities were predicted to range from 19,710 to 98,665 days. In 2009, the ponds supported 55,765 duck use days, and in 2010 the ponds supported 33,500 duck use days. Due to the construction of additional pond acres, the total area of managed moist soil management increased from 35 acres to approximately 50 acres. Distributing the duck use days on a per-acre basis results in 180 to 541 duck use days/acre in 1972, 1,115 duck use day/acre in 2009, and 670 duck use days/acre in 2010. The objective was 540 to 2703 duck use days/acre. The project did meet this objective but was in the lower half of the target. However, the methodology used to collect the original data is not documented, so it is difficult to accurately compare current data to the pre-project condition.

In addition to waterfowl, other wildlife uses the ponds for nesting and feeding. In recent years trumpeter swans and Canada geese have nested in the ponds. Stinkpot turtles have nested on the dikes. Two eagle nests are located in the area. Many other species of fauna use the site for feeding and nesting.

6.3 Other Habitat Changes in the Project Area

Other significant habitat changes in the project area include the habitat restoration project in Bussey Lake. As described above, Bussey Lake was dredged in 1992 to improve aquatic habitat. Dredge material from this project was used in the construction of the Guttenberg Ponds project.

In recent years, two secondary channels in the area—Dead Slough and Swift Slough—have been filling in with sediment. The shallower flows have reduced boat access through the sloughs.

7.0 Project Evaluation

7.1 Construction

No issues related to the construction of this project were identified during this evaluation.

7.2 Engineering/Design

In general, the inlet and outlet structures are operating as intended and have only needed minor repairs, except in cases where major flood events have caused damage. These structures are reportedly effective for facilitating water level management in the ponds and no major design modifications have been recommended. However, some modifications and improvements to the design of the project have been suggested for consideration here and during the planning of similar projects in the future.

According the USFWS, the steep dike slopes have been difficult to maintain because they are too steep to mow with equipment. Flatter dike slopes would facilitate mowing.

Additionally, the narrow dikes have been damaged by muskrat burrows. It was suggested that sacrificial berms at the bases of the dikes could be used to alleviate such problems in the future. Less steep side slopes would also inhibit muskrat damage.

It has also been suggested that raising the cell floors by 5 feet would allow tillage of the cells to facilitate the growth of moist soil vegetation. This would, however, also increase operational costs, which would need to be considered. Similarly, it was suggested that that increasing the topographical diversity of the cell floors would be beneficial, presumably as a way to improve habitat diversity and interspersion. The Fish and Wildlife Service has suggested that future management actions may include raising the bottom elevation in some areas.

Carp exclusion screens were added to the water control structures. These are fairly effective at excluding carp, and individuals that do access that ponds are usually eliminated during late winter when the ponds typically freeze solid. One additional suggestion for improved design included a design for stoplogs that do not require personnel to climb down in the stoplog structure. No specific design solutions were suggested for this problem.

7.3 Costs

The total implementation cost attributable to the Guttenberg Ponds project (as completed by November 1996) was about $763,300. It is difficult to compare the costs of this HREP to other projects because of its unique situation. The project was able to utilize previously existing infrastructure as well as dredged material from another HREP project. These two factors allowed the project to be constructed at a lower cost than would typically be expected for the construction of moist soil units.

7.4 Ecological Effectiveness

7.4.1 Aquatic Resources

Waterfowl surveys indicate that duck use days have increased since project construction. In 2009, the Fish and Wildlife Service estimated that the Guttenberg Ponds supported 55,765 duck use days, and in 2010 the ponds supported 33,500 duck use days. These numbers are within the project goals of 19,710 to 98,665 duck use days per year. Wetland vegetation provides suitable habitat for waterfowl and other wildlife.

7.4.2 Terrestrial Resources

Terrestrial resources were not included in the project objectives, nor were they appreciably impacted by the project.

7.4.3 Attainment of Project Objectives

Objective: Create a staging area for migratory waterfowl (Table 8).

Table 8: Objective criteria and level of attainment

Objective		Criteria		Pre-Project		Post-Project	Degree of Attainment
Staging area habitat for migrating waterfowl	1	20,000 to 98,000 duck use days (DUD)	1972	6,570 to 19,733 DUD	2009	55,765 DUD	Attained the objective criteria
					2010	33,500 DUD	
	2	540 to 2703 DUD/acre	1972	180 to 541 DUD/acre	2009	1,115 DUD/acre	Attained the objective criteria
					2010	670 DUD/acre	

The project did meet its objectives, both for total duck use days and duck use days per acre. The project was anticipated to achieve use on the higher end of the range predicted. The project achieved results toward the lower end of the criteria. However, it must be noted these numbers were set solely on the expected habitat conditions. Basically, the planners examined the available research, determined that moist soil units typically support a certain duck use level, and used that number as the measure of success. In these terms, the project was successful at creating moist soil units with duck use similar to other moist soil units. These criteria do not address any broader objectives related to the overall landscape availability of waterfowl habitat or the habitat needs of the waterfowl population. The position of the ponds adjacent to the 12 Mile Island Closed Area increases their importance along the migratory flyway by creating a larger area of suitable habitat.

7.5 Public Acceptance

The agencies have reported that public acceptance of the project has been good, but there has been interest in more active moist soil management. They have also reported good waterfowl hunting downstream of the closed area, high fishing use in the area and on Big Pond, and birdwatcher use of the area.

8.0 Lessons Learned and Recommendations for Similar Projects

If this project were in the planning stage today, it is likely that floodplain forest creation would be evaluated as a project alternative. To realize the benefits of a moist soil unit, water levels must be actively managed. This management requires an expenditure of time and money that is not always available. HREPs are typically designed to minimize operation and maintenance requirements.

The existing dike side slopes are too steep to allow mechanized vegetation removal, and their structural integrity has been compromised by muskrat burrows. The intent during project design was to maintain the maximum area within the ponds for moist soil vegetation, so 3:1 dike side slopes were selected. In 2010 the USFWS received funds for repairs to the project through the American Recover and Reinvestment Act of 2009. The dikes will be repaired to achieve an even top elevation of 617.5 and re-sloped with side slopes of 4:1. Currently the dike top elevation ranges from 615 to 624, and the side slopes are approximately 3:1. The cost to repair the dikes will total approximately $916,000. In addition to leveling and re-sloping the dikes, the ARRA project will replace the control gate to Big Pond, remove the gate and wood structure at the Big Pond outlet, and replace the spillway outlet from Big Pond into Cassville Slough. The improvements at Big Pond will allow for better water level management in the backwater.

The dike repairs will improve the stability and longevity of the moist soil units. The cost of repairs, however, more than doubles the total cost of the project. Clearly, one lesson to be gained from this project is that dikes with steep side slopes are susceptible to muskrat damage that will require costly repairs.

Although not a significant problem at the Guttenberg Ponds project, another design feature to reduce muskrat damage would be to place rock around the inlets and outlets of all culverts and water control structures to limit burrowing along the structures. Muskrats tend to burrow into the soil directly adjacent to concrete structures.

9.0 Conclusions

When asked to rate the effectiveness of the project, resources managers generally felt that it was reasonably effective with an adequate design at a reasonable cost. The project was intended to capitalize on the opportunity to improve existing infrastructure at a reasonable cost, which was accomplished. The availability of Bussey Lake dredge

material enabled the project to be expanded at a small additional cost. Furthermore, the USFWS is currently investing additional funds into the project to improve the dikes.

Current habitat conditions are considered good by the resource managers. The vegetation is a relatively diverse assemblage of native plants with few invasive plant species. Fall waterfowl use days are within the projected levels, and the project was successful in creating suitable fall habitat for migratory ducks. Based on these factors, the project team has determined that while the project design could have been improved, the goals were met and the project has succeeded.

References

Advisory Council on Historic Preservation. 1992. Memorandum of Agreement, Bussey Lake Environmental Management Program. Washington, D.C.

Anfinson, J. 1993 Commerce and conservation on the Upper Mississippi River. The Annals of Iowa 52(4):385–417

St. Paul District, U.S. Army Corps of Engineers. 1988. Definite Project Report. Guttenberg Waterfowl Ponds. Habitat Rehabilitation and Enhancement Project. Pool 11, Upper Mississippi River. Clayton County, Iowa.

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St. Paul District, U.S. Army Corps of Engineers. 2004. Bussey Lake Completion Report. Operation and Maintenance Manual. Habitat Rehabilitation and Enhancement Project. Pool 11, Upper Mississippi River. Clayton County, Iowa.

U.S. Fish and Wildlife Service. 2008. Upper Mississippi River Refuge Final Environmental Impact Statement/Comprehensive Conservation Plan. Upper Mississippi River Wildlife and Fish Refuge. Winona, Minnesota. Appendix Q: Waterfowl Hunting Closed Areas, History, Description, Background and Rationale for Alternative E.

U.S. Fish and Wildlife Service. 2010. Guttenberg Ponds Annual Inspection Report. Upper Mississippi River Wildlife and Fish Refuge. Winona, Minnesota.

APPENDIX A
Comments by Project Team

Habitat Project Questions for Resource Managers

PROJECT: Guttenburg Waterfowl Ponds

Project Objectives (Stated as Project Accomplishments and Outputs)

1) Renovate 35 acres of ponds into moist soil habitat for migratory waterfowl
2) Increase waterfowl use 3x to 5x to 24 – 125 ducks/acre, use days 19,700 to 98,665
3) Provide attractive habitat for other bird and wildlife species
4) Improved water level control of Big Pond provide greater fish management opportunity
5) (unstated) Provide a placement site for Bussey Lake dredged material
* Look at Bussey Lake DPR for any Guttenberg Ponds objectives

Water Management Plan (USFWS)
6) Produce plant food for migrating waterfowl
7) Detection and treatment of purple loosestrife
8) Produce invertebrate food for migrating waterfowl

Cultural Mitigation
9) Mitigate for effects on historic property

Q1 – Which of the project objectives were effectively addressed by the project?
1) Now have 42 acres of operable moist soil management units (see Bussey Lake DPR for additional acreage)
2) Will have to infer use through counts of Big Pond and 12-Mile Island Pool 10 closed areas
3) Trumpeter swans and Canada geese nested in ponds. Stinkpot turtles nested on dikes. USFWS has attempted to control muskrats and beavers. Otters observed in area
4) Northern pike spawning?
6) For first 5 years had good vegetation, waterfowl response. Now dominated by giant burr reed.
7) Purple loosestrife is not a problem. Some reed canary grass has invaded. Woody vegetation on the dikes has been controlled burning and mowing.
8) No invertebrate monitoring
Inlet structure works well
9) Publication and brochure on Guttenberg Ponds used for interpretation

Q2 – What project features could have been changed to make a more effective project?
Floodwater overflow spillway (added to west cell after 2001 flood)
Convert whole area into floodplain forest
Raise cell floors 5 ft to allow tillage, better growth of moist soil vegetation
Add carp exclosure screens to water control structures (done – need better design)
Need better design for stoplogs that do not require personnel down into stoplog structure
Construct dikes with flatter slopes, flatten slopes on existing dikes
Sacrificial berms at toe of dikes to limit muskrat damage
Dredging in Big Pond to improve fish habitat
Replace existing old water control structures on Big Pond
Diversify topography of cell floors

Q3 – How could the appearance of the project be improved?
Modify southern dike to look better, more like floodplain

Q4 – How did this project affect recreational use of the area?
Closed area during waterfowl hunting season
Birdwatchers use the area
Lots of fishing in the area and on Big Pond
Good waterfowl hunting downstream of the closed area

Q5 – Is the amount of O&M appropriate and how could it be reduced?
If cell floors were raised and cells were tilled, it would be more effective for moist soil vegetation but it the O&M

would be more costly
Flatter dike slopes would allow mechanical vegetation control
If southern dike is lowered, a flood overflow structure would be beneficial

Q6 – Was the monitoring appropriate to assess project effectiveness?

Q7 – What is your assessment of the project overall? C, B, C

A = Excellent – ecologically effective, appropriate design/cost, appearance acceptable
B = Good – mostly ecologically effective, good design, reasonable cost, etc.
C = Fair – marginally effective, fair design, somewhat costly, etc.
D = Poor – not ecologically effective, inappropriate design, too costly, etc.
F = Failure – doesn't have any positive attributes

This is an actively managed waterfowl refuge area

Q8 – What needs to be done to further improve habitat conditions in the project area?
ARRA funds being used to flatten slopes on dikes
Diversity elevations in ponds
New water control structures on Big Pond

Q9 – What was the public reaction to the project?
Generally good public acceptance
Interest in more active moist soil management

Q10 – What were the "lessons learned" from this project?
Dikes with 1:1 and 1:3 slopes too steep
Consider more sustainable (self-maintaining) restoration projects
Conversion of old fish ponds to moist soil units was an opportunity
Check elevation surveys and datum in designing and laying out project
Contributed to modified stoplog design for water control structures

Name (optional) _____

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Upper Mississippi River National Wildlife and Fish Refuge

Guttenberg Waterfowl Ponds HREP

2010 Annual Inspection Report

Tim Yager, McGregor District Manager, at Outlet No. 2, May 2010.

Prepared by
Sharonne Baylor, Environmental Engineer
Upper Mississippi River National Wildlife and Fish Refuge
51 E Fourth St., Room 101
Winona, Minnesota 55987
July 2010

TABLE OF CONTENTS

INSPECTION DAY

Date of Inspection	May 5, 2010
Inspector(s)	Sharonne Baylor, Environmental Engineer Tim Yager, McGregor District Manager
Project Location	• Guttenberg Ponds: Pool 11, RM 615, downstream side of Lock and Dam 10 dike • Bussey Lake: Pool 10, RM 617, right descending side of main channel
Weather	Warm, overcast, mid 60^{o}F
River Level	• Lock and Dam No. 10 tailwater RM 615.1: 606.7 • Lock and Dam No. 10 flow: 45,400 cfs

NOTES

The ponds will be modified in 2010-2011 using ARRA funds.

RECOMMENDATIONS

Recommended Actions to Take Immediately

1. Repair Outlet No. 2 walkway upper footing.
2. Repair Outlet No. 1 broken bracket bolt.
3. Replace Outlet No. 2 broken stem cover plexiglass.
4. Repair water supply line broken brackets and missing bolts.
5. Replace apron on end of water supply line Area 1 outlet.
6. Add support below water supply line pipe between wingwall and knife gate.
7. Remove sediment and debris from knife gate structure.
8. Inspect inside of structures and gates in fall when moving gates.

Recommended Actions to Prolong Life of Project

1. Replace carp barrier winches to provide a safer method of opening and closing barriers.
2. Replace Outlet No. 1 broken padlock bracket.
3. Continue to keep dikes free of woody vegetation.
4. Continue to keep spillway free of woody vegetation.
5. Continue to monitor project.

INSPECTION RESULTS

Item	Observations/Condition	Remarks/Recommendations
Guttenberg Waterfowl Ponds		
Outlet No. 1	Structure is in good shape. Grating and handrail ok. No erosion around structure. A bolt is broken on the gate support bracket. Padlock bracket broken. Photos 1-3.	Replace broken bolt on bracket. Replace broken padlock bracket. Recommend replacing carp barrier winches to provide a safer method of opening and closing barriers. Inspect inside of structures and gates in fall when moving gate.
Outlet No. 2	Structure is in good shape. Grating and handrail ok. Broken stem cover plexiglass. Upper walkway footing undermined. Yager opened up gate, allowing Area 2 to dewater. Photos 4-7.	Repair undermined upper walkway footing. Replace broken stem cover plexiglass. Recommend replacing carp barrier winches to provide a safer method of opening and closing barriers. Inspect inside of structures and gates in fall when moving gate.
Outlet No. 3	Structure is in good shape. Grating and handrail ok. No erosion around structure. Photo 8.	Inspect inside of structures and gates in fall when moving gates.
Water Supply Line	Broken brackets and missing bolts on supply pipeline next to Lock and Dam No. 10 spillway wall. Appears pipe losing groundline support between wingwall and manhole. Knife gate structure interior has debris and vegetation growing in it. Area 1 pipe outlet apron rusted off end of pipe. Junction Box structure ok. Photos 9-12, 14.	Replace broken brackets and missing bolts. Add support below pipe. Clean knife gate structure interior. Replace Area 1 pipe outlet apron. Inspect inside of structures and gates in fall when moving gates.
Spillway	Spillway rock in place and free of woody vegetation. Photo 13.	Continue to keep woody vegetation out of spillway rock.

Item	Observations/Condition	Remarks/Recommendations
Dikes	Walked along perimeter dikes at and around structures. Solid vegetation. Muskrat damage throughout dikes. Area 1 south dike, exterior side, is very steep and was eroded in the past. Photos 1-3, 8, 12, 14-18, 20.	Repair steep and damaged slopes. These narrow dikes with steep slopes are getting damaged by muskrats and will continue to be a problem.
Moist Soil Units	Area 1 drained. Area 2 holding water; Yager opened up Outlet No. 2 to drain area. Photos 1, 2, 4-6, 8, 12, 14-20.	Per Yager, future management actions may include raising the bottom elevation in some areas.
Bussey Lake		
Bussey Lake Channels	Did not inspect.	Have Corps of Engineers perform bathymetric surveys when deemed necessary.

OPERATION AND MAINTENANCE

Operation and Maintenance Responsibilities

Per Guttenberg Waterfowl Ponds O&M manual, page 10:
1. Operate the moist soil units for the benefit of migratory water birds and other fish and wildlife.
2. Operate and maintain structure gates in accordance with manufacturer's instructions.
3. Annual inspection.
4. Keep trees and brush off overflow spillway.
5. Keep trees and brush off dikes.

Per Bussey Lake O&M manual, page 7:
1. None.

Operation and Maintenance Cost History and Activities

Costs before FY03 not well documented.

Year	Years in O&M	Estimated Annual Cost w/ Inflation	Actual FWS Costs	Activities
1997	1	$1,841	$0	Not documented.
1998	2	$1,871	$6,480	Operate water control structures, mow, control woody vegetation
FY 2003	7	$2,112	$3,386	Operate water control structures, mow, control of woody vegetation, experimental seeding of wild

				millet, repair Outlet No. 3.
FY 2004	8	$2,169	$20,188	Operate water control structures, inspect repair work, clean structures, inspect dikes, repair Outlet No. 3.
FY 2005	9	$2,243	$ 620	Operate water control structures, inspect dikes, cleaned structures, invasives control.
FY 2006	10	$2,315	$1,104	Operate water control structures, inspect dikes, vegetation data collection.
FY 2007	11	$2,383	$2,700	Operate water control structures, inspections.
FY 2008	12	$2,472	$677	Operate water control structures, inspections.
FY 2009	13	$2,462	$5,200	Operate water control structures, inspections.

PROJECT HISTORY AND DOCUMENTS

Significant Past Project Events and Activities

Spring 1997	Flood.
April 2001	Second largest flood event on record.
Fall 2003	US Army Corps of Engineers Physical Support Branch repaired Outlet No. 3.

Construction History and Costs

Lock and Dam 10 Spillway Abutment Raise and Guttenberg Waterfowl Pond Construction (water supply line and restoration of pond outlet structures)	
Construction Complete	October 1990
Contractor	Taylor Construction, Inc.
Cost	
Bussey Lake Dredging (dredge Bussey Lake, construct new moist soil unit #5, remove interior dikes)	
Construction Complete	October 1994
Contractor	J.F. Brennan Co., Inc.
Cost	$1,177,207
Bussey Lake Dredging Stage 1B (complete Bussey Lake dredging to Willow Island)	
Construction Complete	June 1996
Contractor	J.F. Brennan Co., Inc.
Cost	$820,102
Bussey Lake Stage 2 (install branch water supply line and install new water control structures)	
Construction Complete	November 1996
Contractor	Taylor Construction, Inc.
Cost	$654,624
Guttenberg Waterfowl Ponds Dike Breach (install overflow section)	

Construction Complete	October 1996
Contractor	Weymiller Marine, Inc.
Cost	
Total Project Cost	$3,921,000

Project Documents

Bussey Lake Definite Project Report/ Environmental Assessment	May 1990
Guttenberg Waterfowl Ponds Operation and Maintenance document	September 1997
Bussey Lake Operation and Maintenance document	September 1997
Bussey Lake Project Completion Report	September 2004
Guttenberg Waterfowl Ponds HREP Project Evaluation Report	Not complete.

INSPECTION PHOTOS

Project inspection photos below taken by Sharonne Baylor on May 5, 2010 unless otherwise noted. See Photo Reference Map for photo locations.


Guttenberg Ponds HREP
2010 Annual Inspection Report
Photo Reference
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
0
0.03
0.06
0.12 Miles
Prepared by Sharonne Baylor, July 2010
Upper Mississippi River National Wildlife and Fish Refuge
Background Imagery: FSA WI 2008

Photo 1: Outlet No. 1 looking southwest. Area 1 dewatered.

Photo 2: Outlet No. 1 walkway looking south. Area 1 dewatered. Yager behind structure.

Photo 3: Outlet No. 1, exterior outlet.

Photo 4: Outlet No. 2 looking northwest. Yager.

Photo 5: Outlet No. 2 walkway upper footing undermined.

Photo 6: Outlet No. 2 broken Plexiglas on gate well stem cover. Yager.

Photo 7: Outlet No. 2 exterior outlet, looking southwest.

Photo 8: Outlet No. 3, looking west. Area 1 dewatered.

Photo 9: Water supply line along spillway wall, looking towards spillway. Yager walking line.

Photo 10: Water supply line looking toward manhole. Losing support underneath this portion of pipe.

Photo 11: Water supply line, looking north from Area 1.

Photo 12: Water supply line, outlet into Area 1. Apron rusted and no longer on end of pipe.

Photo 13: Spillway looking west. Yager.

Photo 14: Area 1 northeast corner looking south. Water supply line outlet.

Photo 15: Area 1 northeast corner looking west.

Photo 16: Area 1 southeast corner looking west.

Photo 17: Area 1 southwest corner looking northwest.

Photo 18: Area 2 southeast corner looking north.

Photo 19: Area 1 southeast corner looking northwest.

Photo 20: Area 2 southeast side looking southwest.

Photo 21: Guttenberg Waterfowl Ponds aerial photo looking west. (US Army Corps of Engineers, October 2005)

AERIAL PHOTO AND PROJECT FEATURES


Guttenberg Ponds HREP
Project Features
Water Supply Line
Knife Gate Manhole
Water Supply Line
Junction Box
Lock and Dam No. 10 Embankment
Outlet No. 1
Outlet No. 3
Outlet No. 2
Area 1
Area 2
Legend
Structure
Water Supply Line
Spillway
Dike
0
0.035
0.07
0.14 Miles
Prepared by Sharonne Baylor, June 2009
Upper Mississippi River National Wildlife and Fish Refuge
Background Imagery - FSA WI 2008

HYDROGRAPHS