Final

US Army Corps
of Engineers
St. Paul District

UPPER MISSISSIPPI RIVER SYSTEM

ENVIRONMENTAL MANAGEMENT PROGRAM

DEFINITE PROJECT REPORT/ENVIRONMENTAL

ASSESSMENT (SP-5)

BUSSEY LAKE

HABITAT REHABILITATION

AND ENHANCEMENT PROJECT

POOL 10
UPPER MISSISSIPPI RIVER
CLAYTON COUNTY, IOWA

AUGUST 1990

BUSSEY LAKE

DEFINITE PROJECT REPORT/ENVIRONMENTAL ASSESSMENT (SP-5)

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INTRODUCTION

AUTHORITY

The authority for this report is provided by Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662). This report includes an integrated environmental assessment, preliminary Section 404(b)(1) evaluation, and draft Finding of No Significant Impact. The proposed project would be funded and constructed under this authorization. Section 1103 is summarized as follows:

Section 1103. UPPER MISSISSIPPI RIVER PLAN

(a)(1) This section may be cited as the Upper Mississippi River Management Act of 1986.

(2) To ensure the coordinated development and enhancement of the Upper Mississippi River system, it is hereby declared to be the intent of the Congress to recognize that system as a nationally significant ecosystem and a nationally significant commercial navigation system....The system shall be administered and regulated in recognition of its several purposes.

(e)(1) The Secretary, in consultation with the Secretary of the Interior and the states of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, is authorized to undertake, as identified in the Master Plan -

(A) a program for the planning, construction, and evaluation of measures for fish and wildlife habitat rehabilitation and enhancement....

A design memorandum (or implementation document) did not exist at the time of the enactment of Section 1103. Therefore, the North Central Division, U.S. Army Corps of Engineers, completed a "General Plan" for implementation of the Upper Mississippi River System - Environmental Management Program (UMRS-EMP) in January 1986. The U.S. Fish and Wildlife Service (USFWS), Region 3, and the five affected States (Illinois, Iowa, Minnesota, Missouri, and Wisconsin) participated through the Upper Mississippi River Basin Association. Programmatic updates of the General Plan for budget planning and policy development are accomplished through Annual Addendums.

Coordination with the States and the USFWS during the preparation of the General Plan and Annual Addendums led to an examination of the Comprehensive Master Plan for the Management of the Upper Mississippi River System. The Master Plan, completed by the Upper Mississippi River Basin Commission in 1981, was the basis of the recommendations enacted into law in Section 1103. The Master

Plan report and the General Plan identified examples of potential habitat rehabilitation and enhancement techniques. Consideration of the Federal interest and Federal policies has resulted in the conclusions below.

Project Eligibility Criteria -

a. (First Annual Addendum). The Master Plan report...and the authorizing legislation do not pose explicit constraints on the kinds of projects to be implemented under the UMRS-EMP. For habitat projects, the main eligibility criterion should be that a direct relationship should exist between the project and the central problem as defined by the Master Plan; i.e., the sedimentation of backwaters and side channels of the UMRS. Other criteria include geographic proximity to the river (for erosion control), other agency missions, and whether the condition is the result of deferred maintenance....

b. (Second Annual Addendum).

(1) The types of projects that are definitely within the realm of Corps of Engineers implementation authorities include the following:

- backwater dredging
- dike and levee construction
- island construction
- bank stabilization
- side channel openings/closures
- wing and closing dam modifications
- aeration and water control systems
- waterfowl nesting cover (as a complement to one of the other project types)
- acquisition of wildlife lands (for wetland restoration and protection) Note: By letter of 5 February 1988, the Office of the Chief of Engineers directed that such projects not be pursued.

(2) A number of innovative structural and nonstructural solutions that address human-induced impacts, particularly those related to navigation traffic and operation and maintenance of the navigation system, could result in significant long-term protection of UMRS habitat. Therefore, proposed projects which include such measures will not be categorically excluded from consideration, but the policy and technical feasibility of each of these measures will be investigated on a case-by-case basis and the measures will be recommended only after consideration of system-wide effects.

PROJECT SELECTION PROCESS

Projects are nominated for inclusion in the District's habitat program by the respective State natural resource agency or the U.S. Fish and Wildlife Service (USFWS) based on agency management objectives. To assist the District in the selection process, the States and USFWS agreed to utilize the expertise of the Fish and Wildlife Work Group (FWWG) of the Channel Maintenance Forum (CMF) to consider critical habitat needs along the Mississippi River and prioritize nominated projects on a biological basis. The FWWG consists of

biologists responsible for managing the river for their respective agency. Meetings were held on a regular basis to evaluate and rank the nominated projects according to the biological benefits that they could provide in relation to the habitat needs of the river system. The ranking was forwarded to the CMF for consideration of the broader policy perspectives of the agencies involved. The CMF submitted the coordinated ranking to the District and each agency officially notified the District of its views on the ranking. The District then formulated and submitted a program that is consistent with the overall program guidance as described in the UMRS-EMP General Plan and Annual Addendums and supplemental guidance provided by the North Central Division.

Projects consequently have been screened by biologists closely acquainted with the river. Resource needs and deficiencies have been considered on a pool-by-pool basis to ensure that regional needs are being met and that the best expertise available is being used to optimize the habitat benefits created at the most suitable locations. Through this process, the Bussey Lake project was recommended and supported as capable of providing significant habitat benefits.

Bussey Lake was identified by the Iowa Department of Natural Resources at the outset of the UMRS-EMP as their highest priority habitat project within the St. Paul District. After consideration of CMF recommended priorities, the public interest in the project, the value of the resource, and the opportunity for rehabilitation/enhancement, the Bussey Lake project was ranked 10th in a listing of the St. Paul District's top 20 projects. Based on that priority, funds were made available to begin study on the project in fiscal year 1987.

PARTICIPANTS AND COORDINATION

Participants in project planning included the Upper Mississippi River Wildlife and Fish Refuge and Region 3 Office of the U.S. Fish and Wildlife Service, the Iowa and Wisconsin Departments of Natural Resources (IDNR and WDNR), and the St. Paul District, Corps of Engineers. The U.S. Fish and Wildlife Service was a cooperating agency throughout the process as defined by regulations developed by the Council on Environmental Quality for the implementation of the National Environmental Policy Act (40 CFR 1500-1508). Meetings of the study participants were held at the project site and other locations to discuss project objectives and designs. During various stages of project development, coordination was supplemented by correspondence between the agencies. This Definite Project Report/Environmental Documentation has been sent to the agencies and interests listed in attachment 5.

PROJECT LOCATION

Bussey Lake is a backwater lake located in lower pool 10 of the Upper Mississippi River on the west (right descending) side of the river, approximately 1 to 2 miles upstream of lock and dam 10. The project area is within the Upper Mississippi River Wildlife and Fish Refuge and is located in Clayton County, Iowa. Immediately adjacent to the lake is the city of Guttenberg, Iowa. The next closest major city is Dubuque, Iowa, about 30 miles downstream (see plate 1 for a location map).

PROJECT SCOPE

The overall purpose of this project is rehabilitation, enhancement, and maintenance of diverse habitat for fish (primarily centrarchids, particularly bluegill) in Bussey Lake. The good fish habitat that was created after the lake level was raised by the construction of the lock and dam system in the 1930's has been gradually declining. The two primary and interrelated causal factors contributing to this decline are the deposition of sediment and the resulting excessive growth of aquatic plants in the shallower parts of the lake. A secondary problem within the lake system has been the potential for contamination of the lake with pesticides, herbicides, and nutrient input carried by runoff from the Buck Creek watershed. This drainage area overflows into the upstream end of Bussey Lake during high runoff periods.

This study focuses on proposed project features that will rehabilitate the deteriorating fish habitat within Bussey Lake and that will help preserve and protect this improved habitat. The project was planned for the benefit of the Upper Mississippi River fishery and will be consistent with refuge management goals and economic considerations.

FISH AND WILDLIFE MANAGEMENT GOALS AND OBJECTIVES

Fish and wildlife management goals and objectives for the area fall under those more broadly defined for the Upper Mississippi River Wildlife and Fish Refuge as a whole (Upper Mississippi River National Wildlife and Fish Refuge Environmental Impact Statement/Refuge Master Plan, 1987, U.S. Fish and Wildlife Service, Department of the Interior, North Central Regional Office, St. Paul, Minnesota). The management objective that most directly applies to the project area is:

Fisheries and Aquatic Resources

+ Maintain and enhance, in cooperation with the States, the habitat of fish and other aquatic life on the Upper Mississippi River.

Because the project area is within the Upper Mississippi River Wildlife and Fish Refuge, this management objective, together with additional input from State and Federal agency natural resource managers, was used to guide the development of specific project objectives (presented in a subsequent section of this report).

EXISTING CONDITIONS

PHYSICAL SETTING

Pool 10 is a part of the Upper Mississippi River navigation system and was created by the construction of lock and dam 10. The entire pool is 32.8 miles in length, extending from river mile (R.M.) 615.1 to 647.9. The river valley in this pool is generally 2 to 3 miles wide and is bordered on either side by weathered bluffs.

The Bussey Lake study area is in the extreme lower end of pool 10. It lies to the west of the navigation channel between R.M. 616.5 and 617.5. The main Iowa shoreline (and the city of Guttenberg) constitutes the western and

southwestern border of the lake. On the north, a causeway crosses from the mainland to a landmass known as Abel-Esmann Island. This road establishes the northern edge of the lake, separating it from a wetland area named Frenchtown Bottoms. Abel-Esmann Island forms the eastern shore of the lake, and the south end of the lake is open to the Mississippi River. (Plate 2 shows features of the study area.)

Immediately downstream of lock and dam 10 are three moist soil units known as the Guttenberg waterfowl ponds. The ponds are bordered by Cassville Slough on the east and Dead Slough on the west. Originally, the ponds were fish hatchery ponds. They ceased operation in the 1970's and were converted to moist soil units in 1989 under the EMP program.

RECREATION AND SOCIOECONOMIC RESOURCES

Agriculture is the dominant industry in the local surrounding area. Manufacturing, trade, and service industries are also of importance in the counties bordering the pool. Pool 10 is paralleled by primary and secondary highways for most of its length. These connect with highways leading laterally toward the pool area. Abel-Esmann Island has an extensive community of summer and year-round homes. The residences are primarily on the lakeward and riverward sides of the island, leaving the center of the island open. The south side of this open area was a grass runway airstrip. Immediately north of the airstrip are a series of three fields, their boundaries defined by dirt roads.

Pool 10 has 33 boat accesses with 47 launching lanes and 1,700 associated parking spaces. It also has 785 marina slips, 141 camping units, 212 picnicking units, and 73 miles of hiking trails. Within the pool are 15 dredged material disposal islands that are used as undeveloped recreation areas. Bussey Lake is a popular fishing site, especially for ice fishing. Adjacent to the lake is Bussey Lake Park. This 6-acre site provides picnic tables, parking, a vault toilet, a two-lane boat ramp, and two courtesy docks. Immediately downstream is Guttenberg Park which provides flush toilets, drinking water, picnic sites, parking, a fishing pier, and 4 to 6 docks open to the general public. A privately-owned marina containing about 195 slips is located within Guttenberg Park. In addition, a large number of private docks are located in the Bussey Lake area.

CULTURAL RESOURCES

According to Section 106 of the National Historic Preservation Act, as amended, the National Register of Historic Places has been consulted. As of 1 March 1989, there are no sites on or determined eligible for the Register in the immediate project area. Pool 10 is rich in archaeological and historic sites, however. Over 300 known sites in the pool have been located through limited surveys and test excavations. Most early surveys concentrated on locating and mapping mound groups, but recent surveys indicate a high potential for deeply stratified archaeological deposits (such as the FTD site) beneath the alluvial soils on the floodplain.

Twelve historic sites are within a 2-mile radius of the project area and sixteen archaeological sites are within a one-half mile radius of the project area. Three of the sites are on Abel-Esmann Island. These three sites are

all mound groups called Harveys Island Mound Group 1, 2, and 3. Mound group 1 consisted of thirty-six conical mounds, one effigy, one compound and two linear mounds. Mound groups 2 and 3 consisted of eight and five conical mounds, respectively. Most of the mounds have been plowed, and surface indications are now obscure.

There are four known and recorded archaeological sites in the vicinity of the Guttenberg waterfowl ponds disposal area. All four sites are historic and include homesteads and a shell button blank factory site. These sites were located during a survey of pool 11 done for the Rock Island District in 1984 by the Great Lakes Archaeological Research Center.

WATER RESOURCES

The main river channel, lock and dam 10, the Iowa shore, the causeway, and Abel-Esmann Island encircle the 390-acre area that includes the Bussey Lake study area and the open water area south to lock and dam 10. Focusing on Bussey Lake alone, it currently has a surface area of approximately 213 acres at normal pool elevation. The Brown surveys of the 1930's indicate that the lake bed was farmland and marsh prior to inundation. Then, as now, the land gradually sloped southward away from the Buck Creek delta area which is just upstream of the present Abel-Esmann Island causeway. Construction of lock and dam 10 was completed in 1937. The structure maintains a water elevation for pool 10 of 611 feet (National Geodetic Vertical Datum (NGVD), 1912 adjustment (adj.)) until a discharge of 42,000 cubic feet per second (cfs) is exceeded. Based on this pool elevation, water depths in the lake were approximately 6 feet near the downstream end of Abel-Esmann Island immediately following construction of the lock and dam system. Currently, the downstream part of the lake is about 3 to 4 feet deep, depending upon the pool elevation. Table 1 shows water depths versus surface acreage for the lake in 1937 and 1987. (See plate 6 for a contour map for these same dates.)

Table 1 - Bussey Lake Water Depths Versus Surface Area

Water Depths (ft)	Surface Area			
	1937 Acres	Cumulative Percentage	1987 Acres	Cumulative Percentage
< 1	12	6	43	20
1-2	20	15	26	32
2-3	36	32	26	45
3-4	30	46	57	71
4-5	42	66	61	100
5-6	59	93	0	
> 6	14	100	0	
Total	213		213	

Note: This is using the low control pool elevation of 611.0.

As can be seen from table 1, in 1937 115 acres, or 54 percent, of Bussey Lake was deeper than 4 feet. By 1987, the area deeper than 4 feet had been reduced to only 61 acres, or 29 percent of the lake. Conversely, the acreage

of very shallow water (less than 2 feet) increased from 32 to 69 acres (15 percent to 32 percent).

There are a number of water resources in the area which influence Bussey Lake. These include the Mississippi River pool 10, Frenchtown Bottoms, and Buck Creek.

Like the rest of the Upper Mississippi River, the project area experiences annual high water which occurs most frequently in March and April. The primary source of floodwaters is spring snowmelt combined with the increased precipitation that can occur during these months. Floodwaters typically enter Bussey Lake concurrently from the north, through the causeway via a 6-foot-diameter culvert, and through backwater flow into the lake from the main channel on the south. The top elevation of the road leading to Abel-Esmann Island is 620.3 feet mean sea level (msl), which is about equivalent to a 6.3-percent exceedence frequency (16-year) flood event. To date, this road has been overtopped only twice, in the spring of 1965 and again in 1969.

Immediately upstream of Bussey Lake, north of the Abel-Esmann Island causeway, is Frenchtown Bottoms. This is a wetland area that opens up on its northern end into Frenchtown Lake, also a backwater of the Mississippi River. Without the presence of the causeway, the southern portion of the Frenchtown Bottoms wetland would be part of Bussey Lake. (About 4 acres of wet meadow north of the causeway appears to have been cut off from the main portion of Bussey Lake.) The aforementioned 6-foot-diameter culvert through the causeway periodically connects Frenchtown Bottoms and Bussey Lake. The invert of this culvert is set at elevation 610 feet (NGVD, 1912 adj.). Water from the Mississippi River flows, via Frenchtown Bottoms, through the culvert into the Bussey Lake area in most years.

Buck Creek is a tributary of the Mississippi River immediately upstream of Bussey Lake. The drainage area of this watershed is approximately 35 square miles. The creek originates in the uplands west of the Mississippi River, flows through agricultural land on the bluffs, then descends rapidly into the river valley. Low flow from Buck Creek drains north through Frenchtown Bottoms and then into Frenchtown Lake. Major floods on Buck Creek can result in discharges to Bussey Lake through the causeway culvert. See appendix A (attachment 7) for a detailed discussion.

The daily operation of lock and dam 10 can cause water to surge into and out of Bussey Lake. This is due to the relative proximity of the lake to the dam in relation to the rest of pool 10. Any change in the water level at lock and dam 10, necessary for water regulation in pool 10, has an almost immediate effect on water elevations in Bussey Lake. Fluctuations that result from operations at the dam can cause daily variations of as much as one-half foot in the water levels in the lake.

Within Bussey Lake itself, the only additional feature of note is a spring located on the western shore of the lake midway between the southern end of the lake (opposite the tip of Abel-Esmann Island) and the causeway. Spring-fed waters typically have stable water temperatures year-round and are able to hold more dissolved oxygen in the summer.

GEOLOGY AND SOILS

Geology - The most significant geological event explaining the nature of the Mississippi River within pool 10 occurred at the end of the Pleistocene glaciation approximately 10,000 years ago. Tremendous volumes of glacial meltwater, primarily from the Red River Valley's glacial Lake Agassiz, eroded the preglacial Minnesota and Mississippi River valleys. As meltwaters diminished, the deeply eroded river valleys aggraded substantially to about the present levels. Since post-glacial times, a braided stream environment has dominated this reach of the Mississippi River, due to the river's low gradient and oversupply of sediment from its tributaries. Prior to the impoundment of pool 10 in 1937, the broad floodplain of the river was characterized by this braided stream system that consisted of swampy depressions, sloughs, natural levees, islands, and shallow lakes. Since impoundment, a relatively thin veneer of silts, clays, or sands has been deposited over most of the river bottom within the pool.

Soils - The 1937 topography presented on plate 6 shows a narrow spit between the southern tip of Abel-Esmann Island and the mainland at Guttenberg. The area of Bussey Lake to the west and north of this spit was as much as 6 feet lower than the spit, resulting in a marshy backwater character.

The available soil boring information within the Bussey Lake project area includes the logs of several borings obtained in 1967 for the Guttenberg flood control project. The locations of these borings and the associated logs are shown on plate 7. Borings MR-1, 2, and 3, within the southwestern portion of the lake, indicate the presence of a thick upper clay layer that extends to depths greater than 15 feet below the normal level of pool 10, which is elevation 611 feet (NGVD, 1912 adj.).

A vertical soil sample was obtained by the Iowa Department of Natural Resources on May 11, 1988 by driving a 2-inch polyvinyl chloride (PVC) pipe 4 feet into the lake bottom near the mouth of the spring along the west side of Bussey Lake (see plate 6 for location of the spring). The pipe sample was sent to the Corps, cut open, and visually classified by a Corps geologist. This visual classification indicated approximately 2 feet of black organic silt and clay (15 to 25 percent estimated organic content) overlying a gray silty clay containing about 5 percent plant matter.

Four shallow core samples (2.5 feet deep) were also obtained in 1988 along the northwest, north, and east sides of the lake. The locations of the samples are shown on plate A-9, and gradation curves for the total samples are shown on plate A-8. These samples indicate primarily silt and clay on the northwest side of the lake, while the samples on the east and north sides of the lake indicate significant percentages of sand and some gravel in the upper bottom sediments.

Sedimentation - Sediment can enter Bussey Lake from two sources: (1) from the north through the culvert in the causeway, depositing in the vicinity

of the culvert and along Abel-Esmann Island; and (2) from the south when suspended material from the Mississippi River enters the open southern end of the lake, depositing primarily at the lower end of Abel-Esmann Island.

Sediment inflow from the north can be attributed to high water flows from both Buck Creek and the Mississippi River. Although the source of sediment that enters from the south is obvious, the predominant means by which sediment enters from the south is much more difficult to assess. There are several mechanisms by which suspended solids could enter from this direction. These include rising lake elevations due to wind set-up or increasing river discharges; wind induced circulation; and eddy effects (i.e., from circulation patterns, caused by river water flowing around the tip of Abel-Esmann Island and into Bussey Lake.) A cursory analysis of the effect of fluctuations in stage on sedimentation in Bussey Lake indicated that, depending upon the assumptions on sediment deposition, less than 15 percent could be attributed to this source. It was also felt that wind set-up would have even less effect than changes in river discharges. Evaluation of the other two methods of introducing sediment into Bussey Lake is difficult and beyond the scope of this study effort. However, it appears that the eddy effect could be the major mechanism by which sediment enters the lake area.

Although sediment load from main river flow around the end of Abel-Esmann Island cannot be quantified at this time, field observations from local residents indicate that in years past this flow pattern extended north along the Iowa mainland shoreline, returning to the river along Abel-Esmann Island. This type of eddy effect has not been noticed in recent years. In 1973, the 9-foot navigation channel in this area was dredged. The material was deposited on a shallow area downstream of the natural spit, forming a visible island, locally called "Willow Island." Prior to this action, depths in this shallow area where the dredged material was placed were approximately 2 to 3 feet. Placement of dredged material on Willow Island in the 1970's probably has interfered with the previously observed circulation pattern. Therefore, at the present time, it is felt that current sedimentation rates in the lake may be lower than what may have occurred prior to the time the island was created.

Based on the available historic information, sedimentation rates within the lake vary. Comparing bathymetric data obtained in 1987 and the original flowage easement surveys taken in the 1930's, the average sedimentation rate for the entire lake was calculated to be 0.31 inch per year. The greatest accumulation of sediment can be found at the downstream end of Bussey Lake where the deposition rate was 0.46 inch per year. This rate decreases as one moves northward, with most of the upper half of the lake having a local deposition rate of 0.23 inch per year. Delta formation near the culvert due to inputs from Buck Creek and the Mississippi River again increases this deposition rate.

Sediment Analysis - Sediment samples were taken at potential dredge sites and tested for the presence of heavy metals, chlorinated hydrocarbons, total available cyanide, ammonia nitrogen, total solids, volatile solids, total organic carbon, percent moisture, and particle size. The results are summarized in the attached Section 404(b)(1) evaluation (attachment 3) and are discussed in the environmental effects section below. Values were low or below detection levels for all chemical parameters tested.

NATURAL RESOURCES

Habitat Types and Distribution

The lower 5 miles of pool 10 include a variety of open water areas, backwater vegetation beds, floodplain forests, sloughs and side channels, as well as the main channel itself. Bussey Lake, Frenchtown Bottoms, and Frenchtown Lake are found along the right descending bank. An assemblage of islands and sloughs is found along the left bank. The main channel meanders down the center of the pool, with branching side channels that weave around islands and vegetation beds.

Habitat classifications were developed for the GREAT (Great River Environmental Action Team) I Environmental Study based on 1973 aerial photography and are used here to describe the habitat types present. About 20 percent of the lower 5 miles of pool 10 is vegetated in lowland hardwood forest. Species present include elm (Ulmus americana), silver maple Acer saccharinum), and river birch (Betula nigra). Backwaters comprise about 40 percent of the lower pool 10 area. The backwaters include a wide variety of emergent and submergent vegetation communities. The Frenchtown Bottoms area contains a rich assemblage of plant communities, including cottonwood (Populus deltoides) and mixed lowland hardwood species larger than 20 feet in height; stands of willow (Salix sp.); pockets of arrowhead (Sagittaria latifolia); and sedge meadows (Carex sp.) along Buck Creek.

Bussey Lake is characterized as having five habitat types that would be affected by the project: slightly deeper open water and four types of plant communities in the vegetated shallows. The last four habitat types present in the lake are classified based on dominant vegetation present: (1) arrowhead (Sagittaria latifolia); (2) water lilies (Nymphaea sp.); (3) a combination of water lilies, pondweeds (Potamogeton sp.), duckweed (Lemnaceae), and coontail (Ceratophyllum demersum); and (4) a combination of wild celery (Valisneria canadensis), pondweeds, and mud plantain (Heteranthera dubia). The arrowhead and water lilies are found in the shallower portions of the lake nearest the causeway, while the other two groups are found in the more open areas of the lake. Based upon August 1989 aerial photography, emergent and submergent aquatic plant growth covers about 90 percent of Bussey Lake in the summer.

Near the southern tip of Abel-Esmann Island, where the lake opens to the main channel, an expanse of water borders the city of Guttenberg immediately above lock and dam 10. This open, off-channel area is somewhat deeper than Bussey Lake and is not as densely vegetated. It is separated from the rest of pool 10 by the main channel. An area south of the natural spit and old road which led from the southern tip of Abel-Esmann Island to the Iowa mainland was dredged in the early 1970's in order to supply fill material for a flood control project for the city of Guttenberg. In 1985, a portion of the open, off-channel area was dredged near the Iowa shore to provide boat access. The dredge cut extended to the public boat landing in Bussey Lake.

The spring that enters Bussey Lake on the west adds to the habitat diversity of the lake. The effects of this particular spring on the dynamics of Bussey Lake are not known. However, springs do provide stable water temperatures throughout the year. The spring water temperatures are relatively cooler than summer water temperatures, and warmer than winter water temperatures near the spring. The groundwater does not necessarily enter the

lake well-oxygenated, but, because of its relatively cooler temperatures, can hold more dissolved oxygen in the summer. Besides having the potential to hold more oxygen, temperature in and of itself is a resource for fish. Magnuson (1979) indicated that in cases where temperature is not considered a limiting factor for fish, it remains an important resource that fish compete for. In Bussey Lake, there are few bathymetric changes that would provide areas with different water temperatures.

Fish and Wildlife

Bussey Lake supports fish populations typical of many backwater lakes on the Upper Mississippi River; i.e., it is dominated by centrarchids with a wide variety of other species also present. Because of the physical boundaries surrounding Bussey Lake in the form of landmasses and the main channel, it is likely Bussey Lake and the off-channel area south of the lake function as a single distinct habitat unit for backwater species such as bluegill, largemouth bass (Micropterus salmoides), and bullheads (Ictalurus spp.). No appreciable interchange with the backwater fish populations on the Wisconsin side of the main channel would be expected because of distance and the current barrier presented by the main channel. Bussey Lake is readily accessible to the main channel, and fish such as freshwater drum (Aplodinotus grunniens), redhorse (Moxostoma spp.), and walleye (Stizostedion vitreum vitreum) can occasionally be found in the lake.

Based on sampling conducted by the Iowa Department of Natural Resources during the summer of 1988, it appears that the summer fish population is dominated by bluegill. It is suspected that high water temperatures and dissolved oxygen sags force species such as black crappie (Pomoxis nigromaculatus), northern pike (Esox lucius), and largemouth bass to seek better habitat conditions in the area south of Bussey Lake and in the main channel border. Dissolved oxygen sampling in July 1989 showed the presence of diurnal dissolved oxygen sags, likely caused by aquatic plant respiration. This is discussed further under "Existing Habitat Deficiencies."

Bussey Lake is used by the Iowa Department of Natural Resources as a site for collecting northern pike brood stock in the spring, as the upper end of the lake provides ideal spawning habitat for this species.

Bussey Lake is important winter habitat for panfish. A good indicator is the popularity of this area for ice fishing. Creel census and IDNR observations show that bluegill is the predominant species. Anglers also take some black crappie, northern pike, and largemouth bass. Wintering bluegill have been found progressively nearer the mouth of Bussey Lake over the past 10 years, indicating a decline in suitable wintering habitat in the northern portions of the lake. This condition is likely caused by the continued shallowing of the northern portion of the lake and reduced dissolved oxygen (DO) caused by decomposing aquatic vegetation. Winter habitat conditions are discussed further under "Existing Habitat Deficiencies."

Diving and dabbling ducks use Bussey Lake and the adjacent Frenchtown Bottoms area. A variety of birds use the Bussey Lake-Frenchtown Bottoms area during migration. Bald eagles (Haliaeetus leucocephalus) overwinter in the area, and a number of species of songbirds nest in Frenchtown Bottoms. Muskrat (Ondatra zibethicus) and beaver (Castor canadensis) are found on Bussey Lake as are otter (Lutra canadensis). Other wildlife present include

white-tailed deer (Odocoileus virginianus), raccoon (Procyon lotor), skunk (Mephitis mephitis), and other small mammals.

Threatened and Endangered Species

The U.S. Fish and Wildlife Service has been contacted regarding threatened and endangered species that could be found within the project area. It was noted that five threatened or endangered species can be present in Clayton County, Iowa: the peregrine falcon (Falco peregrinus), bald eagle, Iowa Pleistocene snail (Discus macclintocki), and the Higgins' eye pearly mussel (Lampsilis higginsi), all endangered, as well as the northern monkshood (Aconitum noveboracense), a threatened species. There is no critical habitat for these species within the project area.

The Iowa Pleistocene snail and the northern monkshood, a plant, are found on talus slopes, a type of habitat that is not found in the project area. It is extremely unlikely that there would be Higgins' eye pearly mussels in the lake due to its soft substrates. There are no bald eagle nests in Frenchtown Bottoms, but there is an active bald eagle nest approximately one-half mile from the study area on the Iowa side of the river. Bald eagles are known to winter along the Upper Mississippi River in floodplain forests, including those near the project area. While there are no peregrine falcon hacking platforms or known nesting areas on the bluff overlooking the project area, there have been increasing efforts to reestablish populations of this species along the Upper Mississippi River.

FUTURE WITHOUT PROJECT CONDITIONS

HISTORICALLY DOCUMENTED CHANGES IN HABITAT

The primary documented changes in Bussey Lake over time are a decrease in water depth and an increase in the expanse and density of aquatic plants.

Bathymetric data collected in 1987 and compared to preinundation surveys (1937) show a decrease in the water depths in the lake, confirming observations by the Iowa Department of Natural Resources and local citizens. The acreage of shallow water has substantially increased such that over 30 percent of the lake is less than 2 feet deep and over 70 percent of the lake is less than 4 feet deep. Deeper open water habitat is currently found only at the downstream end of Bussey Lake.

Plant growth in the lake has increased from a coverage of 75 percent of the lake surface in 1973 (August 1973 aerial photography) to about 90 percent in 1989 (August 1989 aerial photography). The plant communities that contained emergent species such as arrowhead and water lilies have expanded their range in the lake, and the submerged and floating species have begun to more vigorously occupy areas that were previously deeper open water. It has been observed in Bussey Lake that, as the aquatic plant beds have become well established, plant densities have increased.

No historic data is available to document the effect sedimentation and increased aquatic plant growth have had on other habitat parameters over time.

Fish kills have been noted in Bussey Lake. Two confirmed kills occurred in 1974 and 1975. Dead fish were found throughout Buck Creek and along the

west shore of Abel-Esmann Island. It is theorized that these kills were the result of pesticide runoff, as they occurred soon after corn planting followed by a soaking rain. Unconfirmed kills occurred in the summers of 1987 and 1988, and are thought to be related to high water temperature and low dissolved oxygen concentrations. These confirmed and unconfirmed kills indicate that the potential for fish kills exists in Bussey Lake.

FACTORS INFLUENCING HABITAT CHANGE

The most significant factor influencing habitat change in Bussey Lake is sedimentation, a problem that is widespread on the Upper Mississippi River. As discussed in previous sections, sediment enters Bussey Lake from the Mississippi River from both the north and the south and from Buck Creek to the north, with the river the primary source. Based on data gathered, sedimentation rates over the last 50 years would average out to about 0.31 inch per year. However, analysis indicates that formation of Willow Island south of Abel-Esmann Island, through the placement of dredged material, appears to have influenced flow patterns within Bussey Lake. Due to this changed condition, the sedimentation rate in Bussey Lake is likely to be somewhat less than was exhibited during the 1937-1987 period.

Shallower water allows aquatic plants to receive more light which stimulates growth. Decreases in water depth and increases in the growth and density of aquatic plants are interrelated and synergystic. Denser beds of plants provide quiescent areas where fine sediments are more readily deposited. Bathymetric diversity is further reduced with the redistribution of sediment in the spring by wave action in shallow areas before vegetation becomes well established.

Another factor contributing to the increased plant growth may be the general increase in fertilizer use in agriculture over the last few decades. The Upper Mississippi River drains a large watershed, portions of which are intensively farmed. This has probably resulted in increased nutrient availability for aquatic plants as compared to the earlier years of Bussey Lake's existence.

The increasingly dense beds of vegetation have resulted in denser cover for bluegill and other fish in Bussey Lake. An excess of vegetation results in changes in the structural habitat available to fish and their prey and in changes in water chemistry, particularly dissolved oxygen concentrations. This is discussed further under "Existing Habitat Deficiencies" and "Estimated Future Habitat Conditions."

A 6-foot-diameter culvert was placed in the causeway to convey high Mississippi River flows and high flows on Buck Creek from the Frenchtown Bottoms side of the causeway. Its presence creates the potential for pesticide and herbicide spills to enter Bussey Lake directly from Buck Creek.

EXISTING HABITAT DEFICIENCIES

Habitat deficiencies must be viewed in the context of the desired conditions or management goals for a particular area. What may be viewed as a deficiency for one species may be excellent habitat for another. The stated goal of the project is to maintain, and improve if possible, habitat

conditions for a variety of fish species. Because the bluegill is the most abundant and popular sport fish in Bussey Lake, the discussion of habitat deficiencies is focused on this species. Many of the habitat deficiencies discussed below for the bluegill would also apply to other fish species.

In general, optimal riverine bluegill habitat (Stuber, et. al., 1982) includes low velocity or lentic waters with greater than 20 percent littoral area. Deeper water areas are required for overwintering and as a retreat from summer heat. Dissolved oxygen requirements are similar to those for most warmwater species in that concentrations greater than 5 milligrams per liter (mg/l) are considered optimal, while levels below 1 mg/l are likely to be lethal. Bluegill are generally tolerant of slightly higher water temperatures than other common backwater sport fish such as black crappie, northern pike, and largemouth bass. Juveniles and small adults use submerged logs and vegetation as cover, but excessive abundance of vegetation can inhibit bluegill use of prey as well as use of bluegill as prey by other species. Bluegill are opportunistic feeders and can alter their diet depending on the availability of food. Fry feed primarily on zooplankton and small insects, while juveniles and adults add aquatic and terrestrial insects as well as some plant materials to their diet. Bluegill are repeat spawners and can spawn over almost any substrate, although fine gravel or sand is preferred. Spawning season can extend from spring through summer, starting when water temperatures are about 19 degrees C, and peaking in the 24 to 27 degree C range.

Reproduction and food are not believed to be limiting factors in Bussey Lake. Adequate spawning habitat is available in the lake, and high water fertility and the abundant aquatic plant growth should provide for sufficient food resources.

The limiting factors (habitat deficiencies) in Bussey Lake for bluegill, and most other species of fish, are the lack of deep water for thermal refuge, excessive shallow water cover in the form of aquatic vegetation, summer dissolved oxygen depletion, and lack of habitat diversity. At present, winter dissolved oxygen does not appear limiting.

The lack of deep water for a thermal refuge forces fish to leave Bussey Lake when summer temperatures get too high. This is evidenced by many of the more thermally intolerant species being absent from the IDNR fish collections during the summer of 1988. Lack of a thermal refuge can even affect the larger bluegills as they generally are less tolerant of high water temperatures than smaller bluegills.

The excessive aquatic vegetation provides cover for small bluegills and other small forage fish. However, too much cover can result in reduced productivity because predator fish cannot adequately prey on the small bluegills, resulting in reduced growth rates for both the prey and the predator. This condition has not been documented for Bussey Lake, but it is likely occurring to some degree because of the extent and density of the aquatic vegetation present.

Monitoring of diurnal dissolved oxygen changes in Bussey Lake on 20 and 21 July 1989 (plates 3a to 3d) showed DO levels in the early morning dropping to 1 to 2 mg/l. Given the aquatic plant growth present in Bussey Lake in midsummer, this condition was not unexpected. This does indicate that summer

dissolved oxygen sags due to plant respiration are probably having an effect on the ability of fish to use parts of the lake at certain times.

Bussey Lake lacks habitat diversity, as sedimentation and the movement of sediments by wave action have eliminated most bathymetric diversity, and the increased growth of aquatic vegetation has eliminated much of the open water - vegetation edge in the lake.

ESTIMATED FUTURE HABITAT CONDITIONS

As discussed in the Water Resources section and appendix A, water depths have decreased since preinundation as a result of sedimentation from the Mississippi River and Buck Creek. At present, about 30 percent of Bussey Lake is less than 2 feet deep. Another 30 percent of the lake is 2 to 4 feet deep. The continuation of this sedimentation trend over the next 50 years will cause the lake to become even more shallow. Because future sedimentation rates in Bussey Lake cannot be predicted in other than general trends, it is not possible to quantitatively predict what the future effects of sedimentation on Bussey Lake will be.

The five habitat types in Bussey Lake were described in the Habitat Types and Distribution section above. These included four different plant communities in the vegetated shallows and deeper open water habitat near the main channel. As Bussey Lake becomes shallower, the habitat types described earlier will progress to include fewer and fewer acres of submergent plants, with nearly all areas converting to emergent plants typical of a shallow marsh or lacustrine emergent type of wetland. Indeed, in 50 years, much of Bussey Lake may resemble a marsh more than a lake, with the only remaining open water at the lower end and in some western portions of the lake where sedimentation rates appear to be the lowest. Some of the shallower areas in the upper end of the lake will probably be invaded by woody vegetation.

Summer conditions for bluegill and other fish habitat will become progressively worse as the lake shallows. Aquatic plant growth will continue to expand with emergent aquatic growth progressing farther down the lake. At some time within the next 50 years, Bussey Lake will likely cease to be considered a summer fishery resource. The lake (or wetland) will still probably provide some habitat value as a spawning area for northern pike and as habitat for species tolerant of these conditions such as bullhead, carp (Cyprinus carpio), and bowfin (Amia calva).

Summer fish kills will probably not become a real problem since fish will still be able to leave the area when DO levels drop too low. The episodes of low summer DO conditions will continue to increase, reducing the time the lake will be able to provide usable habitat for bluegill and other sport fish.

It is more difficult to predict what will become of the winter fishery since less is known about the winter habitat preferences of bluegills. The limited current winter dissolved oxygen data for Bussey Lake (plates 4 and 5) coupled with Iowa DNR observations indicates that winter dissolved oxygen depletion is not a major problem at this time. However, as shown by the March 21, 1989 data, localized areas of the lake do suffer winter dissolved oxygen sags. This condition is likely to occur more frequently in the future. It is likely that the wintering area for the bluegill will continue to move southward, as evidenced by the trend over the last 10 years. At some point,

the bluegills will likely run out of suitable wintering habitat and this will become another limiting factor on the population.

The potential for fish kills in the lake due to pesticides or herbicides will continue to exist without changes in land management practices upstream or without control of the flows entering Bussey Lake from Buck Creek. While eventually there would be few, if any, fish in the lake year-round due to the shallow depths, the contaminants could still pass through the culvert and move along the shore of Abel-Esmann Island to deeper areas that might remain along the right descending bank of the main channel.

PLANNING OPPORTUNITIES

Existing and future characteristics of the project area were considered during design of the project alternatives at Bussey Lake. Whenever possible, project features utilize these conditions to provide the best habitat improvements while minimizing project expenses.

One of the most important planning opportunities at Bussey Lake is the opportunity to rehabilitate a backwater lake that has no current, a physical attribute that makes it highly desirable for fish. Bussey Lake is naturally protected from Upper Mississippi River currents except during the larger flood events. The lack of current is important for most backwater species, such as bluegill and largemouth bass, and can be important for channel species during certain times of the year.

The spring that flows into Bussey Lake is an important asset to the lake. Fish utilize temperature as a resource and are attracted to this spring which maintains a constant temperature in relation to the water around it. The spring-fed area has the potential for holding higher concentrations of dissolved oxygen when summer water temperatures in the rest of the lake increase. It can also provide warmer water refuge during winter months, if it is deep enough for fish to use. Efforts were made to incorporate this locale into project design by ensuring its accessibility to fish throughout the 50-year project life.

Attempts to control the inflow of water through the causeway culvert were approached by looking at the management needs of Frenchtown Bottoms as well as Bussey Lake. Although Buck Creek usually does not flow in this southerly direction into Bussey Lake, when it does or when the Mississippi River is elevated, the control of water at the causeway could provide additional wildlife benefits. Past experience has shown that the wetland area north of the causeway attracted waterfowl when it was flooded due to a beaver-caused plug in the culvert.

PLANNING CONSTRAINTS

Bussey Lake is part of the Upper Mississippi River Wildlife and Fish Refuge. The Refuge Master Plan includes a fishery rehabilitation project in Bussey Lake. The proposed project does not conflict with the goals of the Master Plan. The Upper Mississippi River Land Use Allocation Plan Map prepared by the St. Paul District, Corps of Engineers shows that the immediate area surrounding Bussey Lake is owned by the Corps and managed by the U.S. Fish and Wildlife Service. Moving counterclockwise around the lake, the land

use allocation varies in the following manner: the shore of Abel-Esmann Island is designated for low intensity recreation, the land bordering the causeway on the north and most of the west (Iowa mainland) is for wildlife management, and the southwestern portion of the Iowa mainland is for high intensity recreation.

This project has a number of hydrologic constraints. Controlling flow through the Abel-Esmann Island causeway culvert would have to be carefully assessed during the design phase to ensure that there would be no adverse effect on Frenchtown Bottoms through an increase in sedimentation. Impoundment of water north of the causeway while the control structure is closed cannot adversely affect the roadway itself or significantly alter existing water surface elevations.

Finding sufficient space for dredged material is critical for this project. High bluffs rise almost immediately from the valley floor along the west side of the lake. Much of the available land between the bluffs and the water is developed, with scattered pockets of undeveloped land or wetland. Because of the limited number of available dredged material disposal sites, reduced dredged material quantities may need to be considered.

Other restraints relate to habitat requirements. While deeper water habitat is important, ingress and egress to existing deeper areas must be maintained during the winter. Without this accessibility, fish could congregate in isolated deep pockets and rapidly use the available dissolved oxygen. In the fall, rough fish in the lake leave for deeper waters before the game fish, reducing the competition for overwintering habitat. To provide accessible winter habitat, without attracting rough fish, dredging should remain constant or include gradual depth changes and should not be so deep as to induce rough fish to remain. However, plant growth must also be considered. To reduce plant growth, dredge cuts should be below the depth to which light penetrates.

In the final stages of project development, the Guttenberg waterfowl ponds were identified as a potential material placement site. Once this occurred, a further constraint was added. If this area was used as a disposal site, this use could not conflict with the management goals of the refuge.

PROJECT OBJECTIVES

From the onset of this study, the project proponent highlighted the need for habitat improvement in support of fish. As the planning process proceeded and the study team focused on available resources and existing conditions, this need was confirmed. (This conclusion is fully explained in the previous "Future Without Project" section. Included in this section is a detailed discussion of the selection of bluegill as the target species to which the project objectives would be tailored.) Other potential objectives involving aquatic resources were not considered due to lack of an identified problem and support from the proponent agency.

As stated previously, an identified objective of the Upper Mississippi River National Wildlife and Fish Refuge at Bussey Lake was rehabilitation of the fishery in the lake. Specific project objectives which evolved are directly related to these refuge objectives and reflect the results of

coordinated planning by the Fish and Wildlife Service, the Iowa Department of Natural Resources, and the Corps of Engineers.

The goal of this project is to rehabilitate and improve the fishery habitat in Bussey Lake, primarily through the reestablishment of habitat diversity in the lake. Habitat diversity can be increased in the lake by (1) reducing aquatic plant cover in the lake and increasing the amount of vegetative/nonvegetative edge, (2) increasing the variety of water depths in the lake, and (3) increasing the diversity of substrate types in the lake.

The following general objectives were developed to assist in planning and design of the project. It is difficult to ascertain the amount of dredging needed to provide optimum fish habitat diversity in Bussey Lake. Cost and the large amount of dredged material that would have to be disposed of add to the problem. In light of this, the goal is to create the maximum amount of habitat diversity in Bussey Lake as is practicable by trying to incorporate the features shown below.

a. Open areas in the aquatic vegetation should maximize the amount of edge created in the most cost effective manner. Based on the recommendations of the Iowa Department of Natural Resources, a minimum width of 75 feet is considered necessary for any area cleared of aquatic vegetation to insure that both sides of the dredge cut function as independent "edge" habitats throughout the project life.

b. Areas deepened to provide open areas with little to no aquatic plant growth should be deepened sufficiently to stay relatively free of aquatic plant growth over the project life.

c. The thermal attractant provided by the spring on the west side of Bussey Lake should be used in the design of habitat modifications. The purpose is to create an area of deeper water that will be somewhat cooler in the summer and/or warmer in the winter for use by fish. This area is currently too shallow to provide sufficient cover for fish seeking to use this thermal resource.

In addition to the above features, maximum reduction of sedimentation within Bussey Lake was a prime project goal. Given the possibility that input from the southern end of the lake has decreased in recent years, at a minimum the project should be designed to:

o Eliminate high water flows into Bussey Lake from Buck Creek, thereby reducing the potential for fish kills from pesticides and reducing suspended sediment load and turbidity at the north end of the lake.

PLAN FORMULATION

The principal purpose of plan formulation is to develop a plan that would provide the best use, or combination of uses, of water and land resources to meet the project objectives. Features that would help alleviate the identified problem sources of sedimentation and excessive aquatic plant growth were incorporated, where possible.

ALTERNATIVES CONSIDERED

The alternatives considered for habitat rehabilitation and enhancement at Bussey Lake included the no action alternative, a control structure at the upper end of the lake, and various dredging alternatives. No other practicable alternatives for Bussey Lake were identified during the planning process.

No Action

With this alternative, no project would be implemented using Federal funds. Specific details of future conditions with no action have been described in previous sections; therefore, they will not be reiterated in this section. (In particular, refer to the "Estimated Future Habitat Types and Distribution" section.)

Sediment Control

Available methods of controlling future sedimentation and the introduction of pesticides and herbicides were evaluated. As stated previously, sediment can enter Bussey Lake from the north through the culvert in the causeway and from the south when suspended material from the Mississippi River enters the open southern end of the lake. Long-term control would require reducing sediment at its source.

Construction of a control structure at the culvert through the causeway on the lake's north shore would reduce the sediment and nutrient load from Buck Creek into Bussey Lake. Closure of this flow source would reduce turbidity in the lake and would serve to prevent pesticide and herbicide inflows from this watershed.

The ability to control sediment entrance from the south was investigated. In addition to the presence of Willow Island, a structural solution that could further help reduce the sediment input from the south would be construction of a barrier across the southern open end of Bussey Lake. This proposal has been rejected, because without a concurrent significant reduction in the aquatic plant problem in the lake, conditions could worsen upstream of the structure. Greater duckweed problems could be present, because this vegetation would not be blown out of the lake as it has been in past years. Presently, wind generated wave action helps disrupt rooted aquatic plant growth. A barrier would break up these waves, requiring them to reform. The reduced wave force would allow even more plants to thrive. This potential worsening of aquatic plant conditions with a barrier in place, coupled with indications that the circulation patterns or "eddy effect" (previously described in the Sedimentation section) in Bussey Lake have not been observed of late (therefore, less flow with its sediment load may be entering the lake), led to the conclusion that pursuit of a structural solution to control sediment from the south was not advisable at this time.

Dredging

The dredging of deeper sections in the lake would improve fish habitat diversity by increasing the amount of nonvegetated habitat, increase the amount of edge habitat, increase bathymetric diversity, and possibly increase substrate diversity in Bussey Lake. In addition, the creation of deeper, vegetation-free water could reduce the extent of summer dissolved oxygen sags

winter fishery habitat. The Iowa Department of Natural Resources prepared a target dredging plan for the lake that was used as the basis for the development of the alternative plans discussed later in this report. Areas deepened to improve bathymetric diversity should be located, where practicable, close to the other most valuable structural component of fishery habitat in Bussey Lake, the shoreline. Locating the deeper areas near the shoreline would also increase the potential for uncovering sand and/or gravel substrates to improve substrate diversity.

Dredged Material Disposal

It was recognized early in the planning process that finding acceptable disposal sites would be the most significant constraint on developing a dredging plan for Bussey Lake. A thorough search of the surrounding area located a limited number of sites where dredged material could be placed. The following discusses each of the various disposal alternatives identified during the planning process.

a. Thalweg Disposal - Disposal of the material in the main channel of the river immediately downstream of the dam was considered. An advantage of this alternative would be nearly unlimited disposal capacity with little or no disposal site preparation costs. A very limited analysis of impacts indicated that the acute water quality impacts of this alternative possibly would be manageable. However, the cumulative impacts on the aquatic ecosystem could only be speculated, as there would be no way to determine the ultimate fate of the dredged material. This uncertainty was considered to be a major problem that could not be overcome as would be required in order to obtain the necessary water quality approvals. For this reason, the thalweg disposal alternative was dropped from further consideration.

b. Willow Island - The man-made island lying immediately south of Bussey Lake could be bermed to provide a 3-acre disposal site with a capacity of approximately 20,000 cubic yards. Use of this site was acceptable to the Federal and State agencies participating in the planning process, and the site was considered in the formulation of alternative project plans.

c. Willow Island Expansion - The man-made island could be expanded into the surrounding open water to provide additional capacity. Expansion by 13 acres would increase the site's capacity to about 180,000 cubic yards. This action, however, would result in the loss of 13 acres of valuable fisheries habitat. Because of these potential impacts, this alternative was dropped from further consideration.

d. Refuge Bottomland Forest - Use of the bottomland forest area on the northwest side of Bussey Lake was considered, for both confined and unconfined disposal. The unconfined disposal plan envisioned use of a perforated pipe system laid between trees. Effluent would be discharged along the pipe, leaving a relatively thin layer of fine sediment on the bottomland forest. With this plan, approximately 20,000 cubic yards of material could be placed in this area. Confined disposal would allow for the placement of approximately 150,000 cubic yards of dredged material. Concerns were raised about potential adverse impacts in the wetland areas with either dredging plan, and the loss of bottomland forest with the larger plan. In the final analysis, these wildlife refuge properties were dropped from further consideration, because their use would be inconsistent with the National Wildlife Refuge System Administration Act.

e. Triangular Site - A privately owned, 13-acre bottomland forest tract lying southwest of Bussey Lake was considered. This area is naturally diked by adjacent roads and a railroad grade, and has a capacity of approximately 140,000 cubic yards. This site is hydrologically isolated; therefore, effluent would have to be pumped from the site back into Bussey Lake or a culvert would need to be jacked under the railroad in order to provide gravity outflow. Use of the site would result in the loss of the bottomland forest habitat on the site. Use of this site was acceptable to the Federal and State agencies participating in the planning process, and the site was considered in the formulation of alternative project plans.

f. Zerly Field - This is a 6-acre agricultural site on Abel-Esmann Island. The site would have a capacity of approximately 30,000 cubic yards. The site would have to be designed to avoid affecting private wells and septic systems lying east of the site. Use of this site was acceptable to the Federal and State agencies participating in the planning process, and the site was considered in the formulation of alternative project plans.

g. Fry Field - This is an agricultural site on Abel-Esmann Island. The site has been dropped from further consideration for hydraulically disposed dredged material because of potential impacts on adjacent low-lying residential properties.

h. Buck Creek Site - An agricultural site located approximately 0.8 mile northwest of Bussey Lake was considered. It was dropped from further consideration due to potential floodplain impacts.

i. Guttenberg Waterfowl Ponds - These are three ponds located below the lock and dam 10 dike that have been recently rehabilitated under the EMP program to be managed as moist soil units for waterfowl food production. The habitat rehabilitation work on these ponds consisted of the conversion of abandoned fish ponds into moist soil units by the addition of a water intake system and two outlet structures. The total area of these existing ponds is about 35 acres. As with typical moist soil units in this area, ideally the ponds would be drained in June of a given year and be refilled in the fall of the same year. It was recognized at the time of project conception that these particular ponds would not be functional every year. This was so because the ponds drain into a slough downstream of the lock and dam 10 spillway. During June, the water surface elevation of this slough frequently is higher than the bottom elevation of the existing ponds. During the design stage of this waterfowl pond project, it was calculated that the ponds would probably be functional in June about 1 year out of 7. It was determined at that point that this original HREP effort should be kept to a minimum (that is, only those structures needed to produce a functional moist soil unit when conditions naturally allowed its use would be constructed.) Further expenditures did not appear to be cost effective solely for this individual project. It was recognized, however, that these ponds would have much greater management potential if their bottom elevations could be raised between 2 and 3 feet and leveled. This would require approximately 115,000 cubic yards of material. As the requirements for the Bussey Lake project unfolded, placement of the dredged material from the lake in the waterfowl ponds was identified. Use of this alternative was acceptable to the Federal and State agencies participating in the planning process, provided the moist soil units would

function as intended with the addition of this dredged material. Use of the three existing moist soil units was considered in the development of alternative project plans.

j. Guttenberg Waterfowl Ponds Expansion - In addition to raising the bottom elevation of the existing moist soil units, the site has the capacity for additional ponds which could act as moist soil units. Expansion of the moist soil capabilities in this manner was acceptable to the Federal and State agencies participating in the planning process, again with the stipulation put on the existing ponds. Additional ponds could be constructed northeast (Pond 1) and west (Pond 5) of the existing ponds (Ponds 2-4). Construction of Pond 1 was dropped from consideration due to a limited capacity for dredged material disposal, and because high quality bottomland forest and other wetland habitat would be lost with the construction of this pond. The construction of Pond 5 was considered in the development of alternative project plans.

Dredging/Disposal Alternative Plans

Because several acceptable disposal sites were identified, numerous plans could be developed using some combination of these sites. Using the target dredging plan developed by the Iowa DNR and the acceptable disposal sites, the following alternative plans were developed as the most practicable, given disposal site capacities and development costs. Since most of the expense of using a disposal site is in up-front development costs, the alternatives assume it would be most cost effective to use the disposal sites to their capacity. In addition, a range of practicable dredging volumes was considered.

Plan A - Under Plan A, 140,000 cubic yards of material would be dredged from Bussey Lake and placed in the 13-acre triangular site southwest of Bussey Lake. The area of Bussey Lake that would be dredged and the disposal site are shown on plate 8a, and the costs are contained in table 2. This plan is considered to represent the minimum amount of dredging that would be required to provide any appreciable benefit to Bussey Lake.

Plan B - Under Plan B, 190,000 cubic yards of material would be dredged from Bussey Lake and placed in the triangular site (140,000 cubic yards), the Willow Island site (20,000 cubic yards), and the Zerly site (30,000 cubic yards). See plate 8b for the area of Bussey Lake that would be dredged as well as the location of the disposal sites. The costs are shown in table 2. This plan uses these three sites to their maximum capacity.

Plan C - Under Plan C, 255,000 cubic yards of material would be dredged from Bussey Lake. Of this, 140,000 cubic yards would be placed in the triangular site and 115,000 cubic yards would be used to raise the bottom elevations of the three existing moist soil units (Ponds 2-4) below the lock and dam 10 dike. Disposal site locations and the area of Bussey Lake that would be dredged are shown on plate 8c. The costs are shown in table 2. This plan uses the triangular site and the existing ponds to their capacity.

Plan D - Under Plan D, 270,000 cubic yards of material would be dredged from Bussey Lake. Of this, 115,000 cubic yards would be used to elevate the bottoms of Ponds 2-4. The remaining 155,000 cubic yards would be used to construct a new 15-acre moist soil unit (Pond 5) to the west of the existing units. The area of Bussey Lake that would be dredged and the disposal site are shown on plate 8d, and the costs are shown in table 2. This plan uses the existing

ponds to their capacity. Obviously, a plethora of alternative sizes could be considered in the construction of a new pond. The 15-acre size was selected because it provides the capacity for the Iowa DNR's target dredging plan and because a pond this size can be constructed in its proposed location with minimal encroachment upon the bottomland forest habitats in the area. Material to construct the dike for Pond 5 may be obtained from a sandbar blocking the mouth of Swift Slough, located 3,000 feet to the southwest, improving the fishery habitat values at this slough and/or from the immediate vicinity of the moist soil unit.

Table 2 - Comparison of Alternative Dredging Plan Costs

Plan	Cubic Yards Dredged	Disposal Sites Used	Total Cost	Average Annual Cost
A	140,000	Triangular Site	$1,158,843	$104,331
B	190,000	Triangular Site, Zerly Field, Willow Island	1,732,964	156,091
C	255,000	Triangular Site, Ponds 2-4	1,722,615	155,087
D	270,000	Ponds 2-4, Pond 5	2,109,500	189,919

COMPARISON OF ALTERNATIVES

The proposed plan and the other dredging alternatives were evaluated for their effect on Bussey Lake using habitat evaluation procedures (HEP). Table 3 summarizes the results of that evaluation. The U.S. Fish and Wildlife Service's habitat suitability index (HSI) model for the bluegill (Stuber, et. al., 1982), modified to include winter habitat variables (Palesh and Anderson, 1990), was used to evaluate potential habitat gains. (See attachment 8 for a detailed explanation of the habitat evaluation.)

The habitat evaluation for Bussey Lake was driven by changes in four variables, percent cover and dissolved oxygen in the summer, and available deep water and dissolved oxygen in the winter. Sixty to seventy percent of the total habitat gain for all of the alternatives over the no action alternative can be attributed to projected improvements in dissolved oxygen conditions, both summer and winter. The basic assumption is that all of the proposed dredging alternatives will delay the onset of severe summer and winter dissolved oxygen problems in Bussey Lake.

Table 3 - Summary of HEP Evaluation for Bussey Lake

Plan	TOTAL HU	AAHU	INCREASE OVER FW/O AAHU	INCREASE OVER FW/O PERCENT
No Action (FW/O)	6,325	126.5	-	-
A	7,550	151.0	24.5	19
B	7,740	154.8	28.3	22
C	8,450	169.0	42.5	34
D	8,550	171.0	44.5	35

AAHU = average annual habitat units
FW/O = future conditions with no action

Thirty to forty percent of the total habitat unit gain projected for the dredging alternatives can be attributed to the structural effects of dredging; i.e., increasing water depths and reducing aquatic plant cover. The differences between the dredging alternatives in terms of AAHU gains, as reflected in table 3, are the result primarily of the amount of dredging with each alternative. The alternatives with more dredging have the greater benefits.

The benefits at the Guttenberg waterfowl ponds site were calculated as moist soil habitat units. Habitat gains are realized by increasing the management capabilities at the existing ponds and by the construction of a new pond (attachment 8).

Table 4 compares the effects of the alternative dredging plans both at Bussey Lake and at the designated disposal sites associated with each plan.

Table 4 - Comparison of Alternative Dredging Plan Effects

	BUSSEY LAKE			DISPOSAL SITE			
Plan	Acres Open Water Created	Linear feet of Edge Created	Aquatic AAHU Gained	Acres Bottomland Forest Lost	Acres Shallow Wetland Lost	Acres Moist Soil Unit Benefited	Moist Soil Unit AAHU Gained
A	15	12,000	24.5	13	0	0	0
B	20	17,000	28.3	13	0	0	0
C	27	24,000	42.5	13	0	35	10.5
D	29	27,000	44.5	0	15	50	24.0

One of the problems with comparing the Bussey Lake alternative dredging plans is that there are two distinct areas of benefit which are not readily comparable, the Bussey Lake fishery and the Guttenberg waterfowl ponds. Initially, an attempt was made to separate costs at the Guttenberg waterfowl ponds according to purpose; i.e., to provide a disposal site for Bussey Lake dredged material (chargeable against Bussey Lake fishery benefits) or to provide for enhanced moist soil unit management (chargeable against waterfowl benefits). This analysis indicated that nearly all of the costs at the Guttenberg waterfowl ponds were required to provide a disposal area for Bussey Lake dredged material. It could be argued that even the remaining costs should be charged against Bussey Lake to comply with the condition that the Guttenberg waterfowl ponds be left in a manageable state following their use as a disposal site.

The information in table 5 was developed to display alternative ways of evaluating the cost per unit return of the various dredging plans. Column (a) displays the cost/AAHU if only Bussey Lake benefits are considered. Column (b) gives full credit to the Bussey Lake habitat gains but only one-half credit to the Guttenberg waterfowl pond habitat gains. The credit is assigned under the premise that the Bussey Lake AAHU gains represent year-round benefits to the fishery, while the Guttenberg waterfowl pond AAHU gains represent only a seasonal waterfowl benefit. Column (c) gives full credit to the Guttenberg waterfowl pond habitat gains, giving equal value to both the fishery and waterfowl AAHU.

Table 5 - Cost/Benefit Comparison of the Alternative Dredging Plans

Plan	Average Annual Cost	(a) Bussey L. Benefits Only Cost/AAHU	(b) GWP Benefits Added At 1/2 Credit Cost/AAHU	(c) GWP Benefits Added At Full Credit Cost/AAHU
A	$104,331	$4,258	$4,258	$4,258
B	156,019	5,513	5,513	5,513
C	155,087	3,649	3,248	2,926
D	189,919	4,268	3,361	2,773

If only Bussey Lake benefits are considered, Plan C is the most cost effective plan (column (a)). However, as credit is given for the Guttenberg waterfowl pond benefits, Plan D becomes the more cost effective plan (column (c)).

Incremental Analysis

Table 6 shows an incremental analysis for the four alternative plans using the figures that give full credit to the Guttenberg waterfowl pond benefits. Plans B and C can be considered incremental increases to Plan A. Plan D is a completely separate alternative, but is treated as a "financial increment" to Plan C for this analysis.

Table 6 - Incremental Analysis of Alternatives

Plan	Average Annual Cost	Incremental Average Annual Cost	AAHU Gain	Incremental AAHU Gain	Incremental Cost/ AAHU
A (base)	$104,331	$104,331	24.5	24.5	$4,258
B (incre.)	156,019	51,688	28.3	3.8	13,602
A (base)	104,331	104,331	24.5	24.5	4,258
C (incre.)	155,087	50,756	53.0	28.5	1,781
C ("base")	155,087	155,087	53.0	53.0	2,926
D ("incre.")	189,919	34,832	68.5	15.5	2,247

Plans A and B and Plans A and C lend themselves well to the concept of incremental analysis because Plans B and C involve adding an easily defined increment (an additional disposal site) to Plan A. The incremental analysis indicates that, if Plan A is considered the base plan (use of the triangular site as a disposal site), the incremental cost/unit return to go to Plan B (adding in the Zerly and Willow Island disposal sites) would triple. It does not appear that the additional expense to obtain the additional 3.8 AAHU with Plan B would be justified.

The analysis indicates that it would be cost effective to implement Plan C over Plan A because the additional AAHU can be obtained at a lower cost per unit return.

Plans C and D do not lend themselves to a true incremental analysis because Plan D is not an additional increment to Plan C; it is an entirely different alternative. A quasi-incremental analysis can be performed showing that, if the cost of achieving the first 53.0 AAHU of benefits with Plan D is assumed to be equal to the cost of achieving 53.0 AAHU with Plan C, then the remaining 15.5 AAHU Plan D provides can be achieved in a cost effective manner.

Plan Selection

Based on the information presented in tables 5 and 6 Plan D is the most cost effective plan if credit is given to the habitat gains at the Guttenberg waterfowl ponds, and Plan C is a relatively close second. Given the sensitivity level of the cost estimate and the habitat evaluation, the cost per unit returns for Plans C and D are essentially equal. Plans A and B are considerably less cost effective than the other alternatives. Plans A and B were eliminated from the final selection process because they are less cost effective and because they do not provide a level of benefits that is desirable to the Iowa DNR and the public.

The final selection involved a choice between Plan C and Plan D, both of which include the disposal of 115,000 cubic yards of the dredged material to enhance the existing moist soil units at the Guttenberg waterfowl ponds. The decision then becomes whether to dredge an additional 140,000 cubic yards and place it at the triangular site (Plan C), or to dredge and use an additional 155,000 cubic yards to construct a new moist soil unit (Plan D). Given that the cost per habitat unit return for the two plans is nearly equal, the following factors were considered important in the final selection process.

(1) The 24-hour retention time condition imposed by the State water quality certification would be difficult to meet at the triangular site, while the addition of Pond 5 would appreciably enhance the ability to meet this condition at the Guttenberg waterfowl pond site.

(2) Use of the triangular site would result in less wildlife habitat loss than the construction of Pond 5 (13 acres of moderate value bottomland forest vs. 15 acres of good shallow wetland habitat, respectively).

(3) The use of the triangular site would have a greater aesthetic impact. It could also present a potential safety hazard, because of the 6 to 10-foot depth of the disposed material prior to drying.

(4) The material for constructing the Pond 5 dike could be obtained from a sandbar blocking the mouth of Swift Slough, located approximately 3,000 feet southwest of the site. This could provide substantial fishery benefits to this 37-acre slough.

(5) The triangular site is fixed in size, and offers no flexibility should further analysis reveal capacity or other problems with the site. Pond 5 offers some flexibility in that it can be decreased in size should further analysis indicate that 15 acres is not necessary to provide the desired disposal capacity.

Of the above factors, only #2 favors the selection of the triangular site (Plan C) to provide the additional disposal capacity. All of the other factors favor selection of Pond 5 (Plan D).

SELECTED PLAN OF ACTION

Dredging - The selected dredging alternative is Plan D, as shown on plate 9. This plan involves dredging approximately 270,000 cubic yards of material to create about 12,000 linear feet of channel in Bussey Lake. The channels would have 75-foot bottom widths with 1:6 side slopes. The majority of the channels would be dredged 8 feet deep. In a few locations, dredged channel depths would be 6 and 7 feet to create more bathymetric diversity while keeping dredging volumes at a minimum. This includes a more shallow area in the vicinity of the spring on the west side of Bussey Lake and a gradual decrease in elevation in the channel along Abel-Esmann Island as it approaches the controlled culvert. At the spring, a 3.5-acre (475- by 325-foot) area would be dredged to a depth of 6 feet. This area is being dredged to provide a wider band of slightly deeper water in the vicinity of the spring. The channel along the east side of the lake would have a 1,000-foot reach at a depth of 6 feet, extending from the culvert southward. This would be followed by a 1,200-foot reach that would be 7 feet in depth. In addition to providing habitat diversity, the primary purpose of this stretch of channel is to carry

flow from north of the culvert into the lake during periods when sedimentation is not considered to be a problem.

Dredged Material Disposal - The material dredged from Bussey Lake would be used at the Guttenberg waterfowl ponds located southeast of Bussey Lake, immediately below the lock and dam 10 dike. About 115,000 cubic yards of the dredged material would be used to elevate and level the bottoms of the three existing moist soil units totaling 35 acres in size. Two smaller ponds lie adjacent to these three major ponds. The dike between these ponds would be broken to expand the present pond system slightly. This would allow for the use of an additional 10,000 cubic yards. The bottom elevation of the ponds would be raised 2 to 3 feet to elevation 608 feet mean sea level (msl). The moist soil units are being managed for waterfowl food production, and raising their bottom elevation would increase their drainability, and thus, increase their manageability. The current operating plan for these ponds calls for filling of the ponds in late August with release of the water in June of the next year. At the present time, because of the bottom elevation of the ponds and the elevation on the Mississippi River, the ponds can be operated (that is, drained) in the month of June only one year out of seven. With the bottom elevation raised to 608 feet msl, the ponds could be drained in June between four and five years out of seven. (At this higher elevation, it appears that there would be opportunities for complete drawdown of the ponds at least six out of seven years sometime in the months of June and July.)

The remaining 145,000 cubic yards of material would be used to create one new moist soil unit, 15 acres in size, immediately to the west of the present system. The elevation of this new pond would be the same as for the upgraded existing dikes, 608 feet msl. The top elevation of the new dikes would be 613 feet msl. The top width would be 10 feet with side slopes of 1 foot vertical for each 3 feet horizontal on the interior of the ponds and 1 foot vertical for each 5 feet horizontal on the outside. The dikes for the expanded pond could be constructed of material from the interior of the site and/or from the mouth of Swift Slough, located about 3,000 feet to the southwest. A sandbar has formed, nearly blocking the mouth of Swift Slough. Removal of this material would enhance the fishery habitat provided by the slough.

Some minimal renovation of the existing ponds would be expected to occur with the addition of approximately 2 to 3 feet of dredged material. There are two outlet structures which were constructed with the original improvement of the ponds. One stop log/culvert system allows drainage of water from the ponds into Cassville Slough. A second slide gate/culvert system allows flow into Big Lake which lies south of the ponds. The two culverts have invert elevations at 604.0 feet msl and walk-out access to the control structures at elevation 609.9 feet msl. With the pond bottom elevations raised to 608 feet msl and the operating water surface elevation at 611 feet msl, modification to these structures would be required. It is anticipated that this would consist of raising the entire control structure and culvert at each of these locations.

With the construction of a fourth pond, additional features have been recommended in order to allow maximum operating flexibility of the ponds. This would consist of the addition of a control structure between ponds 2 and 4. A third controlled outlet would be placed at the lower end of the new pond. This would allow water to be drained into Deadman's Slough. Besides increasing the avenues of delivery from the ponds, the intake pipe would be redesigned. Currently, water entering the ponds is controlled by a knife

valve in a manhole located along the intake pipe approximately 100 feet downstream of the lock and dam 10 spillway. A second pipe system would be added to this pipeline at this point to allow independent operation of some of the ponds. The new pipe would extend 950 feet to the west, outletting into pond 2.

Control Structure - A gated control structure would be constructed on the upstream end of the 6-foot-diameter culvert which extends through the Abel-Esmann Island causeway. The gate would be installed onto the existing corrugated metal pipe. Minimal disturbance of the present roadway is anticipated. Installation of the control structure will entail construction of a sheet pile/concrete headwall to support the proposed slide gate structure. The gate can be raised and lowered by a stem/wheel system. Access to the gated control structure for the purpose of operation would be from the top of the road. Any exposed culvert from the road to the control gate would be covered with fill. The placed fill would slope down on either side of the culvert at 1 foot vertical for every 3 feet horizontal. A fence would be installed at the headwall as a safety and security feature. See plate 10 for plan and cross sectional views of the proposed control structure.

Construction Methods - Based on current information, the following discussion is offered as the likely method of construction for this project. The 270,000 cubic yards of material to be removed from Bussey Lake would be hydraulically dredged. Using existing 1967 survey data of the area south of Bussey Lake and verbal information from Iowa DNR staff knowledgeable of the area, it does not appear that it will be necessary to dig an access channel in order to get a dredge into the project area.

Limited areas on the northern and western sides of the site for the new moist soil unit and the interior of the existing ponds would be cleared and grubbed prior to use. Trees would also be removed from the dike between ponds 2 and 4. Based on past experience with this type of construction, it is expected that the unsalvageable woody material would be burned on site.

Soil borings will be taken along the proposed channel alignment during plans and specifications. This information, along with survey data of the new pond site, will be used to try to determine the amount of dredged material that would be retained within the existing ponds and proposed new pond. The ponds will be sized so that the target finished pond elevation of 608 feet msl can be achieved with minimal construction costs and impact to adjacent floodplain forest areas. The material from the Bussey Lake channel dredging project would be adequately contained in the proposed ponds. As stated previously, this disposal plan was selected because of the additional habitat benefits to be gained. These benefits were based on the fact that little clearing of forest areas would be required and that the ponds would function successfully following completion of the construction work. Because the thrust of this EMP-HREP program is to enhance the environment and because the work is being done on a National Wildlife Refuge, every effort will be made to accomplish dredging at the Bussey Lake project, while maintaining these two goals. From the soil samples obtained at Bussey Lake and past experience in dredging other backwater areas, there is no reason to believe that the renovated ponds cannot accommodate the material from Bussey Lake. However, should it be determined that either of these goals cannot be fully met with the proposed disposal plan, dredging in Bussey Lake would be reduced as required.

The four ponds would be used as cells to produce the highest quality hydraulic effluent from the site during disposal operations. During plans and specifications, a filling sequence will be designed that would maximize the use of the ponds for improving effluent quality. It is expected that the existing outlet from pond 3 into Cassville Slough would be the effluent discharge point. No dredge discharge will be allowed into the Big Pond backwater complex. Iowa water quality criteria state that the turbidity of receiving water shall not be increased by more than 25 Nephelometric turbidity units by any point source discharge. State water quality certification has been received. The State has certified compliance with State water quality standards provided the containment area for the dredged material is designed to provide a minimum return water retention time of 24 hours. This time may be negotiated if it is determined that a shorter retention time would be sufficient.

The side slopes of the containment dike surrounding the new pond would be seeded following completion of the dredging operation. Topsoil would be added, if required. Judging from past dredging operations, there would probably be a 1- to 2-year period when there would be no construction activity at the ponds. After the area has dried sufficiently that construction equipment can work on it, the ponds would be regraded, where required, to achieve the operation elevation of 608 feet msl. At that time, the new control structures would be installed and the existing culverts would be modified as needed.

Any areas cleared for construction access at the Guttenberg waterfowl ponds would be revegetated at the discretion of the U.S. Fish and Wildlife Service. They may wish to allow some of the access to remain in place for their future maintenance and operation needs.

Real Estate Requirements - The dredging project is located in Bussey Lake. This area and most of the contingent land are managed by the U.S. Fish and Wildlife Service for wildlife as part of the Upper Mississippi River Wildlife and Fish Refuge. In addition, the proposed disposal site is located on Refuge lands.

Clayton County is the owner of a 40-foot-wide strip of land at the north end of the project area along which the Abel-Esmann Island causeway runs. U.S. Fish and Wildlife Service Refuge land borders either side of the narrow strip. A second easement would need to be acquired from the county for construction of the control structure.

Appropriate agreements would be made with the U.S. Fish and Wildlife Service to dredge the channels on the refuge and use the waterfowl ponds for dredged material disposal. The county owns the land upon which the closure structure would be constructed. Because this land is already dedicated for public use, additional real estate costs for the construction of this structure should not be required. As with the U.S. Fish and Wildlife Service, agreements will need to be concluded with the county for construction and future operation and maintenance of this control structure. This will be accomplished through an executed local cooperation agreement with the Iowa Department of Natural Resources which will obtain the easement from the county. The local administration costs for acquiring this easement are currently estimated at $500.

Estimated Future Habitat Conditions with the Project

The effects of the project are discussed in more detail in the "Environmental Effects" section. The habitat changes at Bussey Lake that would occur as a result of the project include the establishment of 29 acres of deeper water with reduced vegetation growth, the creation of approximately 27,000 linear feet of open water/vegetation bed edge, an increase in the bathymetric diversity in the lake, and the ability to prevent sediment and contaminants from entering Bussey Lake via Buck Creek.

At the Guttenberg waterfowl ponds, 35 acres of existing moist soil units would be improved to enhance management capabilities. An additional 15-acre moist soil unit would be created.

Fulfilled Goals with the Project

During the plan formulation phase of the study, a number of project objectives were identified. The projected measurable accomplishments of the proposed plan are presented in table 7.

Table 7 - Measurable Goals and Accomplishments of the Proposed Plan

Goal	Project Accomplishment	Potential Enhancement Feature	Unit of Measure	Enhancement Potential		
				Present	Future Without	Future With
GENERAL GOAL:						
Improve aquatic habitat	Overall improvement in fishery habitat	Lake dredging	AAHU	-	126.5	171.0
SPECIFIC PROJECT OBJECTIVES:						
a.) Create more habitat inter-spersion	Open water areas within dense aquatic vegetation	Lake dredging	Linear feet	0	0	12,000
b.) Increase bathy-metric diversity	Maintain adequate water depths (6' or greater)	Lake dredging	Acres of water > 6 feet	0	0	29
c.) Create deep water at thermal attract-ant area	Open, deep water at the spring	Dredging	Acres	0	0	3.5
ELIMINATE HIGH FLOWS						
Reduce sediment carrying flows	Control flow from Buck Creek	Control structure	CFS	0 - 135	0 - 135	0
Improve aquatic habitat	Eliminate the potential for pesticide and herbicide entrance to the lake from Buck Creek	Control structure	Number of fish kills above & below culvert from this source	2	4	0

ENVIRONMENTAL EFFECTS

An environmental assessment has been conducted for the proposed action, and a discussion of the impacts on habitat conditions follows. As specified by Section 122 of the 1970 Rivers and Harbors Act, the categories of impacts listed in the environmental impacts matrix (table 8) were reviewed and considered in arriving at the final determination. In accordance with Corps of Engineers regulations (33 CFR 323.4(a)(2)), a Section 404(b)(1) evaluation was prepared (attachment 3). Water quality certification under Section 401 of the Clean Water Act has been received from the State of Iowa (attachment 4). The Finding of No Significant Impact (attachment 2) will be signed after the public review period has elapsed and any issues have been resolved.

RELATIONSHIP TO ENVIRONMENTAL REQUIREMENTS

The proposed project complies fully with applicable environmental statutes and Executive Orders for the current stage of planning. Among the more pertinent are the National Environmental Policy Act, the Fish and Wildlife Coordination Act, the Clean Water Act, the National Historic Preservation Act, the National Wildlife Refuge System Administration Act, Executive Order 11990 (Protection of Wetlands), and Executive Order 11988 (Floodplain Management).

WATER QUALITY

Dredged Material Disposal - Detailed effects of the dredged material disposal portions of project construction on water quality are described in the attached Clean Water Act Section 404(b)(1) evaluation (attachment 3). Particle size and bulk chemical analysis was performed on sediments obtained from four sites in Bussey Lake in December 1988. Core samples were taken to a depth of 3 feet of sediment, and multiple cores were combined to provide one composite sample per site for analysis.

The samples were tested for the presence of heavy metals, chlorinated hydrocarbons, total available cyanide, ammonia nitrogen, total solids, volatile solids, total organic carbon, percent moisture, and particle size.

Particle size analysis showed the materials to be predominantly silt and clay, with a very high water content. Total solids ranged from 40 to 60 percent. Total volatile solids ranged from 5.5 to 9.0 percent, while total organic carbon ranged from 25,500 to 62,100 mg/l.

Metals concentrations were generally low, especially considering the fine nature of the material. Ten of fifteen chlorinated hydrocarbon compounds tested for were not detected, while those detected were all at levels below 1 ug/kg (ppb). Again, given the location and type of material, these are considered low levels. PCB's were detected in two of the four samples, again at levels that are not of significant concern. Ammonia nitrogen ranged from 41 to 82.1 mg/kg wet weight.

Table 8

ENVIRONMENTAL IMPACT ASSESSMENT MATRIX — MAGNITUDE OF PROBABLE IMPACT

NAME OF PARAMETER	<---- INCREASING BENEFICIAL IMPACT			NO APPRECIABLE EFFECT	INCREASING ADVERSE IMPACT ---->		
A. SOCIAL EFFECTS	SIGNIFICANT	SUBSTANTIAL	MINOR		MINOR	SUBSTANTIAL	SIGNIFICANT
1. Noise Levels					x		
2. Aesthetic Values					x		
3. Recreational Opportunities			x				
4. Transportation				x			
5. Public Health and Safety				x			
6. Community Cohesion (Sense of Unity)				x			
7. Community Growth & Development				x			
8. Business and Home Relocations				x			
9. Existing/Potential Land Use				x			
10. Controversy				x			
B. ECONOMIC EFFECTS							
1. Property Values				x			
2. Tax Revenues				x			
3. Public Facilities and Services				x			
4. Regional Growth				x			
5. Employment				x			
6. Business Activity			x				
7. Farmland/Food Supply				x			
8. Commercial Navigation				x			
9. Flooding Effects				x			
10. Energy Needs and Resources				x			
C. NATURAL RESOURCE EFFECTS							
1. Air Quality				x			
2. Terrestrial Habitat				x			
3. Wetlands			x				
4. Aquatic Habitat		x					
5. Habitat Diversity and Interspersion		x					
6. Biological Productivity		x					
7. Surface Water Quality			x				
8. Water Supply				x			
9. Groundwater				x			
10. Soils				x			
11. Threatened or Endangered Species				x			
D. CULTURAL EFFECTS							
1. Historic Architectural Values				x			
2. Pre-Hist & Historic Archeological Values				x			

Initially, the ponds would provide approximately 110 hours of retention time if a large hydraulic dredge was used. By the end of the project, retention time would be reduced to about 60 hours. This, coupled with the fact that the dredged material is relatively uncontaminated, should insure that the water quality impacts of the disposal operation would be relatively minor.

Dredging - Dredging would have temporary negative effects on water quality in Bussey Lake, mainly from increased turbidity in the immediate area of the hydraulic dredging. Given the results of the bulk chemical analysis, there is no reason to suspect that the temporary resuspension of sediments associated with the hydraulic dredging would have any appreciable adverse effects on aquatic life.

Long Term - Over the long term, the project should have a net positive impact on water quality by reducing the potential for dissolved oxygen depletion in Bussey Lake. While this is a difficult parameter to predict for, it is expected that the proposed project could delay the onset of serious dissolved oxygen depletion problems in Bussey Lake by up to 25 years.

AQUATIC HABITAT

The immediate effects of construction would include the creation of 8-foot-deep channels in the lake. This would result in the removal of about 40 acres of aquatic vegetation, some of which would reestablish itself on the slopes of the channel. All benthos in the dredged areas would be removed. It is expected that the dredged areas would rapidly recolonize with similar organisms, because the substrate type would remain basically silt and clay.

Excavation of the channels would open up 125-foot swaths through the aquatic vegetation in Bussey Lake. The channel bottom would be 75 feet wide and the channel would widen at the top to about 125 feet. About 27,000 feet of open water/vegetation edge would be created. Approximately 3.5 acres of deeper habitat would be created near the spring.

The primary long-term effect of the project on summer habitat for bluegill and other fish species would be to increase the diversity of habitat in Bussey Lake, through increased water depths and bathymetric diversity, and to increase the amount of open water-vegetation interspersion and edge. These benefits would be most pronounced in the areas of the dredge cuts. It is expected that the 29 acres dredged 6 feet or greater would remain relatively vegetation free over most of the project life. The project would improve and prolong the ability of portions of Bussey Lake to satisfy most or all of the summer habitat needs of bluegill and other backwater fish species.

The project should improve habitat conditions for overwintering fish. As indicated earlier, the IDNR has observed that the wintering areas for fish in Bussey Lake have been moving southward as the upper part of the lake has become shallow and choked with vegetation. The creation of 29 acres of deeper water that is expected to remain 6 feet or deeper should insure the availability of adequate wintering habitat for bluegill and many other species throughout the project life.

There are beneficial effects to increasing the availability of the spring to the lake's fishery. The more stable temperatures could provide more reliable concentrations of dissolved oxygen during late summer and winter when

oxygen deficits can easily develop. Temperature is not a limiting resource in Bussey Lake, but it is an important one for fish.

If dike material is taken from the sandbar blocking the mouth of Swift Slough, there would be substantial fishery benefits associated with improving the access into the slough for fish. By its location, Swift Slough is highly valuable as an off-channel feeding and resting place for fish. In its present condition, it has become a fish trap when high waters recede.

The creation of deep channels in Bussey Lake would reduce the density of aquatic vegetation present, some of which is important for migrating waterfowl and mammals such as muskrat. Because the lake would still contain aquatic vegetation over about 70 percent of its area, impacts on waterfowl and muskrat use would be minimal.

TERRESTRIAL/WETLAND HABITAT

Impacts on terrestrial habitat would be negligible. Impacts on wetland habitat would occur with the development of the dredged material disposal site. The construction of the new moist soil unit would result in the direct conversion of about 15 acres of natural shallow wetland habitat to a managed shallow wetland habitat. This wetland is a mixture of riverine emergent nonpersistent and palustrine emergent persistent wetland types (Cowardin, et.al., 1979). In addition, construction of access to and around the units would likely disturb about 2 to 4 acres of bottomland forest.

The areas that would be converted to moist soil units or disturbed by construction provide habitat for the wildlife that typically use shallow vegetated wetlands along the Upper Mississippi River. Wildlife that use this type of habitat include puddle ducks, wading birds, shorebirds, and furbearers. The area that would be converted to a managed moist soil condition has no particularly unique habitat value as compared to other shallow vegetated wetland habitat along the river.

Management capability at the three existing moist soil units would be greatly enhanced. Due to drainage limitations and uneven bottom topography, the ponds cannot be managed to their full potential. Management professionals from the U.S. Fish and Wildlife Service and the Iowa Department of Natural Resources estimate that the value of the moist soil units can be increased by about 50 percent with the proposed filling and leveling. It has been estimated that these three units can provide for 19,710 to 98,665 fall duck use days (St. Paul District, 1988) in those years that they can be managed to their potential.

The newly constructed moist soil unit would be managed along with the existing units and would provide the same type of benefits to migrating waterfowl. This unit would add 15 acres of managed habitat to the 35 acres of the three existing units. While a proportional increase in duck use may not be achievable, it is not unreasonable to expect that, with 50 acres of moist soil unit available, fall duck use days of 30,000 to 125,000 would occur.

Both the existing and newly constructed moist soil units would provide habitat to other wildlife such as wading and shore birds such that some of the wildlife habitat values for non-target species lost in construction of Pond 5 would be replaced.

ENDANGERED SPECIES

There are no eagle nests in Frenchtown Bottoms or in the floodplain forests immediately adjacent to Bussey Lake. There is an active eagle nest at river mile 616.5 on the Wisconsin side of the river. The project is not expected to affect this nest because it is located at a distance from Bussey Lake and the disposal site. In addition, the project area already has a relatively high level of human activity due to the presence of the lock and dam, the city of Guttenberg, and existing recreational boat traffic. Eagles winter along this reach of the Upper Mississippi River, especially below locks and dams. Since the project would be constructed during the summer, there should be no effect on wintering eagles below lock and dam 10. The project should not jeopardize the continued existence of any listed species or affect any critical habitat.

AIR QUALITY

There would be minor adverse effects on air quality during construction due to heavy equipment emissions and the burning of unsalvageable woody vegetation. Because of the nature of the dredged material, the placement areas could be malodorous during settling and drying. The effects would be limited to the project construction period and are not expected to be significant.

SOCIAL FACTORS

The Bussey Lake project has generated concern at the local community level not because it is a dredging project, but because more is not being done at Bussey Lake. In the past, Bussey Lake, in addition to providing excellent fishery habitat, had qualities that made it an attractive recreational lake for boating and other water activities. The shallowing of the lake and excessive aquatic plant growth have greatly reduced the recreational qualities of the lake. Local citizens have expressed a desire that more be accomplished at Bussey Lake to enhance recreational qualities, even though they recognize that it cannot be done under the auspices of the habitat rehabilitation and enhancement project portion of the UMRS-EMP. They are frustrated that the recreational project portion of the UMRS-EMP has not received the emphasis the habitat projects have. There is particular interest in having the western leg of the selected channel alignment extended approximately 1,500 feet downstream, so that access from the marina in Bussey Lake to deeper water south of the lake could be assured. Inclusion of this feature in the habitat project was determined to be unwarranted. It was determined that, if additional dredging were done in the lake, this particular area would not be the best area in which to locate channels to maximize habitat benefits. At the present time, it appears that work in this channel reach will be done through the Iowa Department of Natural Resources using money from the State Marine Fuel Tax Fund.

NOISE LEVELS

Equipment used during dredging operations would temporarily degrade the sights and sounds of the residential and peaceful backwater setting.

RECREATION AND AESTHETIC VALUES

There would be a temporary disruption to fishing during dredging operations. Once the project was completed and the fisheries improved, more anglers would fish in the area. This may eventually result in boat traffic congestion within the dredged channel. To eliminate some of the boating hazards, the area may need to be identified as a no wake zone if it does not have this designation now.

CULTURAL RESOURCES

Abel-Esmann Island and its environs have not been systematically surveyed for cultural resources. The potential for undiscovered sites is high. Coordination with the National Park Service, the State Historic Preservation Office, and the Iowa State Archaeologist revealed the presence of two mound groups at the proposed dredged material disposal areas on the island. Their letter stated that no surface indications of the mounds remained but there was a high potential for intact subsurface features. The State Historic Preservation Office requested a cultural resources survey of the proposed project area before dredging begins.

Archaeologists from the St. Paul District examined four proposed disposal areas in the summer of 1989. Both alternative disposal areas on Abel-Esmann Island were found to have intact burial mounds nearby, although there were no surface indications of burial mounds in the proposed disposal areas themselves. These areas would need to be examined in greater detail before disposal could occur.

The 13-acre triangular site located southwest of Bussey Lake considered for disposal was surveyed and tested in 1989 with negative results. No further cultural resources work would need to be done at this location.

The pool 11 shoreline was surveyed in 1984 by the Great Lakes Archaeological Research Center. Four sites were located in the vicinity of the Guttenberg waterfowl ponds. Only one of these sites, 13 CT 220, may be affected by the disposal of dredged material in this area. The use of this area for dredged material disposal is being coordinated with the Iowa State Historic Preservation Officer and the Iowa State Archaeologist.

PROJECT REQUIREMENTS

OPERATION AND MAINTENANCE

Operation and maintenance (O&M) requirements would be limited to work associated with the control structure and the expanded Guttenberg waterfowl ponds. Work at both the new waterfowl pond and the control structure north of Bussey Lake would center around removal of debris at the culverts. Some control of vegetation on the dikes that surround the new pond would also be required. No future dredging within the proposed channels is anticipated. Throughout areas where deep, open water will be created, channel depths to maximize habitat values are projected to continue throughout the 50-year project life. An O&M manual detailing operation and maintenance requirements would be prepared by the Corps during the plans and specifications phase.

Development of the manual would be coordinated with the U.S. Fish and Wildlife Service and the Iowa Department of Natural Resources. Over the 50-year project life, the average annual O&M costs of the project for the control structure and the ponds are estimated to be $1,000 and $1,500, respectively. The estimated operation and maintenance costs are shown in table 9.

Table 9 - Estimated Operation and Maintenance Costs

Control Structure (Corps/IDNR responsibility):	
Inspection and reporting	$250
Debris removal	500
Operation of the control structure	250
Total annual cost	$1,000
Guttenberg Waterfowl Ponds (USFWS/IDNR responsibility): (1) (2)	
Inspection and reporting	$100
Debris removal	100
Operation of the control structure	300
Dike maintenance	1,000
Total annual cost	$1,500

Note: (1) Total projected operation and maintenance costs over a 50-year project life for the waterfowl ponds are estimated to be $75,000.

(2) The costs shown here do not include original operation and maintenance costs for the waterfowl ponds, estimated to be $2,000 annually.

PERFORMANCE EVALUATION

Monitoring plans for project evaluation purposes were designed to directly measure the degree of attainment of the selected project objectives. Therefore, for each objective, an evaluation plan was developed. These are described below and presented in table 10. The general parameter to be measured for each objective follows.

a. Project Objective: Open areas in the aquatic vegetation should maximize the amount of edge created in the most cost effective manner. Based on the recommendations of the Iowa Department of Natural Resources, a minimum width of 75 feet is considered necessary for any area cleared of aquatic vegetation to insure that both sides of the area function as independent "edge" habitats throughout the project life.

Evaluation: Measure the vegetation-free width of the dredge cut after construction and again at 5-year intervals. Determine the relative abundance of the plant beds in the dredge cuts.

b. Project Objective: Areas deepened to provide open areas with little to no aquatic plant growth should be deepened sufficiently to remain relatively free of aquatic plant growth over the project life.

Evaluation: Monitor the dredge cuts every 10 years and after any extraordinary spring flooding on the Mississippi River by performing bathymetric surveys.

c. Project Objective: Areas deepened to improve bathymetric diversity should be located, where practicable, close to the other most valuable structural component of fishery habitat in Bussey Lake, the shoreline. Locating the deeper areas near the shoreline would also increase the potential for uncovering sand and/or gravel substrates to improve substrate diversity.

Evaluation: None required.

d. Project Objective: The thermal attractant provided by the spring on the west side of Bussey Lake should be used in the design of habitat modifications.

Evaluation: Included in the bathymetric surveys for item b.

e. Project Objective: Given the possibility that input from the southern end of the lake has decreased in recent years, the project should be designed, at a minimum, to eliminate high water flows into Bussey Lake from Buck Creek, thereby reducing the potential for fish kills from pesticides and reducing suspended sediment load and turbidity at the north end of the lake.

Evaluation: Monitor annual operation and maintenance records of the local IDNR office.

In addition to the performance monitoring discussed above for specific project objectives, postproject evaluations will be made of the potential secondary impacts of the project on winter and summer dissolved oxygen and the zone of influence of the spring.

Table 10 - Postconstruction Measurements

Goal	Project Accomplishment	Unit of Measure	Monitoring Plan	Monitoring Interval	Projected Cost per Effort
SPECIFIC PROJECT OBJECTIVES:					
a.) Create more habitat inter-spersion	Open water areas within dense aquatic vegetation	Feet (width)	Vegetative survey	5 years	$2,500
b.) Increase bathy-metric diversity	Maintain adequate water depths (6' or greater)	Feet (depth)	Bathymetric survey	10 years	$10,000
c.) Create deep water at thermal attract-ant area	Deep water	Feet (depth)	(1)		
ELIMINATE HIGH FLOWS					
Reduce sediment carrying flows	Control flow from Buck Creek	CFS	Inspection of IDNR annual report on O&M	Annually	$100

(1) Monitoring plan, monitoring interval, and projected cost accounted for under bathymetric surveys in the second item.

Monitoring activities would be closely coordinated with similar efforts by the Long-Term Resource Monitoring program. Information gathered by local resource agencies on a routine basis, such as test netting or creel census and information on angling success, would also be used. Ideally, test netting or creel census should be coordinated with Corps monitoring sites, or vice versa, so that these efforts would be conducted in the same areas. Species, length, and age of all fish should be noted, as well as remarks on condition.

COST ESTIMATE

The total project cost for the selected plan was estimated to be $2,109,500. This cost does not include prior allocations of $141,000 for general design (planning) nor does it include the real estate acquisition

costs that would be expended on the control structure. Quantities and unit costs will be verified during preparation of construction plans and specifications. A detailed cost estimate for this project is contained in attachment 9.

Annualized first costs, using first construction costs and general design expenditures (based upon a 50-year economic life and an 8-7/8 percent discount rate) would amount to $189,900. With the addition of annual operation and maintenance costs of $2,500, the total average annual costs are estimated to be $192,800.

PROJECT IMPLEMENTATION

DIVISION OF PLAN RESPONSIBILITIES

The responsibilities of plan implementation and construction fall to the Corps of Engineers as the lead Federal agency. The Iowa Department of Natural Resources would obtain the permanent easement for the control structure. After construction of the project, no annual project operation and maintenance would be required for the dredged channels; however, some operation and maintenance duties would be required at the Guttenberg waterfowl ponds as well as at the control structure north of Bussey Lake. This includes debris removal at the culverts and vegetation control on the new waterfowl pond dike. At the ponds, these actions would be the responsibility of the U.S. Fish and Wildlife Service in cooperation with the Iowa Department of Natural Resources. Discussions will be taking place between the Iowa Department of Natural Resources, Clayton County, and the Corps concerning agreements that will be needed for construction and operation and maintenance of the control structure. This will be the responsibility of the Iowa Department of Natural Resources and the Corps. Should rehabilitation of the Bussey Lake project which exceeds the annual maintenance requirements be needed (as a result of a specific storm event or flood event), the Federal share of rehabilitation would be the responsibility of the Corps of Engineers. Performance evaluation, which includes monitoring of physical/chemical conditions and some limited biological parameters, would be a Corps responsibility. Attachment 6 contains a draft copy of the formal agreement that delineates the responsibilities which would be entered into by the Corps of Engineers and the U.S. Fish and Wildlife Service and a draft local cooperation agreement for execution by the Corps of Engineers and the Iowa Department of Natural Resources.

COST APPORTIONMENT

Construction - The dredging activities would be conducted on the Upper Mississippi River National Wildlife and Fish Refuge. The control structure is on land owned by Clayton County. Therefore, in accordance with Section 906(e)(3) of Public Law 99-662, first costs for construction of the dredging portion of the Bussey Lake project would be 100 percent Federal and would be borne by the Corps of Engineers. With regard to the control structure, 25 percent of the first costs would be provided by non-Federal interests (in this case, the Iowa Department of Natural Resources). The apportionment of costs for the control structure is presented in table 11.

Table 11 - Summary of Estimated First Costs for the Control Structure

Item	First Costs		
	Non-Federal	Federal	Total
Control structure			$30,000
E & D			11,700
S & A			1,600
Total	$10,825	$32,475	$43,300
Cost Share	25%	75%	

(It is estimated that an additional $600 will be expended by the Iowa Department of Natural Resources for real estate acquisition. Under the Water Resources Development Act of 1986, Section 906(c), this cost is not credited against the non-Federal share of the project.)

Operation and Maintenance - After construction of the project, operation and maintenance will need to be conducted by the U.S. Fish and Wildlife Service on the expanded Guttenberg waterfowl ponds. The U.S. Fish and Wildlife Service will assure that non-Federal operation and maintenance responsibilities associated with the ponds are in conformance with Section 906(e) of the Water Resources Development Act of 1986. The non-Federal sponsor is the Iowa Department of Natural Resources. O&M responsibilities with regard to the control structure would be shared between the Corps and the non-Federal interest, the Iowa Department of Natural Resources. In this instance, 25 percent of these costs would be the responsibility of the IDNR and 75 percent would be the responsibility of the Corps of Engineers. Specific operation and maintenance features associated with either the Guttenberg waterfowl ponds or the control structure would be defined in a project O&M manual prepared by the Corps and coordinated with the involved agencies during the plans and specifications phase.

STEPS PRIOR TO PROJECT CONSTRUCTION

Funds for plans and specifications can be provided by the Office of the Chief of Engineers (OCE), prior to approval of the project by the Assistant Secretary of the Army (Civil Works), upon a recommendation from Civil Works Planning after OCE staff review of the final report. As described in this report, this work would include additional soil borings along the proposed channel alignment and in the containment area. Under the current schedule, preparation of plans and specifications would be initiated in fiscal year 1990. Prior to initiation of a construction contract for the control structure, a local cooperation agreement (LCA) would need to be executed between the Corps of Engineers and the Iowa Department of Natural Resources. A construction contract for the Bussey Lake project would be advertised by the competitive bid process and would likely be awarded in fiscal year 1992 and completed in fiscal year 1993. A second construction contract for completion of the work at the waterfowl ponds would be awarded in fiscal year 1994 or 1995.

An archaeological survey will be completed on any land currently considered for placement of dredged material. Additional coordination would be done with the State Historic Preservation Officer if dredged material placement sites that have not been presented to that office are considered.

RECOMMENDATIONS

I have weighed the accomplishments to be obtained from this dredging and control structure construction project against its cost and have considered the alternatives, impacts, and scope of the proposed project. In my judgment, the proposed project is a justified expenditure of Federal funds. I recommend that the Secretary of the Army approve the Bussey Lake project for habitat rehabilitation and enhancement at pool 10 in Clayton County, Iowa. The total estimated construction cost of the project is $2,109,500, of which amount $2,066,200 would be a 100-percent Federal cost according to Section 906(e)(3) of Public Law 99-662. The remaining $43,300 would be cost shared 75 percent Federal and 25 percent non-Federal (Iowa Department of Natural Resources). I further recommend that funds be allocated in fiscal year 1990 to initiate the preparation of plans and specifications.

Roger L. Baldwin
Colonel, Corps of Engineers
District Engineer

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Magnuson, et al, 1979. Temperature as an Ecological Resource, Am. Zoology, 19:331-343.

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St. Paul District, Corps of Engineers, 1988. Definite Project Report/Environmental Documentation (SP-2), Guttenberg Waterfowl Ponds Habitat Rehabilitation and Enhancement Project. 21 pp + app.

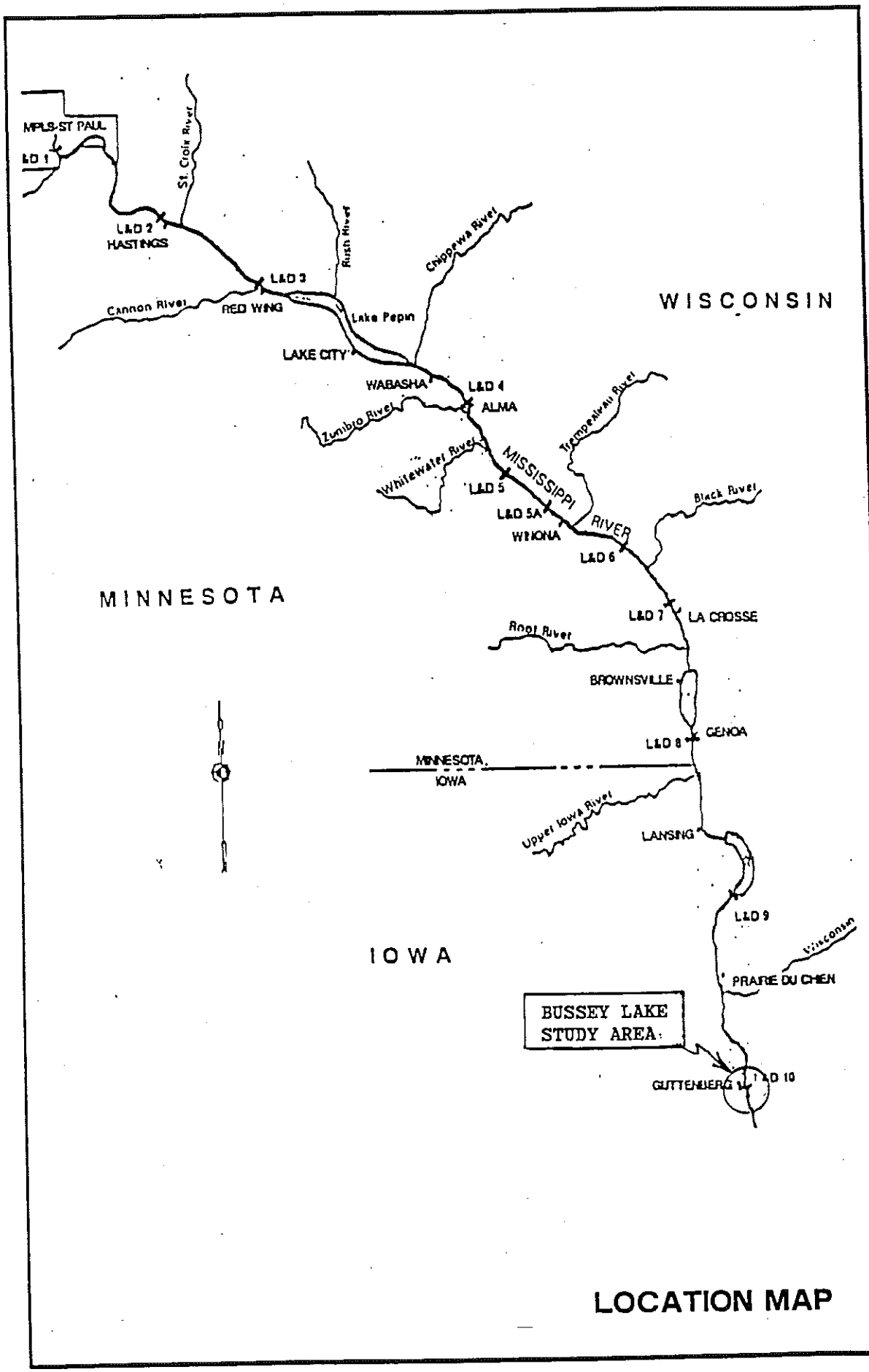
Stuber, R.J., G. Gebhart, and O.E. Maughan. 1982. Habitat suitability index models: Bluegill. U.S.D.I. Fish and Wildlife Service. FWS/OBA-82/10.8, 26 pp.

Attachments:

1. Plates:
   - 1 - Location Map
   - 2 - Study Area Map
   - 3 - O_2 Data July 1988
   - 4 - O_2 Data November 1988 - January 1989
   - 5 - O_2 Data March 21, 1989
   - 6 - Contour Map (1937 and 1987)
   - 7 - Boring Logs
   - 8 - Alternative Dredging Plans
   - 9 - Selected Plan
   - 10 - Control Structure - Plan View
   - 11 - Disposal Site Plan
2. Finding of No Significant Impact
3. Sediment Quality Data and Section 404(b)(1) Evaluation Report
4. Coordination
5. Distribution List
6. Local Cooperation Agreement and Memorandum of Agreement
7. Hydraulics and Sedimentation Analysis
8. Habitat Evaluation Procedures
9. Detailed Cost Estimate

Attachment 1

Plates



LOCATION MAP

PLATE 1

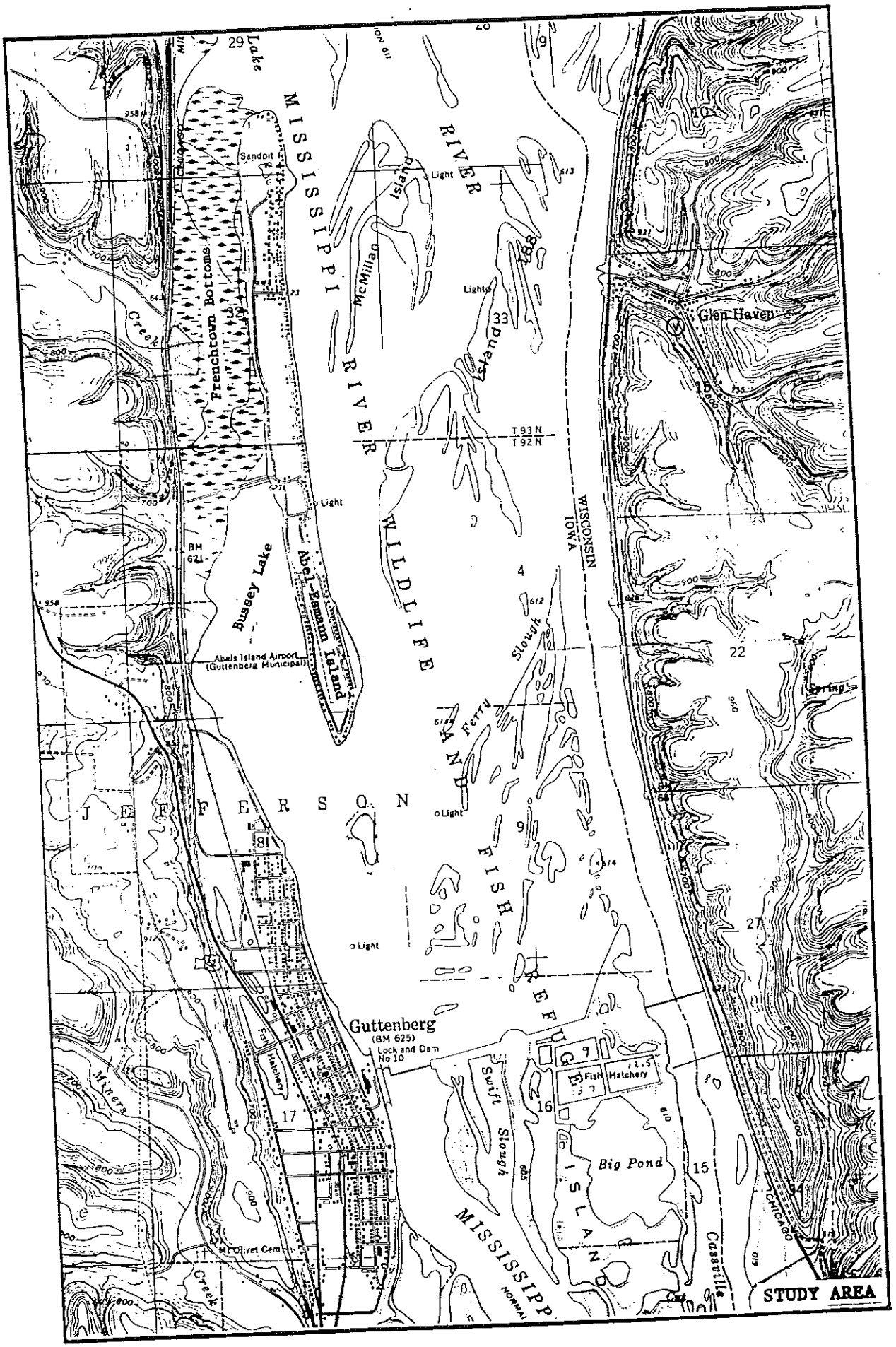

MISSISSIPPI RIVER
WILDLIFE
FISH
REFUGE
ISLAND
Lake
Sandpit
Frenchtown Bottoms
Creek
McMillan Island
Light
Lights
Glen Haven
T 93 N
T 92 N
WISCONSIN
IOWA
Bussey Lake
Abel Bamam Island
Abels Island Airport
(Guttenberg Municipal)
Slough
Ferry
JEFFERSON
Guttenberg
(BM 625)
Lock and Dam
No 10
Fish Hatchery
Swift Slough
Big Pond
Spring
Creek
MISSISSIPP
NORMAL
STUDY AREA

PLATE 2

BUSSEY LAKE SITE A D.O./TIME READINGS

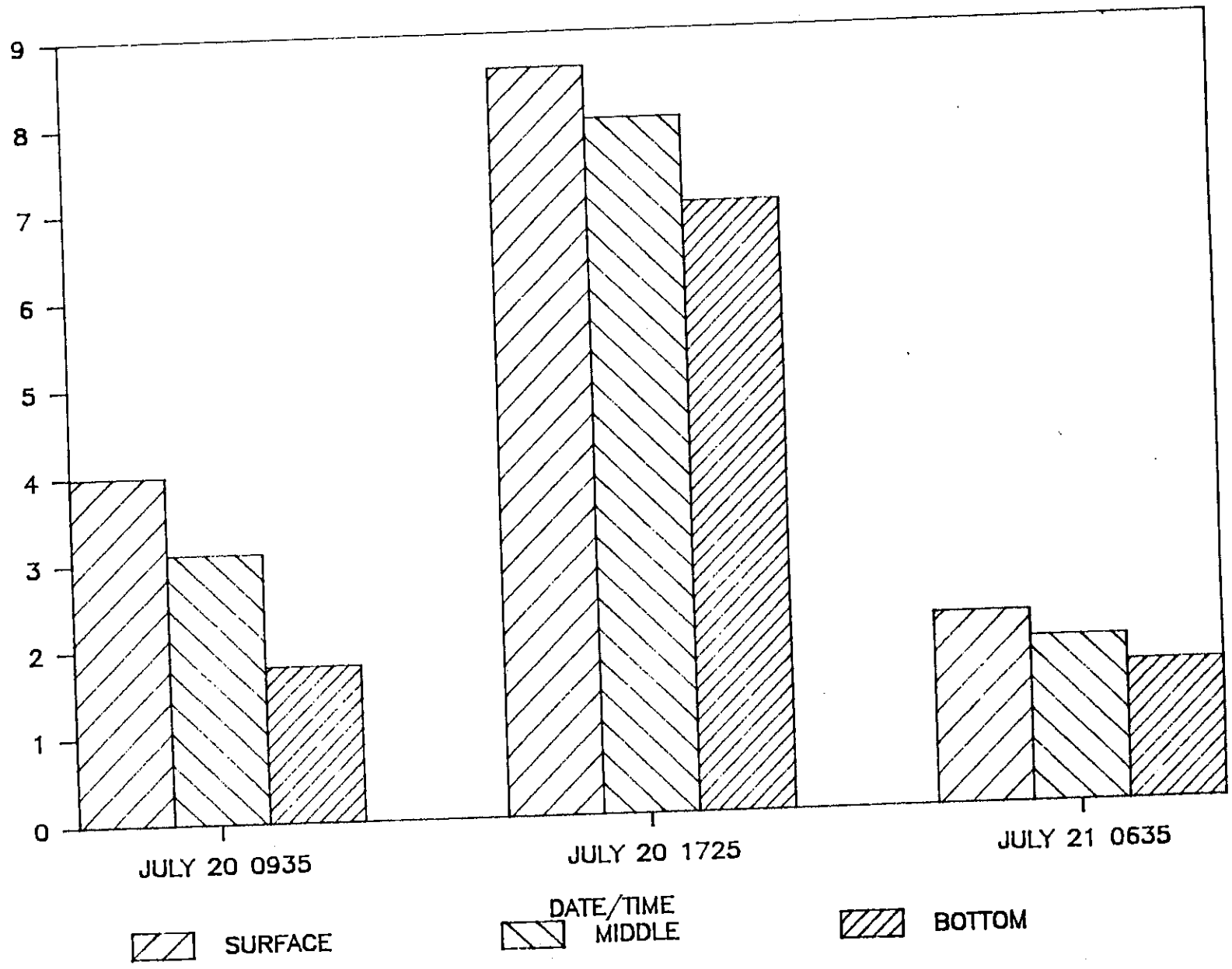


Plate 3-A

BUSSEY LAKE A EAST D.O./TIME READINGS

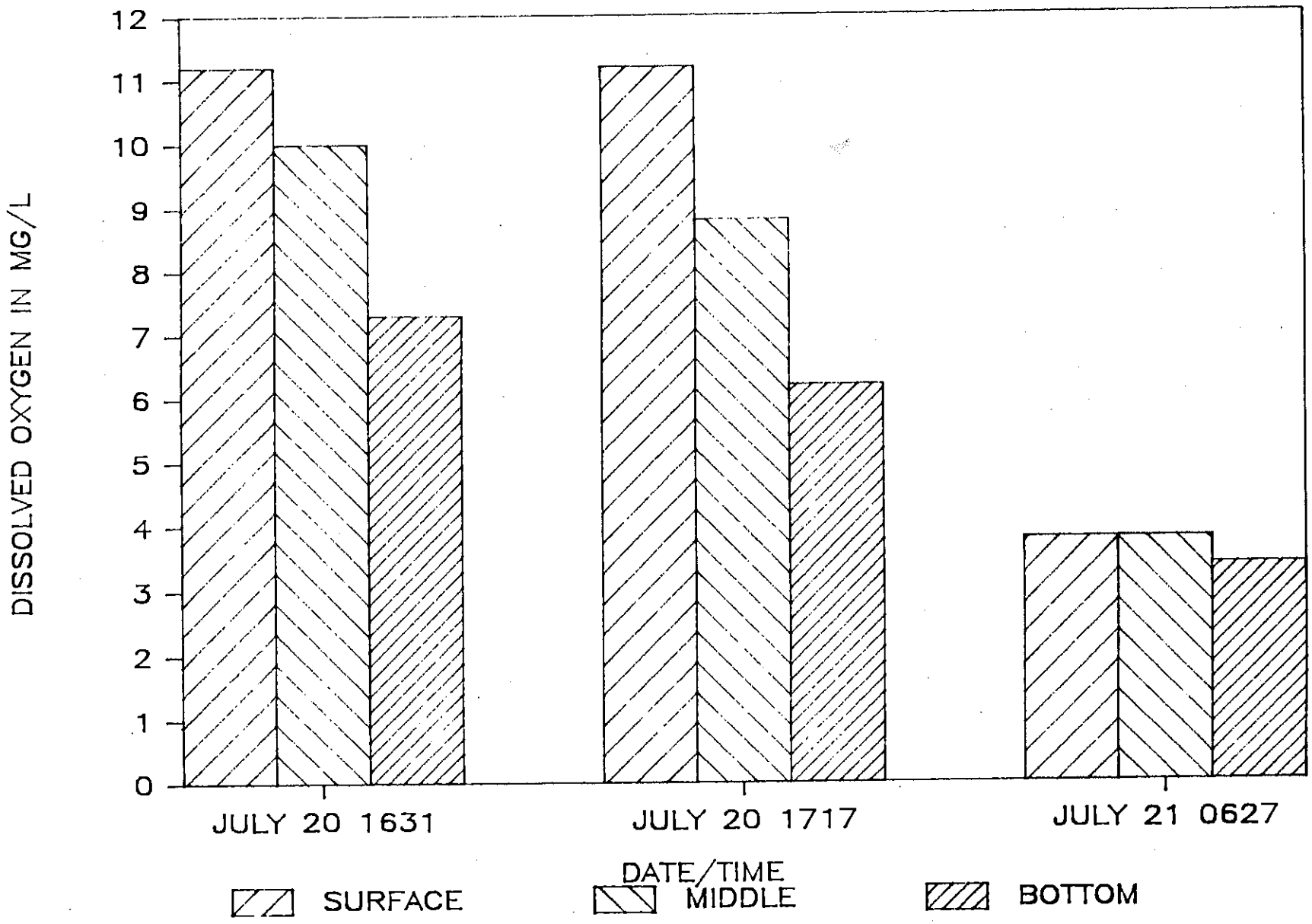


Plate 3-B

BUSSEY LAKE SITE B D.O./TIME READINGS

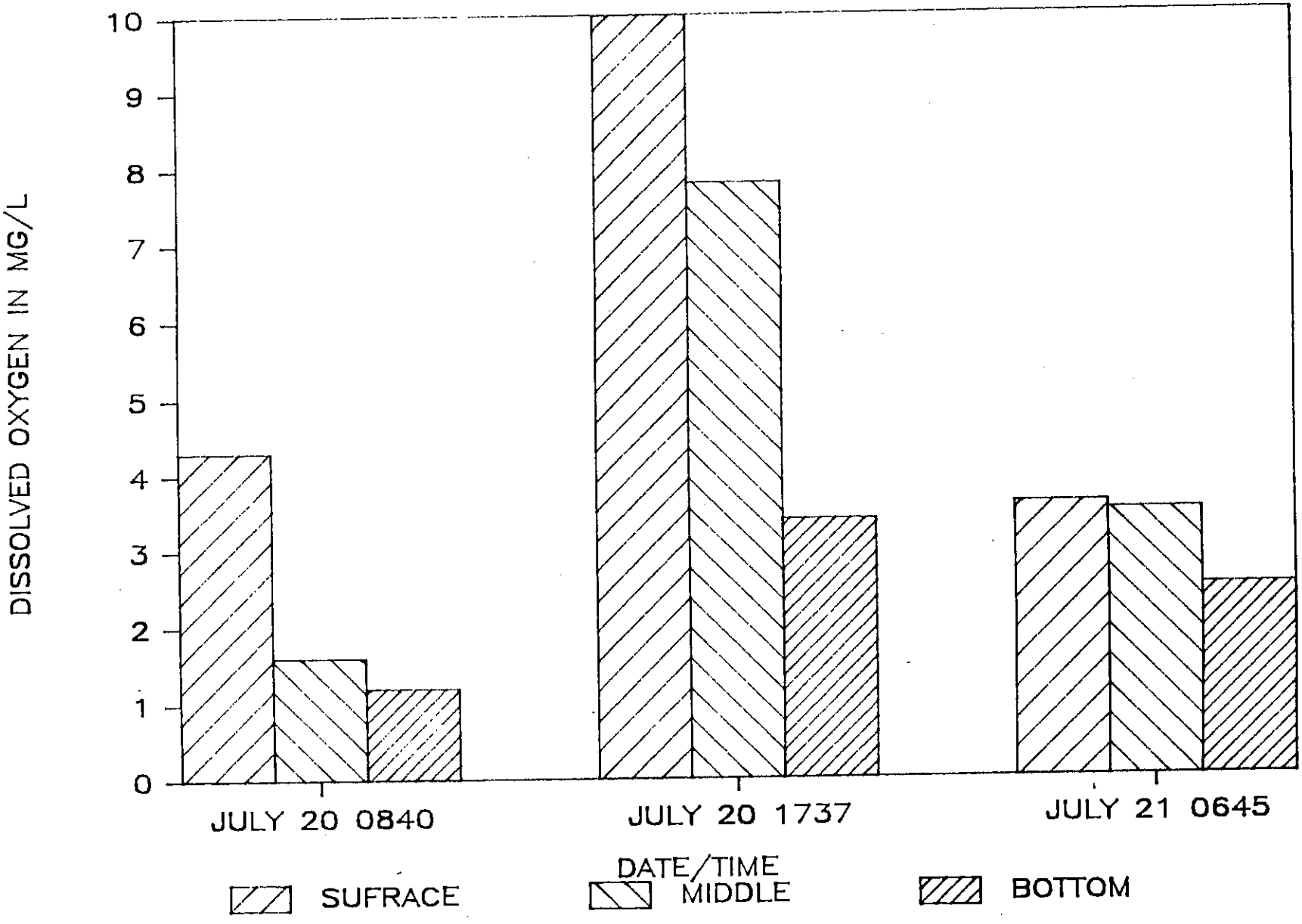


Plate 3-C

BUSSEY LAKE SITE C D.O./TIME READINGS

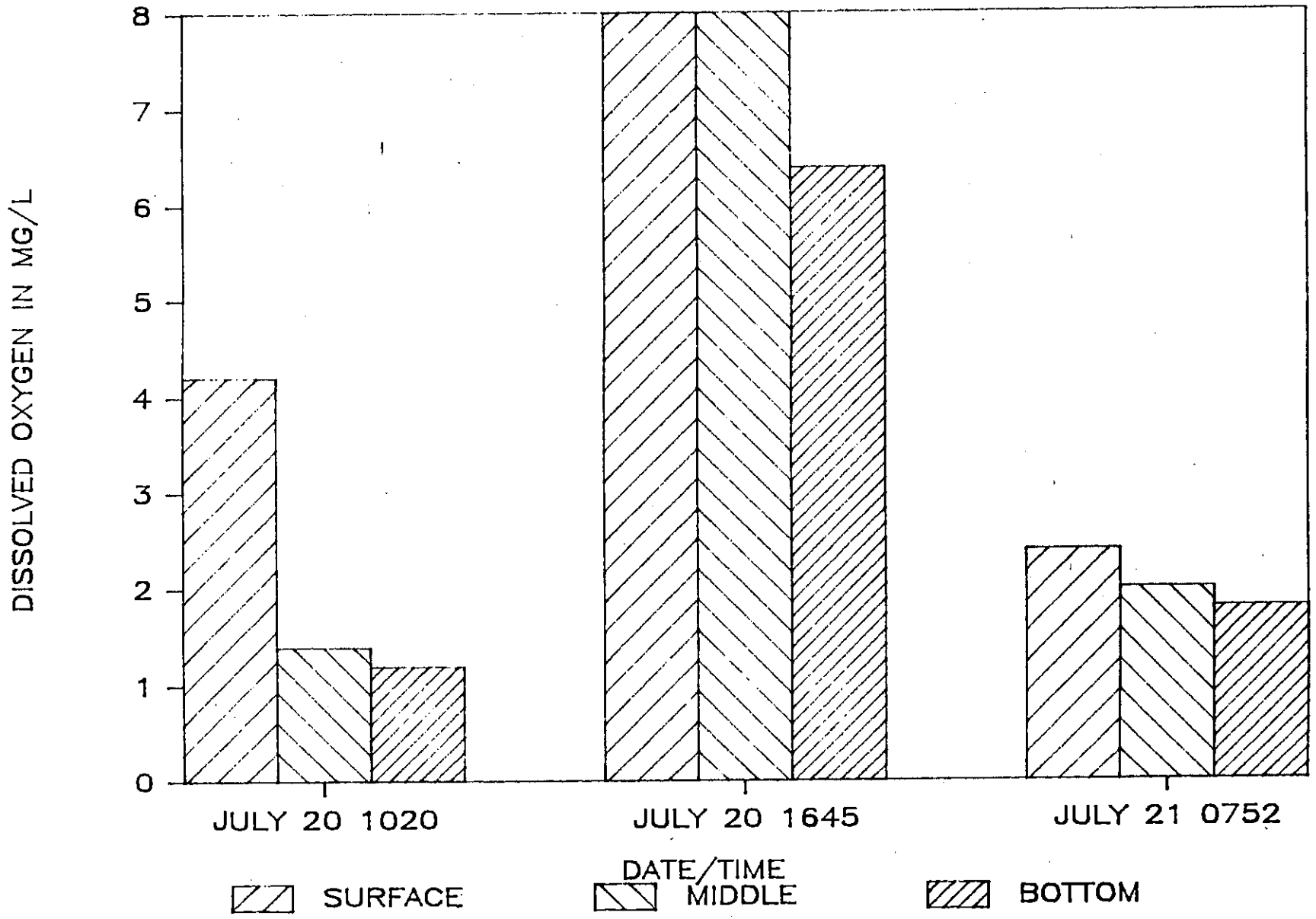


Plate 3-D

BUSSEY LAKE WINTER MONITORING

SITES 1 & 3

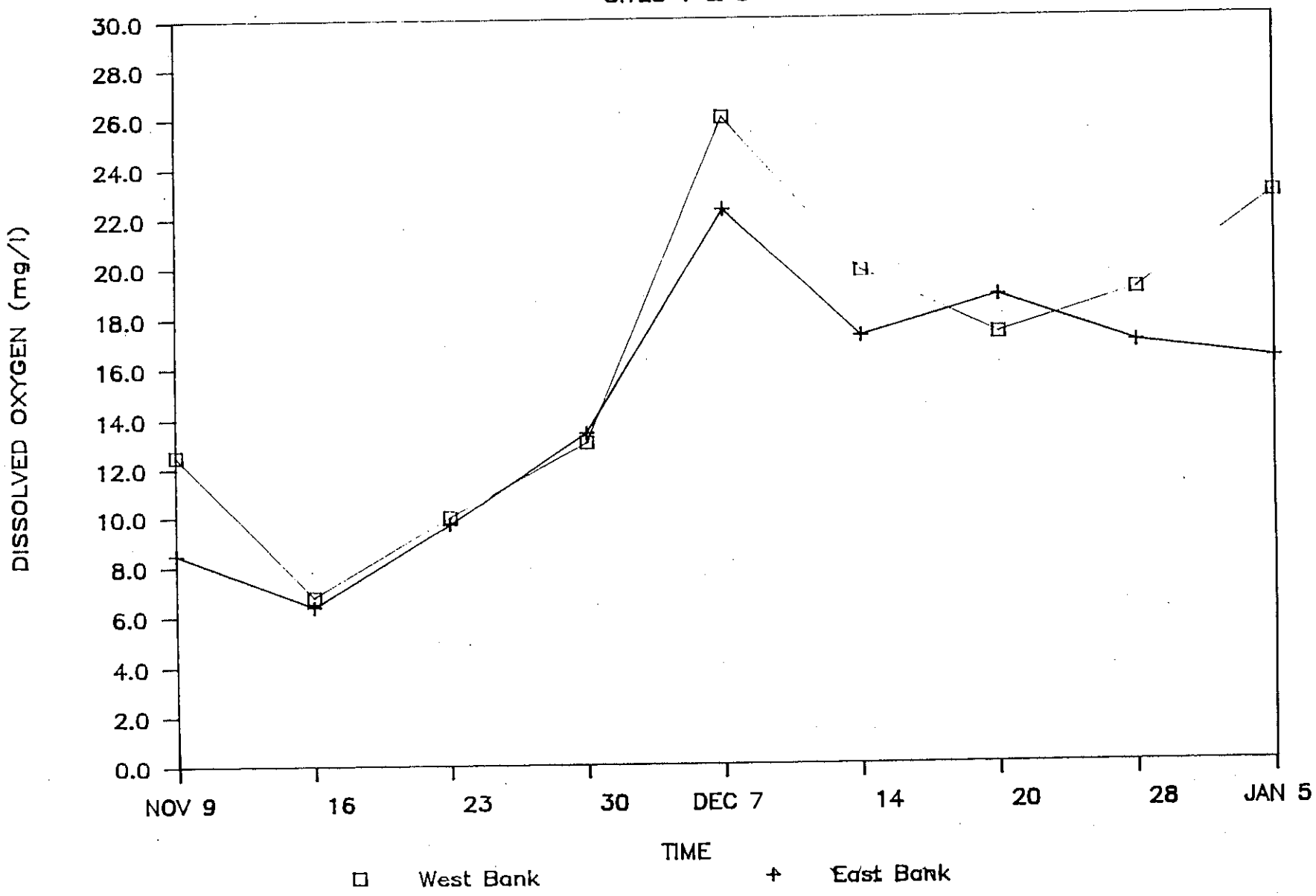
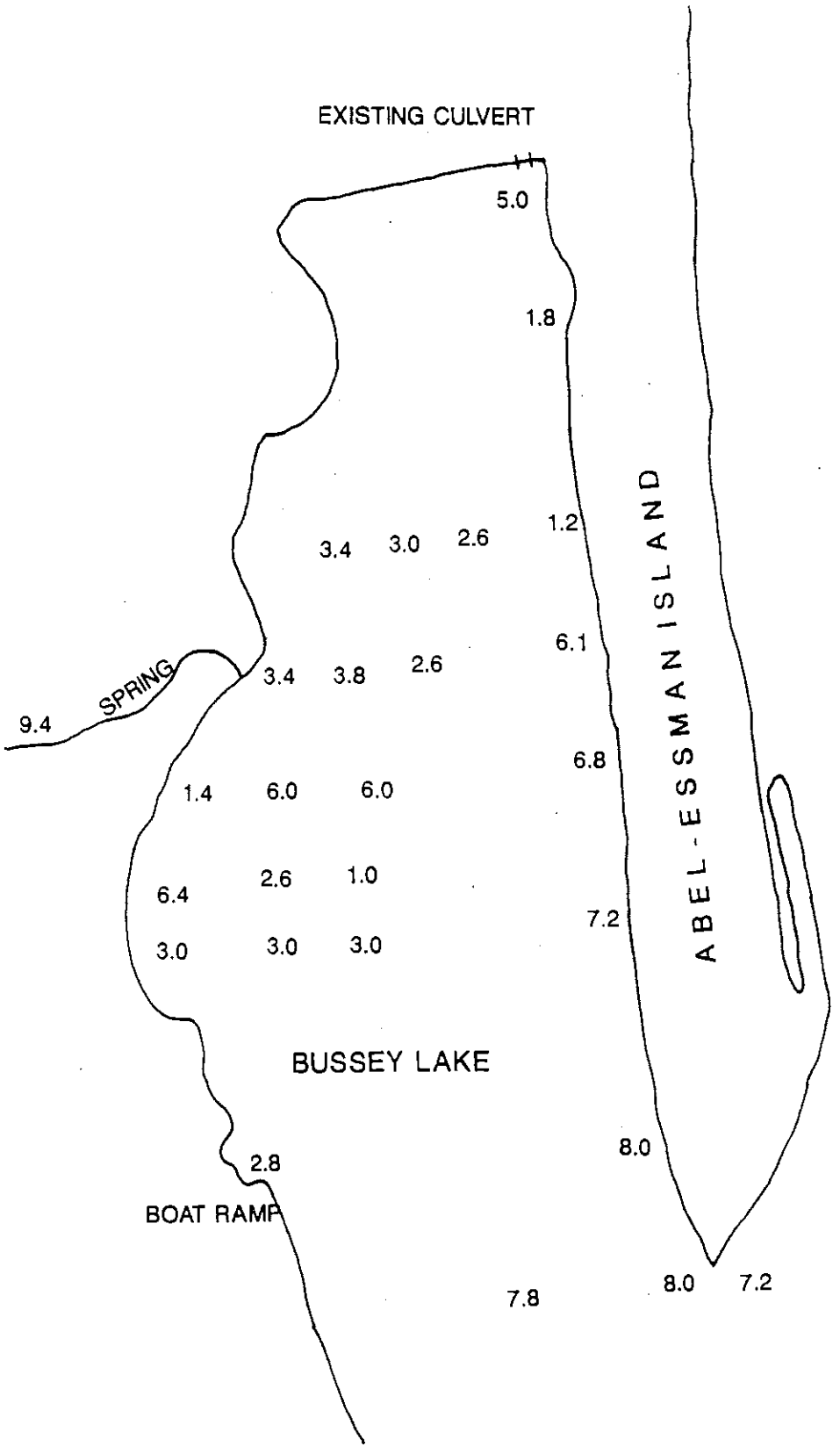


PLATE 4

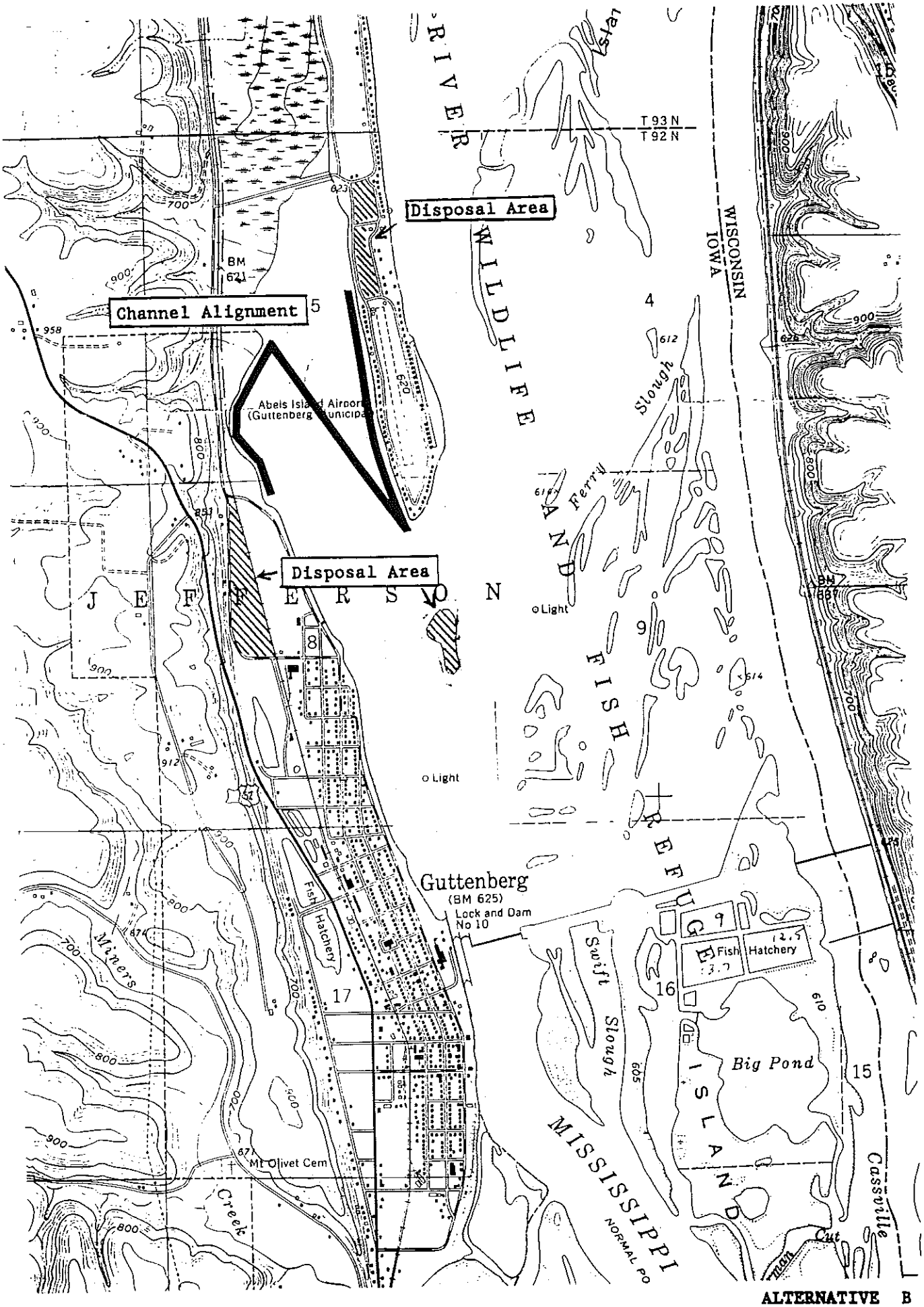


BUSSEY LAKE

WINTER OXYGEN CONCENTRATIONS (MG/L)

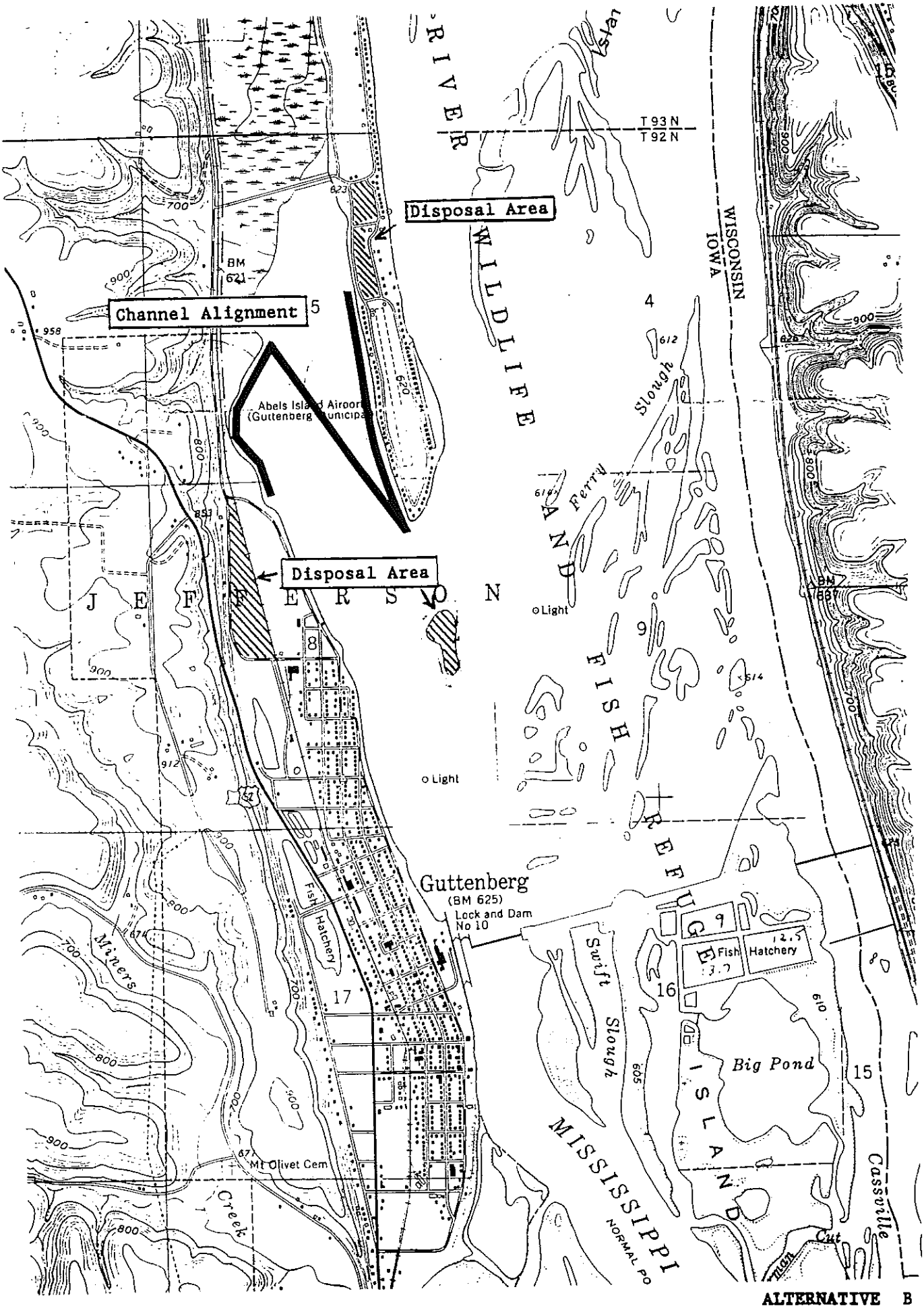
MARCH 21, 1989

PLATE 5



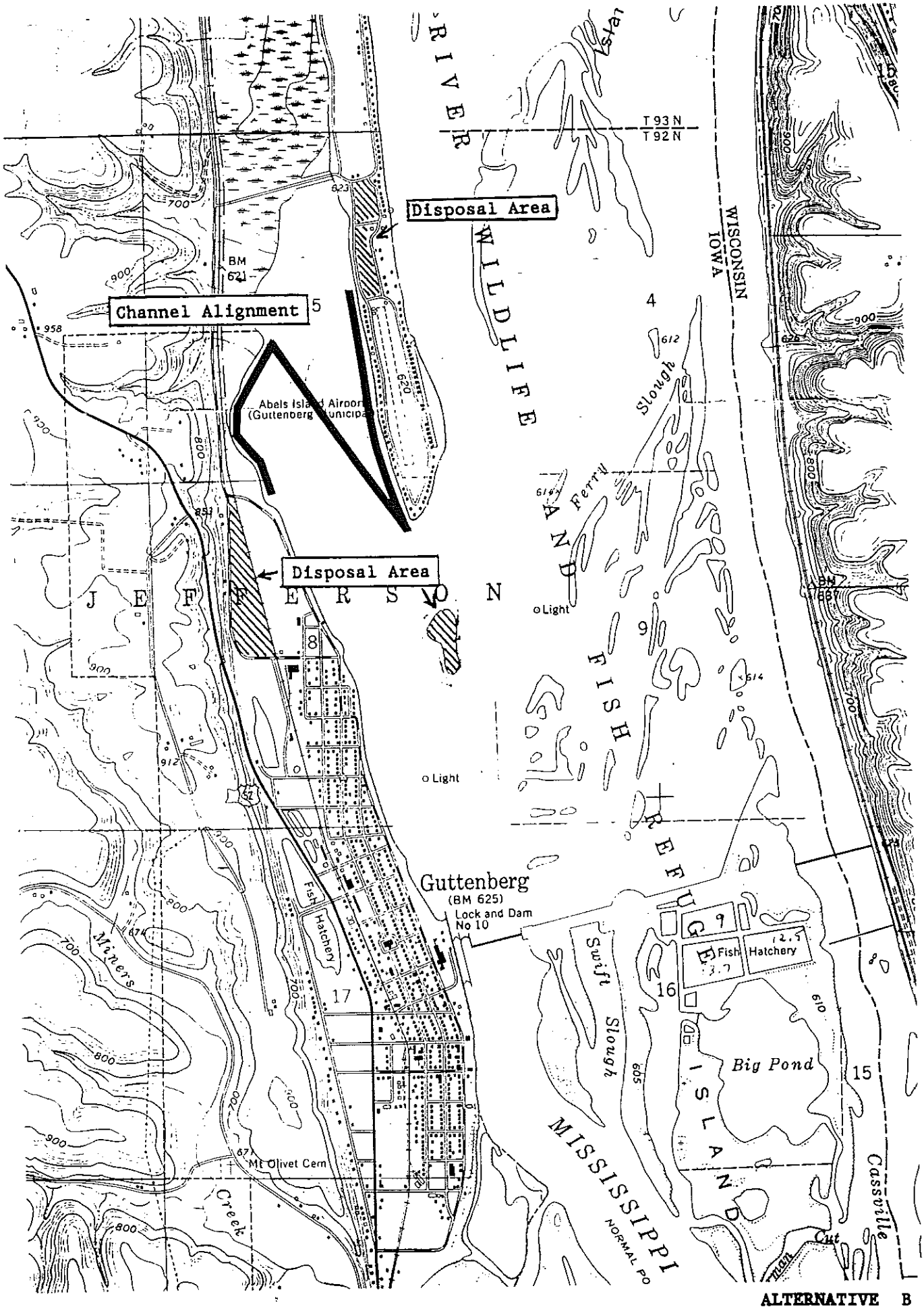
ALTERNATIVE B

Plate 81



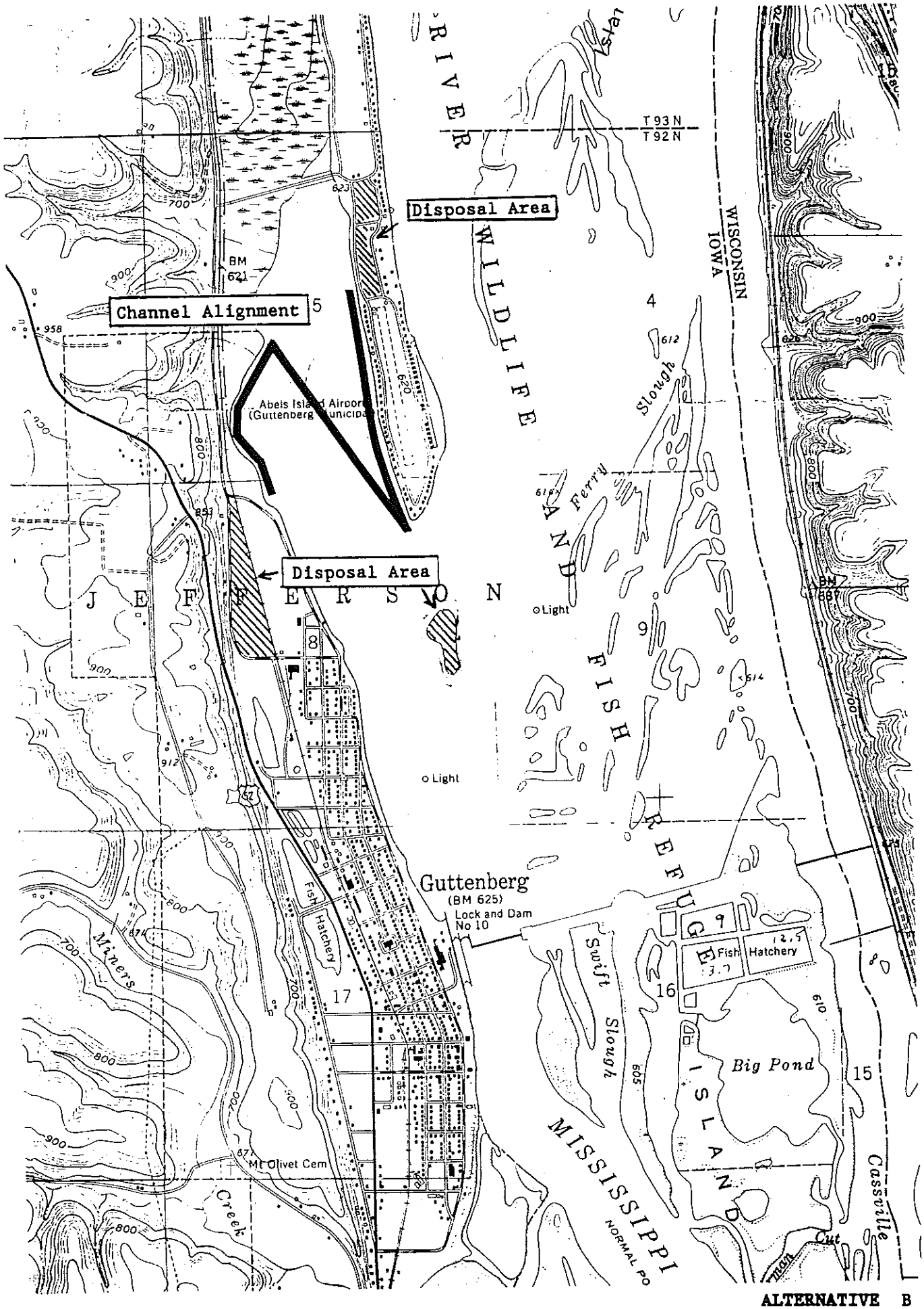
ALTERNATIVE B

Plate 8



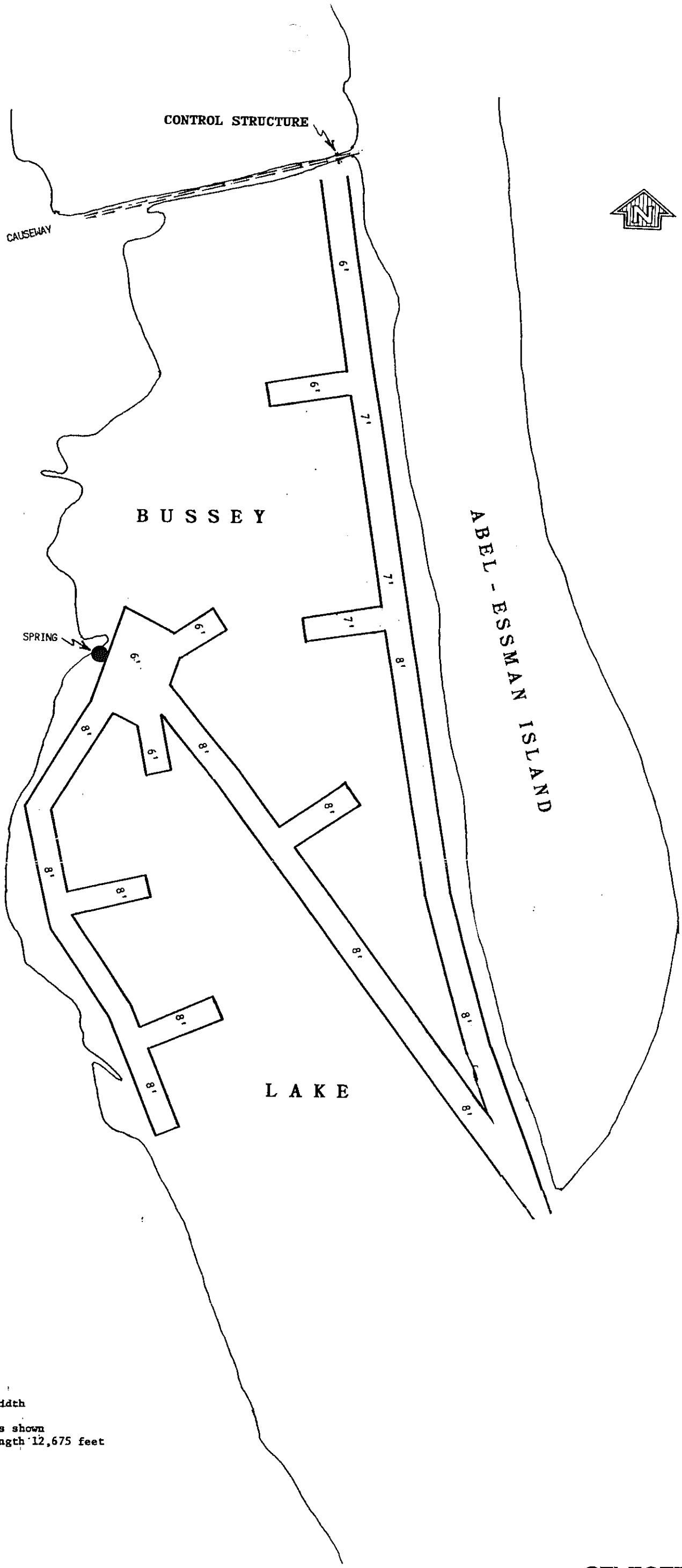
ALTERNATIVE B

Plate 8



ALTERNATIVE B

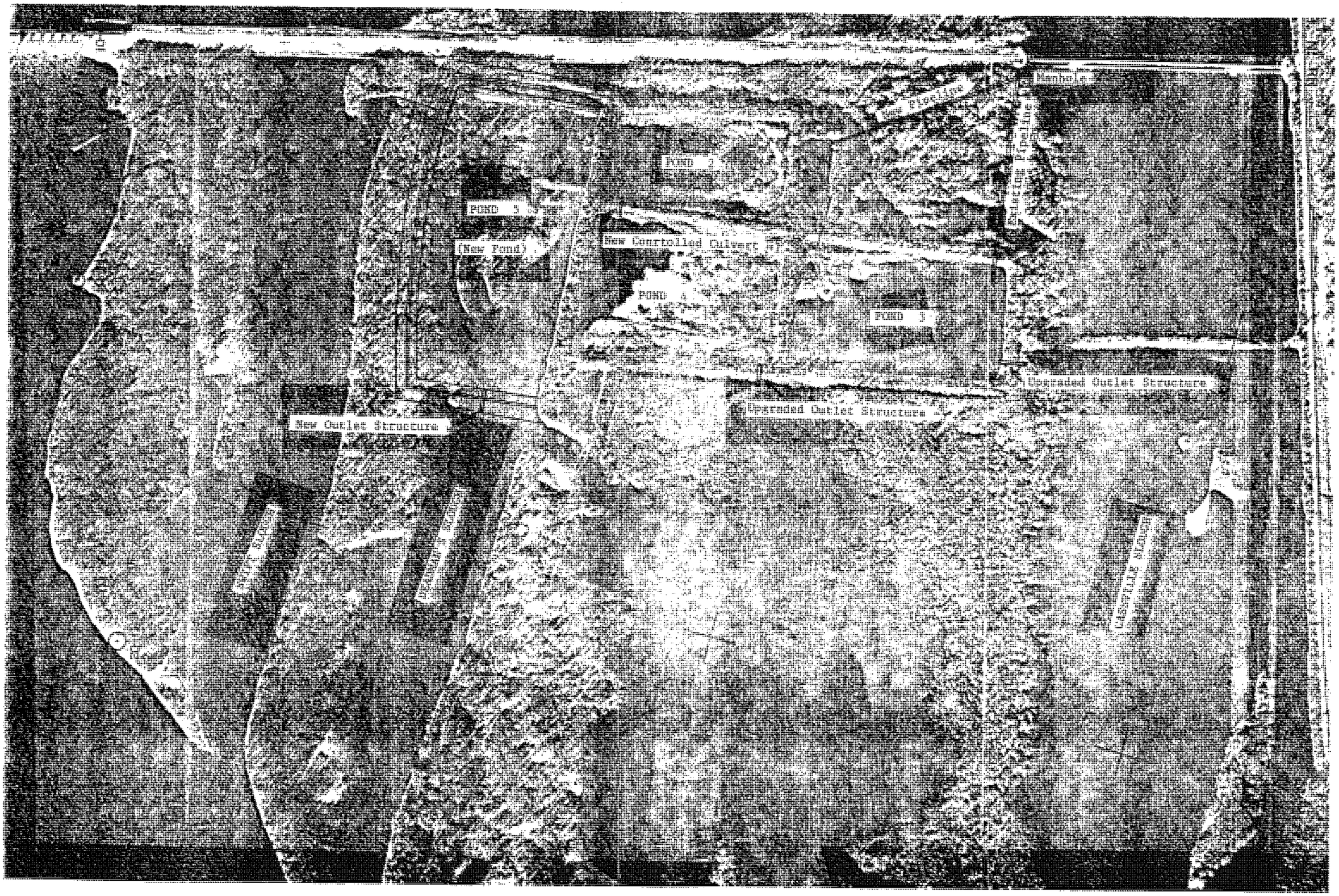
Plate 8



- 75 feet bottom width
- 6:1 side slopes
- Channel depths as shown
- Total channel length 12,675 feet

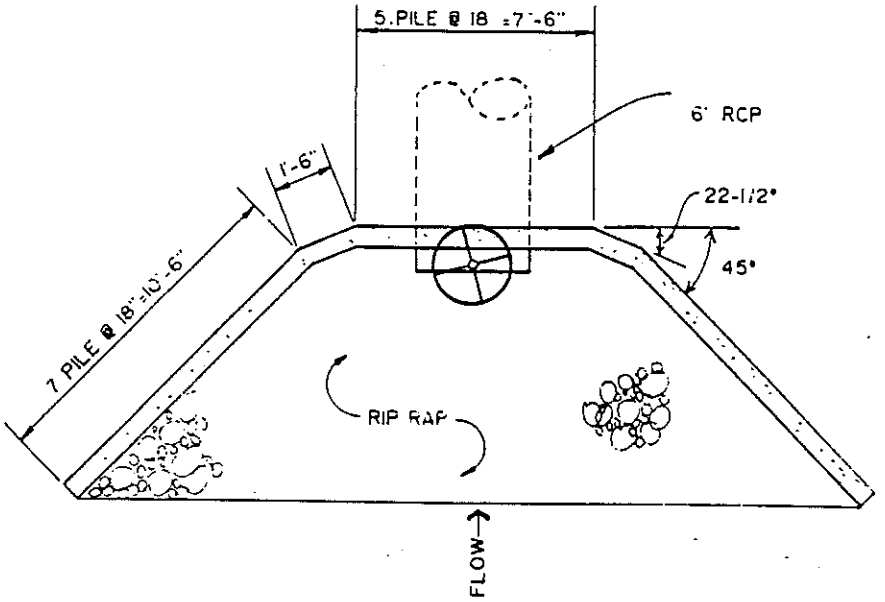
SELECTED PLAN
DREDGE ALIGNMENT

PLATE 9

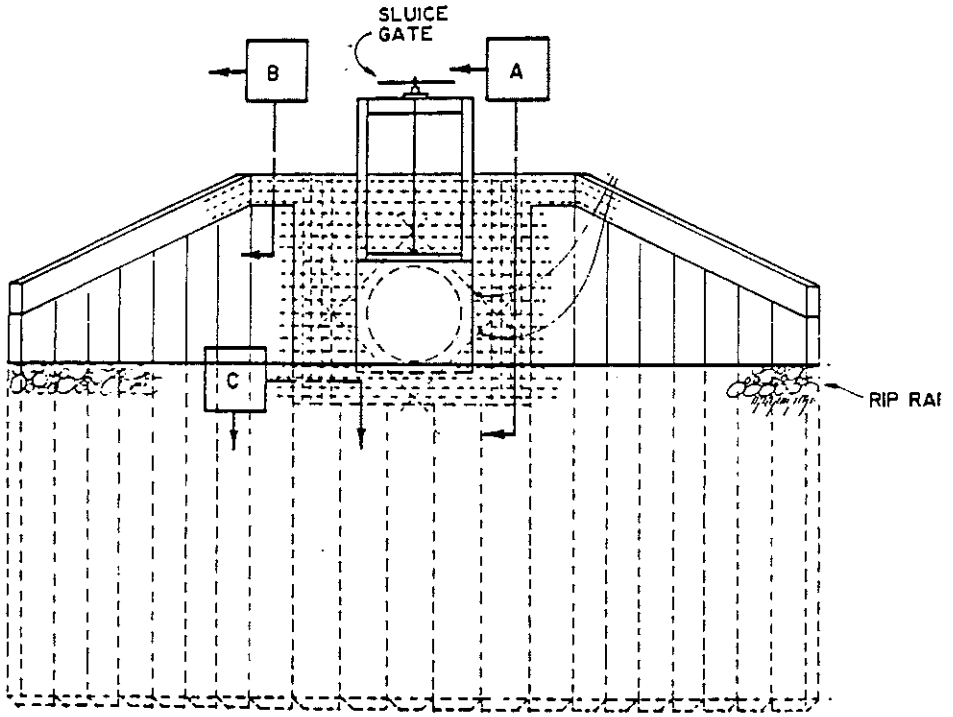


DISPOSAL SITE PLAN

Plate 1



PLAN VIEW



CONTROL STRUCTURE

Attachment 2

Finding of No Significant Impact

FINDING OF NO SIGNIFICANT IMPACT

In accordance with the National Environmental Policy Act of 1969, the St. Paul District, Corps of Engineers, has assessed the environmental impacts of the following proposed project.

UPPER MISSISSIPPI RIVER SYSTEM POOL 10
ENVIRONMENTAL MANAGEMENT PROGRAM
BUSSEY LAKE FISH HABITAT REHABILITATION
CLAYTON COUNTY, IOWA.

The proposed action involves dredging of 270,000 cubic yards of bottom sediments from Bussey Lake in the form of 12,000 feet of 75-foot-wide channels and installation of a culvert in a causeway at the lake's north end. The dredged material would be used to enhance three existing moist soil units and create one new moist soil unit at the Guttenberg waterfowl ponds.

The proposed work would increase the diversity of fish habitat in the lake, reduce the potential for dissolved oxygen depletion, and prevent fish kills due to pesticide or herbicide inflows from Buck Creek through the culvert at the lake's north end. At the Guttenberg waterfowl ponds, the dredged material would be used to increase the manageability of the existing moist soil units totaling 35 acres and to create a new 15-acre moist soil unit.

The finding of no significant impact is based on the following factors: (1) habitat disturbance as well as noise and air quality impacts due to construction would be temporary, (2) effects on human use characteristics would be minimal, (3) there would be a substantial improvement in the quality of fish habitat in Bussey Lake, and (4) there would be a substantial improvement in waterfowl management capabilities at the Guttenberg waterfowl ponds. The expected impacts of the proposed action are discussed in the Environmental Effects section of the Definite Project Report and Environmental Assessment.

The environmental review process indicates that the proposed action does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, an environmental impact statement will not be prepared.

11 July 90
Date

Roger L. Baldwin
Colonel, Corps of Engineers
District Engineer

Attachment 3

Section 404(b)(1) Evaluation Report

SECTION 404(b)(1) EVALUATION
DREDGED MATERIAL DISPOSAL
BUSSEY LAKE, POOL 10, UPPER MISSISSIPPI RIVER

I. PROJECT DESCRIPTION

A. Location - The proposed dredged material disposal action would take place immediately below the Lock and Dam 10 dike on the Upper Mississippi River near Guttenberg, Iowa.

B. General Description - In 1989-90 three old fish ponds located below the Lock and Dam 10 dike were rehabilitated to be managed as moist soil units for waterfowl. A limiting factor on the manageability of these ponds is their bottom configuration and elevation. Management of these ponds as moist soil units would be improved by raising their bottom elevation. Approximately 115,000 cubic yards of material hydraulically dredged from Bussey Lake would be placed in these three ponds to raise their bottom elevation 2-3 feet. In addition, 155,000 cubic yards of material hyraulically dredged from Bussey Lake would be used to create an additional moist soil unit 15 acres in size.

The dikes for the new unit would be created from material pushed up from the interior of the unit or with material obtained by dredging a sand bar blocking the entry of Swift Slough located about 3,000 feet southwest of the waterfowl ponds. The four units (3 existing and 1 new) would be used as four cells during the hydraulic dredging operation. Material would be discharged into Pond 5, with the hydraulic effluent routed through Ponds 4, 2, and 3 consecutively. The final effluent would be discharged from Pond 3 into Cassville Slough, a major slough lying east of the ponds. Following dewatering and drying out, the dredged material would be moved around mechanically within and between the ponds to achieve final elevations and slopes.

C. Authority and Purpose - Federal authority for this project is in Section 1103 of the Upper Mississippi River Management Act of 1986. The overall purpose of the project is to improve the fishery habitat in Bussey Lake. The disposal action will provide a disposal site for dredged material in a manner that will result in a beneficial use of the material.

D. General Description of Dredged or Fill Material

1. General Characteristics of Material - The dredged material from Bussey Lake will consist of fine sediments that have accumulated in the lake over the last 50+ years. Bulk chemical analysis (attached) indicates the sediments contain low levels of heavy metals, PCB's, and traces of some chlorinated hydrocarbon pesticides. The levels of these contaminants are relatively low for fine sediments on the Upper Mississippi River, and are not present in significant enough amounts to warrant any special concern.

Material dredged from the mouth of Swift Slough would consist of sand sediments that have formed a sand bar across the mouth the slough. This material has not been tested for chemical contaminants. However, based on past experience with testing of Upper Mississippi River main channel sands it is expected that the sediments comprising the sand bar would be relatively contaminant free. There is no evidence that would indicate that this material may be contaminated in any manner.

2. Quantity of Material - Approximately 270,000 cubic yards of of dredged material would be placed at the proposed disposal site. Approximately 52,000 of material would be needed for dike construction.

3. Source of Material - The dike material would come from the interior of the site or would be dredged from a sandbar located at the mouth of a slough about 3,000 feet from the site. The dredged material would come from the lakebed of Bussey Lake.

E. Description of the Proposed Discharge Sites

1. Location - The proposed disposal site is located immediately below Lock and Dam 10 at Guttenberg, Iowa.

2. Size - The proposed disposal site is 50 acres, 35 acres of existing ponds and 15 acres for the proposed new pond.

3. Type of Site - As indicated above, 35 acres of the site are existing ponds that have been recently rehabilitated to be managed as moist soil units for waterfowl food production. The 15 acres that would be converted to the new moist soil unit is presently a shallow herbaceous wetland that is a combination of riverine emergent nonpersistent and palustrine emergent persistent wetland types.

4. Types of Habitat - The interior of the existing ponds currently contain a mixture of native herbaceous and shrubby wetland vegetation that over time, would be replaced by a more managed mixture of grasses, sedges and herbs desired as waterfowl food plants. The habitat that would be converted into a new moist soil unit is a shallow herbaceous wetland.

5. Timing and Duration - Subject to approval, the disposal operation would likely occur in the summer of 1992. Duration of use would be 2-3 months. Following drying out the material would be final graded during the summer of 1993.

F. Description of Disposal Method - If taken from the interior of the site, the dike material would be put in place by mechanical equipment. If taken from the sandbar at the mouth of Swift Slough, the material could be placed mechanically or by a small hydraulic dredge.

The dredged material from Bussey Lake would be placed into the site hydraulically. The hydraulic effluent would be routed through the four ponds to maximize retention time, and discharged to Cassville Slough from Pond 3 via an existing discharge structure.

II. FACTUAL DETERMINATIONS

A. Physical Substrate Determinations

1. Substrate Elevation and Slope - The surface elevation in the existing three ponds would be raised 2-3 feet. The surface elevation in the newly created pond would be raised 3-5 feet. The natural slope would be changed to facilitate drainage of the ponds as part of their management as moist soil units.

2. Sediment Type - The soil in the proposed disposal site is a mixture of sand and silt based alluvial soils.

3. Dredged Material Movement - The dredged material would be contained within the boundaries of the proposed disposal site.

4. Physical Effects on Benthos - Any benthos present in the shallow wetlands on site would be buried by the disposal action.

5. Actions Taken to Minimize Impacts - Because the basic purpose of the proposed disposal action is to elevate and alter the nature of the substrate at the disposal site, no actions are proposed to reduce impacts on the substrate.

B. Water Circulation, Fluctuation, and Salinity Determinations

1. Water

a. Salinity - Not applicable.

b. Water Chemistry - Neither the proposed disposal action nor the discharge of dredge carriage water is expected to have any significant impact on Cassville Slough water chemistry.

c. Clarity - Some minor, short-term decreases in clarity may occur in the vicinity of discharge point for the dredge carriage water. This effect would be limited to the duration of the construction phase of the project.

d. Color - The proposed disposal activities should have no impact on Cassville Slough water color.

e. Odor - The proposed disposal activities should have no appreciable impact on Cassville Slough water odor.

f. Taste - The proposed disposal activities should have no impact on Cassville Slough water taste.

g. Dissolved Gas Levels - The proposed disposal activities should have no significant impact on dissolved gas levels in Cassville Slough.

h. Nutrients - The proposed disposal activities should have no significant impact on nutrient levels in Cassville Slough.

i. Eutrophication - The proposed disposal activities should have no impact on the level or rate of eutrophication of Cassville Slough.

j. Temperature - The proposed disposal activities would have no appreciable impact on Cassville Slough water temperature.

2. Current Patterns and Circulation

a. Current Patterns and Flow - The proposed disposal activities would have no effect on Cassville Slough current patterns and flow. The shallow wetland that would be converted to moist soil unit use in currently inundated by backwater flooding. This would occur at much less frequency once the area is elevated by the dredged material disposal action.

b. Velocity - The proposed disposal activities would have no effect on Cassville Slough water velocity.

c. Stratification - The proposed disposal activities would have no effect on the development of stratified conditions.

d. Hydrologic Regime - The proposed disposal activities would have no impact on the hydrologic regime of Cassville Slough. The area of the new moist soil unit would be flooded by backwater flooding infrequently as compared to the nearly annual flooding that takes place now.

3. Normal Water-Level Fluctuations - The proposed disposal activities would have no effect on normal water-level fluctuations.

4. Salinity Gradient - Not applicable.

5. Actions Taken to Minimize Impact - The four ponds would be used as individual cells during the dredging and disposal operation to maximize the quality of effluent discharged from the site.

C. Suspended Particulate/Turbidity Determination - The dredge carriage water discharged from the disposal site would contain some suspended sediments. Levels of suspended particulates in the discharge water are expected to be relatively low because retention times of 60 to 110 hours are expected to be achieveable, even if a large hydraulic dredge is used. There may be a very localized increase in these parameters at the point of discharge into Cassville Slough. Due to the dilutional capacity of Cassville Slough it is expected that these increases would be detectable only a short distance downstream of the discharge point.

D. Contaminant Determinations - Due to the relatively low levels of contaminants in the dredged material, the affinity of these contaminents for sediment particles, and the projected retention times available in the disposal site, no appreciable release of contaminants into Cassville Slough via the discharge of the dredge carriage water is expected.

E. Aquatic Ecosystem and Organism Determinations - No appreciable impact on the aquatic ecosystem is expected. The shallow herbaceous wetland that would be converted to moist soil units has limited fishery habitat value. The habitat value the wetland provides for semi-aquatic species such as wading birds, shore birds, furbearers, reptiles, and amphibians would be lost; though much of the lost habitat value would be regained through use of the managed moist soil units by these same forms of wildlife.

F. Proposed Disposal Site Determinations

1. Mixing Zone Determination - The discharge of the dredge carriage water would require a small mixing zone in Cassville Slough. This slough has flows of 200-500 cfs during normal summer flow periods. Depending upon the size of the dredge used, discharges from the disposal site are likely to be in the 10-30 cfs range.

2. Determination of Compliance with Applicable Water Quality Standards- It is expected that the proposed discharge will comply with State water quality

Sediment Analysis of Bussey Lake

Parameter Tested For	Concentration in dry weight B1	B2	B3	B4
Ammonia Nitrogen* mg/kg	60.1	82.1	41.0	45.6
Cyanide mg/kg	<0.89	<0.82	<0.93	<1.2
METALS (in mg/kg or ppm)				
Arsenic (As)	<0.1	0.61	<0.1	<0.1
Cadmium (Cd)	<0.1	<0.1	0.16	<0.1
Chromium (Cr)	5.2	<1.0	5.2	3.3
Copper (Cu)	3.8	<1.0	3.6	2.2
Lead (Pb)	9.6	11.7	8.5	5.1
Mercury (Hg)	<0.01	<0.01	<0.01	<0.01
Nickel (Ni)	6.4	<1.0	49.8	3.0
Selenium (Se)	<1.0	<1.0	<1.0	<1.0
Manganese (Mn)	185	<1.0	158	118
Zinc (Zn)	0.71	<1.0	19.8	12.2
CHLORINATED HYDROCARBONS (in ug/kg or ppb) All undetected at limits shown on following page except numbers noted below				
Aldrin			0.42	
alpha BHC				
beta BHC				
delta BHC				
gamma BHC				
Chlordane			0.2	0.61
DDD				0.65
DDE			0.29	0.80
DDT				
Dieldrin				
Endrin				
Endrin Aldehyde				
Endosulfan I				
Ednosulfan II				0.81
Endosulfan Sulfate				
Heptachlor				
Heptachlor Epoxide				
Methoxychlor				
Toxaphene				
PCB's				
Arochlors 1016				
1221				
1232				
1242				

* wet weight

Parameter Tested For	Concentration in dry weight B1	B2	B3	B4
PCB's				
Arochlors 1254	.....		6.1	23 ..
1260	.....			

HERBICIDES (all undetected at the limits shown on the following page)

2,4-D
2,4,5-T
2,4,5-TP (Silvex)

PHYSICAL PARAMETERS

% Moisture	43.9	39.1	46.4	59.6
Tot. Org. Carbon (mg/kg)	25,500	39,100	35,000	62,100
% Tot. Solids	56.1	60.9	53.6	40.4
% Vol. Solids	5.5	8.2	5.6	9.0
% Solids at 103 C	56.0	71.4	57.4	39.6

Particle Size FINES % FINER

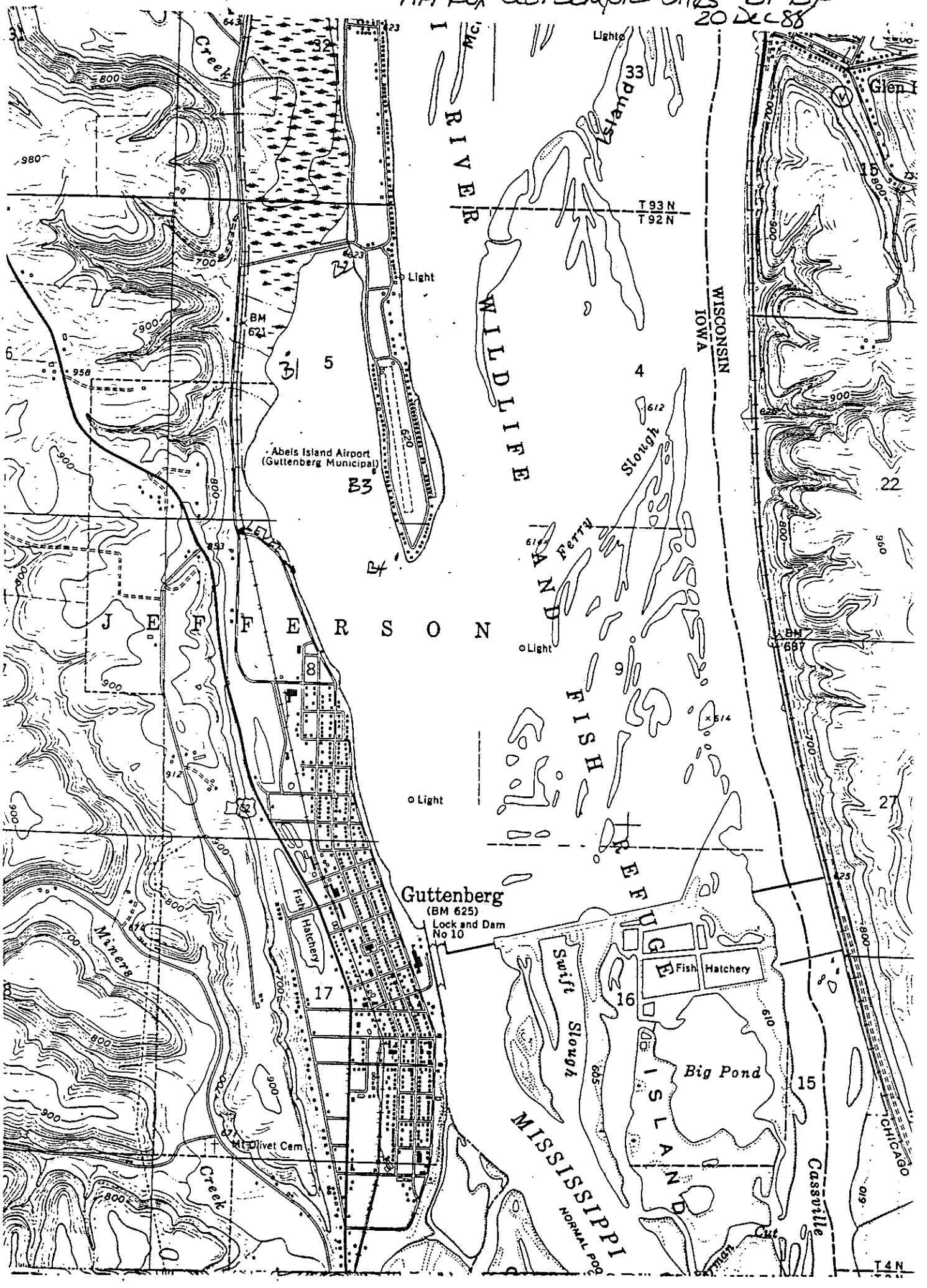
phi size	class	B1	B2	B3	B4
4	coarse silt	35.97	35.49	40.12	25.37
5	medium silt	28.21	35.74	28.58	23.66
6	fine silt	19.82	27.91	20.41	20.30
7	v. fine silt	11.84	19.76	14.92	16.58
8	coarse clay	7.51	13.62	11.68	13.51
9	medium clay	4.25	8.72	7.52	9.48

COARSE % LARGER

phi size	class	B1	B2	B3	B4
-5	gravel	-	-	-	-
-4	gravel	-	-	-	-
-3	gravel	-	-	-	-
-2	gravel	0.12	16.82	1.80	6.00
-1	v. coar. snd.	0.22	4.00	1.90	3.93
0	coarse sand	0.47	3.46	3.30	3.95
1	medium sand	1.48	6.94	13.76	19.35
2	fine sand	1.18	5.94	13.49	22.83
3	v. fine sand	0.79	4.76	11.35	5.18
4	coarse silt	0.67	2.36	5.42	5.05

DETECTION LIMITS FOR THOSE PARAMETERS THAT WERE NOT DETECTED

Parameter Tested For	Dry Weight Detection Limit B1	B2	B3	B4
CHLORINATED HYDROCARBONS (in ug/kg or ppb)				
Aldrin	0.10	0.009		0.013
alpha BHC	0.033	0.003	0.003	0.004
beta BHC	0.10	0.009	0.009	0.013
delta BHC	0.10	0.009	0.009	0.013
gamma BHC	0.10	0.009	0.009	0.013
Chlordane	2.5	0.23		
DDD	0.17	0.02	0.02	
DDE	0.10	0.009		
DDT	0.43	0.04	0.04	0.06
Dieldrin	0.17	0.02	0.02	0.02
Endrin	0.30	0.03	0.03	0.04
Endrin Aldehyde	0.33	0.03	0.03	0.04
Endosulfan I	0.17	0.02	0.02	0.02
Ednosulfan II	0.33	0.03	0.03	
Endosulfan Sulfate	0.33	0.03	0.03	0.04
Heptachlor	0.10	0.009	0.009	0.013
Heptachlor Epoxide	0.17	0.02	0.02	0.02
Methoxychlor	0.73	0.07	0.07	0.10
Toxaphene	5.0	0.47	0.46	0.65
PCB's				
Arochlors 1016	2.5	0.23	0.23	0.33
1221	2.5	0.23	0.23	0.33
1232	2.5	0.23	0.23	0.33
1242	2.5	0.23	0.23	0.33
1248	2.5	0.23	0.23	0.33
PCB's **				
Arochlors 1254	4.2	0.39		
1260	4.2	0.39	0.39	0.54
HERBICIDES (in ug/kg or ppb)				
2,4-D	0.080	0.075	0.074	0.10
2,4,5-T	0.037	0.035	0.034	0.048
2,4,5-TP (Silvex)	0.056	0.052	0.052	0.073


APPROX Sed. Sample Sites B1-B4
20 Dec 88
Creek
Light
33
Island
Glen I
RIVER
T93N
T92N
WILDLIFE
WISCONSIN
IOWA
Light
BM
621
B2
B1
B3
B4
5
4
Abels Island Airport
(Guttenberg Municipal)
Slough
22
Ferry
LAND
JEFFERSON
Light
8
9
FISH
REFUGE
27
Light
Guttenberg
(BM 625)
Lock and Dam
No 10
Fish Hatchery
Swift Slough
Fish Hatchery
17
16
Big Pond
15
ISLAND
MISSISSIPPI
NORMAL POOL
Miners
Creek
Mt Olivet Cem
Cassville
CHICAGO
Cut
T4N

Attachment 4

Coordination

United States Department of the Interior

FISH AND WILDLIFE SERVICE

FEDERAL BUILDING, FORT SNELLING
TWIN CITIES, MINNESOTA 55111

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

FWS/ARW-SS

AUG 8 1990

Colonel Roger L. Baldwin
District Engineer
U. S. Army Engineering District, Saint Paul
1421 U. S. Post Office and Custom House
Saint Paul, Minnesota 55101-1479

Dear Colonel Baldwin:

The U.S. Fish and Wildlife Service (Service) has reviewed the Definite Project Report (May 1990) for the Bussey Lake Habitat Rehabilitation and Enhancement Project. This project, located in Pool 10 of the Mississippi River, is proposed under the Water Resources Development Act of 1986 (Public Law 99-662) as part of the Upper Mississippi River System Environmental Management Program.

The Bussey Lake project has been coordinated with the Service, and we approve and support the project as planned and described in the Definite Project Report. The Service agrees with the preferred alternative described in the Environmental Assessment. The compatibility determination for this project signed on April 25, 1990, by the Refuge Manager, Upper Mississippi River National Wildlife and Fish Refuge, does not include disposal of dredged material from the additional off-refuge commercial/recreation channel proposed by the Iowa Department of Natural Resources. Upon completion of formal Service review of this proposal during the Section 10/404 process, the Refuge Manager will make a separate compatibility determination for placement of additional dredged material on refuge land.

The Service will assure that operation and maintenance requirements of the project will be accomplished in accordance with Section 906(e) of the Water Resources Development Act of 1986. The Service will perform the operation and maintenance requirements for this project, the portion on refuge lands on the Guttenburg moist soil units, in accordance with the policies stated in the Fourth Annual Addendum.

Since the project is on Service land, the Service will complete its finding of no significant impact upon learning from you that the public review period produced no substantive changes in the Definite Project Report/Environmental Assessment.

We look forward to our continued cooperative efforts in developing habitat rehabilitation and enhancement projects under the Environmental Management Program.

Sincerely,

Gerald R. Lowry
Acting Regional Director

STATE OF IOWA

TERRY E. BRANSTAD, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LARRY J. WILSON, DIRECTOR

July 6, 1990

Colonel Joseph Briggs
District Engineer
U.S. Army Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, MN 55101-1479

Dear Colonel Briggs:

This is to inform you that the Iowa Department of Natural Resources supports construction of the Environmental Management Program Habitat Rehabilitation and Enhancement Project at Bussey Lake in lower Pool 10 near Guttenberg, Iowa as outlined in the draft Definite Project Report dated May 1990. This letter also provides you with the assurance that the State of Iowa intends to assume the responsibilities for that project which are outlined in this report.

With regard to the water control structure which is a local cost-share item for this project, the draft Local Cooperation Agreement (LCA) for this portion of the project as presented in this Definite Project Report has been reviewed. We realize that the responsibilities contained therein must be legally assumed by the local sponsor as a prerequisite to implementation of this project. It is understood that the actual execution of the final LCA would follow approval of the Definite Project Report and precede the issuance of any construction funds. It is also understood that although funds, based on the estimated cost of construction, must be received from the State of Iowa prior to construction, the final project cost would be determined after final payment is made to the construction contractor. The local share of the project would then be adjusted to reflect actual rather than estimated costs.

As for the remainder of this habitat project, upon completion and final acceptance of this project by the Corps of Engineers and the U.S. Fish and Wildlife Service, the Iowa Department of Natural Resources agrees to cooperate with the U.S. Fish and Wildlife Service and the Corps of Engineers to ensure that operation, maintenance and any mutually agreed upon rehabilitation as described in the Definite Project Report will be accomplished in accordance with Section 906(e) of the Water Resources Development Act of 1986.

Sincerely,

LARRY J. WILSON
DIRECTOR
IOWA DEPARTMENT OF NATURAL RESOURCES

LJW:sao
cc: Moe, Wisconsin DNR
Beseke, USFWS
Moeller, Iowa DNR

Upper Mississippi River National
Wildlife and Fish Refuge
Established 1924

Compatibility Study
Bussey Lake Rehabilitation

Establishment Authority:

Public Law No. 268, 68th Congress, The Upper Mississippi River Wildlife and Fish Refuge Act.

Purpose for Which Established:

"The refuge shall be established and maintained (a) as a refuge and breeding place for migratory birds included in the terms of the convention between the United States and Great Britain for the protection of migratory birds, concluded August 16, 1916, and (b) to such extent as the Secretary of Agriculture may by regulations prescribe, as a refuge and breeding place for other wild birds, game animals, fur-bearing animals, and for the conservation of wild flowers and aquatic plants, and (c) to such extent as the Secretary of Commerce may by regulations prescribe a refuge and breeding place for fish and other aquatic animal life."

Description of Proposed Use:

The proposal is a Habitat Rehabilitation and Enhancement project authorized by the Water Resource Development Act of 1986 (Pub. L. 99-662). The proposed project will be constructed within Bussey Lake located in Guttenberg, Iowa. The project will include the dredging of approximately 270,000 linear feet of channel in Bussey Lake. The channels would have 75-foot bottom widths with 1:6 side slopes. The material dredged from Bussey Lake would be disposed at the Guttenberg waterfowl ponds located southeast of Bussey Lake. Approximately 115,000 cubic yards of dredged material would be used to elevate and level the bottoms of the three existing moist soil units. The bottom elevation of the ponds would be raised 2-3 feet to a maximum elevation of 608 feet MSL. This will increase pond manageability and thus increase their wildlife values. The remaining 145,000 cubic yards of material will be disposed of in a new moist soil unit, 15 acres in size, created immediately to the west of the present ponds.

Complete details of the project, including maps and engineering drawings, are contained in the draft report entitled, "Upper Mississippi River System Environmental Management Program Definite Project Report with Integrated Environmental Assessment (SP-5) Bussey Lake Habitat Rehabilitation and Enhancement, Pool 10, Upper Mississippi River, Clayton County, Iowa" prepared by the St. Paul District, Corps of Engineers.

Anticipated Impacts on Refuge Purposes:

As a result of the project fish populations should increase which will be a direct benefit toward maintaining and accomplishing refuge purposes. The above mentioned report contains detailed information on the project's impacts

on fish. Also as a result of the project the manageability of the Guttenberg Moist Soil Units will increase. This will have positive benefits for the waterfowl resource. Thus accomplishing refuge purposes.

Justification:

The proposed project works toward the accomplishment of the stated objectives of the refuge.

Determination:

The proposed project is compatible with purposes for which the refuge was established.

Determined by: _____ Refuge Manager — 4/25/90 Date

Reviewed by: _____ Acting Wildlife Biologist-1 — 5/3/90 Date

Concurred by: Acting _____ Regional Director — 5-14-90 Date

STATE OF IOWA

TERRY E. BRANSTAD, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LARRY J. WILSON, DIRECTOR

April 20, 1990

ATTN: PLANNING DIVISION
FLOODPLAIN MANAGEMENT & SMALL PROJECTS

Mr. Louis Kowalski, Chief of Planning Division
St. Paul District, Corps of Engineers
1421 U.S. Post Office & Custom House
St. Paul, MN 55101-1479

Dear Mr. Kowalski:

This letter provides Iowa Department of Natural Resources (IDNR) endorsement of the Definite Project Report and Environmental Assessment (SP-5) for the Bussey Lake Habitat Rehabilitation and Enhancement Project (HREP) in Pool 10 of the Upper Mississippi River.

The IDNR enthusiastically endorses the selected plan of action (Plan D) that involves dredging approximately 12,000 linear feet of channel in Bussey Lake. Our fisheries staff is confident the proposed construction will have a very high level of benefit to fisheries populations, resultant from this significant increase in aquatic habitat diversity. Several aspects of this dredge plan - various dredge depths, 6:1 side slopes, numerous dredge cut spurs, and near-shore and off-shore dredge alignments - will allow for post-project evaluations that will be very beneficial to designing future backwater dredging HREP projects.

In addition, our wildlife staff is excited about the prospect of using the Bussey Lake spoil material to significantly improve the manageability of the Guttenberg Waterfowl Ponds and the creation of an additional 15-acre pond. The prospect of using one HREP project (Bussey Lake) to improve a different HREP project (Guttenberg Waterfowl Ponds) is certainly unique, but is in this case highly desirable.

There is an additional beneficial aspect that can easily be incorporated in this project. Use of sand deposits that currently lie at the mouth of Swift Slough and partially block it could be utilized to construct the dikes for the new waterfowl management pond (Pond 5). Use of these materials would significantly improve fish ingress and egress to Swift Slough, a relatively important 35-acre backwater habitat located adjacent to the Lock and Dam 10 tailwater. I recommend you seriously consider requiring the Bussey Lake project contractor to use sand from the mouth of Swift Slough to construct the Pond 5 dike system.

The IDNR also will assume the 25% non-Federal cost-share to initially construct the water control structure located on the causeway at the north end of Bussey Lake. This cost is estimated to be $8,850.

Thank you again for the continued coordination and cooperation on this and other important Environmental Management Program projects.

Sincerely,

LARRY J. WILSON
DIRECTOR
IOWA DEPARTMENT OF NATURAL RESOURCES

LJW:sao

cc: Moe, Wisconsin DNR
Beseke, USFWS
Moeller, Iowa DNR
Dalziel, Iowa DNR

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*		Date Of Land Evaluation Request	
Name Of Project	Bussey Lake Env. Mgmt. Project	Federal Agency Involved	US Army Corps of Engineers
Proposed Land Use	Temp Dredged Material Disposal	County And State	Clayton Co. IA
PART II *(To be completed by SCS)*		Date Request Received By SCS	6-10-89

Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply – do not complete additional parts of this form).*	Yes	No	Acres Irrigated	Average Farm Size
	☒	☐	None	262

Major Crop(s)	Farmable Land In Govt. Jurisdiction	Amount Of Farmland As Defined in FPPA
Corn, Hay, Oats	Acres: 396,892 % 77	Acres: 91,207 % 20
Name Of Land Evaluation System Used	Name Of Local Site Assessment System	Date Land Evaluation Returned By SCS
Clayton County	None - FPPA	6-15-89

PART III *(To be completed by Federal Agency)*	Alternative Site Rating			
	Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	24	15		
B. Total Acres To Be Converted Indirectly	24	15		
C. Total Acres In Site	50	15		
PART IV *(To be completed by SCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	0	0		
B. Total Acres Statewide And Local Important Farmland	24	0		
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted	.008%	0		
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value	80%			
PART V *(To be completed by SCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*	25			
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points			
1. Area In Nonurban Use		13	4	
2. Perimeter In Nonurban Use		6	0	
3. Percent Of Site Being Farmed		20	1	
4. Protection Provided By State And Local Government		0	0	
5. Distance From Urban Builtup Area		0	0	
6. Distance To Urban Support Services		0	0	
7. Size Of Present Farm Unit Compared To Average		0	0	
8. Creation Of Nonfarmable Farmland		25	25	
9. Availability Of Farm Support Services		5	5	
10. On-Farm Investments		0	2	
11. Effects Of Conversion On Farm Support Services		0	0	
12. Compatibility With Existing Agricultural Use		10	0	
TOTAL SITE ASSESSMENT POINTS	160	79	37	
PART VII *(To be completed by Federal Agency)*				
Relative Value Of Farmland *(From Part V)*	100	25	0	
Total Site Assessment *(From Part VI above or a local site assessment)*	160	79	37	
TOTAL POINTS *(Total of above 2 lines)*	260	104	37	

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

Each site scored less than 160 points, thus further consultation is not warranted under FPPA should either site be chosen for dredged material disposal.

STATE OF IOWA

TERRY E. BRANSTAD, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LARRY J. WILSON, DIRECTOR

June 7, 1989

Mr. Gary Palesh
Chief, Environmental Resources
Department of the Army
St. Paul District, Corps of Engineers
1421 U. W. Post Office & Custom House
St. Paul, MN 55101-1479

Dear Mr. Palesh:

I have attached a map of our records for threatened and endangered species in the vicinity of the proposed project.

1) Stinkpot (Sternotherus odoratus) a state listed threatened species reported from the site marked in 1982.
2) Higgins Eye Clam (Lampsilis higginsi) federal and state listed in endangered. Found during study by Fuller 1980. Exact location not given (the triangle indicates minute precision for the record or within about 3/4 mile of the triangle).
4) Western Sand Darter (Ammocrypta clara) a state listed threatened species. Last observed in 1977 just upriver from the dam.
28) Bald Eagle nest which produced two young in 1988 according to USFWS records.

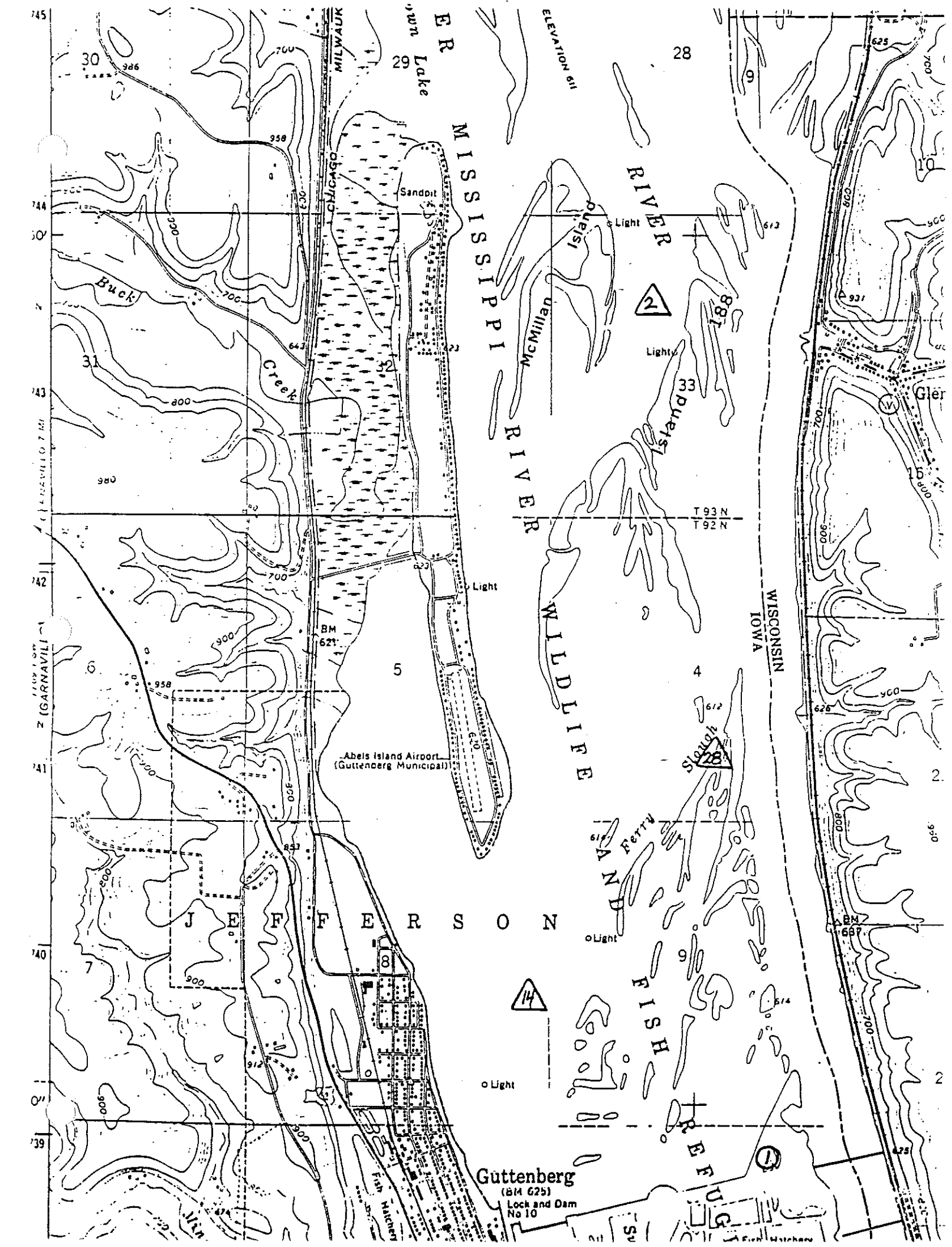
Based on our records the proposed project appears no to adversely impact any threatened or endangered species. It should be noted that these records do no represent a complete survey of the proposed project sites.

If you have any questions, please contact me at 515/281-8524.

Sincerely,

Daryl Howell

Daryl Howell


MISSISSIPPI RIVER
WILDLIFE AND FISH REFUGE
JEFFERSON
Lake
Sandpit
Buck Creek
McMillan Island
Island
Slough
Ferry
Abels Island Airport
(Guttenberg Municipal)
Guttenberg
(BM 625)
Lock and Dam
No 10
Fish Hatchery
WISCONSIN
IOWA
T 93 N
T 92 N
Light
BM
621
697
ELEVATION 611

State Historical Society of Iowa

The Historical Division of the Department of Cultural Affairs

October 14, 1988

Charles E. Workman
Chief, Environmental Resources Branch
Planning Division
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, MN 55101-1479

RE: COE - CLAYTON COUNTY - BUSSEY LAKE - ALTERNATIVE DREDGE DISPOSAL AREAS

Dear Mr. Workman:

We have reviewed the plans and specifications submitted for the above referenced project and make the following recommendations.

Three archeological sites have been previously recorded on Abels Island. These sites were recorded several years ago during the GREAT II survey, which was not a 100% reconnaissance survey. The geomorphological potential of sites and landforms also was not addressed at that time. We recommend an archeological survey be conducted prior to your disposal activities.

If we may be of additional assistance, please contact the Review and Compliance Program at 515/281-8744.

Sincerely,

Kay Simpson
Review and Compliance Program
Bureau of Historic Preservation

Enclosure

☐ 402 Iowa Avenue
Iowa City, Iowa 52240
(319) 335-3916

☐ Capitol Complex
Des Moines, Iowa 50319
(515) 281-5111

☐ Montauk
Box 372
Clermont, Iowa 52135
(319) 423-7173

The University of Iowa
Iowa City, Iowa 52242

Office of the State Archaeologist
Eastlawn

(319) 335-2389

1847

October 11, 1988

Charles Workman
Environmental Resources Branch
Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101-1479

Dear Mr. Workman:

Thank you for your letter of September 28 regarding the proposed dredge material placement site on Abel-Essman Island near Guttenberg. Archaeological site 13CT66, the Harvey's Island Mound Group No. 2, is located north of the airstrip near the east-west road that connects the island to the mainland. Other archaeological sites also exist on the island. It appears that the proposed placement site is very likely to contain archaeological remains.

This information is provided for use in your planning efforts. Formal review in accordance with section 106 of the National Historic Preservation act is performed by the Bureau of Historic Preservation, State Historical Society of Iowa.

Please let me know if we can be of any additional assistance on this subject.

Sincerely,

William Green

William Green
Director

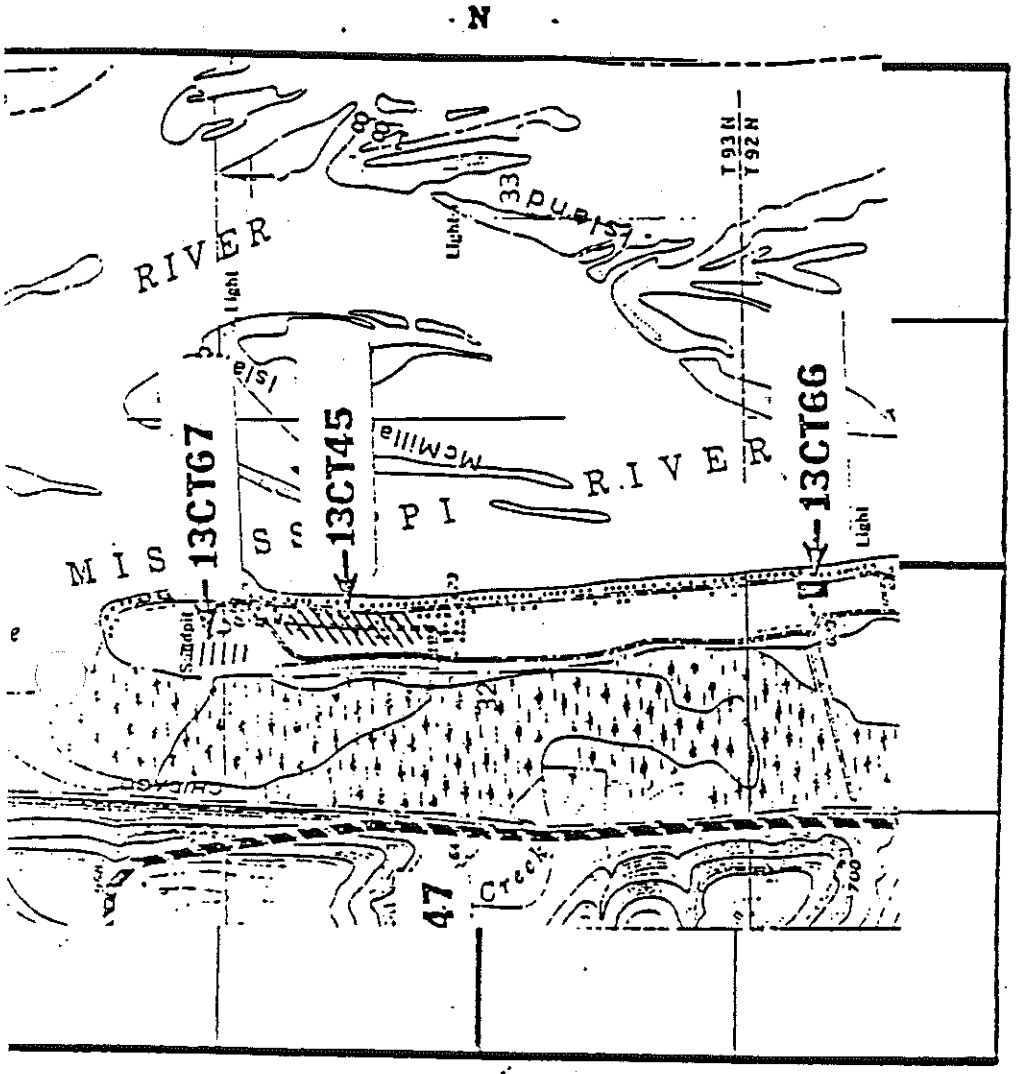
lv

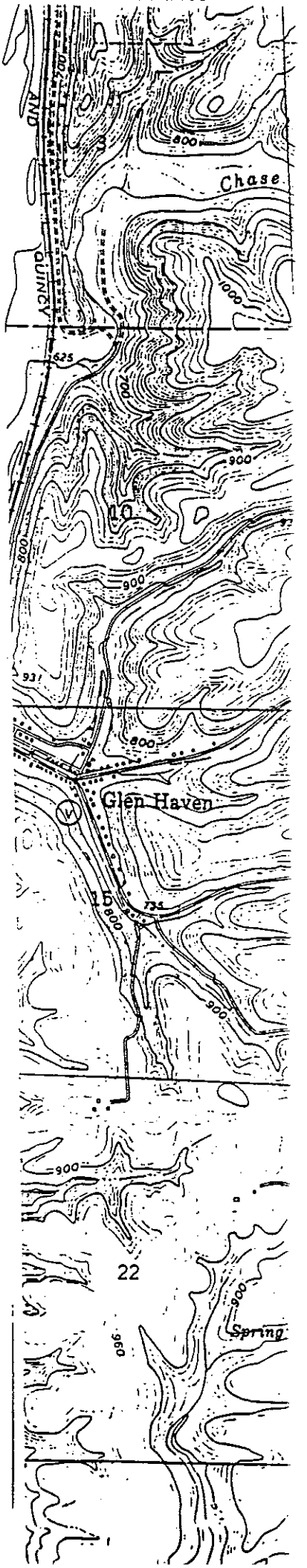
cc: Kay Simpson

Sketch map of location

Township _____ Range _____

ographical features, such as streams and elevations. Also indicate houses and roads. Indicate the site location by
h dotted line.





Attachment 5

Distribution List

This Draft Definite Project Report/Environmental documentation will be sent to the following agencies and interests:

Congressional
Sen. Tom Harkin (Washington, D.C.; Council Bluffs)
Sen. Charles Grassley (Washington, D.C.; Davenport)
Sen. Robert W. Kasten, Jr. (Madison)*
Sen. Herbert Kohl (Madison)*
Rep. Thomas Tauke (Washington, D.C.; Cedar Rapids)

Federal
Department of Transportation (Chicago; Kansas City)*
Environmental Protection Agency (Kansas City; Chicago)
U.S. Coast Guard (St. Louis)*
U.S. Fish and Wildlife Service (Beseke - 8 to be distributed to La Crosse - Berry, LTRM: McGregor - Lyons; Winona - Lennartson, Bolton; Rock Island - Nelson; Twin Cities - Gritman, Gibbons)
U.S. Geological Survey (St. Paul*; Madison*; Iowa City*)
National Park Service (Omaha)*
Soil Conservation Service (Madison*)
Advisory Council on Historic Preservation (Washington, D.C.)*
Office of Environmental Compliance - DOE (Washington, D.C.)*
Office of Environmental Project Review - DOI (Washington, D.C.)*

State of Iowa
Governor Terry Branstad (Des Moines)*
Department of Administration (Des Moines)*
Department of Agriculture (Des Moines)*
Department of Health (Des Moines)*
Department of Natural Resources (Des Moines - Wilson, Szcodronski, Moeller, Roseland, Tunkle, Ackerman, and Connover)
Department of Transportation (Ames)*
State Historic Preservation Officer (Des Moines)
State Archeologist

State of Wisconsin
Department of Natural Resources (La Crosse - Moe*, Kennedy)

State of Minnesota
Department of Natural Resources (Frontenac - Johnson*)

*Public Notice Only

Local
Clayton County Board of Supervisors
Clayton County Engineer (Elkader, IA)*
Guttenberg Public Library*
Guttenberg Post Office*
Guttenberg Press (Guttenberg, IA)*
North Iowa Times (McGregor, IA)*

Other Interests
Upper Mississippi River Conservation Committee (Rock Island - Carmody)
Sierra Club*
Izaak Walton League*
Minnesota/Wisconsin Boundary Area Commission (Hudson)
National Audubon Society (Mpls)*
Upper Mississippi River Basin Association (St. Paul)*
Mississippi River Regional Planning Commission (La Crosse)*

*Public Notice Only

Attachment 6

Local Cooperation Agreement

and

Memorandum of Agreement

LOCAL COOPERATION (28E) AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE STATE OF IOWA
FOR CONSTRUCTION OF THE BUSSEY LAKE HABITAT PROJECT
NEAR GUTTENBERG, IOWA

THIS AGREEMENT, entered into this ___ day of _____, 19___, by and between the DEPARTMENT OF THE ARMY (hereinafter referred to as the "Government"), acting by and through the Assistant Secretary of the Army (Civil Works), and the STATE OF IOWA (hereinafter referred to as the "Local Sponsor"), acting by and through the Director of the Iowa Department of Natural Resources.

WITNESSETH, THAT:

WHEREAS, the Bussey Lake Habitat Project near Guttenberg, Iowa (hereinafter referred to as the "Project", as defined in Article I.a. of this Agreement), was authorized by the Upper Mississippi River Management Act of 1986, Section 1103 of Public Law 99-662; and,

WHEREAS, Section 906(e) of the Water Resources Development Act of 1986, Public Law 99-662, as amended, specifies the cost-sharing requirements applicable to the Project; and,

WHEREAS, Section 221 of the Flood Control Act of 1970, Public Law 91-611, as amended, provides that the construction of any water resources project by the Secretary of the Army shall not be commenced until each non-Federal interest has entered into a written agreement to furnish its required cooperation for the project; and,

WHEREAS, the Local Sponsor has the authority and capability to furnish the cooperation hereinafter set forth and is willing to participate in cost-sharing and financing in accordance with the terms of this Agreement;

NOW, THEREFORE, the parties agree as follows:

ARTICLE I - DEFINITIONS AND GENERAL PROVISIONS

For purposes of this Agreement:

a. The term "Project" shall mean that portion of the Bussey Lake Environmental Management Program (EMP) Project located at the eastern end of the causeway which runs between Abel/Esmann Island and the mainland of Iowa at Guttenburg. This sub-project feature consists of the addition of a control structure onto an existing culvert. This structure will help reduce sediment input into Bussey Lake and eliminate introduction of pesticides into the lake from upstream sources.

b. The term "total project costs" shall mean all costs incurred by the Local Sponsor and the Government directly related to construction of the Project. Such costs shall include, but not necessarily be limited to, continuing planning and engineering costs incurred after October 1, 1985; costs of applicable engineering and design; actual construction costs; supervision and administration costs; costs of contract dispute settlements or awards; but shall not include any costs for betterments, operation, repair, maintenance, replacement, or rehabilitation.

c. The term "period of construction" shall mean the time from the advertisement of the first construction contract to the time of acceptance of the Project by the Contracting Officer.

d. The term "Contracting Officer" shall mean the U.S. Army Engineer for the St. Paul District, or his designee.

e. The term "highway" shall mean any highway, thoroughfare, roadway, street, or other public or private road or way.

f. The term "relocations" shall mean alterations, modifications, lowering or raising in place, and/or new construction related to, but not limited to, existing: railroads, highways, bridges, railroad bridges and approaches thereto, buildings, pipelines, public utilities (such as municipal water and sanitary sewer lines, telephone lines, and storm drains), aerial utilities, cemeteries, and other facilities, structures, and improvements determined by the Government to be necessary for the construction, operation and maintenance of the Project.

g. The term "fiscal year" shall mean one fiscal year of the United States Government, unless otherwise specifically indicated. The Government fiscal year begins on October 1 and ends on September 30.

h. The term "functional portion of the Project" shall mean a completed portion of the Project as determined by the Contracting Officer to be suitable for tender to the Local Sponsor to operate and maintain in advance of completion of construction of the entire Project.

i. The term "rehabilitation" is defined as reconstructive work that significantly exceeds the estimated annual operation and maintenance requirements, and which is needed as the result of major storm or flood events.

ARTICLE II - OBLIGATIONS OF THE PARTIES

a. The Government, subject to and using funds provided by the Local Sponsor and appropriated by the Congress of the United States, shall expeditiously construct the Project (including relocations of railroad bridges and approaches thereto), applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The Local Sponsor shall be afforded the opportunity to review and comment on all contracts, including relevant plans and specifications, prior to the issuance of invitations for bids. The Local Sponsor will be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. The Government will consider the comments of the Local Sponsor, but award of the contracts, modifications or change orders, and performance of all work on the Project (whether the work is performed under contract or by Government personnel), shall be exclusively within the control of the Government.

b. When the Government determines that the Project or a functional portion of the Project is complete, the Government shall turn the completed Project or functional portion over to the Local Sponsor, which shall accept the Project or functional portion and be solely responsible for operating, repairing, maintaining, replacing, and rehabilitating the Project or functional portion in accordance with Article VIII hereof.

c. As further specified in Article VI hereof, the Local Sponsor shall provide, during the period of construction, a cash contribution of 25 percent of total project costs.

d. As further specified in Article III hereof, the Local Sponsor shall provide all lands, easements, rights-of-way, and dredged material disposal areas, and perform all relocations (excluding railroad bridges and approaches thereto) determined by the Government to be necessary for construction of the Project.

e. As further specified in Article VIII.a. of this Agreement, the Government shall, after completion of construction of the Project, provide to the Local Sponsor a cash payment in the amount of $_____, which is the present worth of 75 percent of the estimated cost of operation and maintenance of the Project, in consideration of the assumption by the Local Sponsor of Federal operation and maintenance responsibilities.

f. In the event that the Government and the Local Sponsor mutually agree that rehabilitation is necessary, the Government shall provide payment to the Local Sponsor in an amount equal to 75 percent of the cost of such rehabilitation.

g. No Federal funds may be used to meet the Local Sponsor share of project costs under this Agreement unless the expenditure of such funds is expressly authorized by statute as verified in writing by the granting Agency.

ARTICLE III - LANDS, FACILITIES, AND PUBLIC LAW 91-646 RELOCATION ASSISTANCE

a. The Local Sponsor shall furnish to the Government all lands, easements, and rights-of-way, including suitable borrow and dredged material disposal areas, as may be determined by the Government to be necessary for the construction, operation, and maintenance of the Project, and shall furnish to the Government evidence supporting the Local Sponsor's legal authority to grant rights-of-entry to such lands. The necessary lands, easements, and rights-of-way may be provided incrementally, but all lands, easements, and rights-of-way determined by the Government to be necessary for work to be performed under a construction contract must be furnished prior to the advertisement of the construction contract.

b. The Local Sponsor shall provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged material disposal areas necessary for construction of the Project.

c. Upon notification from the Government, the Local Sponsor shall accomplish or arrange for accomplishment at no cost to the Government all relocations (excluding railroad bridges and approaches thereto) determined by the Government to be necessary for construction of the Project.

d. The Local Sponsor shall comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987, Public Law 100-17, and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way for construction and subsequent operation and maintenance of the Project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

ARTICLE IV - CONSTRUCTION PHASING AND MANAGEMENT

a. To provide for consistent and effective communication between the Local Sponsor and the Government during the period of construction, the Local Sponsor and the Government shall appoint representatives to coordinate on scheduling, plans, specifications, modifications, contract costs, and other matters relating to construction of the Project. The Local Sponsor will be informed of any changes in cost estimates.

b. The representatives appointed above shall meet as necessary during the period of construction and shall make such recommendations as they deem warranted to the Contracting Officer.

c. The Contracting Officer shall consider the recommendations of the representatives in all matters relating to construction of the Project, but the Contracting Officer, having ultimate responsibility for construction of the Project, has complete discretion to accept, reject, or modify the recommendations.

ARTICLE V - METHOD OF PAYMENT

a. The Local Sponsor shall provide, during the period of construction, cash payments required to meet its obligations under Article II of this Agreement. Total project costs are presently estimated to be $43,300.00. In order to meet its cash payment requirements, the Local Sponsor must provide a cash contribution presently estimated to be $10,825.00. The dollar amounts set forth in this Article are based upon the Government's best estimates which will reflect projection of costs, price level changes, and anticipated inflation. Such cost estimates are subject to adjustments based upon costs actually incurred and are not to be construed as the total financial responsibilities of the Government and the Local Sponsor.

b. The required cash contribution shall be provided as follows: 30 calendar days prior to the award of the first construction contract, the Government shall notify the Local Sponsor of the Local Sponsor's estimated share of project costs, including its share of costs attributable to the Project incurred prior to the initiation of construction. Within 15 calendar days thereafter, the Local Sponsor shall provide the Government the full amount of the required contribution by delivering a check payable to "FAO, USAED, St. Paul" to the contracting Officer representing the Government. In the event that total project costs are expected to exceed the estimate given at the outset of construction, the Government shall immediately notify the Local Sponsor of the additional contribution it will be required to make to meet its share of the revised estimate. Within 45 calendar days thereafter, the Local Sponsor shall provide the Government the full amount of the additional required contribution.

c. Upon completion of the Project and resolution of all relevant contract claims and appeals, the Government shall compute the total project costs and tender to the Local Sponsor a final accounting of the Local Sponsor's share of total project costs. In the event the total contribution by the Local Sponsor is less than its minimum required share of total project costs, the Local Sponsor shall, no later than 90 calendar days after receipt of written notice, make a cash payment to the Government of whatever sum is required to meet its minimum required share of total project costs.

d. In the event the Local Sponsor has made cash contributions which result in the Local Sponsor's having provided more than its required share of total project costs, the Government shall, no later than 90 calendar days after the final accounting is complete, subject to the availability of appropriations, return said excess to the Local Sponsor.

ARTICLE VI - DISPUTES

Before any party to this Agreement may bring suit in any court concerning an issue relating to this Agreement, such party must first seek in good faith to resolve the issue through negotiation or other forms of nonbinding alternative dispute resolution mutually acceptable to the parties.

ARTICLE VII - OPERATION, MAINTENANCE, REPAIR REPLACEMENT, AND REHABILITATION

a. After the Government has turned the completed Project, or functional portion of the Project, over to the Local Sponsor, the Local Sponsor shall have the sole responsibility to operate and maintain the completed Project, or functional portion of the Project, in accordance with regulations or directions prescribed by the Government. In the event of damage to the Project from major storm or flood events, the Government and the Local Sponsor will discuss the need for and efficacy of rehabilitation of the Project.

b. The Local Sponsor hereby gives the Government a right to enter, at reasonable times and in a reasonable manner, upon land which it owns or controls for access to the Project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. If an inspection shows that the Local Sponsor for any reason is failing to fulfill its obligations under this Agreement without receiving prior written approval from the Government, the Government will send a written notice to the Local Sponsor. If the Local Sponsor persists in such failure for 30 calendar days after receipt of the notice, then the Government shall have a right to enter, at reasonable times and in a reasonable manner, upon

lands the Local Sponsor owns or controls for access to the Project for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Government shall operate to relieve the Local Sponsor of responsibility to meet its obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to assure faithful performance pursuant to this Agreement.

ARTICLE VIII - RELEASE OF CLAIMS

The Local Sponsor shall hold and save the Government free from all damages arising from the construction, operation, and maintenance of the Project, except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE IX - HAZARDOUS SUBSTANCES

a. After execution of this Agreement and upon direction by the Contracting Officer, the Local Sponsor shall perform, or cause to be performed, such environmental investigations as are determined necessary by the government or the Local Sponsor to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 USC 9601-9675, on lands necessary for Project construction, operation, and maintenance. All actual costs incurred by the Local Sponsor which are properly allowable and allocable to performance of any such environmental investigations shall be included in total project costs and cost shared as a construction cost in accordance with Public Law 99-662.

b. In the event it is discovered through an environmental investigation or other means that any lands, easements, rights-of-way, or disposal areas to be acquired or provided for the Project contain any hazardous substances regulated under CERCLA, the Local Sponsor and the Government shall provide prompt notice to each other, and the Local Sponsor shall not proceed with the acquisition of lands, easements, rights-of-way, or disposal areas until mutually agreed.

c. The Government and the Local Sponsor shall determine whether to initiate construction of the Project, or if already in construction, to continue with construction of the Project, or to terminate construction of the Project for the convenience of the Government in any case where hazardous substances regulated under CERCLA are found to exist on any lands necessary for the Project. Should the Government and the Local Sponsor determine to proceed or continue with construction after considering any liability that may arise under CERCLA, as between the Government and the Local Sponsor, the Local Sponsor shall be solely responsible for any and all necessary clean up and response costs, to

include the costs of any studies and investigations necessary to determine an appropriate response to the contamination. Such costs shall not be considered a part of total project costs as defined in this Agreement. In the event the Local Sponsor fails to provide any funds necessary to pay for clean up and response costs or to otherwise discharge its responsibilities under this paragraph upon direction by the Government, the Government may either terminate or suspend work on the Project or proceed with further work as provided in Article XVII of this Agreement.

d. The Local Sponsor and the government shall consult with each other under the Construction Phasing and Management Article of this Agreement to assure that responsible parties bear any necessary cleanup and response costs as defined in CERCLA. Any decision made pursuant to paragraph c. of this Article shall not relieve any party from any liability that may arise under CERCLA.

e. The Local Sponsor shall operate, maintain, repair, replace, and rehabilitate the Project in a manner so that liability will not arise under CERCLA.

ARTICLE X - MAINTENANCE OF RECORDS

The Government and the Local Sponsor shall keep books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement to the extent and in such detail as will properly reflect total project costs. The Government and the Local Sponsor shall maintain such books, records, documents, and other evidence for a minimum of three years after completion of construction of the Project and resolution of all relevant claims arising therefrom, and shall make available at their offices at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the parties to this Agreement.

ARTICLE XI - GOVERNMENT AUDIT

The Government shall conduct an audit when appropriate of the Local Sponsor's records for the Project to ascertain the allowability, reasonableness, and allocability of its costs for inclusion as credit against the non-Federal share of project costs.

ARTICLE XII - FEDERAL AND STATE LAWS

In acting under its rights and obligations hereunder, the Local Sponsor agrees to comply with all applicable Federal and state laws and regulations, including section 601 of Title VI of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.II issued pursuant thereto and published in Part 300 of Title 32, Code of

Federal Regulations, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

ARTICLE XIII - RELATIONSHIP OF PARTIES

The parties to this Agreement act in an independent capacity in the performance of their respective functions under this Agreement, and neither party is to be considered the officer, agent, or employee of the other.

ARTICLE XIV - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, or resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XV - COVENANT AGAINST CONTINGENT FEES

The Local Sponsor warrants that no person or selling agency has been employed or retained to solicit or secure this Agreement upon agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Local Sponsor for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this Agreement without liability, or, in its discretion, to add to the Agreement or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE XVI - TERMINATION OR SUSPENSION

a. If at any time the Local Sponsor fails to make the payments required under this Agreement, the Secretary of the Army shall terminate or suspend work on the Project until the Local Sponsor is no longer in arrears, unless the Secretary of the Army determines that continuation of work on the Project is in the interest of the United States or is necessary in order to satisfy agreements with any other non-Federal interests in connection with the Project. Any delinquent payment shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 percentum of the average bond equivalent rate of the 13-week Treasury bills auctioned immediately prior to the date on which such payment became delinquent, or auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

b. If the Government fails to receive annual appropriations for the Project in amounts sufficient to meet Project expenditures for the then-current or upcoming fiscal year, the Government shall so notify the Local Sponsor. After 60 calendar days either party may elect without penalty to terminate this Agreement pursuant to that Article or to defer future performance hereunder; however, deferral of future performance under this Agreement shall not affect existing obligations or relieve the parties of liability for any obligation previously incurred. In the event that either party elects to terminate this Agreement pursuant to this Article, both parties shall conclude their activities relating to the Project and proceed to a final accounting in accordance with Article VI. of this Agreement. In the event that either party elects to defer future performance under this Agreement pursuant to this Article, such deferral shall remain in effect until such time as the Government receives sufficient appropriations or until either party elects to terminate this Agreement.

ARTICLE XVII - NOTICES

a. All notices, requests, demands, and other communications required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and delivered personally, given by prepaid telegram, or mailed by first-class (postage-prepaid), registered, or certified mail, as follows:

If to the Local Sponsor:

Director
Iowa Department of Natural Resources
Wallace Building
Des Moines, Iowa 50319-0034

If to the Government:

District Engineer
St. Paul District, U.S. Army Corps of Engineers
1421 U.S. Post Office and Custom House
St. Paul, Minnesota 55101-1479

b. A party may change the address to which such communications are to be directed by giving written notice to the other in the manner provided in this Article.

c. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at such time as it is personally delivered or seven calendar days after it is mailed, as the case may be.

ARTICLE XVIII - CONFIDENTIALITY

To the extent permitted by the law governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

ARTICLE XIX - FILING AND RECORDING

A copy of this Agreement shall be filed with the Secretary of State and a second copy of this Agreement shall be recorded with the Clayton County Recorder before it shall be in full force and effect, all pursuant to Iowa Code Section 28.E.8.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date it is signed by the Assistant Secretary of the Army (Civil Works).

THE DEPARTMENT OF THE ARMY	THE STATE OF IOWA
BY: _____	BY: _____
Assistant Secretary of the Army (Civil Works)	Director, Iowa Department of Natural Resources
DATE: _____	DATE: _____

STATE OF IOWA)
COUNTY OF POLK)

On this _____ day of _____, 19____, before me, a Notary Public in and for said County, personally appeared _____, who stated that he is the duly appointed and acting Director of the Iowa Department of Natural Resources, that he was authorized to execute the foregoing Agreement on behalf of the Iowa Department of Natural Resources, and that he executed the foregoing Agreement as his voluntary act and deed, and as the voluntary act and deed of the Iowa Department of Natural Resources.

_____

Notary Public
in and for the State of Iowa

CERTIFICATE OF AUTHORITY

I, _____, do hereby certify that I am the _____Attorney General of the State of Iowa, that the State of Iowa is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the DEPARTMENT OF THE ARMY and the State of Iowa in connection with the Project, and pay damages, if necessary, in the event of the failure to perform, in accordance with Section 221 of Public Law 91-611, and that the persons who have executed the contract on behalf of the State of Iowa have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this Certificate this _____ day of _____, 19___.

_____

THE BUSSEY LAKE HABITAT PROJECT
NEAR GUTTENBERG, IOWA

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with this Federal contract, grant, loan or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

THE STATE OF IOWA

by:_____
Commissioner
Iowa Department of Natural Resources

CERTIFICATION OF LEGAL REVIEW

The draft Local Cooperation Agreement for construction of the Bussey Lake Habitat Project near Guttenberg, Iowa, has been fully reviewed by the Office of Chief Counsel, USAED, St. Paul.

EDWIN C. BANKSTON
District Counsel

MEMORANDUM OF AGREEMENT

BETWEEN

THE UNITED STATES FISH AND WILDLIFE SERVICE

AND

THE DEPARTMENT OF THE ARMY

FOR

ENHANCING FISH AND WILDLIFE RESOURCES

OF THE

UPPER MISSISSIPPI RIVER SYSTEM

AT

BUSSEY LAKE

CLAYTON COUNTY, IOWA

I. PURPOSE

The purpose of this Memorandum of Agreement (MOA) is to establish the relationships, arrangements, and general procedures under which the U.S. Fish and Wildlife Service (FWS) and the Department of the Army (DOA) will operate in constructing, operating, maintaining, repairing, and rehabilitating the Bussey Lake separable element of the Upper Mississippi River System - Environmental Management Program (UMRS-EMP).

II. BACKGROUND

Section 1103 of the Water Resources Development Act of 1986, Public Law 99-662, authorizes construction of measures for the purpose of enhancing fish and wildlife resources in the Upper Mississippi River System. Under conditions of Section 906(e) of the Water Resources Development Act of 1986, Public Law 99-662, with the exception of a control structure on a culvert that is located outside of the Upper Mississippi River National Wildlife and Fish Refuge, all construction costs of those fish and wildlife features for the Bussey Lake project are 100% Federal, and all operation, maintenance, repair, and rehabilitation costs are to be cost shared 75% Federal and 25% non-Federal.

III. GENERAL SCOPE

The Bussey Lake project rehabilitates and improves the fishery habitat in the lake primarily through the reestablishmnet of habitat diversity in the lake. This would be accomplished through the establishment of 29 acres of deeper water with reduced aquatic plant cover, the creation of about 27,000 linear feet of open water/vegetation bed edge, and an increase the variety of water depths in the lake. through the dredging of channels within the lake.

IV. RESPONSIBILITIES

A. DOA is responsible for:

1. Construction: Construction of the Project which consists of dredging about 12,000 linear feet of channel in Bussey Lake. The material from this excavation will be used at the Guttenberg waterfowl ponds (located southeast of Bussey Lake) to elevate and level the bottoms of the three existing moist soil units and create one new moist soil unit.

2. Major Rehabilitation: Any mutually agreed upon rehabilitation of the project that exceeds the annual operation and maintenance requirements identified in the Definite Project Report and that is needed as a result of specific storm or flood events.

3. Construction Management: Subject to and using funds appropriated by the Congress of the United States, DOA will construct the Bussey Lake project as described in the Definite Project Report/Environmental Assessment, Bussey Lake, Habitat Rehabilitation and Enhancement, dated May 1990, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The FWS will be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. If DOA encounters potential delays related to construction of the Project, DOA will promptly notify FWS of such delays.

4. Maintenance of Records: DOA will keep books, records, documents, and other evidence pertaining to costs and expenses incurred in connection with construction of the Project to the extent and in such detail as will properly reflect total costs. DOA shall maintain such books, records, documents, and other evidence for a minimum of three years after completion of construction of the Project and resolution of all relevant claims arising therefrom, and shall make available at its offices at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the FWS.

B. FWS is responsible for:

1. Operation, Maintenance, and Repair: Upon completion of construction as determined by the District Engineer, St. Paul, the FWS shall accept the Project and shall operate, maintain, and repair the Project as defined in the Definite Project Report entitled "Bussey Lake Habitat Rehabilitation and Enhancement," dated May 1990, in accordance with Section 906(e) of the Water Resources Development Act, Public Law 99-662.

2. Non-Federal Responsibilities: In accordance with Section 906(e) of the Water Resources Development Act, Public Law 99-662, the FWS shall obtain 25% of all costs associated with the operation, maintenance, and repair of the Project from the Iowa Department of Natural Resources.

V. MODIFICATION AND TERMINATION

This MOA may be modified or terminated at any time by mutual agreement of the parties. Any such modification or termination must be in writing. Unless otherwise modified or terminated, this MOA shall remain in effect for a period of no more than 50 years after initiation of construction of the Project.

VI. REPRESENTATIVES

The following individuals or their designated representatives shall have authority to act under this MOA for their respective parties:

FWS: Regional Director
U.S. Fish and Wildlife Service
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

DOA: District Engineer
U.S. Army Engineer District, St. Paul
1421 U.S. Post Office and Custom House
St. Paul, Minnesota 55101-1479

VII. EFFECTIVE DATE OF MOA

This MOA shall become effective when signed by the appropriate representatives of both parties.

THE DEPARTMENT OF THE ARMY

BY:

(signature)

ROGER L. BALDWIN
Colonel, Corps of Engineers
St. Paul District

Date

THE U.S. FISH AND WILDLIFE SERVICE

BY:

(signature)

JAMES C. GRITMAN
Regional Director
U.S. Fish and Wildlife Service

Date

Attachment 7

Appendix A

Hydraulics and Sedimentation Analysis

BUSSEY LAKE
DEFINITE PROJECT REPORT

APPENDIX A
HYDRAULICS AND SEDIMENTATION ANALYSIS

HYDRAULIC CHARACTERISTICS

Bussey Lake is a shallow backwater lake in lower pool 10 between RM 616.4 (River Mile 616.4) and RM 617.4. The downstream end of the lake is approximately 3.5 feet deep, while most of the upper half of the lake is less than 3 feet deep. Lock and Dam 10, at RM 615.1, is just 1.3 miles downstream of Bussey lake. A plan view of the project area is shown on plate A-1. Stage-discharge curves for the downstream end of Bussey Lake (RM 616.4) and the upstream end of French Town Bottoms (RM 619) are shown on plate A-2. The average Mississippi River discharge in the project area is 44,340 cfs. Elevation 611.0 is maintained at Lock and Dam 10, the control point for pool 10, until a discharge of 42000 cfs is exceeded. The discharge-frequency curve, discharge-duration curve, and operating curve for Lock and Dam 10 are shown on plates A-3, A-4, and A-5.

Historically, Bussey Lake and the French Town Bottoms area provided conveyance for annual flood events on the Mississippi River. Flood discharges entered through the upstream end of French Town Bottoms at RM 619 and flowed between Abel-Essman Island and the west side of the Mississippi Valley (see plate 1). Prior to construction of the causeway to Abel-Essman Island, the Buck Creek delta formed the high point between the upstream end of French Town Bottoms and Bussey Lake. Based on 1935 flowage surveys, the minimum elevation of this delta was approximately 611. Prior to construction of Lock and Dam 10, this corresponded to a Mississippi River discharge of 70,000 cfs which is the 95 percent frequency flood. In other words, flow through Bussey Lake occurred almost every year.

Construction of the causeway to Abel-Essman Island in the early 1930's greatly reduced the magnitude of flood discharges from the Mississippi River through Bussey Lake. A 6 foot corrugated metal pipe with an upstream invert elevation of 610.00, is located at the east end of the causeway embankment. This culvert is the only source of flow into the upstream end of Bussey Lake. Plate A-6 shows culvert rating curves for water surface elevations on the Mississippi River at RM 616.4 and RM 619. Based on 1987 ground surveys, the minimum elevation of the causeway is 620.0. A Mississippi River discharge of 210,000 cfs which is the 6.3 percent frequency flood (16 year event) is required to overtop this road. Records show that overtopping has occurred twice, in 1965 and 1969.

Buck Creek enters the French Town Bottoms area upstream of the causeway. Normally Buck Creek flows north into the Mississippi River via Frenchtown Lake at RM 619. However, major flood events on Buck Creek result in overtopping of the right bank of the creek in the delta area and subsequent flow to the south towards the causeway. Some of this flow enters Bussey Lake through the causeway culvert, however there is a significant amount of conveyance to the north resulting in the majority of Buck Creek discharges flowing north. Plate A-7 shows cross sections of the causeway and the Buck Creek delta. Several water surface elevations with the corresponding conveyance areas of the causeway culvert and the Buck Creek delta have been superimposed on these cross sections. For example, if the water surface north of the causeway was at elevation of 614.00 the conveyance area of the Buck Creek delta would be approximately 450 square feet while the conveyance area of the causeway culvert would only be 20 square feet. A combination of flood events on the Mississippi

River and Buck Creek increases the potential for Buck Creek discharges to enter Bussey Lake. This is because flood water in the French Town Bottoms area decreases the effective conveyance to the north.

SEDIMENT DATA

Four core samples of the upper 2.5 feet of sediment were obtained in Bussey Lake in 1988. The gradation curves for these samples are shown on Plate A-8. The samples were labeled B1 through B4 and their location is shown on Plate A-9. On the east side of the lake, the greatest amount of coarse material (66 percent coarse) was found in sample B4 near the southeast corner of the lake. Coarse material is defined as having a particle diameter greater than 0.062 millimeters. The percentage of coarse material decreases with distance up the lake as indicated by the gradation curves for samples B3 and B2 which have 56 percent and 44 percent coarse material respectively. Most of the material in samples B3 and B4 is in the medium to fine sand size range. The highest percentage of gravel size material was found in sample B2 at the upstream end of the lake near the causeway culvert. Sample B1, which was obtained on the west side of Bussey Lake, only had 5 percent coarse material. However, 77 percent of this sample had sediment in the silt size range (particle diameter of .004 to .062 millimeters). Visual inspection of grab samples obtained in the southeast quadrant of Bussey Lake during a September 1989 field trip indicated a high percentage of fine material (muck) with little if any coarse material present. Because of the discrepancy between the 1988 sediment samples and those observed during the 1989 field trip, it is felt that the three 1988 samples on the east side of Bussey Lake may not be representative of the sediment characteristics in Bussey Lake. This is probably a result of the samples being taken to close to shore where shoreline erosion could introduce coarse sediments. The fourth sample, on the west side of Bussey Lake is probably more representative of the sediment in Bussey Lake. This sample had a composite specific weight of 55 pounds per cubic foot. This isn't significantly different than the average of all 4 samples which is 60 pounds per cubic foot, however the higher percentage of silt is probably more representative of Bussey Lake sediments. A vertical soil sample in the same area as sample B1, obtained by the IDNR (Iowa Department of Natural Resources), gave similar results. Soil borings obtained in the southwest part of the lake for the Guttenburg flood control project indicate an upper layer of clay.

By comparing bathymetric data obtained in 1987 to the 1935 flowage surveys an average sedimentation rate for Bussey Lake of 0.31 inches per year was found. As shown on plate A-9, sediment accumulations are greatest at the downstream end of Bussey lake and decrease with distance up the lake. Sediment accumulations are also greater on the east side of the lake than on the west side. Over 2 feet of sediment has accumulated at the downstream end of Bussey Lake and this corresponds to a local deposition rate of 0.46 inches per year. Accumulations in excess of 1 foot, which corresponds to a local deposition rate of 0.23 inches per year, have occurred over most of the downstream half of the lake. There is some evidence of delta formation at the outlet of the 6 foot diameter culvert at the upstream end of the lake.

Plate A-10 shows sediment accumulations at various locations in the Buck Creek Delta area based on the 1987 topography and the 1935 flowage surveys. While the topographic data in this area is somewhat sketchy, it appears that sediment accumulations of over 2 feet have occurred in some areas. The minimum elevation of the Buck Creek delta has increased by about 1 foot from elevation 611 to 612. Elevation 612 corresponds to a Mississippi river discharge of approximately 85,000 cfs.

SEDIMENT SOURCES

Processes that transport sediment into Bussey Lake include advective transport of suspended sediment through the culvert at the upstream end of the lake and diffusive transport of suspended sediment at the downstream end of the lake. Flow through the culvert occurs during highwater events on Buck Creek or on the Mississippi River. Processes that result in diffusive transport of sediment at the downstream end of the lake include a large eddy that forms as river water flows past the southern tip of Abel-Essman Island, wind driven surface currents, and rising water surface elevations caused by increasing river discharge or by wind setup. The following is a discussion of these various processes.

Volume 4 of GREAT 1, Study of the Upper Mississippi River, shows that the Buck Creek watershed is located in a severe sediment yield region. Suspended sediment data collected at USGS gaging sites on larger rivers in this area indicate annual sediment loads greater than 100 tons per square mile. The USGS data also indicates that a high percentage of the annual sediment load can be transported during single large storm events. This sediment data was collected at gages with drainage areas of between 250 and 1400 square miles. Since Buck Creek has a drainage area of approximately 35 square miles, the USGS data is not necessarily representative of the Buck Creek watershed. It does however give some indication of the potential sediment yield from Buck Creek. Most importantly it shows that a significant amount of the annual sediment load may be transported during large flood events on Buck Creek which result in discharges through the causeway culvert. Large sediment plumes discharging from the culvert into Bussey Lake have been observed during major flood events on Buck Creek. Assuming that a flood event occurs on Buck Creek and that the water surface elevation of the creek upstream of the causeway is 614.00, the percentage of the discharge entering Bussey Lake should be roughly proportional to the ratio of the culvert area to the conveyance area through French Town Bottoms. From figure A-7 this ratio is .044. If the annual sediment yield in the Buck Creek watershed is 100 tons per square mile and all this sediment is transported in this one event, then the volumetric load to Bussey Lake would amount to .009 inches over the entire lake. This is 3 percent of the total annual deposition rate obtained from field data. This number was obtained using an average specific weight of 55 pounds per cubic foot and assuming that all of the sediment entering the lake settles out. As mentioned previously a combination of flood events on the Mississippi River and on Buck Creek increases the amount of Buck Creek flow that could enter Bussey Lake. It appears, however, that Buck Creek only contributes a small amount of sediment to Bussey Lake, probably less than 5 percent.

The sediment load through the causeway culvert caused by flood events on the Mississippi River was analyzed using the suspended sediment load versus Mississippi River discharge relationship at McGregor, Iowa. This sediment load was also found to be small, accounting for sediment accumulations in the lake of approximately 0.01 inches per year or 3 percent of the total annual deposition rate obtained from field data. Note that the Wisconsin River enters the Mississippi River between McGregor, Iowa and Bussey Lake, thus the sediment discharge relationship in lower pool 10 may differ from that at McGregor.

Rising river stages in lower pool 10 and Bussey Lake, caused by increasing river discharges, result in sediment laden water backing up into Bussey Lake. This process occurs on a seasonal time scale (ie. because of increasing river discharges during spring runoff) where fluctuations in stage may typically be 1 to 2 feet and on a daily time scale where fluctuations of less than 0.1 feet

are more typical. Inflowing water has a suspended sediment concentration approximately equal to the concentration in the Mississippi River. An analysis was performed to quantify sediment loading to Bussey Lake due to this process. Suspended sediment concentrations were obtained from the USGS gage at McGregor, Iowa. Changes in water surface elevation at Lock and Dam 10 were obtained from the DSS data base and this data was assumed to represent fluctuations at Bussey Lake. This is a reasonable assumption since Bussey Lake is less than 1 mile upstream of Lock and Dam 10. To simplify the analysis it was assumed that all of the sediment entering Bussey Lake settles out. This also will give us a worst case scenario. Sediment accumulations in ft/day were calculated using the following equation:

SH (ft) = SS (mg/L) * DH (ft) * .000062543 / SW (lbs/cubic feet)

were

SH = the daily accumulation of sediment in Bussey Lake due to increases in stage
SS = Suspended sediment concentration at McGregor
DH = the daily increase in water surface elevation in Bussey Lake
SW = the specific weight of sediment deposits

On days when the stage at Lock and Dam 10 decreased from the previous days stage or remained the same, SH was set equal to zero. The sum of the daily accumulations for the 11 year period 1976 through 1986, assuming a specific weight of 55 pounds per cubic foot and uniform distribution over the lake was .24 inches which amounts to .021 inches per year. Over a 50 year period (ie. the time period since lock and dam 10 was constructed) this would amount to 1.07 inches. The assumption of uniform distribution of sediment over Bussey Lake is probably not realistic. A particle with a diameter of .016 millimeters (average particle size of the sample taken on the West side of Bussey Lake in 1988) in water at 10 degrees celsius settles at a rate of 50 feet per day. At this settling velocity it would take approximately 90 minutes for the particle to settle 3 feet, which is a typical water depth at the downstream end of Bussey Lake. Since the rate of inflow to Bussey Lake due to rising river stages is a relatively slow process (ie. one day time scale), the majority of suspended sediments probably settles out in the downstream end of the lake. If it was assumed that the total sediment load entering Bussey Lake settled out in the lower one third of the lake, the annual deposition rate would be 0.063 inches per year which would equal 3.21 inches over a 50 year period. It appears, based on this analysis, that sediment loading to Bussey Lake associated with rising river stages is only a small fraction of the sediment that has deposited since construction of Lock and Dam 10. Sediment deposition due to rising river stages was determined to be .021 inches per year if uniformly distributed over the lake and this accounts for approximately 7 percent of the sediment that has accumulated since 1935. If inflowing sediments were distributed over the downstream third of the lake a deposition rate of .063 inches per year results. This equals approximately 14 percent of the local sediment depth at the downstream end of the lake.

A rigorous analysis of the effects of wind setup on Bussey Lake sediment loading was not done for this study. The magnitude of this process was determined by the following equation from Technical Memorandum 27 of the Beach Erosion Board (1952).

$$S = \frac{k * (1+m) * da * W^{**2} * F}{dw * g * h} * \cos x$$

where

S = setup in feet
k = coefficient for transfer of wind energy to water surface
.003 is recommended
m = ratio of bottom shear stress to water surface shear stress
.01 is recommended
da = density of air
W = wind speed
F = fetch length
dw = density of water
g = acceleration of gravity
h = water depth
x = angle between fetch and wind direction

For a south wind with a velocity of 15 miles per hour, a fetch length of 1 mile (ie. the distance from Lock and Dam 10 to the downstream end of Bussey Lake), and an effective water depth of 5 feet, the setup from the above equation would be .06 feet. This is of the same order of magnitude as typical water surface fluctuations due to changes in discharge (not including flood events). Thus wind setup may result in some sediment loading to Bussey Lake, however it is doubtful if it is as great as the effects of rising water surface elevations due to increasing river discharges.

Other processes that could contribute sediment to Bussey Lake include wind induced surface currents and the formation of a large eddy at the downstream end of the lake. The contribution of sediment from these processes is difficult to quantify and will not be done for this analysis. The occurrence of currents flowing into Bussey Lake has been observed in the past. Whether these currents are the result of wind or the result of a large eddy forming as river water flows past the southerly tip of Abel-Essman Island is not known.

HYDRAULICS AND SEDIMENTATION CONCLUSION

The Mississippi River appears to be the main source of sediment to Bussey Lake with Buck Creek contributing a smaller percentage. The processes causing sediment inflows is not clearly understood. Inflows from Buck Creek and the Mississippi River at the upstream end of Bussey Lake account for less than 10 percent of the sediment load. Rising Mississippi River stages contribute approximately 7 percent of the total sediment deposited in Bussey Lake. Wind setup may cause an inflow of water and associated sediment loading to Bussey Lake, but it is doubtful that this is any greater than the sediment load from rising river stages. Wind induced surface currents and the formation of a large eddy at the downstream end of the lake could result in sediment loading, however these process are poorly understood and difficult to quantify.

PROJECT DESIGN

The overall Bussey Lake project design takes into account effects on fish and wildlife habitat, and economics. Project costs are minimized while following sound engineering procedures. Plate 7 in the main body of the report shows the plan view for the project.

The hydraulic and sedimentation analysis for this area indicate that both the Mississippi River and Buck Creek contribute to sediment deposition in Bussey Lake. Constructing a gated control structure on the upstream end of the 6 foot culvert under the Abel-Essman Island causeway will reduce sediment loading due to flows through this culvert from Buck Creek and Mississippi River. During periods of high flow on Buck Creek or the Mississippi River when sediment laden flow through the culvert occurs, the gate would be closed. Besides reducing sediment deposition, the gated control structure would also reduce turbidity in the lake caused by inflows.

The effects of closing the culvert on hydraulic characteristics of the French Town Bottoms area will be small. Floods on the Mississippi River cause this area to act much as a backwater lake. Whether or not discharges through the culvert occur will not change this characteristic. When Buck Creek floods, the effects of closing the culvert will be to force all of the Buck Creek flow north out of French Town Bottoms at RM 619. Less than 5 percent of this flow enters Bussey Lake through the culvert now. Increases in aggradation in the French Town Bottoms area, if there are any, will be small.

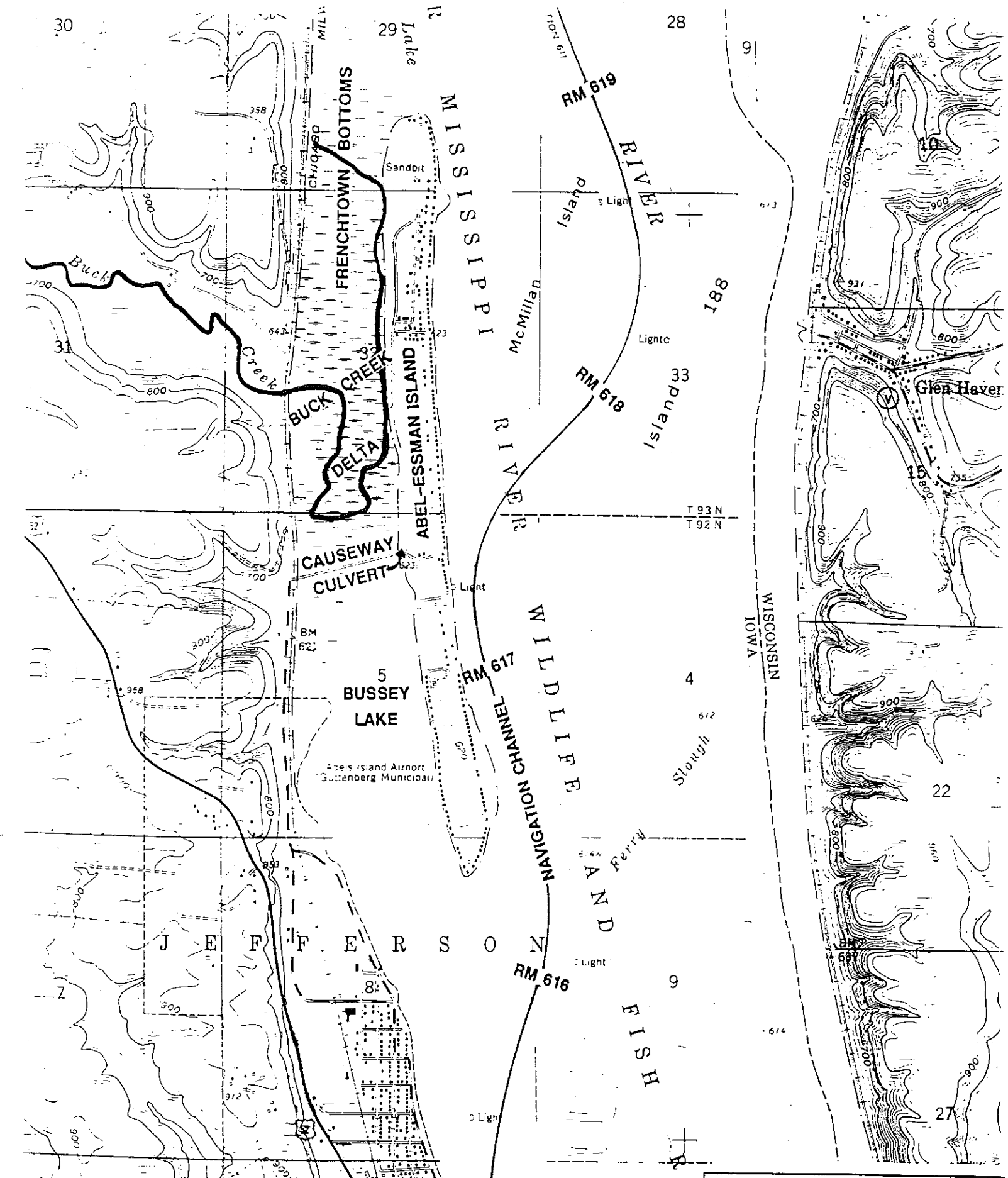
To provide deep water fish habitat in Bussey Lake channels will be dredged in Bussey Lake. The alignment of these channels was discussed in the main part of this report and is shown on plate 7. The channels are located on the western half of Bussey Lake, which historically, has received less sediment than the eastern half of the lake. The local deposition rate in the dredge cut area for existing conditions varies from 0.33 inches per year at the downstream end to 0.12 inches at the upstream end of the dredge cuts. With the installation of the gated control structure, the sedimentation rates given above will be reduced up to 10 percent. The channels are located far enough from the shoreline of Bussey Lake so that shoreline erosion will not be a problem.

Preventing diffusive inflows of sediment at the downstream end of the lake would be difficult. The sediment loading caused by rising water surface elevations due to increases in discharge or wind set up could only be stopped by constructing a complete closure structure across the downstream end of the lake. This is unacceptable from a water quality and recreational standpoint. A partial closure may decrease the effects of eddying, however this also could seriously impact water quality in the lake.

REFERENCES

GREAT 1, Study of the Upper Mississippi River, (1980). Vol. 4, "Sediment and Erosion."

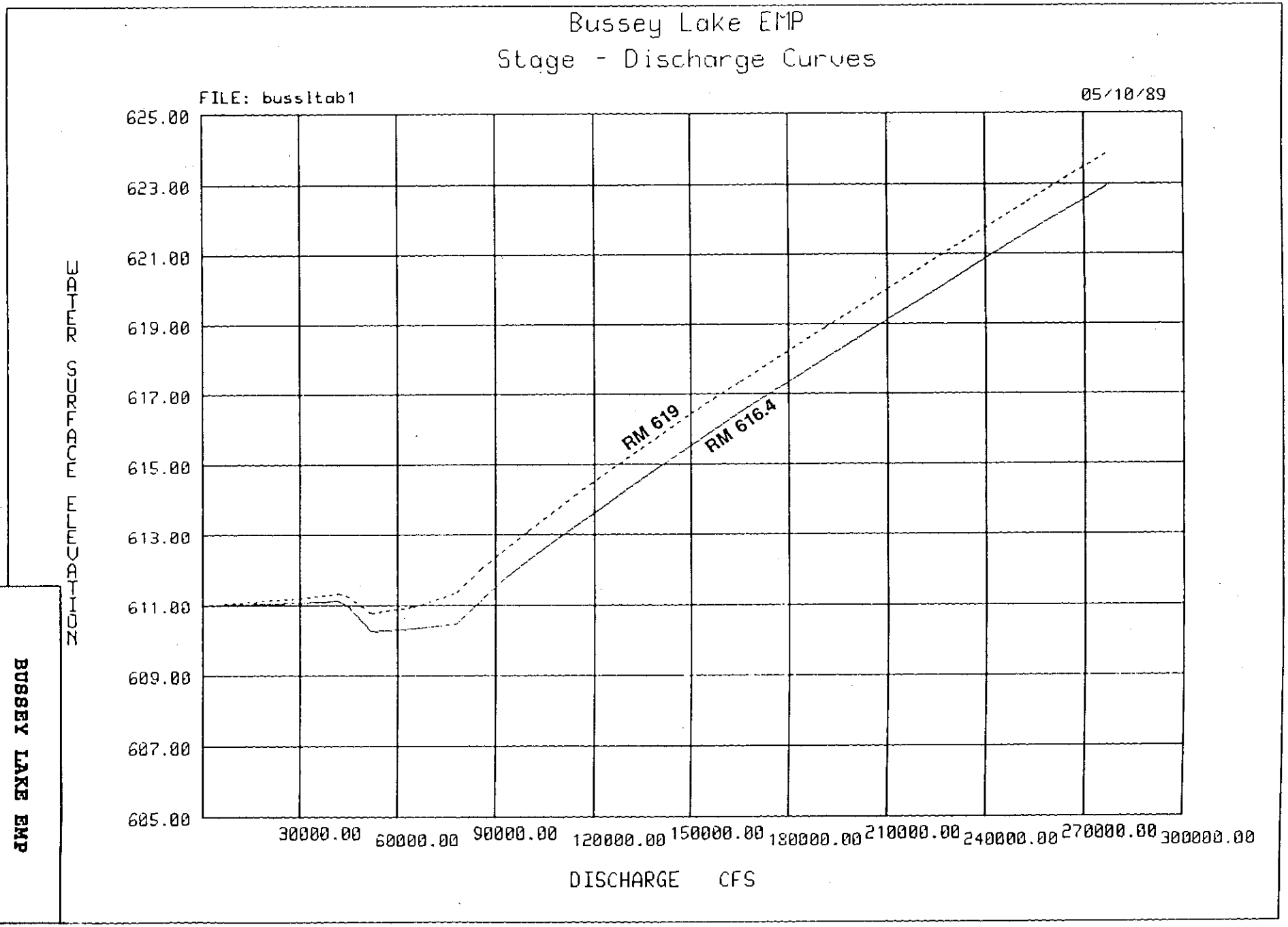
Tornes, L.H. (1986). "Suspended Sediment in Minnesota Streams." U.S. Geological Survey, Water Resources Investigations Report 85-4312.



BUSSEY LAKE EMP

PLAN VIEW

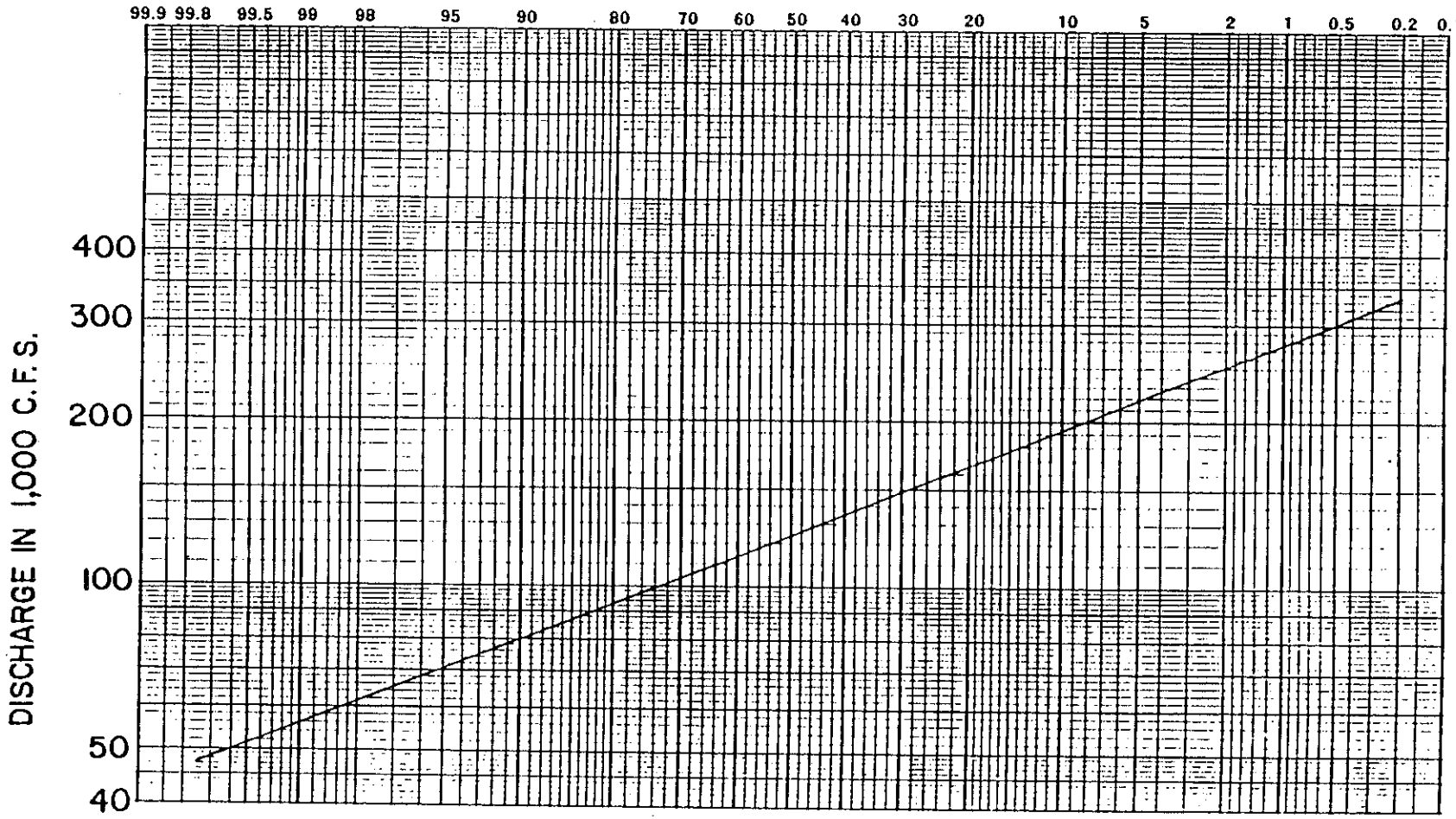
PLATE A-1



BUSSEY LAKE EMP

MISSISSIPPI RIVER
STAGE-DISCHARGE CURVE

PLATE A-2



DISCHARGE—FREQUENCY CURVE
MISSISSIPPI RIVER AT
LOCK AND DAM NO. 10
GUTTENBERG, IOWA

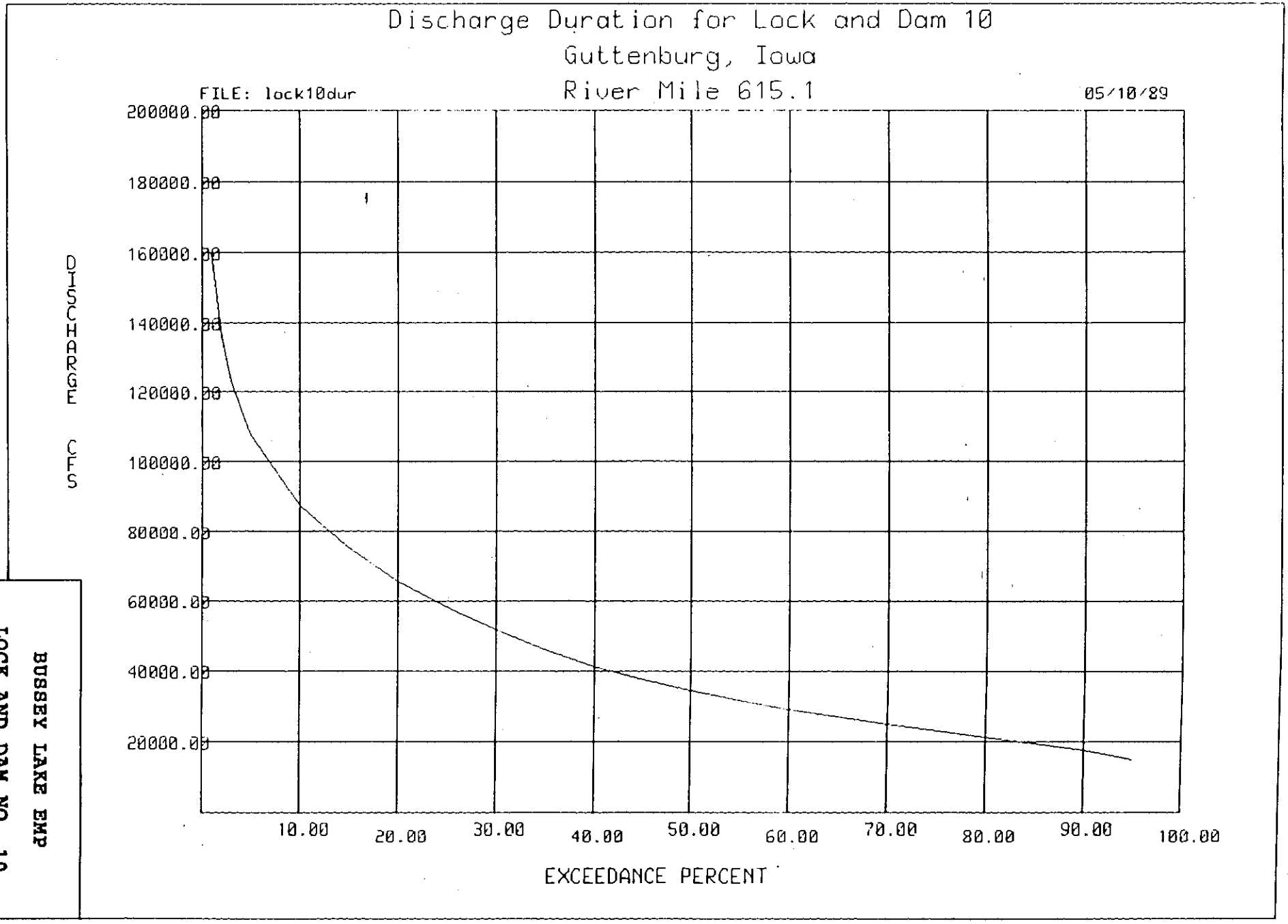
LOCK & DAM REGULATION MANUAL
REVISED: OCTOBER 1980

(NOV. 81 MANUAL REVISION)

BUSSEY LAKE EMP

LOCK AND DAM NO. 10
DISCHARGE-FREQUENCY CURVE

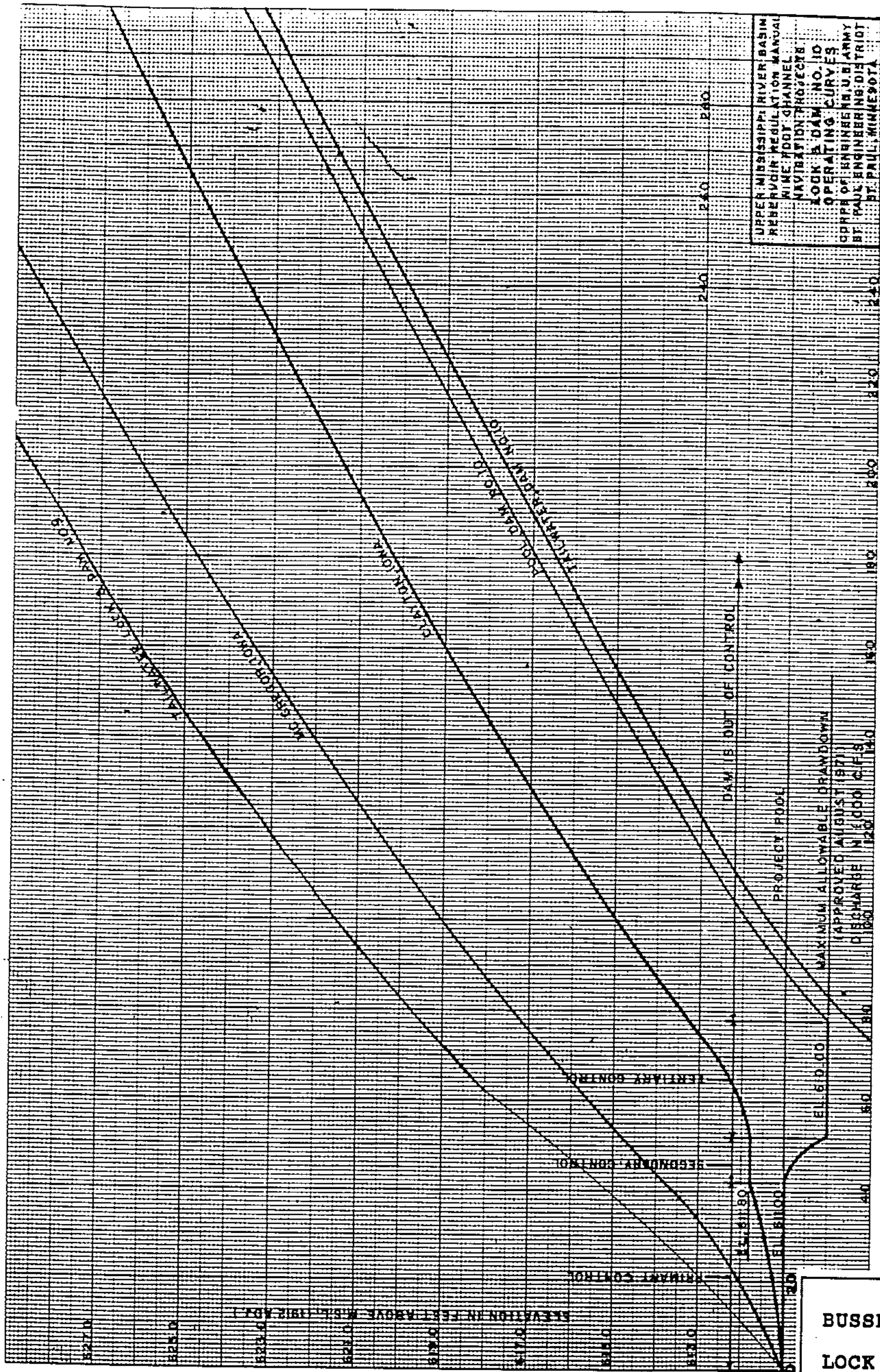
PLATE A-3



BUSSEY LAKE EMP

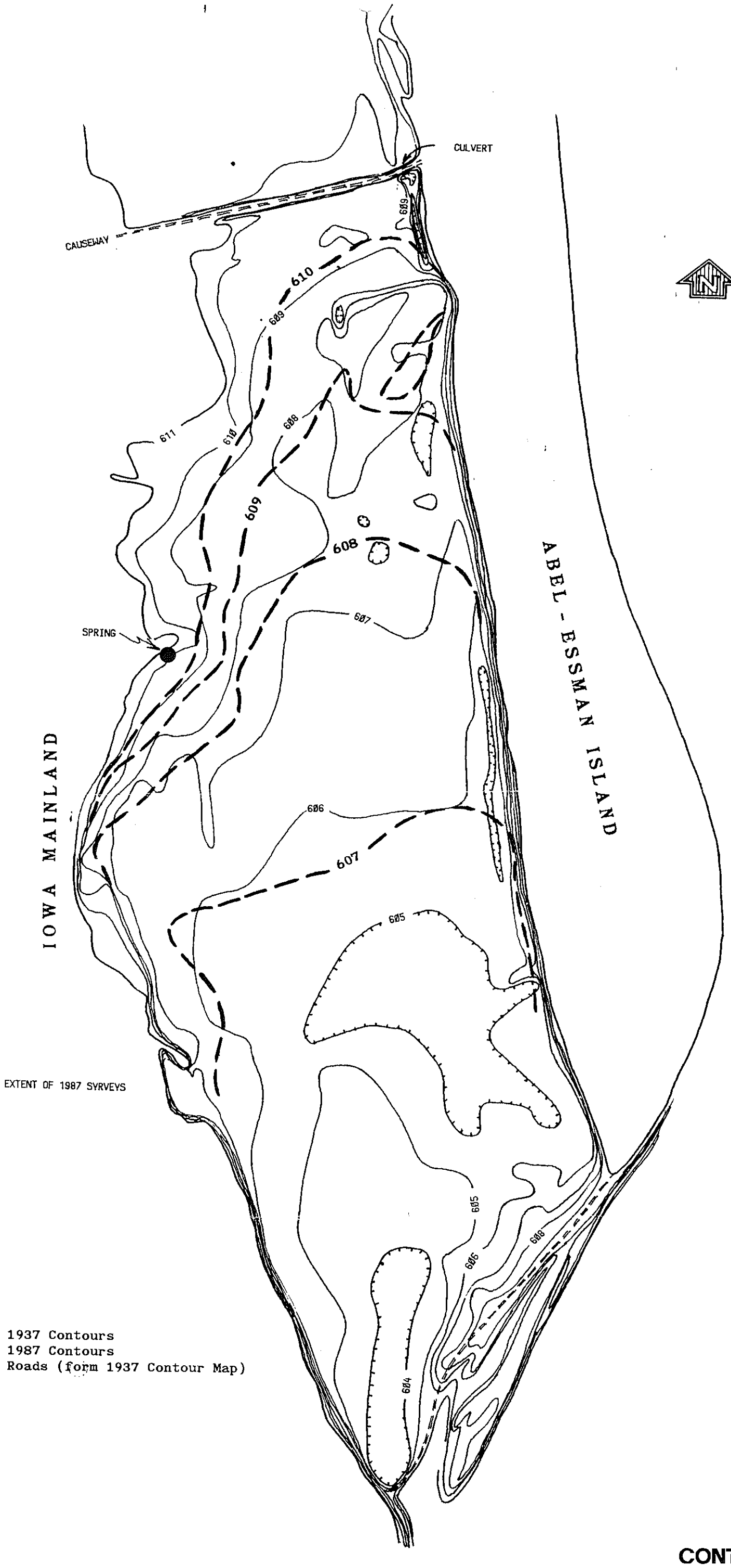
LOCK AND DAM NO. 10
DISCHARGE-DURATION CURVE

PLATE A-4



BUSSEY LAKE EMP

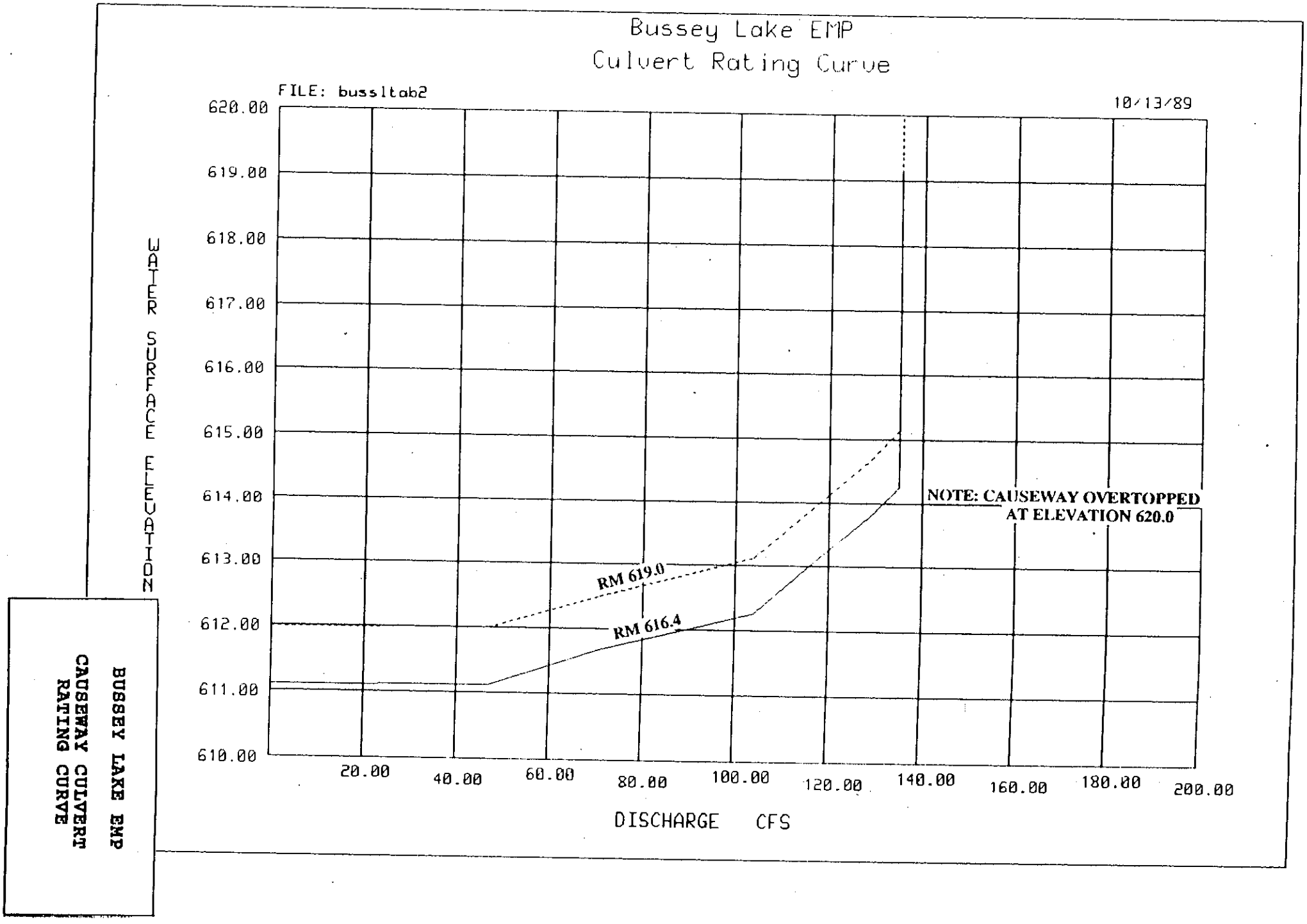
LOCK AND DAM 10
OPERATING CURVES



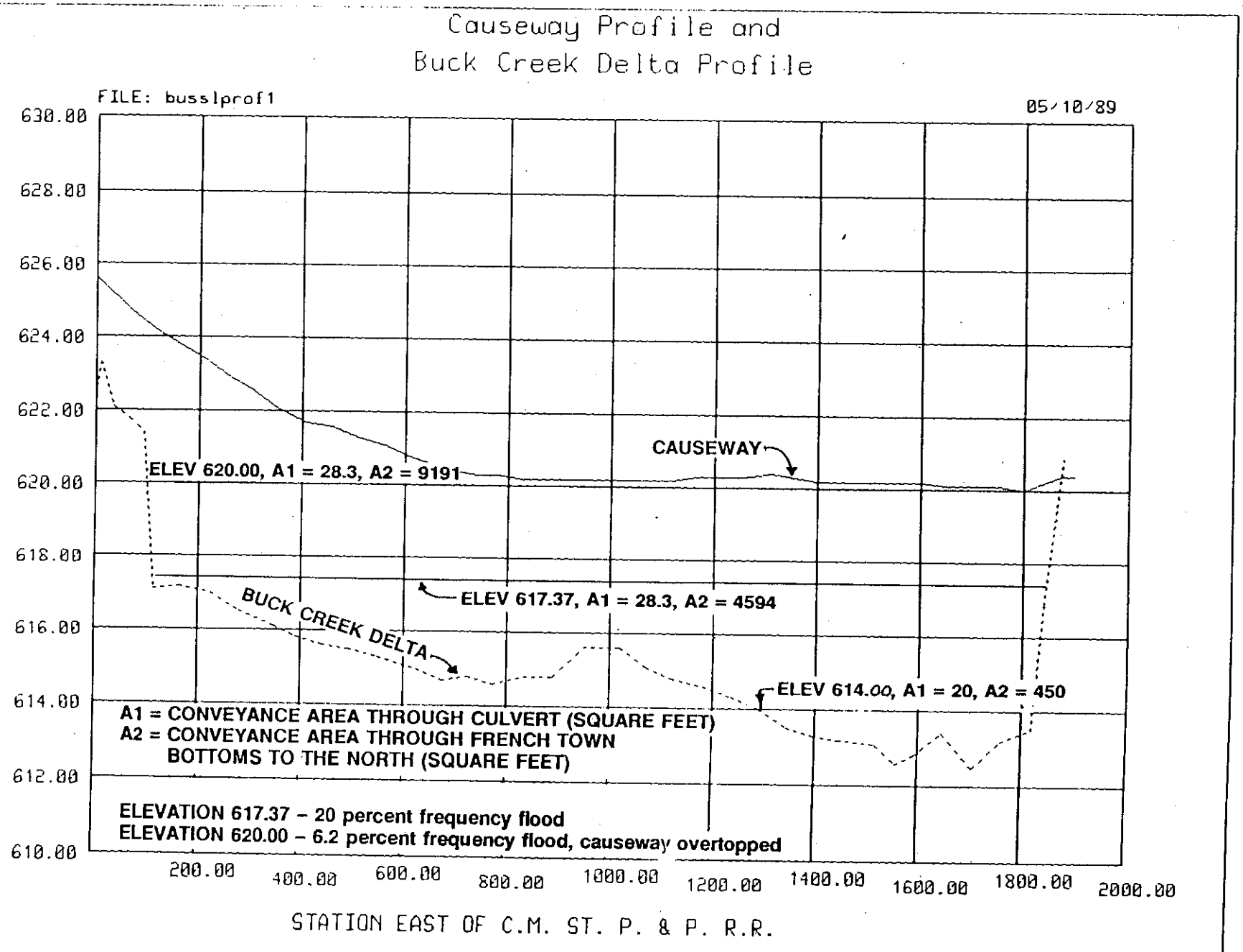
LEGEND

- 1937 Contours
- 1987 Contours
- Roads (form 1937 Contour Map)

CONTOUR MAP
(1937 and 1987)



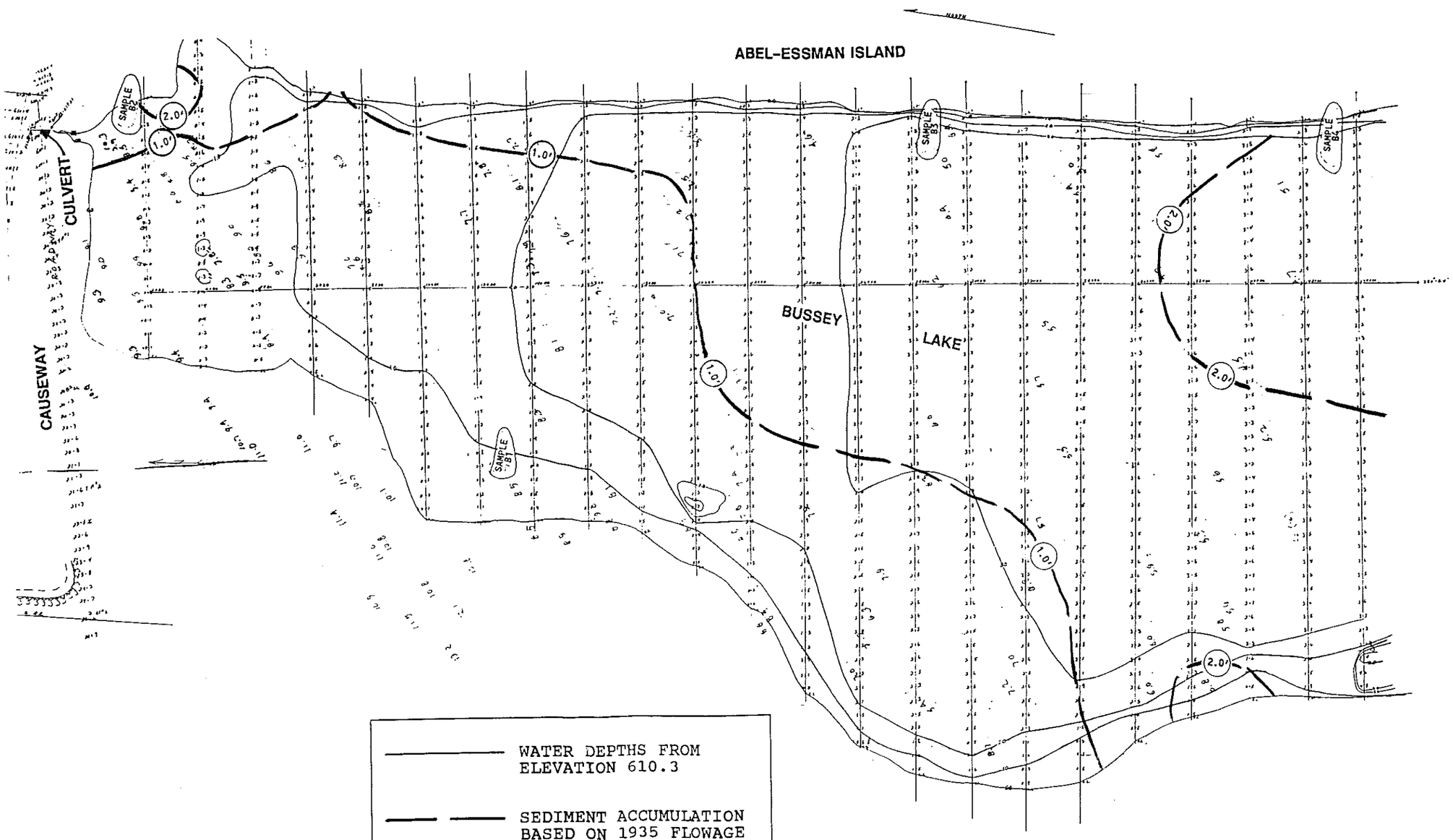
BUSSEY LAKE EMP
CAUSEWAY CULVERT
RATING CURVE



BUSSEY LAKE EMP

BUCK CREEK
AND
CAUSEWAY CONVEYANCE AREAS

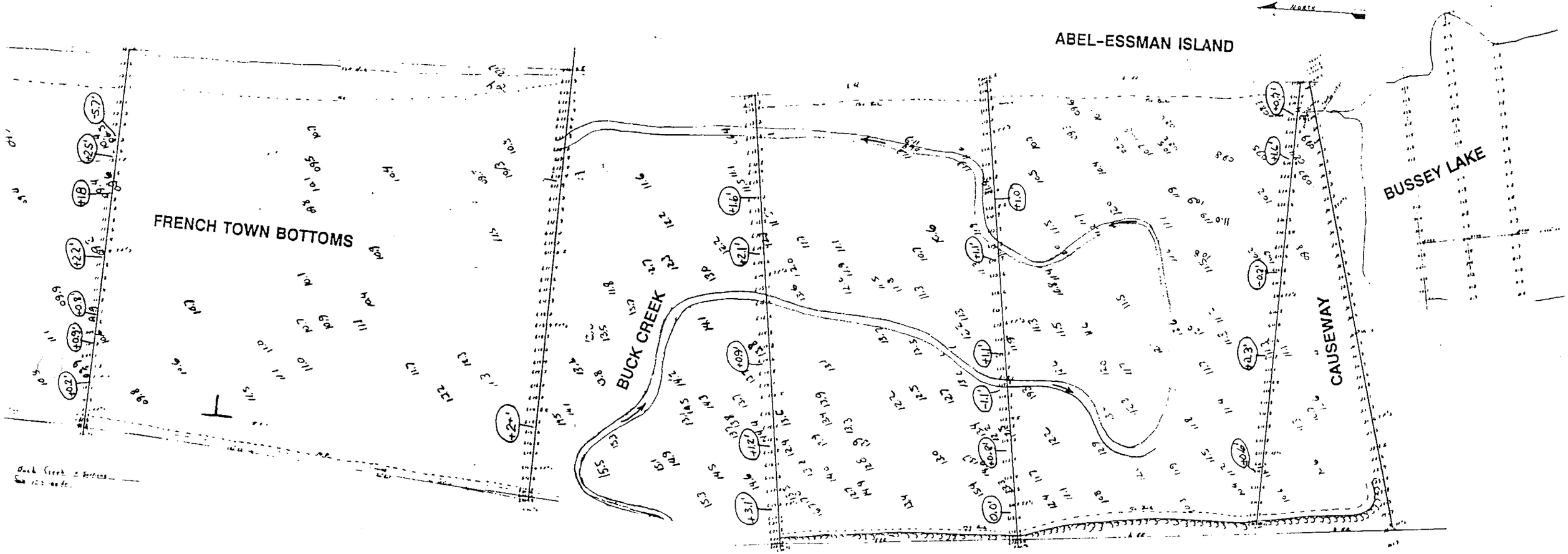
PLATE A-7



BUSSEY LAKE EMP

BUSSEY LAKE SEDIMENTATION

PLATE A-9



LEGEND

——— 1987 Bussey Lake Surveys

12·2 Hand written numbers with random orientation are 1935 Flowage Easement Surveys

(1·1') Sediment accumulation over the period 1935 to 1987

BUSSEY LAKE EMP

BUCK CREEK SEDIMENTATION

PLATE A-10

Attachment 8

Habitat Evaluation Procedure

SUMMARY OF HABITAT EVALUATION FOR BUSSEY LAKE HREP

This appendix summarizes the procedures used to quantify the habitat benefits expected to accrue from the Bussey Lake HREP project. Habitat benefits were quantified for both Bussey Lake and the Guttenberg waterfowl ponds.

BUSSEY LAKE

METHODS

The habitat evaluation for the Bussey Lake habitat rehabilitation and enhancement project (HREP) was conducted using the U.S Fish and Wildlife Service habitat suitability index (HSI) model for the bluegill (Lepomis macrochirus), as modified by the St. Paul District to include variables to address winter habitat conditions. The bluegill was selected as the evaluation species because it is the most common and sought after species of interest in Bussey Lake. In addition, habitat suitablility for the bluegill in Bussey Lake would also indicate habitat suitability for other common backwater species of interest in Bussey Lake, most notably the largemouth bass (Micropterus salmoides).

Target Years -The Bussey Lake HREP has a projected 50-year project life. Thus, the target years of 0 (present day), 1 (immediately following construction), and 50 (end of project life) were selected for evaluation. In order to help differentiate between project alternatives target years 25 and 40 were added.

Data Availability - The evaluation was conducted using existing data on Bussey Lake. No new information was collected specifically for the habitat evaluation. Available information included bathymetric mapping, summer aerial photography, limited summer and winter water quality data, sediment data, and miscellaneous information from first hand sources and observations. The only variables for which there was an obvious paucity of important data were summer and winter dissolved oxygen. Because of this data gap considerable judgement was required in assigning suitability index values for the dissolved oxygen variables.

MODEL APPLICATION

In applying the HSI models existing habitat conditions were considered optimum (SI = 1.0) for the following variables: percent pool area, turbidity, pH, summer water temperature (embryo, fry, & adult), winter water temperature, and summer and winter current velocity. Water temperature (juvenille) and spawning substrate conditions were considered to be slightly suboptimal (SI = .80-.90 and .70 respectively). None of these variables were projected to change appreciably with any of the dredging alternatives. Thus, their SI values remained constant for all alternatives.

Dredging would have an appreciable effect on four model variables - summer and winter cover and summer and winter dissolved oxygen. The effect of dredging on these variables was strongly related to the amount of dredging conducted. As a

result, all of the projected habitat benefits associated with the various dredging alternatives resulted from changes to these variables.

Tables 1-4 show the suitability index values for these four important variables for the dredging alternatives evaluated. It is readily evident from these tables how increased dredging affects the variables.

Table 1. Summer Percent Cover Suitability Index Values

Dredging Alternative	TY 0	TY 1	TY 25	TY 40	TY 50
Future Without	.35	.35	.25	.20	.15
140,000 c.y.	.35	.40	.30	.25	.20
185,000 c.y.	.35	.45	.35	.30	.25
220,000 c.y.	.35	.50	.40	.35	.30
245,000 c.y.	.35	.50	.40	.35	.30
255,000 c.y.	.35	.50	.40	.35	.30
270,000 c.y.	.35	.50	.45	.40	.35
310,000 c.y.	.35	.60	.50	.45	.40

The suitability index values for summer cover are relatively low under existing conditions (TY 0) because of excessive aquatic vegetation. Dredging improves this condition by opening up areas and increasing water depths to below the photic zone. For all of the dredging alternatives it was projected that by the end of the 50-year project life the dredged areas would probably be the only areas within Bussey Lake relatively free of aquatic vegetation. Changes in the SI values for summer cover are directly related to the area dredged under the various dredging alternatives.

Table 2. Winter Cover Suitability Index Values

Dredging Alternative	TY 0	TY 1	TY 25	TY 40	TY 50
Future Without	.75	.75	.55	.45	.40
140,000 c.y.	.75	.80	.60	.50	.45
185,000 c.y.	.75	.85	.65	.55	.50
220,000 c.y.	.75	.85	.70	.55	.50
245,000 c.y.	.75	.90	.70	.60	.55
255,000 c.y.	.75	.90	.75	.65	.55
270,000 c.y.	.75	.90	.75	.65	.55
310,000 c.y.	.75	.95	.80	.70	.60

The winter cover variable is directly related to the areal extent of water depths greater than 4 feet. As with the summer cover variable, improvements are nearly directly related to the amount of area dredged. Location of dredge cuts had a minor influence on the TY 1 value as dredging areas already over 4 feet in depth would not benefit this variable. Declines in this variable over

time are based on an assumption of continued sedimentation in the lake. By TY 50 the only areas of the lake that would likely be greater than 4 feet in depth would be the dredged areas.

Table 3. Summer Dissolved Oxygen Suitability Index Values

Dredging Alternative	TY 0	TY 1	TY 25	TY 40	TY 50
Future Without	.70	.70	.40	.40	.40
140,000 c.y.	.70	.70	.70	.40	.40
185,000 c.y.	.70	.70	.70	.40	.40
220,000 c.y.	.70	.70	.70	.55	.40
245,000 c.y.	.70	.70	.70	.70	.40
255,000 c.y.	.70	.70	.70	.70	.40
270,000 c.y.	.70	.70	.70	.70	.40
310,000 c.y.	.70	.70	.70	.70	.40

Table 4. Winter Dissolved Oxygen Suitability Index Values

Dredging Alternative	TY 0	TY 1	TY 25	TY 40	TY 50
Future Without	.70	.70	.40	.40	.40
140,000 c.y.	.70	1.00	.70	.40	.40
185,000 c.y.	.70	1.00	.70	.40	.40
220,000 c.y.	.70	1.00	.70	.55	.40
245,000 c.y.	.70	1.00	.70	.70	.40
255,000 c.y.	.70	1.00	.70	.70	.40
270,000 c.y.	.70	1.00	.70	.70	.40
310,000 c.y.	.70	1.00	.70	.70	.40

The dissolved oxygen variable was one of the most difficult to predict for because of it's significance as a limiting factor, the limited data available for Bussey Lake, and the general lack of knowledge concerning the effect of backwater dredging on this variable. The basic assumption used was that dredging would improve dissolved oxygen conditions primarily by setting back or postponing the time dissolved oxygen will become a severe limiting factor in Bussey Lake. The model considers an SI value of .40 for dissolved oxygen as the level whereby it becomes a limiting factor.

The model only has values of 1.0, .70, .40, or .10 for the dissolved oxygen variable. A deviation from the model was made for the 220,000 c.y. alternative in assigning an SI value of .55 for TY 40. A value of .70 was considered too high for this alternative while a value of .40 was considered too low when compared to the alternatives immediately above and below it.

RESULTS

Tables 5-7 shows the summer, winter, and overall habitat suitability index (HSI) values for the future without condition and the various sized dredging alternatives that were evaluated. A deviation from the model was made in the calculation of the HSI values in that dissolved oxygen was not considered absolutely limiting the first target year a value of .40 appeared because fish in Bussey Lake have the opportunity to move out of the lake when dissolved oxygen declines. Instead, the HSI calculations were carried out in normal fashion.

The second target year that dissolved oxygen had a value of .40 it was considered limiting in the calculation of the HSI values. The .55 value assigned the 220,000 c.y. was viewed as a .40 value when applying this rule. It was felt that by the second target year of occurrence (a 10 or 15 year gap) the frequency of occurrence of low dissolved oxygen conditions would be such that it warranted consideration as a true limiting factor.

Table 5. Summer Habitat Suitability Index Values

Dredging Alternative	TY 0	TY 1	TY 25	TY 40	TY 50
Future Without	.72	.72	.64	.40	.40
140,000 c.y.	.72	.75	.70	.64	.40
185,000 c.y.	.72	.77	.72	.67	.40
220,000 c.y.	.72	.79	.75	.70	.40
245,000 c.y.	.72	.79	.75	.72	.67
255,000 c.y.	.72	.79	.75	.72	.70
270,000 c.y.	.72	.81	.77	.75	.70
310,000 c.y.	.72	.83	.79	.77	.72

Table 6. Winter Habitat Suitability Index Values

Dredging Alternative	TY 0	TY 1	TY 25	TY 40	TY 50
Future Without	.83	.83	.67	.40	.40
140,000 c.y.	.83	.95	.79	.65	.40
185,000 c.y.	.83	.96	.80	.67	.40
220,000 c.y.	.83	.96	.82	.72	.40
245,000 c.y.	.83	.97	.82	.79	.67
255,000 c.y.	.83	.97	.83	.80	.67
270,000 c.y.	.83	.97	.83	.80	.67
310,000 c.y.	.83	.99	.85	.82	.68

Table 7. Overall Habitat Suitability Index Values

Dredging Alternative	TY 0	TY 1	TY 25	TY 40	TY 50
Future Without	.77	.77	.65	.40	.40
140,000 c.y.	.77	.84	.74	.65	.40
185,000 c.y.	.77	.86	.76	.67	.40
220,000 c.y.	.77	.87	.78	.72	.40
245,000 c.y.	.77	.88	.78	.76	.67
255,000 c.y.	.77	.88	.79	.76	.68
270,000 c.y.	.77	.89	.80	.78	.68
310,000 c.y.	.77	.90	.82	.79	.70

Table 8 below shows the caluculated habitat gains for the various dredging alternatives. The results of the evaluation generally show what would be intuitively expected from a dredging project at Bussey Lake, i.e., habitat improvement that is generally correlated with the amount of dredging. The more dredging that would be done, the more improvement that would accrue for the fishery.

Table 8. Habitat Gains with Bussey Lake Dredging Alternatives

Dredging Alternative	Total AAHU	AAHU	Increase over FW/O AAHU	Percent
Future Without	6,325	126.5	-	-
140,000 c.y.	7,550	151.0	24.5	19
185,000 c.y.	7,740	154.8	28.3	22
220,000 c.y.	7,985	159.7	33.2	26
245,000 c.y.	8,400	168.0	41.5	33
255,000 c.y.	8,450	169.0	42.5	34
270,000 c.y.	8,550	171.0	44.5	35
310,000 c.y.	8,730	174.6	48.1	38
500,000 c.y.*	9,780	195.6	69.1	55
750,000 c.y.*	10,185	203.7	77.2	61
1,000,000 c.y.*	10,520	210.4	83.9	66

The habitat evaluation was run for three abnormally large dredging volumes (*) to place the previously evaluated dredging alternatives in perspective. The 1,000,000 c.y. alternative represents the upper limit of dredging in Bussey Lake that would provide a measurable return using the bluegill model. With this alternative the HSI for Bussey Lake would be .99 for the entire 50-year planning period. Table 9 shows the percent of maximum attainable dredging benefit provided by each dredging alternative.

Table 9. Percent of Maximum Attainable Dredging Benefit

Dredging Alternative	AAHU Gain	Percent of Maximum Attainable
140,000 c.y.	24.5	29
185,000 c.y.	28.3	34
220,000 c.y.	33.2	40
245,000 c.y.	41.5	49
255,000 c.y.	42.5	51
270,000 c.y.	44.5	53
310,000 c.y.	48.1	57
500,000 c.y.*	69.1	82
750,000 c.y.*	77.2	92
1,000,000 c.y.*	83.9	100

What the analysis in table 9 shows is that the dredging larger volumes of material from Bussey Lake would not provide a commensurate return in benefits. The law of diminishing returns applies in that excessively larger amounts of material would have to be dredged to achieve the last attainable benefits that dredging could provide.

GUTTENBERG WATERFOWL PONDS

METHODS

The evaluation of potential benefits at the Guttenberg waterfowl ponds (GWP) focused on the management purpose of these managed moist soil units, provision of feeding habitat for migratory waterfowl. Because the proposed actions at the GWP would be primarily result in increased water management capabilities Iowa Department of Natural Resource and U.S. Fish and Wildlife Service wildlife managers were asked to assign HSI values for the existing condition and the with project condition based on their professional experience and judgement.

RESULTS

The general view of the wildlife managers was that under existing conditions where full water management capability is only available on an infrequent basis that the existing moist soil units would have an HSI of .60 as waterfowl feeding habitat. They believed that the increased management capabilities that the proposed project would offer would increase the HSI value to .90.

The net gain for the three existing moist soil units would be .30. At 35 acres this results in an average annual gain in waterfowl feeding habitat HU of 10.5. For the new moist soil unit the net gain is .90 times 15 acres for an average annual gain of 13.5 waterfowl feeding habitat HU.

This evaluation did not take into account the habitat value loss to non-target

species associated with the conversion of 15 acres of natural wetland to a managed wetland nor did it take into account any gains in habitat value to non-target species that may accrue as part of the improved management at the moist soil units. These gains and losses were not viewed as significant and to some degree will cancel each other out.

Attachment 9

DETAILED COST ESTIMATE

ACCOUNT CODE	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES AMOUNT	CONTINGENCIES PERCENT	REASON
01.-.-.-	LANDS AND DAMAGES							
01.B.-.-	POST-AUTHORIZATION PLANNING	LS	0	$0	$0	$0	0.0	1
01.D.-.-	ACQUISITION:							
01.D.-.-	ACQUISITION (LOCAL SPONSOR)	TRT	1	500	500	100	20.0	2,3 & 4
01.D.-.-	ACQUISITION (FED. REVIEW/ ASSISTANCE)	TRT	1	100	100	0	0.0	1
01.E.-.-	CONDEMNATION (POST-DT FILING):							
01.E.-.-	CONDEMNATION (POST DT) - LOCAL SPONSOR	TRT	0	0	0	0	0.0	1
01.E.0.E	FEDERAL REVIEW OF DOCUMENTS	TRT	0	0	0	0	0.0	1
01.F.-.-	APPRAISALS:							
01.F.2.H	PREPARE APPRAISALS - LOCAL SPONSOR	OSP	0	0	0	0	0.0	1
01.F.2.J	FEDERAL REVIEW OF APPRAISALS	OSP	0	0	0	0	0.0	1
01.H.-.-	RELOCATIONS:							
01.H.1.-	P.L.91-646 RELOCATIONS - LOCAL SPONSOR	OSP	0	0	0	0	0.0	1
01.H.1.E	FEDERAL REVIEW OF DOCUMENTS	OSP	0	0	0	0	0.0	1
01.M.-.-	REAL ESTATE RECEIPTS/PAYMENTS:							
01.M.3.-	LAND PAYMENTS	LS	0	0	0	0	0.0	1
01.M.3.-	P.L.91-646 RELOCATIONS	LS	0	0	0	0	0.0	1
	SUBTOTAL CONSTRUCTION COSTS				$600			
	SUBTOTAL CONTINGENCIES (AVER.)		16.7%			$100		
	TOTAL 01. LANDS AND DAMAGES					$700		

REASONS FOR CONTINGENCIES:

1. NOT APPLICABLE.
2. UNKNOWNS DUE TO LEGAL COST.
3. UNKNOWNS DUE TO LAND PRICES.
4. UNKNOWNS DUE TO QUANTITIES.

NOTES:

A. FEDERAL, NONFEDERAL COST TO BE IN ACCORDANCE WITH 1986 WRDA.
B. UNIT PRICES ARE AT APRIL 1990 PRICE LEVEL.
C. TRT = TRACT
D. OSP = OWNERSHIP
E. LS = LUMPSUM

ACCOUNT CODE	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES AMOUNT	CONTINGENCIES PERCENT	CONTINGENCIES REASON
12.-.-.-	OREDGING							
12.0.A.-	MOBILIZATION AND DEMOBILIZATION							
12.0.A.-	MOBILIZATION	LS	1	$266,000	$266,000	$66,500	25.0%	1,4
12.0.R.-	ASSOC. GEN. ITEMS							
12.0.R.B	CLEARING AND GRUBBING	ACRE	7	3,125	21,900	7,200	32.9	1,4
12.0.R.B	CONTROL STRUCTURE, SITE NO. 6 EXPANDED WATERFOWL POND NO. 4 - SWIFT SLOUGH	LS	1	10,000	10,000	2,500	25.0	1,4
12.0.R.B	CONTROL STRUCTURE, EXISTING PONDS NO. 2 & 4	LS	2	10,000	20,000	5,000	25.0	1,4
12.0.R.B	SLIT SCREEN	FT	3,000	2.00	6,000	1,200	20.0	1,4
12.0.R.B	RAISE EXISTING OUTLETS	EA	2	6,625	13,300	3,300	24.8	1,4
12.0.R.B	MODIFIY MANHOLE (NEAR ABUTMENT WALL)	EA	1	625	600	100	16.7	1,4
12.0.R.B	VALUES IN MANHOLES (NEAR ABUTMENT WALL AND NEW POND)	EA	2	18,750	37,500	7,500	20.0	1,4
12.0.R.B	24" CMP. (BELOW DIKE)	LF	950	88	83,100	12,500	15.0	1,4
12.0.2.B	MATERIAL HANDLING	CY	90,000	1.50	135,000	27,000	20.0	1,2,4
12.0.2.B	MATERIAL HANDLING CONTRACT	LS	1	5,000.00	5,000	1,300	26.0	1,4
12.0.2.-	PIPELINE DREDGING							
12.0.2.B	PIPELINE DREDGING	CY	270,000	2.25	607,500	91,100	15.0	1,2,4
12.0.4.-	MECHANICAL DREDGING							
12.0.4.B	MECHANICAL DREDGING	CY	26,000	5.60	145,600	36,400	25.0	1,2,4
12.0.4.B	DREDGED MAT'L DISPOSAL	CYM	26,000	0.20	5,200	1,300	25.0	1,2,4
12.0.4.B	DIKE CONSTRUCTION	CY	26,000	2.00	52,000	13,000	25.0	1,2,4
	SUBTOTAL CONSTRUCTION COSTS				$1,408,700			
	SUBTOTAL CONTINGENCIES (AVER.)			19.6%		$275,900		
	TOTAL 12. DREDGING					$1,684,600		

REASONS FOR CONTINGENCIES:

1. QUANTITY UNKNOWNS.
2. UNKNOWN SITE CONDITIONS.
3. UNKNOWN HAUL DISTANCE.
4. UNIT PRICE UNKNOWNS.

NOTES:

ACCOUNT CODE	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES AMOUNT	CONTINGENCIES PERCENT	CONTINGENCIES REASON

A. FEDERAL, NONFEDERAL COST TO BE IN ACCORDANCE WITH 1986 WRDA.
B. UNIT PRICES ARE AT APRIL 1990 PRICE LEVEL.

ACCOUNT CODE	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES AMOUNT	CONTINGENCIES PERCENT	CONTINGENCIES REASON

A. FEDERAL, NONFEDERAL COST TO BE IN ACCORDANCE WITH 1986 WRDA.

ACCOUNT CODE	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES AMOUNT	CONTINGENCIES PERCENT	REASON
30.-.-.-	PLANNING, ENGINEERING AND DESIGN							
30.A.-.-	PLANNING:							
30.A.-.-	CONTRACTS	LS	1	$4,000	$4,000	$600	15.0%	2
30.A.-.-	ENVIRONMENTAL	LS	1	4,860	4,900	700	14.3%	2
30.A.-.-	CULTURAL	LS	1	2,296	2,300	300	13.0%	2
30.A.-.-	PROJECT MANAGEMENT	LS	1	10,400	10,400	1,600	15.4%	2
30.E.-.-	DESIGN RELATED ENGINEERING:							
30.E.2.-	GEOTECH	LS	1	21,080	21,100	3,200	15.2%	2
30.E.2.-	TESTING	LS	1	3,000	3,000	500	16.7%	2
30.E.2.-	HYDRAULICS	LS	1	9,440	9,400	1,400	14.9%	2
30.E.2.-	SURVEYS	LS	1	5,080	5,100	800	15.7%	2
30.H.-.-	PLANS AND SPECIFICATIONS:							
30.H.2.-	GENERAL ENG.	LS	1	71,399	71,400	10,700	15.0%	2
30.H.2.-	SPECIFICATIONS	LS	1	33,613	33,600	5,000	14.9%	2
30.H.2.-	STRUCTURAL	LS	1	45,263	45,300	6,800	15.0%	2
30.H.2.-	ESTIMATING	LS	1	19,500	19,500	2,900	14.9%	2
30.H.2.-	CONSTRUCTION	LS	1	2,600	2,600	400	15.4%	2
30.J.-.-	ENGINEERING DURING CONSTRUCTION:							
30.J.9.-	GENERAL ENG.	LS	1	11,427	11,400	1,700	14.9%	2
30.J.9.-	SPECIFICATIONS	LS	1	17,000	17,000	2,600	15.3%	2
30.J.9.-	STRUCTURAL	LS	1	9,607	9,600	1,400	14.6%	2
30.J.9.-	ESTIMATING	LS	1	2,500	2,500	400	16.0%	2
30.J.9.-	GEOTECH	LS	1	6,770	6,800	1,000	14.7%	2
30.J.9.-	HYDRAULICS	LS	1	2,000	2,000	300	15.0%	2
30.J.9.-	CONTRACTS	LS	1	8,000	8,000	1,200	15.0%	2
30.J.9.-	ENVIRONMENTAL	LS	1	3,060	3,100	500	16.1%	2
30.J.9.-	CULTURAL	LS	1	0	0	0	0.0%	1
30.P.-.-	PROJECT MANAGEMENT:							
30.P.1.-	PROJECT MANAGEMENT	LS	1	10,400	10,400	1,600	15.4%	2
	SUBTOTAL CONSTRUCTION COSTS				$303,400			
	SUBTOTAL CONTINGENCIES (AVER.)		14.5%			$44,000		
	TOTAL 30. PLANNING, ENGINEERING AND DESIGN					$347,400		

REASONS FOR CONTINGENCIES:

1. NOT APPLICABLE.
2. UNKNOWNS DUE MANHOURS REQUIRED.

NOTES:

ACCOUNT CODE	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES AMOUNT	CONTINGENCIES PERCENT	REASON
31.-.-.-	CONSTRUCTION MANAGEMENT (S&I)	LS	1	$77,469	$77,500	$0	0.0%	1
	SUBTOTAL CONSTRUCTION COSTS				$77,500			
	SUBTOTAL CONTINGENCIES			0.0%		$0		
	TOTAL 31. CONSTRUCTION MANAGEMENT (S&I)					$77,500		

REASONS FOR CONTINGENCIES:

1. CONTINGENCIES ARE INCLUDED IN LUMP SUM AMOUNT.

NOTES:

A. FEDERAL, NONFEDERAL COST TO BE IN ACCORDANCE WITH 1986 WRDA.
B. UNIT PRICES ARE AT APRIL 1990 PRICE LEVEL.