SHELBYVILLE WILDLIFE MANAGEMENT AREAS
MOULTRIE COUNTY, ILLINOIS

ECOSYSTEM RESTORATION REPORT WITH ENVIRONMENTAL ASSESSMENT

DRAFT

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LAKE SHELBYVILLE
IMPROVEMENTS TO WILDLIFE MANAGEMENT AREAS
MOULTRIE COUNTY, ILLINOIS
ECOSYSTEM RESTORATION REPORT
WITH ENVIRONMENTAL ASSESSMENT AND
FINDING OF NO SIGNIFICANT IMPACT
SECTION 1135 OF THE WATER RESOURCES
DEVELOPMENT ACT OF 1986, AS AMENDED

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SHELBYVILLE WILDLIFE MANAGEMENT AREAS ECOSYSTEM RESTORATION REPORT AND ENVIRONMENTAL ASSESSMENT

EXECUTIVE SUMMARY

Purpose. This Ecosystem Restoration Report is prepared under the authority of Section 1135 of the Water Resources Development Act (WRDA) of 1986, as amended, in response to a request for Federal assistance from the Illinois Department of Natural Resources for an ecosystem restoration project.

Project Location. Lake Shelbyville is located in Shelby and Moultrie Counties of east-central Illinois. The dam site is located on the Kaskaskia River and about one-half mile east of Shelbyville, Illinois. The lake lies approximately 113 miles northeast of St. Louis, 208 miles southwest of Chicago and 54 miles southeast of Springfield, Illinois. Construction of Lake Shelbyville was completed in 1970 and its authorized purposes include flood control, water supply, water quality control, fish and wildlife conservation, and recreation. Lake Shelbyville empties into the Kaskaskia River, which runs through an agricultural area. The lake levels are regulated in part to control flooding to these agricultural lands.

Background. The Illinois Department of Natural Resources is licensed by the St. Louis District Corps of Engineers to manage 6,231 acres of land and water in Moultrie County at the northern end of the lake, including four wildlife management areas (McGee, North and South Dunn, Jonathan, and Fishhook). All areas currently incorporate levees and some pumping (watering and/or portable dewatering) capability.

Existing natural and man-made wetlands in the Shelbyville Fish and Wildlife Area in the upper reaches of the Lake Shelbyville Project have been seriously degraded by frequent flooding caused by the manipulation of the Lake Shelbyville Dam. The problem is compounded by the inability to dewater these wetland areas at critical times to promote the growth of natural and artificial food sources that are vital to maintaining bio-diversity in any wetland ecosystem. This can have a devastating impact on food production within the managed areas that, in turn, has a negative impact on habitat. Additionally, the operation of the Lake Shelbyville dam has negatively impacted the historical frequency and duration of overbank flooding to forested wetland areas in the upper reaches of the lake. The changes in hydrology and vegetation have diminished the value of the mid-migration habitat for shorebirds and waterfowl.

The present assumption is that levees and pumps capable of watering and dewatering each management unit that are the subject of this study will provide water conditions that are predictable and controlled most years. Elevated areas that are reestablished to bottomland hardwoods would provide greater diversity as the project matures. It would also be beneficial to the Lake Shelbyville fisheries to have a nursery area that would provide a high level of nutrients (which contain no predatory fish). These conditions

would promote increased size of the young of the year fish that enter the lake and, in turn, increase the success of an individual to become a sexually mature adult.

Alternatives Considered. Because the four management areas are not contiguous, are operated independently, and have independent benefits, each area was studied as a separate entity. Alternative plans for the areas were developed by using different criteria for pumps (electric versus diesel), revetment (with bedding versus geotextile), and by including or not including additional improved areas or tree plantings.

Proposed Features. Proposed features of this restoration project consist of new low profile levee construction to form separate management compartments and rehabilitation of several low profile levees, two overflow weirs, the excavation of a ditch drainage system, revetment of critical berm sections and pump station locations, fish nursery areas, and additional watering and dewatering capacity.

Project Costs. Cost estimates were developed for each alternative. Combined first costs for the initially evaluated plans of each area ranged from $5,828,750 to $6,740,050. Average annual costs were based on an expected project life of 50 years, a Federal discount rate of 6.125 percent, and March 2002 price levels. Average operation and maintenance costs range from $28,906 to $32,709 for the four plans combined. A detailed cost estimate was developed for the recommended plan incorporating the value engineering study. Total project cost is estimated at $5,986,200.

Recommended Plan. McGee - Levee work (including fish nursery catch basin and water control structures) with diesel pump (dewatering) and revetment of critical areas. The additional average annual habitat units generated for the McGee area versus the without project condition are 32 habitat units at first cost of $301,050 and an average annual cost of $23,728.

North and South Dunn - Levee work with diesel pump (dewatering), water control structures, revetment of critical areas, and natural tree regeneration. With a first cost of $1,055,700, 27.9 average annual habitat units are generated at average annual cost of $76,286.

Jonathan Creek - Levee work with electric pumps (watering and dewatering), water control structures, and revetment of critical areas. The Jonathan Creek proposed improvements generate 27.4 average annual habitat units at a first cost of $1,140,750 and an average annual cost of $82,554.

Fishhook - Levee work, diesel pumps (two watering, one dewatering), water control structures, revetment of critical areas, natural tree regeneration, and fish nursery catch basins (one in each of two areas). This alternative generates 112.1 habitat units at a first cost of $3,488,700 and an average annual cost of $248,671.

Findings and Conclusions. The operation of Lake Shelbyville water management plan adversely impacts habitat at the McGee, North and South Dunn, Jonathan, and Fishhook

wildlife management areas. Flooding and the inability to get rid of water impounded in these areas prevent optimum management of the areas for food production and habitat. Implementation of the proposed measures at the areas would result in positive benefits by allowing more control over water levels within the management areas. The long-term benefits of this proposed habitat restoration project outweigh the minor and temporary adverse impacts associated with project construction. The local sponsor (Illinois Department of Natural Resources) has indicated that it wishes to pursue the project at this time.

Recommendation. It is recommended that the ecosystem restoration plan for the Lake Shelbyville Wildlife Management Areas, Moultrie County, Illinois, as discussed in this report be approved for implementation as a Federal project under authority of Section 1135 of WRDA of 1986, as amended, at a total project cost of $5,986,200, provided that, prior to construction, local interests provide the assurances of local cooperation as stated previously.

The recommendations contained herein reflect the policies governing formulation of individual projects and the information available at this time. They do not necessarily reflect program and budgeting priorities inherent in the state programs or the formulation of a national Civil Works construction program. Consequently, the recommendations may be modified prior to approval and implementation funding.

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INTRODUCTION

STUDY AUTHORITY

1. This Ecosystem Restoration Report is prepared under the authority of Section 1135 of the Water Resources Development Act (WRDA) of 1986, as amended, in response to a request for Federal assistance from the Illinois Department of Natural Resources for an ecosystem restoration project.

STUDY AREA DESCRIPTION

2. Lake Shelbyville is located in Shelby and Moultrie Counties of east-central Illinois. The dam site is located on the Kaskaskia River and about one-half mile east of Shelbyville, Illinois. The lake lies approximately 113 miles northeast of St. Louis, 208 miles southwest of Chicago and 54 miles southeast of Springfield, Illinois. Construction of Lake Shelbyville was completed in 1970. Its authorized purposes include flood control, water supply, water quality control, fish and wildlife conservation, and recreation. The drainage area of the lake upstream from the dam site is 1030 square miles. Lake Shelbyville empties into the Kaskaskia River, which runs through an agricultural area. The lake levels are regulated in part to control flooding to these agricultural lands.

3. The Illinois Department of Natural Resources is licensed by the St. Louis District Corps of Engineers to manage 6,231 acres of land and water at the northern end of the lake, including four wildlife management areas (McGee, North and South Dunn, Jonathan, and Fishhook). As a result of the water regulation plan for the lake, these areas experience periodic flooding resulting in adverse effects to the wildlife management areas. Photos 1 through 3 show high water levels experienced during the spring of 2002 at three of the management areas. All areas currently incorporate levees and some pumping (watering and/or portable dewatering) capability.

4. The wildlife management areas are important to waterfowl and terrestrial resources. The restoration area is situated in Moultrie County at the northern end of Lake Shelbyville on the Kaskaskia and West Okaw Rivers. Waterfowl hunting is available during the fall and early winter months. See Plate 1 (click to view) for the general location of the restoration project.

Photo 1. North Dunn Management Area – 19 June 2002

Photo 2. Jonathan Creek Management Area – 19 June 2002

Photo 3. Fishhook Management Area – 19 June 2002

5. Proposed features of this restoration project consist of new low profile levee construction to form separate management compartments and rehabilitation of several low profile levees, two overflow weirs, the excavation of a ditch drainage system, revetment of critical berm sections and pump station locations, fish nursery areas, natural tree regeneration, and additional watering and dewatering capacity.

PROJECT'S CONTRIBUTION TO ENVIRONMENTAL DEGRADATION

6. Existing natural and man-made wetlands in the Shelbyville Fish and Wildlife Area in the upper reaches of the Lake Shelbyville Project have been seriously degraded by frequent flooding caused by the manipulation of the Lake Shelbyville Dam to provide downstream flood control. The problem is compounded by the inability to dewater these wetland areas at critical times to promote the growth of natural and artificial food sources that are vital to maintaining bio-diversity in any wetland ecosystem. Additionally, the operation of the Lake Shelbyville dam has negatively impacted the historical frequency and duration of overbank flooding to forested wetland areas in the upper reaches of the lake. The changes in hydrology and vegetation have diminished the value of the mid-migration habitat for neotropical migrants and waterfowl.

STUDY PURPOSE AND SCOPE

7. This document presents the findings of the feasibility phase ecosystem restoration study conducted for the McGee, North and South Dunn, Jonathan, and Fishhook Wildlife Management Areas at Lake Shelbyville. Current and future ecosystem conditions were evaluated and plans developed to meet those needs. The study was conducted with sufficient detail to select a recommended plan and to determine Federal and non-Federal responsibility. An incremental cost analysis was performed to aid in final plan selection.

SIGNIFICANT RESOURCES

The following are significant resources recognized by institutional (existing laws, plans and policy), public interest or the scientific community (scientific knowledge) that will be components of the proposed ecosystem restoration project.

- Brood rearing habitat for fish (managing sub impoundment)
- Bottomland hardwood regeneration
- Hydrology regime for emergent wetland vegetation (hydrophytic plant regeneration)
- Waterfowl nutritional needs during the fall and spring migration (seeds and tubers)
- Shorebird and wading bird foraging and nesting habitat (water depth/stability)
- Threatened and endangered species habitat (foraging/nesting/overwintering)
- Nutrient retention from the water column (water quality)
- Aquatic invertebrate habitat (protein for reproductive cycle of fish and wildlife)

8. The ecological value of riparian habitats depends on their integration as units within the surrounding landscape because of the different and distinct habitats needed by organisms with complex life histories that use wetland sites. Restoration of the project area will provide for greater ecosystem functions by increasing energy flow into the ecosystem through restoring native aquatic and terrestrial vegetation. The total amount of energy available to the entire food chain is fixed by plants and moves to other trophic levels by consumption and/or predation.

9. The Moultrie-Shelby Pheasants Forever organization, The Lake Shelbyville Chapter of the Illinois Waterfowl Association (IWA), and the Lake Shelbyville Development Association have all provided letters in support of the project. The public will have the opportunity to provide additional comment during the review period of the draft Ecosystem Restoration Report. These comments and responses to the same will be included in the final report document.

PROJECT SCOPING

PROBLEMS AND OPPORTUNITIES

Problems

10. Optimum pool management of Lake Shelbyville is at times in conflict with optimum management of the four wildlife management areas that are the subject of this study. Limiting releases at the dam to control downstream flooding has resulted in flooding of the management areas. This can have a devastating impact on food production within the managed areas that, in turn, has a negative impact on habitat. Gravity dewatering of these areas cannot be accomplished when the lake levels are high; loss of woody habitat has been experienced due to flooding. The changes in hydrology and vegetation have diminished the value of the mid-migration habitat for neotropical migrants and waterfowl. The following list presents various sponsor identified problems experienced at the four wildlife management areas included in this study. Topography also presents a problem in the Fishhook area in that in order to provide water levels conducive to habitat in one area, other areas are inundated with depths too deep for optimum habitat.

- Management areas are flooded by lake levels
- Dewatering management areas takes too long (too dependent on gravity flow)
- Habitat deterioration due to
    - Sediment
    - Water level fluctuation
    - Several flood events over El. 610 since 1973
    - Inability to produce food
- Higher maintenance costs to recover after flood events including
    - Repairs to levee and water control structures
    - Replanting costs
    - Ditch cleaning
- High pumping costs(for limited portable pumps)
- Food sources inadequate for increasing local duck and geese population
- Seepage from areas when lake level is low
- Loss of woody structure for heron nesting due to flooding (Jonathan only)
- Levee deterioration due to flooding
- Inability to effectively distribute water due to elevation differences (Dunn, Jonathan, and Fishhook)
- Woody habitat not available to be flooded (need to plant) – important for wildlife
- Unpredictable spawing and brood rearing habitat at lake
- Turbidity in management areas
- Lack of gravel substrate for spawning
- Lack of recreational opportunities during flooding (birdwatching, fishing, hunting, hiking)
- Safety issues for recreational users during flooding
- Lack of invertebrate production areas

Lack of aquatic vegetation (brood rearing for wood ducks and good fish habitat)

11. Most of the problems listed above are related to the inability to control the water levels within the managed areas. The problems are further grouped by physical and biological categories in Table 1. The proposed project improvements will allow more control over the water levels, resulting in an improved and more stable habitat.

Table 1. Study Problems

CONSOLIDATED PROBLEMS LIST		**SPONSOR IDENTIFIED PROBLEMS LIST ***
Physical	Lack of Adequate Water Control	Lake flooding of management areas
		Takes too long to dewater (gravity flow only available)
		Management is dependent on lake water levels
		Management is dependent on water level fluctuation
		Seepage—can't hold water when lake is low
		Levee deterioration due to flood
		Inability to effectively distribute water due to elevation differences
		Lack of electricity
		Habitat is deteriorating due to water level fluctuation
		Habitat is deteriorating due to recent flood events.
		High levee repair, water control structure, replanting costs, and ditch cleaning
	Lack of Sedimentation Control	Habitat is deteriorating due to sediment
	Lack of Turbidity Control	Turbidity in management areas

Table 1. Continued.

CONSOLIDATED PROBLEMS LIST		SPONSOR IDENTIFIED PROBLEMS LIST *
	Levee Damage	High operation and maintenance costs
Biological	Lack of Adequate Food Production	Local geese and duck populations increasing—not enough ability to produce food.
		Lack of Invertebrate Production Areas
	Lack of Woody Plant Cover	Loss of woody structure for heron nesting due to flooding (trees are killed).
		Woody habitat not available to be flooded
		Beaver damage to higher areas increase during flooding as beavers move to higher ground.
	Lack of Non-Woody Plant Cover	Lack of aquatic submergent and emergent plants
		Lack of lotus beds (brood rearing for wood ducks and good fish habitat)
	Lack of Reproductive Habitat for Fish	Lake has unpredictable spawning and brood rearing habitat
		Lack of gravel substrate for spawning

* While not directly habitat restoration related, the sponsor did mention site-related flooding problems that impact upon the site's recreational usage.

12. Under existing conditions, management areas must be dewatered by gravity drainage or portable pumps. Depending on the lake levels, gravity drainage is not always possible and food production in the areas is threatened. It is assumed that a food production area needs to be dewatered by the following dates (+/- 1 to 2 days) and then stay relatively dry in order to achieve seed maturity before the first frost.

Corn – June 1
Buckwheat – July 1
Soybeans/ Milo – June 15
Japanese Millet/Native Vegetation – July 15

Charts 1 through 7 show daily stage elevations and critical levee and interior elevations for various management areas on the critical dates. Table 2 shows what food production was possible for the various areas based on the lake levels during the years 1984 through 2000.

13. Analysis of Table 2 shows that food production possibility rises in each area with the addition of dewatering capability.

- McGee – food production possibility rises from the present 7 years out of 17 years to 17 years out of 17 years

- Jonathan – food production possibility rises from the present 9 years out of 17 years to 17 years out of 17 years
- Fishhook (Refuge) – food production possibility rises from the present 7 years out of 17 years to 13 years out of 17 years
- Fishhook (Redhead) – food production possibility rises from the present 7 years out of 17 years to 17 years out of 17 years
- Dunn (North and South) – food production possibility rises from the present 9 years out of 17 years to 14 years out of 17 years

14. It is significant to note that areas protected by higher levees (McGee, Jonathan, and Fishhook Redhead) have higher predictability of food production as the higher levees further remove the lake level elevation as a factor. High construction costs, however, prohibit raising all management area levees to the elevation 609 – 610 range and this wholesale levee raising was not considered.

15. Dewatering of the management unit will be required (depending on crop selected) if lake levels do not allow for gravity drainage during the growing season when a hydrologic event occurs within the management units watershed or excessive seepage occurs due to high lake levels for an extended period of time.

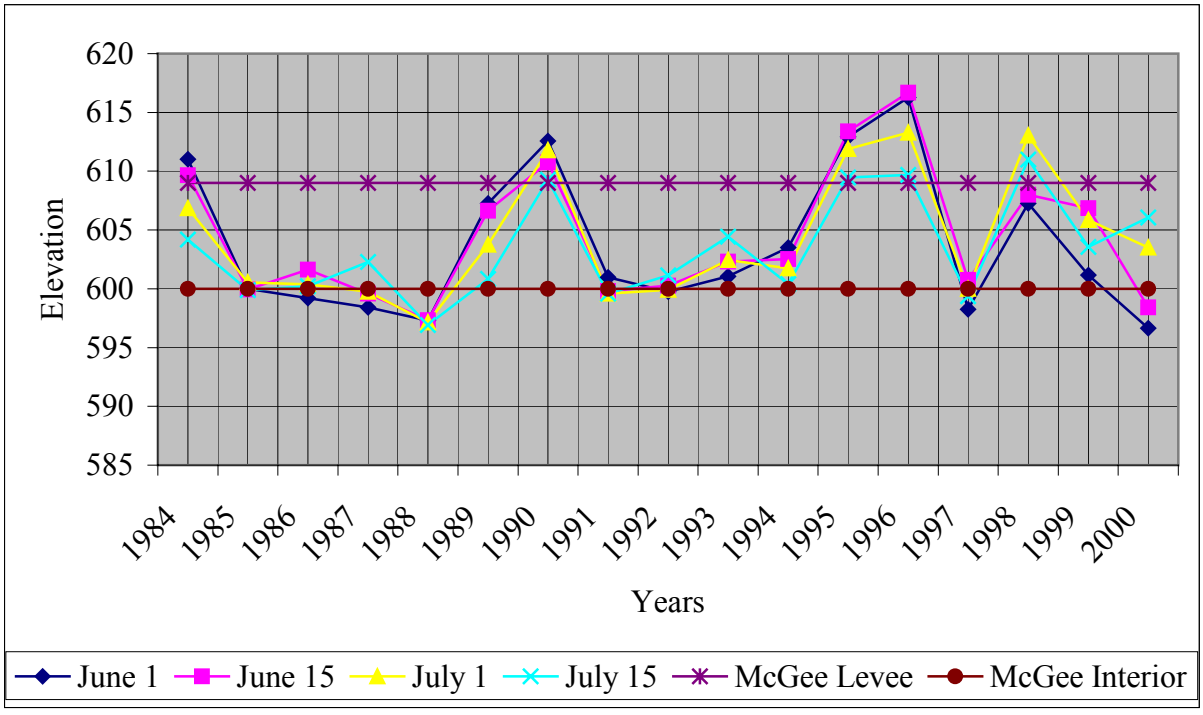


Chart 1. Daily Stage Elevations for Selected Years – McGee Area

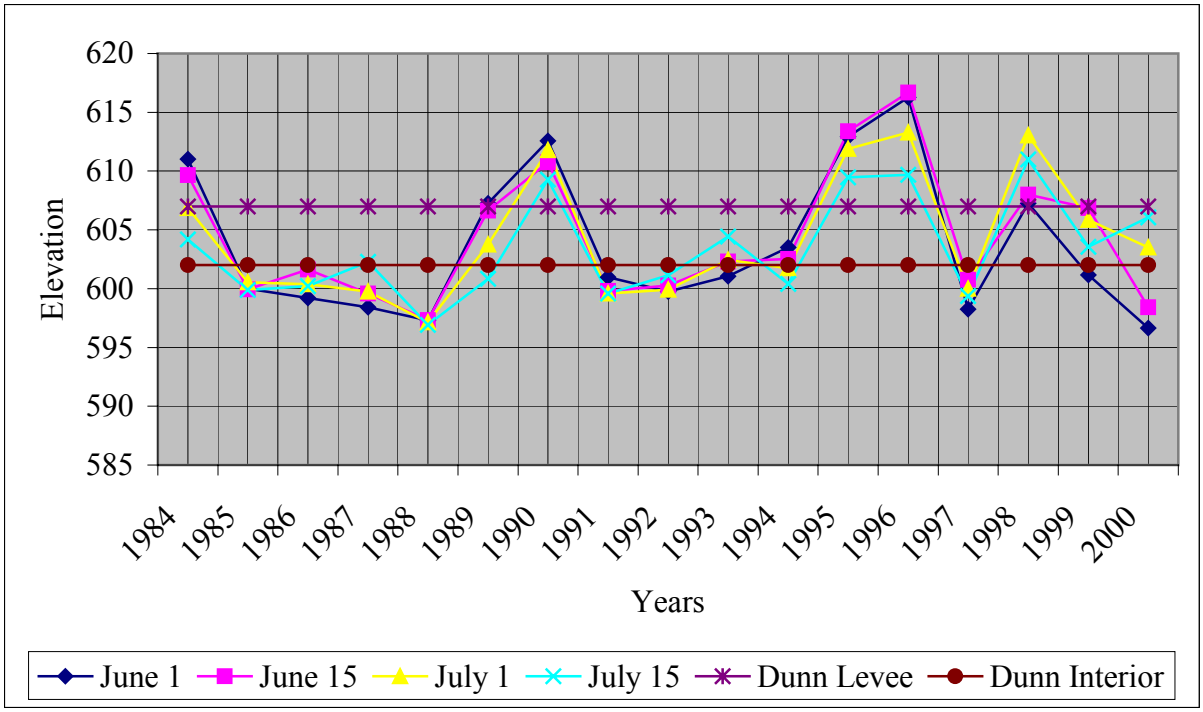


Chart 2. Daily State Elevations for Selected Dates – Dunn Area

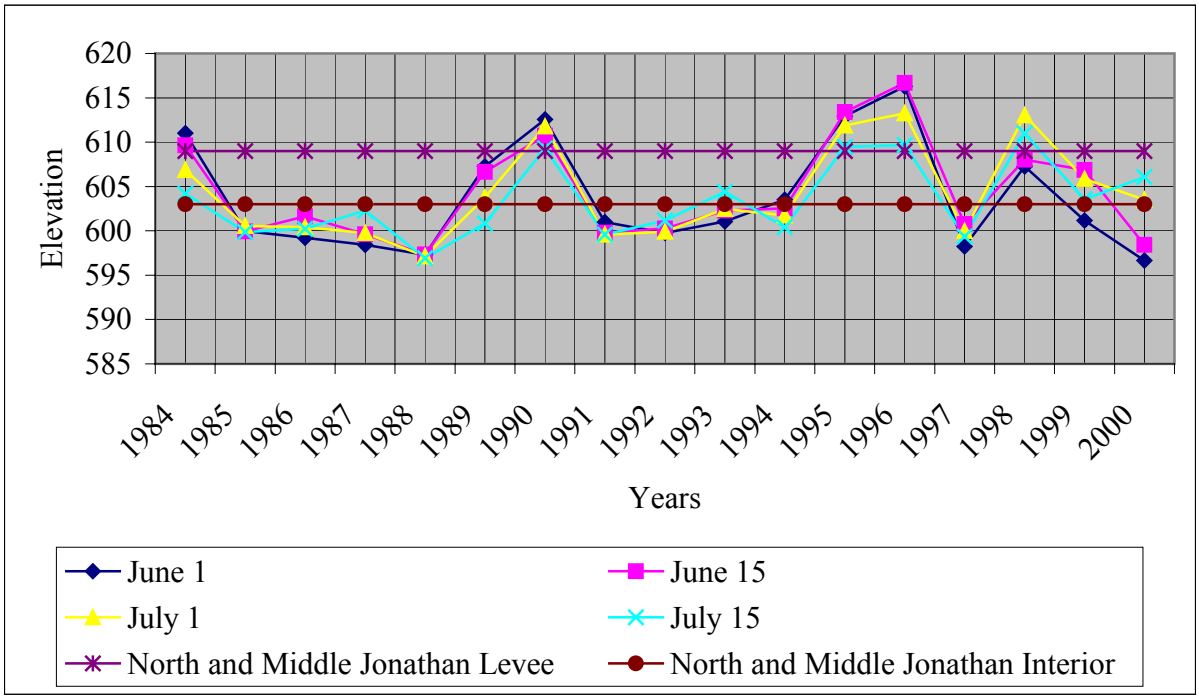


Chart 3. Daily Stage Elevations for Selected Dates – North and Middle Jonathan Areas

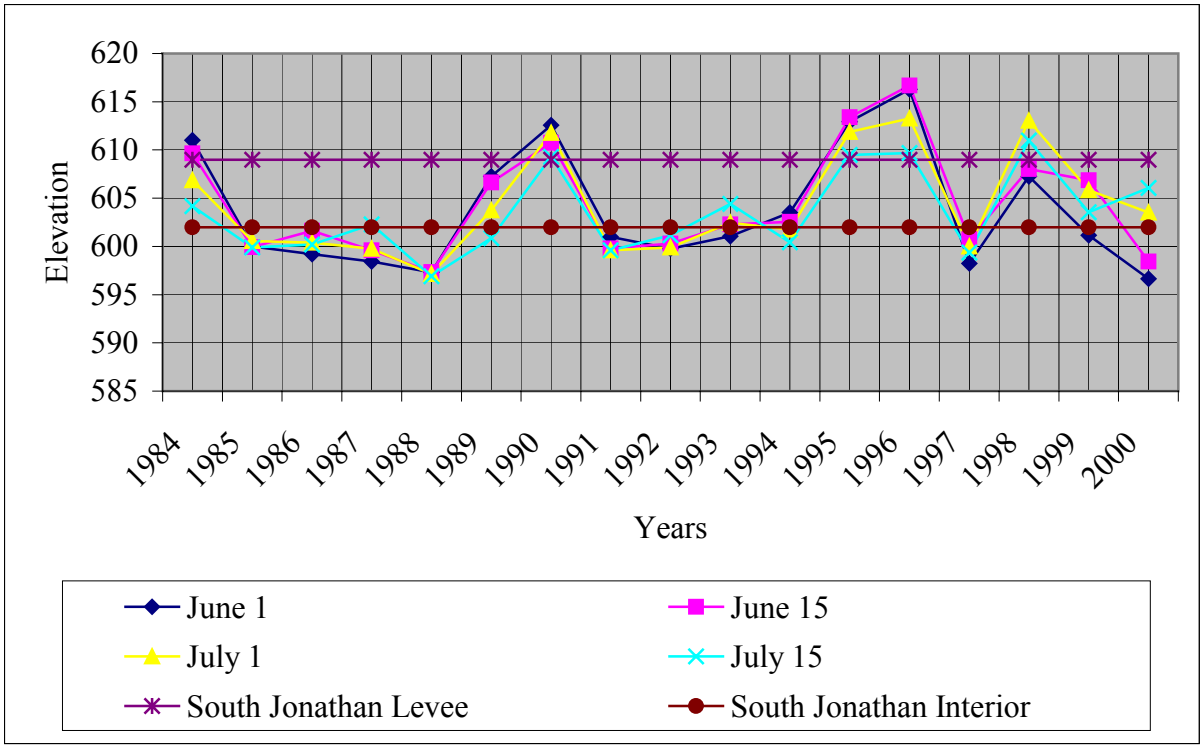


Chart 4. Daily Stage Elevations for Selected Dates – South Jonathan

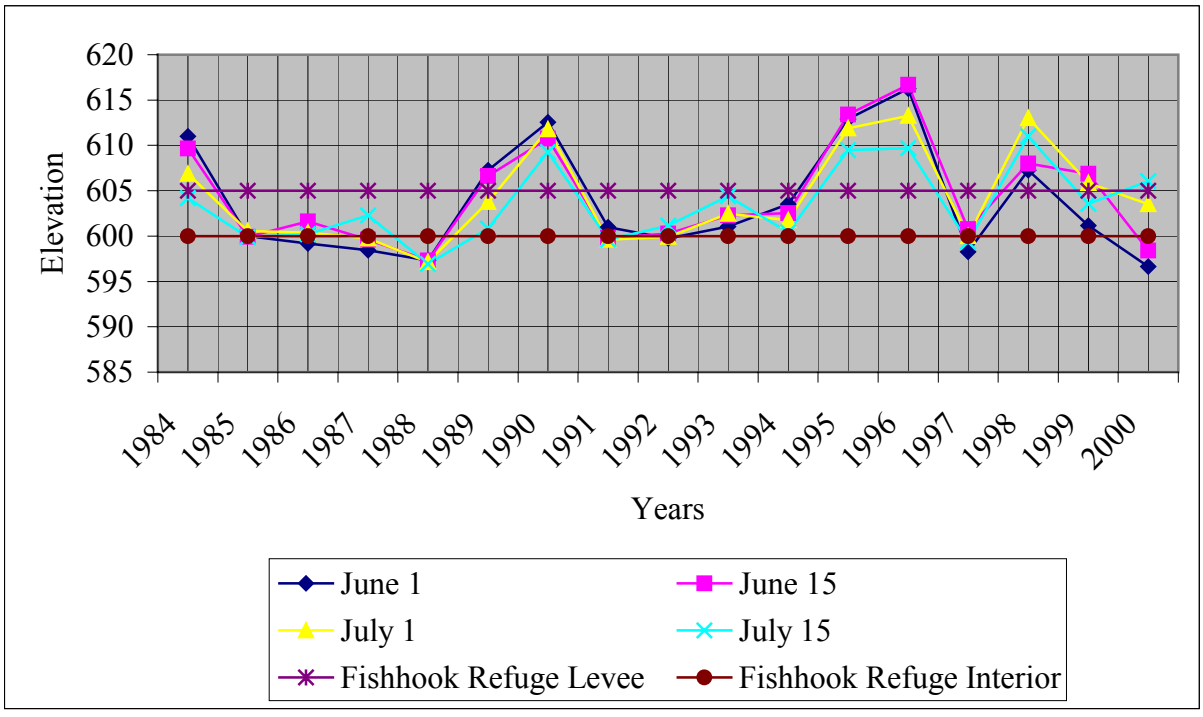


Chart 5. Daily Stage Elevation for Selected Dates – Fishhook Refuge Area

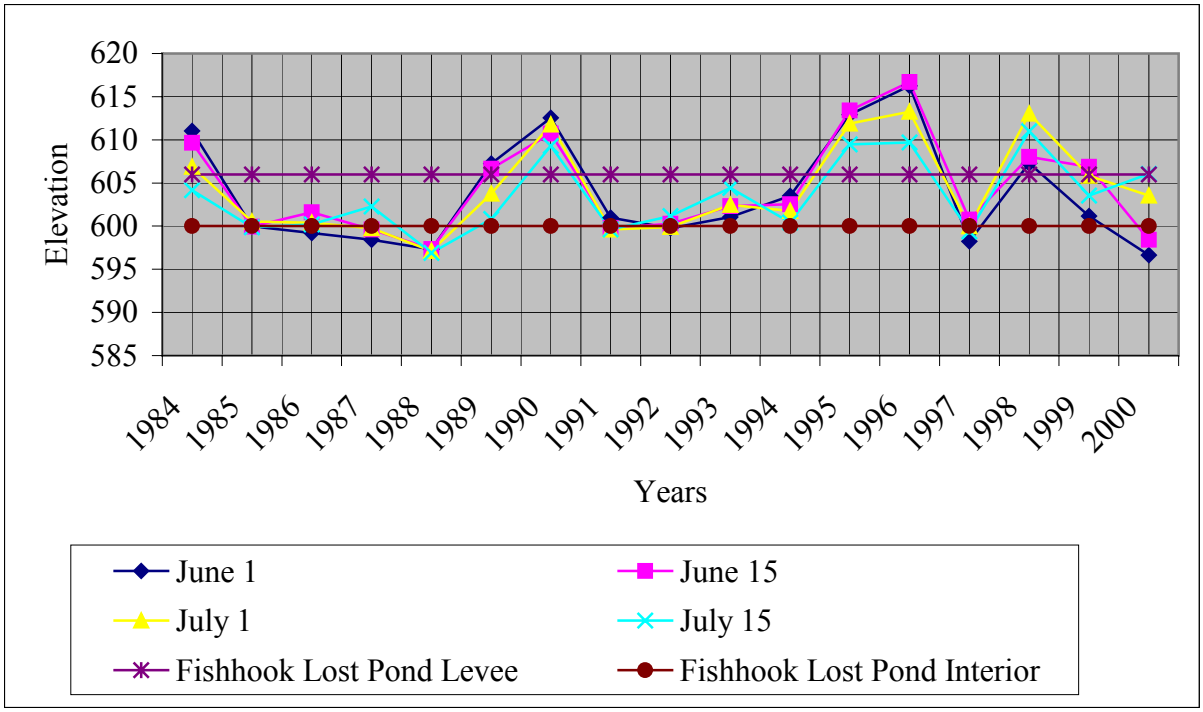


Chart 6. Daily Stage Elevations for Selected Dates – Fishhook Lost Pond Area

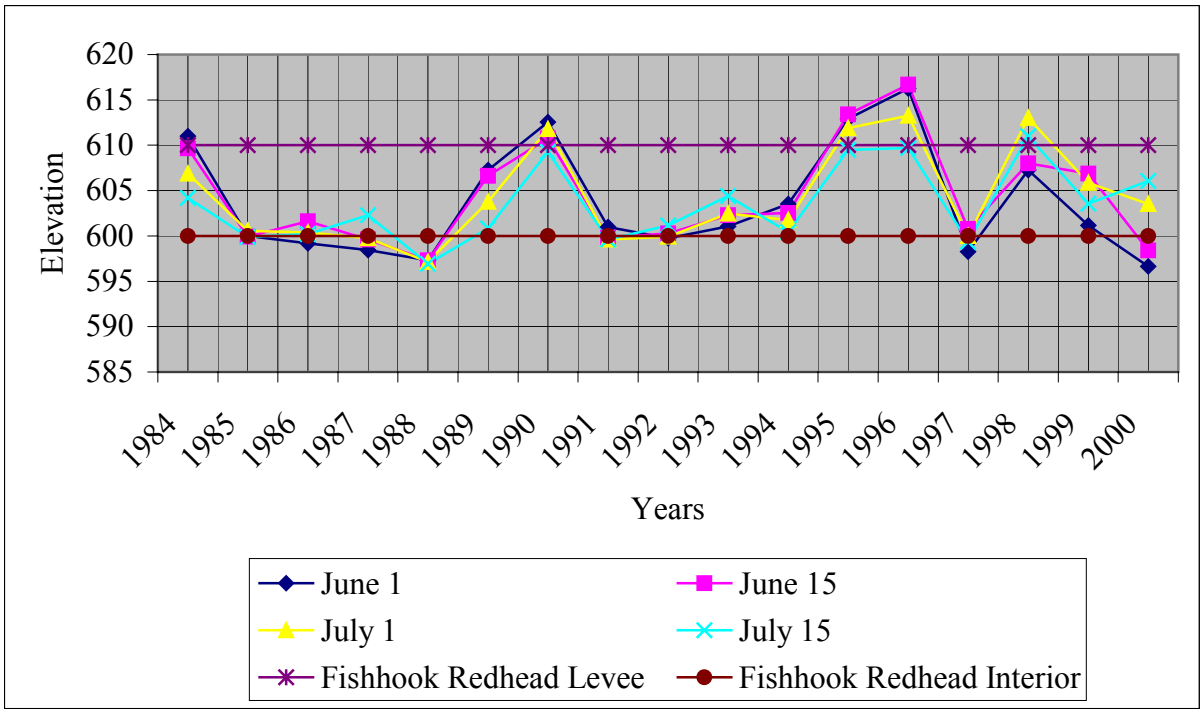


Chart 7. Daily Stage Elevation for Selected Dates – Fishhook Redhead Area

Table 2. Potential for Food Production

Fishhook Refuge - 605 levee; 600 bottom	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Corn																	
Soybeans/Milo																	
Buckwheat																	
Japanese Millet/Native Vegetation																	
Fishhook Lost Pond - 606 levee, 600 bottom	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Corn																	
Soybeans/Milo																	
Buckwheat																	
Japanese Millet/Native Vegetation																	
Fishhook Redhead - 610 levee, 600 bottom	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Corn																	
Soybeans/Milo																	
Buckwheat																	
Japanese Millet/Native Vegetation																	

LEGEND:

No dewatering needed

Dewatering was needed

Dewatering would not have allowed food production due to high lake levels

Table 2. Continued.

McGee - 609 levee; 600 bottom	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Corn																	
Soybeans/Milo																	
Buckwheat																	
Japanese Millet/Native Vegetation																	
Jonathan (South) – 609 levee, 602 bottom	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Corn																	
Soybeans/Milo																	
Buckwheat																	
Japanese Millet/Native Vegetation																	
Jonathan (North, Middle) - 609 levee, 603 bottom	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Corn																	
Soybeans/Milo																	
Buckwheat																	
Japanese Millet/Native Vegetation																	

LEGEND:

Dewatering was not needed

Dewatering was needed

Dewatering would not have allowed food production due to high lake levels

Opportunities

16. There are opportunities at the subject wildlife management areas to

- create better water management that will enhance the availability and quality of habitat
    - seasonal wetlands
    - wetland areas
    - shore-bird and neo-tropical migrant habitat
    - reptile/amphibian habitat
    - fish spawning habitat
- increase habitat diversity
- restoration of bottomland hardwood tree species
- reduce O&M costs
- increase user satisfaction
- increase recreational opportunities.

PROJECT GOALS, OBJECTIVES, AND CONSTRAINTS

GENERAL HABITAT GOALS

17. Present conditions in and around the proposed project areas provide limited habitat value for most species associated with marsh habitat due to the lack of water control to the management units. The water level within Lake Shelbyville will continue to fluctuate due to hydrologic events because the lake is managed to provide flood protection downstream. If a hydrologic event occurs during the growing season the existing levees may be overtopped and/or the present gravity drains may not be able to function and habitat quality is reduced or becomes unavailable.

18. The present assumption is that levees and pumps capable of watering and dewatering each management unit will provide water conditions that are predictable and controlled most years. Elevated areas that are reestablished to bottomland hardwoods would provide greater diversity as the project matures. It would also be beneficial to the Lake Shelbyville fisheries to have a nursery area that would provide a high level of nutrients (which contain no predatory fish). These conditions would promote increased size of the young of the year fish that enter the lake and, in turn, increase the success of an individual to become a sexually mature adult.

SPECIFIC HABITAT GOALS

19. The creation of a mosaic of habitat types would allow a diversity of organisms representing different trophic levels to coexist and provide a richer more continuous food source for mobile fauna. Specific habitat goals to accomplish this include the establishment of

- fish nursery areas
- bottomland hardwood restoration
- creation of microtopography

- moist soil production capability
- more controllable water elevations
- habitat predictability for fish, birds, mammals, reptiles, invertebrates, amphibians, as well as bottomland hardwood regeneration.

Tables 3 and 4 provide additional information regarding study problems and objectives, and the relationship between the project goals and the proposed measures.

Table 3. Relationship Between Problems and Study Objectives

PROBLEMS		**OBJECTIVES**
Physical	Lack of Adequate Water Control	Improve Water Control
	Lack of Sedimentation Control	Reduce Sedimentation
	Lack of Turbidity Control	Reduce Turbidity
	High O&M Costs	Reduce O&M Costs
Biological	Lack of Adequate Food Production	Improve Feeding Habitat
	Lack of Woody Plant Cover	Improve Woody Plant Cover
	Lack of Non-Woody Plant Cover	Improve Non-woody Plant Cover
	Lack of Reproductive Habitat for Fish	Provide Reproductive Habitat for Fish

Table 4. Relationship Between Study's Biological and Physical Goals

BIOLOGICAL GOALS		**PHYSICAL GOALS**				
GOAL	**OBJECTIVES**	**IMPROVE WATER CONTROL**	**REDUCE SEDIMENTATION**	**REDUCE TURBIDITY**	**ALTER BOTTOM SUBSTRATE**	**OTHER MODIFICATIONS**
Restore Ecosystem Structure and Function	Improve feeding habitat	X	X	X		X
	Improve woody plant cover					X
	Improve non-woody plant cover	X	X	X		
	Improve reproductive habitat for fish	X	X	X	X	X
ALTERNATIVE MEASURES		Levee Work	Levee Work	Levee Work	Revetment with Bedding	Tree Restoration
		Electric Pumps		Drawdowns	Revetment with Geotextile	
		Diesel Pumps			Drawdowns	

CONSTRAINTS

20. Constraints considered during the planning process included

a. No change to lake level management is possible
b. Construction schedule vs. available construction season
c. Existing topography must be incorporated into the modification
d. Public reaction to pump noise
e. Potential reduction of flood storage capacity
f. Regulatory issues
g. Federal cost limit.

PLAN FORMULATION

EVALUATION CRITERIA AND PLANNING CONSTRAINTS

21. During the course of managing the four wildlife areas that are the subject of this study over several years, the sponsor experienced a history of problems primarily related to the lack of water control within the areas. These problems hampered their ability to effectively manage those areas. As a result the sponsor, which has significant experience with the management of wildlife areas, developed a set of possible options that would facilitate improved water control at the four studied management areas. The Corps of Engineers became involved when the local sponsor requested an ecosystem restoration study and it was determined that the potential project fit the criteria of a Section 1135 study. As the study progressed some of the measures originally identified by the sponsor dropped out of consideration due to the obvious costliness of the measure or because the sponsor had already performed the construction (e.g. overflow spillways at the McGee management area). For each management area, baseline levee improvements (embankment and water control structures) needed to enhance the ability to manage its water levels were determined and these became the basis for each of the alternative plans for the management areas. Because the four management areas are not contiguous, are operated independently, and have independent benefits, each area was studied as a separate entity. Alternative plans for the areas were developed by using different criteria for pumps (electric versus diesel), revetment (with bedding versus geotextile), and by including or not including additional work-in-kind areas or tree plantings. Plans are also evaluated for the planning test criteria of completeness, effectiveness, efficiency, and acceptability (see Section EVALUATION OF ALTERNATIVES).

ALTERNATIVES CONSIDERED IN DETAIL[1]

22. The proposed project features described below include integral components of a water control system needed to restore and improve predictability of hydric conditions within each management unit to improve biodiversity of the wetland complex. The low profile levee work (some new, some work on existing levees) enhances existing and creates additional wetland compartments that will be able to be independently managed for moist soil, fish nursery, and row crop production.

McGee Management Area

23. In addition to the no action alternative, specific measures considered included levee improvements (clearing and stripping, embankment, establishment of turf, road stone to new pump location, one water control structure), additional dewatering capability (diesel vs. electric pump), and revetment on critical sections of embankment (riprap with bedding vs. riprap with geotextile). These measures resulted in five alternative plans for the McGee area as shown in Table 5. Tree plantings were considered for the McGee area. However, it was apparent early on that the additional increase in habitat units due to the tree plantings was very expensive because of the high cost of constructing elevated areas to an appropriate elevation to effectively sustain the trees based on the prevailing ground elevation and desired water management levels. This measure was dropped from consideration before the incremental cost analysis. Plate 2 (click to view) shows the McGee area with the proposed improvements.

Table 5. McGee Management Area Alternatives Considered

MCGEE ALTERNATIVE	LEVEE WORK	ELECTRIC DEWATERING PUMP	DIESEL DEWATERING PUMP	REVETMENT WITH BEDDING	REVETMENT WITH GEOTEXTILE
1	No Federal Action				
2	x	x		x	
3	x	x			x
4	x		x	x	
5	x		x		x

North and South Dunn Management Area

24. In addition to the no action alternative, specific measures considered for the North and South Dunn management area included levee improvements (clearing and stripping, embankment, establishment of turf, road stone to new pump locations, water control structures, and removal of existing corrugated metal pipe, and construction of overflow spillway), one new watering and one new dewatering pump (electric vs. diesel), revetment on critical sections (riprap with bedding vs. riprap with geotextile), and tree plantings. Tree plantings were included for further consideration because the higher existing ground elevations in the North Dunn area made it less costly to plant at

appropriation elevations. These measures resulted in the nine alternative plans for the North and South Dunn area shown in Table 6. Plate 3 (click to view) shows the Dunn area and its proposed improvements.

Table 6. Dunn Management Area Alternatives Considered

NORTH AND SOUTH DUNN ALTERNATIVE	LEVEE WORK	ELECTRIC PUMPS	DIESEL PUMPS	REVETMENT WITH BEDDING	REVETMENT WITH GEOTEXTILE	TREES
1	No Federal Action					
2	x	x		x		
3	x	x		x		x
4	x	x			x	
5	x	x			x	x
6	x		x	x		
7	x		x	x		x
8	x		x		x	
9	x		x		x	x

Jonathan Creek Management Area

25. In addition to the no action alternative, specific measures considered for the Jonathan management area included levee improvements (clearing and stripping, embankment, establishment of turf, road stone to new pump locations, water control structures), one new watering and one new dewatering pump (electric vs. diesel), revetment on critical sections (riprap with bedding vs. riprap with geotextile), and work-in-kind consisting of clearing, new levee embankment, water control structure, and establishment of turf for a new north Jonathan Creek area. Various combinations of these measures resulted in nine alternative plans for the Jonathan area as shown in Table 7. Tree plantings were considered, but it was apparent early on that the additional increase in habitat units due to the tree plantings was very expensive. For this reason, tree plantings were eliminated prior to the incremental cost analysis. Plate 4 (click to view) shows the Jonathan Creek area and the proposed improvements.

Table 7. Jonathan Creek Management Area Alternatives Considered

JONATHAN ALTERNATIVE	LEVEE WORK	ELECTRIC PUMPS	DIESEL PUMPS	REVETMENT WITH BEDDING	REVETMENT WITH GEOTEXTILE	WORK-IN-KIND
1	No Federal Action					
2	x	x		x		
3	x	x		x		x

4	x	x			x	
5	x	x			x	x
6	x		x	x		
7	x		x	x		x
8	x		x		x	
9	x		x		x	x

Fishhook Management Area

26. Besides the no action alternative, specific measures considered for the Fishhook management area included levee improvements for new and existing levees (clearing and stripping, embankment, establishment of turf, road stone to new pump locations, and water control structures), one new watering and one new dewatering pump (electric versus diesel) with distribution system, revetment on critical sections (riprap with bedding versus riprap with geotextile), and work-in-kind consisting of clearing, new levee embankment, water control structure, and establishment of turf for the new Lost Pond area. The water distribution system will allow optimum independent management of the existing and newly constructed compartments. Various combinations of these measures resulted in nine alternative plans for the Fishhook area as shown in Table 8. Similar to the McGee and Jonathan areas, tree plantings were considered, but dropped from further consideration prior to the incremental cost analysis due to the high cost of achieving the gain in habitat units. Plate 5 (click to view) shows the proposed improvements for the Fishhook area.

Table 8. Fishhook Management Area Alternatives Considered

FISHHOOK ALTERNATIVE	LEVEE WORK	DIESEL PUMPS	ELECTRIC AND DIESEL PUMPS	REVETMENT WITH BEDDING	REVETMENT WITH GEOTEXTILE	WORK-IN-KIND
1	No Federal Action					
2	x	x		x		
3	x	x		x		x
4	x	x			x	
5	x	x			x	x
6	x		x	x		
7	x		x	x		x
8	x		x		x	
9	x		x		x	x

EVALUATION OF ALTERNATIVES

ENGINEERING ANALYSES

Levees

27. The goal of having more water management control provided basic direction regarding the layout of the levees. Topographic surveys, site visits and coordination with Illinois Department of Natural Resources determined the optimal location of new levees and alternative alignments were not considered. Levee heights were based on topography within the proposed units*, water depth required for desired use of the unit, historical lake levels and cost. Wholesale levee raises for the project were not considered since it would clearly be cost prohibitive to completely protect these areas from all lake flooding events. Additional work-in-kind levee work to form a new management compartment in both the Jonathan Creek and Fishhook areas was considered to form additional plans. Levee cross sections are based on a 10-foot crown width with 1V:3H side slopes and are constructed with compacted clay material. Crown width will allow vehicular access; side slopes are typical for environmental type levees. All borrow will be taken from the management area sites.

* Contour mapping from the late 1970's was available for the project. Because of the expense of resurveying the entire four areas, a more limited topographic survey was conducted to address new berm alignment locations, areas where structures were planned, and spot elevations to use in conjunction with the late 1970 surveys.

Watering and Dewatering Pumps

28. Pumping capacity analyses were performed for all four wildlife management areas. Hydraulic design for the watering and dewatering pumps assumes similar watering and dewatering operation configurations for all sites. The impounded water surface area of all four areas will increase in their proposed configurations relative to their existing configurations. Pumping requirements were based on the predictability of water levels for meeting life requirement needs. Details on the criteria used for the analyses (watering and dewatering times desired, etc.) are provided in Section 2 of Appendix B.

29. The elevation-storage data for the various impoundments, which was available during this feasibility phase, pertained to the existing configurations of all four areas. No such data were available for the proposed impoundments, nor were such data available for extensions of existing impoundments. In lieu of such storage data, estimates of the additional storage were made by linearly extrapolating the data for the existing configurations of all four areas.

30. A total of seven pumps were considered for the four management areas. The structural elements required for the project consist of pipe pile pump supports, reinforced concrete slab-on-grade diesel engine and shaft foundations, and a fenced reinforced concrete slab for mounting of the electric pump controls. Preliminary pile loadings were developed based on dead load and live load (including thrust for live load).

31. Both electric and diesel pumps were evaluated. Electric pumps are quieter and cleaner to operate but are more expensive and require power to the site, which can be cost prohibitive to provide. Electric pumps were selected where electrical power can be economically furnished, but diesel-driven pumps were selected in the more remote locations.

32. The pumps located at the McGee, Dunn, and Fishhook areas will be diesel driven, angle mounted, line-shaft type, propeller pumps. The Illinois Department of Natural Resources prefers this type of pump due to extensive positive experience with the operation and maintenance of these pumps. This type of pump also requires minimal structural requirements, in most cases, which further reduces cost and enhances maintainability. The pump drive system will consist of a diesel engine, a universal drive shaft that is connected to a jackshaft with a pulley mounted on the end, a drive belt mounted on the pulley, which transmits power to the pulley at the top of the pump shaft to drive the pump. The jackshaft assembly will consist of a pulley shaft supported by two pillow block bearing assemblies, slide rails, adjustment bolts for horizontal shaft adjustment, a structural steel pedestal, and a shaft safety guard. Diesel driven pumps will be manually started and stopped. Pump station layout is similar to the layout of existing pump stations constructed by Illinois Department of Natural Resources.

33. The pumps located at the Jonathan Creek area will be submersible electric propeller pumps. In the case of this area, cost between electric and diesel pumps were minimal. Because of the benefits associated with electric pumps versus diesel, electric pumps were selected. The submersible pump will be mounted inside a 30° angle mounted intake bell and pump column. The electric submersible pumps will be manually started and automatically stopped.

34. The Illinois Department of Natural Resources will coordinate with the local utility to bring a new overhead three-phase service into the Jonathan Creek area. The new service shall feed approximately 1 ½ mile to a location to be determined.

ENVIRONMENTAL OUTPUTS

35. Habitat conditions are not usually static. Either through natural processes or human activity, habitat generally evolves and may change in quality and/or quantity. Imbedded in each cover type evaluation, change has been added to the model. To assess the change over the period of analysis, target years were defined. Moist soil wetlands drained in April through June were scored as rapid drying and this is a limiting factor for Green-backed heron and Least bittern. In analysis of the preferred alternative the percent of the wetland area with water 4 to 18 inches deep increased by approximately 50% and fall and winter conditions changed from irregular and unpredictable to predictable and controlled in all management areas in most years. In general, the Wildlife Habitat Appraisal Guide (WHAG) results showed that the project generated stable Habitat Suitability Index (HIS) values for all of the target species over the project life.

PROJECT COSTS

36. Cost estimates were developed for each alternative to facilitate the incremental cost analysis and are provided in Table 9. Operation and maintenance costs are shown in Appendix C. Combined first costs for the initially evaluated plans of each area ranged from $5,828,750 to $6,740,050. Average annual costs were based on an expected project life of 50 years, a Federal discount rate of 6.125 percent, and March 2002 price levels. Average annual costs include operation and maintenance costs that range from $28,906 to $32,709 for the four plans combined. Planned rehabilitation for the pumps is expected at years 20 and 40. A detailed cost estimate was developed for the recommended plan incorporating the value engineering study and is shown in Appendix C. This estimate, at $5,986,200, varies from the initial estimate primarily due to refinements in the pump designs and results of a value engineering analysis and USF&WS coordination. (See Section VALUE ENGINEERING FUNCTIONAL ANALYSIS STUDY AND USF&WS COORDINATION).

Table 9. Project Costs

Management Areas	PROJECT COSTS ($1000)											
	Levee Work	Electric Pump	Diesel Pumps	Electric/Diesel Pumps	Revetment with Bedding	Revetment with Geotextile	Work-In-Kind Area	Trees	Construction Cost (w/ contingency)	Planning, Engineering, & Design (15%)	Construction Management (10%)	Total
Mc Gee Plans												
Alternative 1 – No Action												
Alternative 2	59.00	153.00			259.00				471.00	70.65	47.10	588.75
Alternative 3	59.00	153.00				251.00			463.00	69.45	46.30	578.75
Alternative 4	59.00		85.00		259.00				403.00	60.45	40.30	503.75
Alternative 5	59.00		85.00			251.00			395.00	59.25	39.50	493.75
Dunn Plans												
Alternative 1 – No Action												
Alternative 2	565.00	319.00			596.00				1480.00	222.00	148.00	1850.00
Alternative 3	565.00	319.00			596.00			128.00	1608.00	241.20	160.80	2010.00
Alternative 4	565.00	319.00				573.00			1457.00	218.55	145.70	1821.25
Alternative 5	565.00	319.00				573.00		128.00	1585.00	237.75	158.50	1981.25
Alternative 6	565.00		203.00		596.00				1364.00	204.60	136.40	1705.00
Alternative 7	565.00		203.00		596.00			128.00	1492.00	223.80	149.20	1865.00
Alternative 8	565.00		203.00			573.00			1341.00	201.15	134.10	1676.25
Alternative 9	565.00		203.00			573.00		128.00	1469.00	220.35	146.90	1836.25
Jonathan Plans												
Alternative 1 – No Action												
Alternative 2	281.00	343.00			40.00				664.00	99.60	66.4	830.00
Alternative 3	281.00	343.00			40.00		86.0		750.00	112.50	75.00	937.50
Alternative 4	281.00	343.00				38.00			662.00	99.30	66.20	827.50
Alternative 5	281.00	343.00				38.00	86.00		748.00	112.20	74.80	935.00
Alternative 6	281.00		335.00		40.00				656.00	98.40	65.60	820.00
Alternative 7	281.00		335.00		40.00		86.00		742.00	111.30	74.20	927.50
Alternative 8	281.00		335.00			38.00			654.00	98.10	65.40	817.50
Alternative 9	281.00		335.00			38.00	86.00		740.00	111.00	74.00	925.00
Fishhook Plans												
Alternative 1 – No Action												
Alternative 2	1604.00		283.00		418.00				2305.00	345.75	230.50	2881.25
Alternative 3	1604.00		283.00		418.00		103.00		2408.00	361.20	240.80	3010.00
Alternative 4	1604.00		283.00			386.00			2273.00	340.95	227.30	2841.25
Alternative 5	1604.00		283.00			386.00	103.00		2376.00	356.40	237.60	2970.00
Alternative 6	1604.00			438.00	418.00				2460.00	369.00	246.00	3075.00
Alternative 7	1604.00			438.00	418.00		103.00		2563.00	384.45	256.30	3203.75
Alternative 8	1604.00			438.00		386.00			2428.00	364.20	242.80	3035.00
Alternative 9	1604.00			438.00		386.00	103.00		2531.00	379.65	253.10	3163.75
								TOTALS (High)	5392.00	808.80	539.20	6740.00
								TOTALS (Low)	4663.00	699.45	466.30	5828.75

PLANNING EVALUATION CRITERIA

37. Table 10 rates the alternative plans against the planning criteria of completeness, effectiveness, efficiency, and acceptability. These criteria are defined as

> Completeness – the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives.
>
> Effectiveness – the extent to which the alternative plans contribute to achieve the planning objectives.
>
> Efficiency – the extent to which an alternative plan is the most cost effective means of achieving the objectives.
>
> Acceptability – the extent to which the alternative plans are acceptable in terms of applicable laws, regulations and public policies.

38. All plans were rated high for completeness. Differences in effectiveness were based essentially on quantity/type of habitat provided. Plans that included additional benefits from work-in-kind or tree plantings were rated higher that those that did not. To rate the efficiency of a plan, the average cost of the plans (excluding the No-Action plan) was determined. Plans with costs below the average received a higher rating than those with costs above the average. All plans (other than the no action plan) were considered to achieve a high level of acceptability.

Table 10. Planning Criteria Evaluation for Alternative Plans

MANAGEMENT AREAS	PLANNING EVALUATION CRITERIA				
	COMPLETENESS	EFFECTIVENESS	EFFICIENCY	ACCEPTABILITY	OVERALL
Mc Gee Plans					
Alternative 1 – No Action	LOW	LOW	LOW	LOW	LOW
Alternative 2	HIGH	HIGH	MEDIUM	HIGH	HIGH-MEDIUM
Alternative 3	HIGH	HIGH	MEDIUM	HIGH	HIGH-MEDIUM
Alternative 4	HIGH	HIGH	HIGH	HIGH	HIGH
Alternative 5	HIGH	HIGH	HIGH	HIGH	HIGH
Dunn Plans					
Alternative 1 – No Action	LOW	LOW	LOW	LOW	LOW
Alternative 2	HIGH	MEDIUM	HIGH	HIGH	HIGH
Alternative 3	HIGH	HIGH	MEDIUM	HIGH	HIGH
Alternative 4	HIGH	MEDIUM	HIGH	HIGH	HIGH
Alternative 5	HIGH	HIGH	MEDIUM	HIGH	HIGH
Alternative 6	HIGH	MEDIUM	HIGH	HIGH	HIGH
Alternative 7	HIGH	HIGH	MEDIUM	HIGH	HIGH
Alternative 8	HIGH	MEDIUM	HIGH	HIGH	HIGH
Alternative 9	HIGH	HIGH	MEDIUM	HIGH	HIGH
Jonathan Plans					
Alternative 1 – No Action	LOW	LOW	LOW	LOW	LOW
Alternative 2	HIGH	MEDIUM	HIGH	HIGH	HIGH
Alternative 3	HIGH	HIGH	MEDIUM	HIGH	HIGH
Alternative 4	HIGH	MEDIUM	HIGH	HIGH	HIGH
Alternative 5	HIGH	HIGH	MEDIUM	HIGH	HIGH
Alternative 6	HIGH	MEDIUM	HIGH	HIGH	HIGH
Alternative 7	HIGH	HIGH	MEDIUM	HIGH	HIGH
Alternative 8	HIGH	MEDIUM	HIGH	HIGH	HIGH
Alternative 9	HIGH	HIGH	MEDIUM	HIGH	HIGH
Fishhook Plans					
Alternative 1 – No Action	LOW	LOW	LOW	LOW	LOW
Alternative 2	HIGH	MEDIUM	HIGH	HIGH	HIGH
Alternative 3	HIGH	HIGH	HIGH	HIGH	HIGH+
Alternative 4	HIGH	MEDIUM	HIGH	HIGH	HIGH
Alternative 5	HIGH	HIGH	HIGH	HIGH	HIGH+
Alternative 6	HIGH	MEDIUM	MEDIUM	HIGH	MEDIUM-HIGH
Alternative 7	HIGH	HIGH	MEDIUM	HIGH	HIGH
Alternative 8	HIGH	MEDIUM	MEDIUM	HIGH	MEDIUM-HIGH
Alternative 9	HIGH	HIGH	MEDIUM	HIGH	HIGH

ORIGINAL INCREMENTAL COST ANALYSIS[2]

39. Table 11 presents the first costs, operation and maintenance cost, and replacement cost associated with each of these potential management measures. Table 11 also displays the total average annual cost of each of the management measures given an estimated 50-year project life. The total average annual cost is computed using a project discount rate of 6.125 percent. All costs are expressed at March 2002 price levels.

40. Table 12 presents the estimated average annual habitat units created by the possible solution measures for selected target species. The estimated average annual habitat units displayed in Table 12 are computed under both the "without project" and "with project" future conditions. The incremental difference is used as measure of the environmental outputs of the alternatives. The total habitat units are employed in conducting the incremental cost analysis.

41. Table 13 presents the incremental cost analysis for measures producing the habitat units. The average annual habitat units and average annual cost are displayed in Table 13, as well as the incremental average annual cost curve for the provision of average annual habitat units.

[2] Subsequent to identification of a recommended alternative for each of the management areas, a Value Engineering Functional Analysis study was conducted that made some refinements to the recommended alternatives. In addition, USF&WS presented concerns regarding the proposed management emphasis (waterfowl) and the target species that had been selected for the habitat analysis. Subsequent coordination between the Service, the Corps, and Illinois Department of Natural Resources resulted in a revised habitat analysis using different target species to reflect a new management philosophy for these areas as well as some refinements to the recommended alternatives with emphasis placed more heavily on shorebird requirements and bottomland hardwood habitat. The information used to determine the originally selected recommended alternative for each management area is presented in this portion of the report. However, in order to verify the validity of these originally selected alternatives, a revised Incremental Cost Analysis was performed for two of the management areas (McGee Creek and Dunn) using the revised habitat benefit analysis. The original Environmental Assessment and a revised incremental Cost analysis can be found in Appendix I. The revised analysis shows that the National Ecosystem Restoration Plan and the locally preferred plan did not change. An assumption has been made that since similar type work is being proposed at all four areas, the revised habitat analysis would not affect the outcome of the Jonathan and Fishhook areas as well.

Table 11. First Costs, O&M Costs, and Replacement Costs

Area/ Alternative	Solution	First Cost	Average Annual First Cost	Replacement Cost	Replacement Interval	O&M Cost	Total Average Annual Cost
McGee							
Alternative	99.7 Acres						
2	L-E-B*	$588,750	$38,006	$18,250	20	$3,414	$41,888
3	L-E-G	$578,750	$37,361	$18,250	20	$3,414	$41,242
4	L-D-B	$503,750	$32,519	$15,925	20	$3,370	$36,297
5	L-D-G	$493,750	$31,874	$15,925	20	$3,370	$35,652
Dunn							
Alternative	182 Acres						
2	L-E-B	$1,850,000	$119,425	$39,125	20	$6,286	$126,714
4	L-E-G	$1,821,250	$117,569	$39,125	20	$6,286	$124,858
6	L-D-B	$1,705,000	$110,065	$38,275	20	$7,203	$118,249
8	L-D-G	$1,676,250	$108,209	$38,275	20	$7,203	$116,393
3	L-E-B-T	$2,010,000	$129,754	$39,125	20	$6,286	$137,043
5	L-E-G-T	$1,981,250	$127,898	$39,125	20	$6,286	$135.187
7	L-D-B-T	$1,865,000	$120,393	$38,275	20	$7,203	$128,578
9	L-D-G-T	$1,836,250	$118,537	$38,275	20	$7,203	$126,722
Jonathan							
Alternative	28.3 Acres						
2	L-E-B	$830,000	$53,580	$37,100	20	$5,242	$59,773
4	L-E-G	$827,500	$53,418	$37,100	20	$5,242	$59,612
6	L-D-B	$820,000	$52,934	$39,250	20	$4,751	$58,692
8	L-D-G	$817,500	$52,773	$39,250	20	$4,751	$58,531
Alt.	48.5 Acres						
3	L-E-B-W	$937,500	$60,519	$37,100	20	$5,242	$66,712
5	L-E-G-W	$935,000	$60,358	$37,100	20	$5,242	$66,551
7	L-D-B-W	$927,500	$59,874	$39,250	20	$4,751	$65,631
9	L-D-G-W	$925,000	$59,712	$39,250	20	$4,751	$65,470
Fishhook							
Alternative	375.7 Acres						
2	L-D-B	$2,881,250	$185,996	$54,325	20	$16,850	$204,239
4	L-D-G	$2,841,250	$183,414	$54,325	20	$16,850	$201,657
6	L-ED-B	$3,075,000	$198,503	$50,425	20	$14,499	$214,296
8	L-ED-G	$3,035,000	$195,921	$50,425	20	$14,499	$211,714
Alternative	406.9 Acres						
3	L-D-B-W	$3,010,000	$194,307	$54,325	20	$16,850	$212,551
5	L-D-G-W	$2,970,000	$191,725	$54,325	20	$16,850	$209,969
7	L-ED-B-W	$3,203,750	$206,815	$50,425	20	$14,499	$222,607
9	L-ED-G-W	$3,163,750	$204,233	$50,425	20	$14,499	$220,025

Symbol*	Key*	Symbol	Key	Symbol	Key
L	Levee Work	E	Electric Pumps	W	Work-in-kind
B	Revetment / Bedding	D	Diesel Pumps	T	Trees
G	Revetment /Geotextile	ED	Electric/Diesel Pumps		

Highlighted = Incrementally Optimal Plan
Interest Rate = 0.06125 Price level = March 2002

Table 12. Estimated Average Annual Habitat Units

AREA	ALTERNATIVES	CONDITION	ACRES	WHAG[1] INDEX	WHAG HUs[1]	ACRES	AHAG[1] INDEX	AHAG HUs	TOTAL HUs
McGee									
No Action	1	Existing Conditions	99.7	.10	10.0	NA	NA	NA	10.0
Construction	2,3,4,5	With Project	99.7	.56	55.8	10.6[2]	.83	8.80	64.6
								Increase in Habitat Units	54.6
Dunn									
No Action	1	Existing Conditions	185.1	.10	18.5	NA	NA	NA	18.5
Const, no trees	2,4,6,8	With Project	182	.58	105. 6	NA	NA	NA	105. 6
								Increase in Habitat Units	87.1
No Action	1	Existing Conditions	185.1	.10	18.5	NA	NA	NA	18.5
Const + Trees	3,5,7,9	With Project	182	.64	116.5	NA	NA	NA	116.5
								Increase in Habitat Units	98.0

[1] WHAG – Wildlife Habitat Appraisal Guide; AHAG – Aquatic Habitat Appraisal Guide. See Environmental Assessment for additional information.
[2] Acres shown are double-use. They provide both WHAG and AHAG benefits depending on use at the time.

Table 12. Continued

AREA	ALTERNATIVES[3]	CONDITION	ACRES	WHAG[1] INDEX	WHAG HUs[1]	ACRES	AHAG[1] INDEX	AHAG HUs	TOTAL HUs
Jonathan									
No Action	1	Existing Conditions	29.1	.10	2.9	NA	NA	NA	2.9
Construction	2,4,6,8	With Project	28.3	.57	16.1	26[2]	.83	21.6	37.7
								Increase in Habitat Units	34.8
No Action	1	Existing Conditions	21.6	.10	2.2	NA	NA	NA	2.2
Work-in-Kind	3,5,7,9	With Project	20.2	.57	11.5	NA	NA	NA	11.5
								Increase in Habitat Units	9.3
								Total Increase in Habitat Units	44.1
Fishhook									
No Action	1	Existing Conditions	377.5	.10	37.8	NA	NA	NA	37.8
Construction	2,4,6,8	With Project.	375.7	.56	210.4	NA	NA	NA	210.4
								Increase in Habitat Units	172.6
No Action		Existing Conditions	33.4	.10	3.3	NA	NA	NA	3.3
Work-in-Kind	3,5,7,9	With Project.	31.2	.56	17.5	NA	NA	NA	17.5
								Increase in Habitat Units	14.2
								Total Increase in Habitat Units	186.8

[1] WHAG – Wildlife Habitat Appraisal Guide; AHAG – Aquatic Habitat Appraisal Guide. See Environmental Assessment for additional information.
[2] Acres shown are double-use. They provide both WHAG and AHAG benefits depending on use at the time.
[3] For Jonathan and Fishhook areas, "Work-in-kind" values shown are in addition to the "Construction" values shown.

Table 13. Incremental Cost Analysis

Area	Habitat Unit Total Cost Curve			Incremental Average Annual Cost
	Solution	Average Annual Habitat Units	Average Annual Cost	
McGee	99.7 Acres			
	Alternative			
	5*	54.6	$35,652	$653.0
	4	54.6	$36,297	
	3	54.6	$41,242	
	2	54.6	$41,888	
	*National Ecosystem Restoration(NER) and Preferred Plan			
Dunn	182 Acres			
	Alternative			
	8	87.1	$116,393	$1,336.3
	6	87.1	$118,249	
	4	87.1	$124,858	
	2	87.1	$126,714	
	182 Acres			
	Alternative			
	9	98.0	$126,722	$1,293.1
	7	98.0	$128,578	
	5	98.0	$135,187	
	3	98.0	$137,043	
	182 Acres			
	Alternative			
	8	87.1	$116,393	$1,336.3
	9*	98.0	$126,722	$947.6
	* National Ecosystem Restoration Plan and Preferred Plan			
Jonathan Creek	28.3 Acres			
	Alternative			
	8	34.8	$58,531	$1,681.9
	6	34.8	$58,692	
	4	34.8	$59,612	
	2	34.8	$59,773	
	48.5 Acres			
	Alternative			
	9	44.1	$65,470	$1,484.6
	7	44.1	$65,631	
	5	44.1	$66,551	
	3	44.1	$66,712	
	Alternative			
	8	34.8	$58,531	$1,681.9
	9*	44.1	$65,470	$746.2
	Alternative			
	8	34.8	$58,531	$1,681.9
	3**	44.1	$66,712	$879.8
	* National Ecosystem Restoration Plan			
	** Preferred Plan			

Table 13. Continued

Area	Habitat Unit Total Cost Curve			Incremental Average Annual Cost
Fishhook	375.7 Acres			
	Alternative			
	4	172.60	$201,657	$1,168.4
	2	172.60	$204,239	
	6	172.60	$214,296	
	8	172.60	$211,714	
	406.9 Acres			
	Alternative			
	5	186.80	$209,969	$1,124.0
	3	186.80	$212,551	
	9	186.80	$220,025	
	7	186.80	$222,607	
	Alternative			
	4	172.60	$201,657	$1,168.4
	5*	186.80	$209,969	$585.3
	* National Ecosystem Restoration Plan and Preferred Plan			

National Ecosystem Restoration (NER) Plan

42. For ecosystem projects, the National Ecosystem Restoration (NER) Plan is the planthat reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the Federal objective

McGee Management Area

43. The additional average annual habitat units generated under the with project condition versus the without project condition are 54.6 habitat units for an average annual cost of $35,652. These 54.6 habitat units are also generated at an incremental average annual cost of $653.0 per average annual habitat unit. $653.0 is calculated as the incremental average annual cost divided by the incremental average annual habitat units. For example, ($35,652-$0) / (54.6-0) = $653.0. Since the different cost solutions all generate the same number of average annual habitat units (54.6), and no other plan produces either the same output for less cost, or produces more output for the same or less cost, solution #5 would be the incremental optimal solution at a first cost of $493,750 and an average annual cost of $35,652.

North and South Dunn Management Area

44. The additional average annual habitat units generated under the with project condition versus the without project condition are 87.1 habitat units, *excluding* tree plantings, for an average annual cost of $116,393. These 87.1 habitat units are also generated at an incremental average annual cost of $1,336.3 per average annual habitat unit. $1,336.3 is calculated as the incremental average annual cost divided by the incremental average annual habitat units. Since the different cost solutions all generate

the same number of average annual habitat units (87.1), and no other plan produces either the same output for less cost, or produces more output for the same or less cost, solution #8 would be the incremental optimal solution, *excluding* tree plantings, at a first cost of $1,676,250.

45. However, although these *first* 87.1 average annual habitat units can be produced at an incremental cost of approximately $1,336.3 per average annual habitat unit, *including* tree plantings generates an additional 10.9 average annual habitat units (totaling 98.0 average annual habitat units) for an average annual cost of $126,722. Since the different cost solutions *including* tree plantings all generate the same number of average annual habitat units (98.0), and no other plan produces either the same output for less cost, or produces more output for the same or less cost, solution #9 would be the incremental optimal solution of those solutions which *include* tree plantings, at a first cost of $1,836,250.

46. Incremental cost analysis is again necessary to determine the incremental optimal solution between solution #8, *excluding* tree plantings, and solution #9, *including* tree plantings. As noted above, for solution #8, 87.1 average annual habitat units are generated at an incremental average annual cost of $1,336.3 per average annual habitat unit. For solution #9, an additional 10.9 average annual habitat units are generated at an additional incremental average annual cost of $947.6 per average annual habitat unit. $947.6 is calculated as the incremental average annual cost per average annual habitat unit, or the incremental average annual cost divided by the incremental average annual habitat units. For example, ($126,722-$116,393) / (98.0-87.1) = $947.6.

47. Since $947.6 is less than $1,336.3 and no other plan produces either the same output for less cost, or produces more output for the same or less cost, solution #9, at a total cost of $1,836,250, would be the incremental optimal solution between solutions #8 and #9.

48. Therefore the incremental optimal and preferred solution is #9, which *includes* tree plantings and generates 98.0 habitat units at a first cost of $1,836,250 and an average annual cost of $126,722.

Jonathan Creek Management Area

49. The additional average annual habitat units generated under the with project condition versus the without project condition are 34.8 habitat units, *excluding* work-in-kind, for an average annual cost of $58,531. These 34.8 habitat units are also generated at an incremental average annual cost of $1,681.9 per average annual habitat unit. $1,681.9 is calculated as the incremental average annual cost divided by the incremental average annual habitat units. Since the different cost solutions all generate the same number of average annual habitat units (34.8), and no other plan produces either the same output for less cost, or produces more output for the same or less cost, solution #8 would be the incremental optimal solution, *excluding* work-in-kind, at a first cost of $817,500.

50. However, although these *first* 34.8 average annual habitat units can be produced at an incremental cost of approximately $1,681.9 per average annual habitat unit, *including*

work-in-kind generates an additional 9.3 average annual habitat units (totaling 44.1 average annual habitat units) for an average annual cost of $65,470. Since the different cost solutions *including* work-in-kind all generate the same number of average annual habitat units (44.1), and no other plan produces either the same output for less cost, or produces more output for the same or less cost, solution #9 would be the incremental optimal solution of those solutions which *include* work-in-kind, at a first cost of $925,000.

51. Incremental cost analysis is again necessary to determine the incremental optimal solution between solution #8, *excluding* work-in-kind, and solution #9, *including* work-in-kind. As noted above, for solution #8, 34.8 average annual habitat units are generated at an incremental average annual cost of $1,681.9 per average annual habitat unit. For solution #9, an additional 9.3 average annual habitat units are generated at an additional incremental average annual cost of $746.2 per average annual habitat unit. $746.2 is calculated as the incremental average annual cost per average annual habitat unit, or the incremental average annual cost divided by the incremental average annual habitat units. For example, ($65,470-$58,531) / (44.1-34.8) = $746.2.

52. Since $746.2 is less than $1,681.9 and no other plan produces either the same output for less cost, or produces more output for the same or less cost, solution #9, at a total cost of $925,000, would be the incremental optimal solution between solutions #8 and #9.

53. However, the preferred solution is #3 (see next paragraph), which *includes* work-in-kind and generates 44.1 habitat units at a first cost of $937,500 and an average annual cost of $66,712.

54. *Several different options were selected for the recommended plan #3. Electric pumps were selected over diesel since difference in cost was minimal ($8000) and electric pumps avoid the risk of fuel spillage, are quieter to operate, and require less manpower to operate. For an additional $2000, revetment with bedding was selected over revetment with geotextile since it is more difficult to place the geotextile than the bedding. Therefore solution #3 has been chosen as the preferred plan, at a total cost of $937,500. For solution #3, an additional 9.3 average annual habitat units are generated at an additional incremental average annual cost of $879.8 per average annual habitat unit.*

Fishhook Management Area

55. The additional average annual habitat units generated under the with project condition versus the without project condition are 172.6 habitat units, *excluding* work-in-kind, for an average annual cost of $201,657. These 172.6 habitat units are also generated at an incremental average annual cost of $1,168.4 per average annual habitat unit. $1,168.4 is calculated as the incremental average annual cost divided by the incremental average annual habitat units. Since the different cost solutions all generate the same number of average annual habitat units (172.6), and no other plan produces either the same output for less cost, or produces more output for the same or less cost, solution #4 would be the incremental optimal solution, *excluding* work-in-kind, at a first cost of $2,841,500.

56. However, although these *first* 172.6 average annual habitat units can be produced at an incremental cost of approximately $1,168.4 per average annual habitat unit, *including* work-in-kind generates an additional 14.2 average annual habitat units (totaling 186.8 average annual habitat units) for an average annual cost of $209,969. Since the different cost solutions *including* work-in-kind all generate the same number of average annual habitat units (186.8), and no other plan produces either the same output for less cost, or produces more output for the same or less cost, solution #5 would be the incremental optimal solution, *including* work-in-kind, at a first cost of $2,970,000.

57. Incremental cost analysis is again necessary to determine the incremental optimal solution between solution #4, *excluding* work-in-kind, and solution #5, *including* work-in-kind. As noted above, for solution #4, 172.6 average annual habitat units are generated at an incremental average annual cost of $1,168.4 per average annual habitat unit. For solution #5, an additional 14.2 average annual habitat units are generated at an additional incremental average annual cost of $585.3 per average annual habitat unit. $585.3 is calculated as the incremental average annual cost per average annual habitat unit, or the incremental average annual cost divided by the incremental average annual habitat units. For example, ($209,969 -$201,657) / (186.8-172.6) = $585.3.

58. Since $585.3 is less than $1,168.4 and no other plan produces either the same output for less cost, or produces more output for the same or less cost, solution #5, at a total cost of $2,970,000, would be the incremental optimal solution between solutions #4 and #5. Therefore the incremental optimal and preferred solution is #5, which in*cludes* work-in-kind and generates 186.8 habitat units at a first cost of $2,970,000 and an average annual cost of $209,969.

VALUE ENGINEERING FUNCTION ANALYSIS STUDY AND USF&WS COORDINATION

59. A Value Engineering Function Analysis workshop was performed from March 19-21 2003 for the purpose of reviewing the efforts to date and to develop a consensus-based plan that can be used as a springboard for implementation. The following desired functional improvements for the project were kept in mind during the workshop.

- Simplification of operations
- Increased functionality
- Improved multi-use impoundment areas
- Increased habitat areas
- Improved water control predictability
- Improved natural wetland functions
- Meet majority of stakeholder needs

60. The following project needs were determined by the value engineering team.

- Stay under $6,670,000 for project cost ($5,000,000 federal limit)
- Non-gravity dewatering capability
- Increased efficiency and economic value (bringing in dollars to area)

Efficiency equals.,….

- Better land use management
- More timely water level management
- Multi-use of water (waterfowl and fisheries)
- Low operation and maintenance costs
- More habitat units at a lower cost

- Provide habitat for fish and wildlife
- Easily permittable
- Provide opportunity/value for constituents/animals
- More habitat acres
- Appropriate compartmentalization
- Improve quality of existing habitat
- Manage habitat for increased diversity
- Sustainable solutions – biology- and engineering- wise
- Manage succession of vegetation
- Protection from headwater and backwater flooding
- Maximize return on investment for individual project features
- Restore bottomland hardwood
- Protect impoundment levees against overtopping erosion
- Provide fish nursery areas for endemic fish populations
- Coordinate with Corps on lake water level fluctuations
- Independent control of each compartment – both watering and dewatering
- Interchangeability of pumping equipment
- Power units need to be mobile and self contained
- Equipment should be environmentally safe and spill containable
- Accessibility to pump sites
- Low-noise pump units
- Vandal resistant
- Safety shielding for public floodway clearance
- Floodway clearance
- Functional, easily maintainable water control structures
- Reduce ice damage to water control structures
- Reduce levee damage from overtopping

61. The following value engineering proposals/design considerations were developed and incorporated into the recommended plan for the various management areas. The complete report for this Value Engineering workshop is on file with the St. Louis District.

<u>McGee Management Unit</u>

- Fish nursery with catch basin/water control structure in Wood Duck impoundment

Dunn Management Units

- Remove inner levee in Golden Eye (including 2-24" and 2-36" gravity drains)
- Rehab north levee to El. 607 (no raise to El. 609)
- Raise south levee to EL. 607; set back southwest corner (to improve floodway conveyance); remove weir, move dewatering pump to South Dunn
- Eliminate watering pump (Illinois Department of Natural Resources to replace prior to Section 1135 project)
- Eliminate 36" gatewell at upper end

Jonathan Creek Management Unit

- Eliminate berm along western side of main area, construct new cross levee (El. 609) and reroute swale to Jonathan Creek
    - Move 36" CMP structure on east side above new cross levee
    - Add 24" in-line gravity drain with riverside flap gate above east end of cross levee
    - Add 24" inline drain (no flap) in new cross levee
- Eliminate 2-24" gravity drains at south end of eliminated berm
- Eliminate 1-36" gravity drain next to new dewatering pump at south end
- Add 24" culvert under gravel road to water wetland area to the west

Fishhook Management Unit

- Shorten water distribution pipe (from refuge pump) and add supply pump at the Pintail impoundment (re-evaluate pump sizes accordingly)
- Independent water control structures for all units
- Fish nursery with catch basin/water control structure at Widgeon and Mallard impoundments instead of in the Jonathan Management Unit

62. The following people participated in the Value Engineering Study.

Ken Dalrymple	Corps/Biologist
Stan Duzan	Illinois Department of Natural Resources/Site Superintendent
Art Neal	Illinois Department of Natural Resources/Civil Engineer
Sue Horneman	Corps/Regulatory
Mike Mounce	Illinois Department of Natural Resources/ORC/Fisheries
Tamara Atchley	Corps/Project Manager
Ray Kopsky, Jr.	Corps/Hydraulic Engineer
Ted Moore	Corps/Civil Engineer
Gene Degenhardt	Corps/Value Engineer

63. Upon review of the recommended plan, USF&WS had concerns regarding the proposed management emphasis (waterfowl) and the target species that had been selected for the habitat analysis. Subsequent coordination between the Service, the Corps, and Illinois Department of Natural Resources resulted in a revised habitat analysis using different target species to reflect a new management philosophy for these areas.

Emphasis was placed more heavily on shorebird requirements and bottomland hardwood habitat.

RECOMMENDED PLAN

64. Following the Value Engineering workshop and the revised habitat analysis, the incremental cost analysis was revisited to incorporate results from the workshop. (See paragraphs 65 – 78). A recommended plan was selected with input from the sponsor. The recommended plan for each management area is discussed below, described in Table 14, and depicted in Plates 6 through 9 (click to view). Estimated Average Annual Habitat Units for the revised analysis is shown in Table 15.

Table 14. Recommended Plan Measures

Management Unit	**Recommended Plan Measure**	**Description**
McGee 99.7 acres	Levee	Minimal embankment at new dewatering pump site, revetment at pump site and critical levee location, stone surfacing to pump station. Removal of existing 18" gravity drain.
	Pumps	4500 gpm diesel dewatering pump and associated structural support. No engine or fuel tank is included as the existing watering pump's engine and fuel tank will also be used for the dewatering pump.
	Catch Basin/Water Control Structures	Gated concrete structure through the cross levee separating the Black Duck and Wood Duck impoundments. Structure will facilitate catching fingerlings for release when area is used as a nursery; will also function as a water control structure. One 24" in-line gravity drain near existing 36" gravity drain.

Table 14. Continued

Management Unit	Recommended Plan Measure	Description
Dunn 176.6 acres	Levee	Levee raise (to El. 607, 2700'), levee removal (1240') and setback (1000') in South Dunn Refuge area, revetment at critical areas and new dewatering pump site, levee rehab (El. 607, 925') and levee setback (El. 607, 670') in Bufflehead impoundment.
	Water Control Structures	Four 24" in-line gravity drains, one 36" sluice-gated gravity drain, removal of five existing 24" gravity drains
	Pump	6000 gpm diesel dewatering pump and structural support. Does not include power unit or fuel tank. Use same power unit as for new Illinois Department of Natural Resources watering pump.
	Bottomland Hardwood Restoration	39.1 acres managed for bottomland hardwood regeneration
Jonathan 73.1 acres	Levee	New cross levee at El. 609 (510'), new levee (El. 609, 1750') for Green Wing Teal Impoundment, revetment at pump and critical sites.
	Water Control Structures	Four 24" in-line gravity drains, one 24" gated gravity drain, two 36" gated gravity drains, removal of two existing 24" gravity drains.
	Pumps	One 7000 gpm electric supply pump and one 12,000 gpm electric dewatering pump, fencing, and electric power to the site.
	Bottomland Hardwood Restoration	21.7 acres managed for bottomland hardwood regeneration

Table 14. Continued

Management Unit	Recommended Plan Measure	Description
Fishhook 405.1 acres	Levee	Breach repairs at Lost Pond impoundment, raise existing cross levee from El. 607.5 to El. 610 (1230'), new levees for Widgeon (El. 606, 925') and Mallard (El. 607, 1550') impoundments, repair existing refuge levee to El. 605 (3460'), construct drainage swale, revetment at new pump station sites, two overflow sections at refuge area.
	Water Control Structures	Five 24" in-line gravity drains, two 24" ungated gravity drains, four 36" sluice-gated gravity drains with 72" risers, two 42" gravity drains with 72" risers, removal of nine existing 24" gravity drains.
	Pump	One 7000 gpm diesel supply pump at the refuge area, one 12,000 gpm diesel supply pump at the Pintail impoundment (with distribution pipes and valves), one 20,000 gpm diesel dewatering pump for the Redhead impoundment, all with structural supports.
	Catch Basin/Water Control Structure	Two gated concrete structures (one each at Mallard and Widgeon impoundments). Structure will facilitate collecting fingerlings for release when area is used as a nursery; will also function as a water control structure.
	Bottom Hardwood Restoration	51.8 acres managed for bottomland hardwood regeneration
	Lost Pond Area	Construct 3-acre pothole. Water levels in pothole will be able to be managed for open water habitat within new bottomland hardwood complex; create island with excavated material

Table 15. Estimated Average Annual Habitat Units

AREA	ALTERNATIVES	CONDITION	ACRES		WHAG HUs[1]	ACRES		AHAG HUs	TOTAL HUs
McGee									
No Action	1	Existing Conditions	99.7		39.39	NA		NA	39.39
Construction	2,3,4,5	With Project	99.7		62.61	10.6[2]		8.8	71.41
								Increase In Habitat Units	32.02
Dunn									
No Action	1	Existing Conditions	181.2		92.86	NA		NA	92.86
Construction	2,4,6,8	With Project	177.6		97.08	NA		NA	97.08
								Increase In Habitat Units	4.22
No Action	1	Existing Conditions	181.2		92.86	NA		NA	92.86
Construction + Trees	3,5,7,9	With Project	177.6		120.76	NA		NA	120.76
								Increase In Habitat Units	27.90

[1] WHAG – Wildlife Habitat Appraisal Guide; AHAG – Aquatic Habitat Appraisal Guide. See Environmental Assessment for additional information.
[2] Acres shown are double-use. They provide both WHAG and AHAG benefits depending on use at the time.

Table 15. Continued

AREA	ALTERNATIVES[3]	CONDITION	ACRES		WHAG HUs[1]	ACRES		AHAG HUs	TOTAL HUs
Jonathan									
No Action	1	Existing Conditions	52.9		20.1	NA		NA	20.1
Construction	2,4,6,8	With Project	52.9		36.0	NA		NA	36.0
								Increase in Habitat Units	15.9
No Action	1	Existing Conditions	20.2		2.0	NA		NA	2.0
Work-in-Kind	3,5,7,9	With Project	20.2		13.5	NA		NA	13.5
								Increase in Habitat Units	11.5
								Total Increase in Habitat Units	27.4
Fishhook									
No Action	1	Existing Conditions	375.7		204.3	NA		NA	204.3
Construction	2,4,6,8	With Project	375.7		246.9	59.9[2]		49.7	296.6
								Increase in Habitat Units	92.4
No Action		Existing Conditions	31.2		3.1	NA		NA	3.1
Work-in-Kind	3,5,7,9	With Project	31.2		22.8	NA		NA	22.8
								Increase in Habitat Units	19.7
								Total Increase in Habitat Units	112.1

[1] WHAG – Wildlife Habitat Appraisal Guide; AHAG – Aquatic Habitat Appraisal Guide. See Environmental Assessment for additional information.
[2] Acres shown are double-use. They provide both WHAG and AHAG benefits depending on use at the time.
[3] For Jonathan and Fishhook areas, "Work-in-kind" values shown are in addition to the "Construction" values shown.

MCGEE MANAGEMENT AREA

65. Besides the no action plan, the least cost option was the basic levee, diesel dewatering pump, and revetment with bedding. Other construction options (electric dewatering pump, revetment with geotextile) increased the cost with no corresponding increase in output.

66. Recommended Plan: McGee Alternative #5 (VE) - Levee work with diesel pump and revetment with geotextile. The additional average annual habitat units generated under McGee Alternative #5 versus the without project condition are 32.0 habitat units for an average annual cost of $23,738. These 32.0 habitat units are generated at an incremental average annual cost of $741.4 per average annual habitat unit. $741.4 is calculated as the incremental average annual cost divided by the incremental average annual habitat units. For example, ($23,738-$0.0) / (32.0-0.0) = $741.4. Since the different cost solutions all generate the same number of average annual habitat units (3), and no other plan produces either the same output for less cost, or produces more output for the same or less cost, McGee Alternative #5 is recommended as the incremental optimal and preferred solution and generates 32.0 habitat units at a first cost of $301,050 and an average annual cost of $23,738.

NORTH AND SOUTH DUNN MANAGEMENT AREA

67. The least cost option for the North and South Dunn area includes the levee work, diesel pumps, and revetment with bedding. In order to realize additional valuable benefits, natural tree regeneration will be allowed on 39.1 acres.

68. Recommended Plan: North and South Dunn Alternative #9 (VE/USFWS) - Levee work with diesel pumps, revetment with geotextile, and natural tree regeneration. Incremental cost analysis is necessary to determine the incremental optimal solution between North and South Dunn Alternative #8, *excluding* natural tree regeneration, and North and South Dunn Alternative #9, *including* natural tree regeneration. For North and South Dunn Alternative #8, 4.22 average annual habitat units are generated at an incremental average annual cost of $18,077.3 per average annual habitat unit. For North and South Dunn Alternative #9, 27.90 average annual habitat units are generated at an incremental average annual cost of $2,734.3 per average annual habitat unit. Therefore, for North and South Dunn Alternative #9, an <u>additional</u> 23.7 average annual habitat units are generated at NO <u>additional</u> incremental average annual cost.

69. Since North and South Dunn Alternative #9 produces more output for the same cost as North and South Dunn Alternative #8, rendering Alternative #8 i*neffective* (defined as when another plan [Alternative #9] generates greater output at a lesser or equal cost), then North and South Dunn Alternative #9, at a first cost of $1,055,700, would be the incremental optimal solution between North and South Dunn Alternative #8 and North and South Dunn Alternative #9.

70. Therefore, the incremental optimal and preferred solution is North and South Dunn Alternative #9, and generates 27.90 habitat units at a first cost of $1,055,700 and an average annual cost of $76,286.

JONATHAN CREEK MANAGEMENT AREA

71. The least cost option included the levee work, diesel pumps, and revetment with geotextile. Several different options were selected for the recommended plan, however. Electric pumps were selected over diesel since difference in cost was minimal ($8000) and electric pumps avoid the risk of fuel spillage, are quieter to operate, and require less manpower to operate. For an additional $2000, revetment with bedding was selected over revetment with geotextile since it is more difficult to place the geotextile than the bedding. The work-in-kind option was selected since an additional 11.48 habitat units could be gained at an additional incremental average annual cost of $657.1 per unit.

72. Recommended Plan: Jonathan Alternative #3 (VE/USFWS) - Levee work with electric pumps, revetment with bedding, natural tree regeneration, and work-in-kind. Incremental cost analysis is necessary to determine the incremental optimal solution between Jonathan Alternative #8, *excluding* work-in-kind, and Jonathan Alternative #9, *including* work-in-kind. For Jonathan Alternative #8, 15.94 average annual habitat units are generated at an incremental average annual cost of $4,705.8 per average annual habitat unit. For Jonathan Alternative #9, 27.42 average annual habitat units are generated at an incremental average annual cost of $2,964.8 per average annual habitat unit. Therefore, for Jonathan Alternative #9, an additional 11.48 average annual habitat units are generated at an additional incremental average annual cost of $547.4 per average annual habitat unit. $547.4 is calculated as the incremental average annual cost per average annual habitat unit, or the incremental average annual cost divided by the incremental average annual habitat units. For example, ($81,295-$75,011) / (27.42-15.94) = $547.4.

73. Since $547.4 is less than $4,705.8 and no other plan produces either the same output for less cost, or produces more output for the same or less cost, Jonathan Alternative #9 would be the incremental optimal solution between Jonathan Alternative #8 and Jonathan Alternative #9, generating 27.42 average annual habitat units at a first cost of $1,125,540 and an average annual cost of $81,295.

74. However, the preferred alternative is Jonathan Alternative #3, which *includes* work-in-kind and generates 27.42 habitat units at an incremental average annual cost of $3,010.7 per average annual habitat unit. An additional 11.48 average annual habitat units are generated at an additional incremental average annual cost of $657.1 per average annual habitat unit. Jonathan Alternative #3 has a first cost of $1,140,750 and an average annual cost of $82,554.

FISHHOOK MANAGEMENT AREA

75. Features of the least cost option for Fishhook include levee work, diesel pumps, and revetment with geotextile. In order to realize additional valuable benefits, the work-in-kind was included as part of the recommended plan.

76. Recommended Plan: Fishhook Alternative #5 (VE) - Levee work, diesel pumps, revetment with geotextile, natural tree regeneration, and work-in-kind. Incremental cost analysis is necessary to determine the incremental optimal solution between Fishhook Alternative #4, *excluding* work-in-kind, and Fishhook Alternative #9, *including* work-in-kind. For Fishhook Alternative #4, 92.39 average annual habitat units are generated at an incremental average annual cost of $2,542.6 per average annual habitat unit. For Fishhook Alternative #5, 112.10 average annual habitat units are generated at an incremental average annual cost of $2,218.3 per average annual habitat unit. Therefore, for Fishhook Alternative #5, an additional 19.71 average annual habitat units are generated at an additional incremental average annual cost of $698.0 per average annual habitat unit. $698.0 is calculated as the incremental average annual cost per average annual habitat unit, or the incremental average annual cost divided by the incremental average annual habitat units. For example, ($248,671-$234,912) / (112.10-92.39) = $698.0.

77. Since $698.0 is less than $2,542.6 and no other plan produces either the same output for less cost, or produces more output for the same or less cost, Fishhook Alternative #5, at a first cost of $3,488,700, would be the incremental optimal solution between Fishhook Alternative #4 and Fishhook Alternative #5.

78. Therefore, the incremental optimal and preferred solution is Fishhook Alternative #5, which *includes* work-in-kind and generates 112.10 habitat units at a first cost of $3,488,700 and an average annual cost of $248,671.

PROJECT IMPACTS

79. Detailed discussions on the baseline conditions, methodologies and analyses are in the Environmental Assessment.

CULTURAL RESOURCES

80. A file search for previous surveys and reported archaeological sites was conducted at the Illinois State Museum by Illinois Department of Natural Resources in August 2001. Because the project involves modifications of an existing project, at least 10 archaeological surveys had been conducted in various portions of the project area previously (Appendix E) and about 22 archaeological sites had been reported. Ten areas (total 55 acres) which had not been previously surveyed for archaeological sites where there will be new ground disturbance (levee enlargement, borrow) according to plans as of April 2002, were selected for Phase I archaeological survey (Appendix E). Also during the survey, seven (7) known archaeological sites (Mt77, 133, 144, 160, 187, 188,

and 195) (Appendix E) which could be impacted were be revisited and delimited surrounded by a 50 to 100 feet buffer zone using Global Positioning System. The sites could then be avoided by the project. The Scope of Work for site delimiting and survey was agreed to by Illinois State Historic Preservation Officer (ISHPO) staff by letter on April 23, 2002. (Initially the investigation was planned for May 2002, but has been delayed by flooding and then the fall 2002 hunting season)

81. Between March 4 and April 8, 2003, Phase I archaeological survey of the 10 selected areas and revisits of the seven known archaeological sites were conducted by Dr. Paul P. Kreisa, Program Coordinator, Public Service Archaeology Program, University of Illinois at Urbana-Champaign. In addition to pedestrian survey, tracts located on terraces or infrequently flooded floodplains were tested for buried archaeological deposits. No new archaeological sites were recorded by this survey. All seven archaeological sites were revisited. However, five sites (11MT77, 133, 144, 160, 187) lacked intact deposits and have been determined not eligible for listing on the National Register of Historic Places (NRHP). Therefore, these five do not have to be avoided by the project. The two remaining sites (11MT188 and 195) have been determined potentially eligible for NRHP listing. These two sites will be avoided by the project or formally tested for NRHP eligibility. Coordination with the ISHPO on the survey results is pending. Project modification (South Dunn levee realignment and raise, removal of borrow at site 11MT188) made after the survey was completed may require additional Phase I archaeological survey and ISHPO coordination.

82. A Tribal Coordination letter was sent on June 26, 2002 to learn if any Native American groups have an interest in the project area. Thus far, no tribes have indicated an interest. Correspondence from the Illinois State Historic Preservation Officer and the Tribal coordination letter are included in Appendix A.

WETLANDS

83. Approximately 6.4 acres of vegetated wetlands would be permanently converted to non-wetland areas (e.g., under the footprint of new levees) but due to increased water management capability a net increase of 20.9 acres of usable wetland habitat would become available. Benefits in conjunction with net gains in fisheries and wetland resource values would produce an overall wetland resource gain.

84. Man-made wetland habitats can be only as good as the site, design, and construction characteristics of the impoundment and soil types permit.

WETLAND WILDLIFE

85. Available wetland wildlife habitat would increase significantly with the recommended plan. The water control system and levees, coupled with vegetation management, will allow for the restoration of more natural hydric and vegetative conditions. Wetland wildlife will benefit from the effects of improved water control due to the diverse foods (seeds, tubers, and invertebrates) that can be produced.

TERRESTRIAL

86. 112.8 acres of bottomland hardwoods will be re-established in the Dunn, Jonathan, and Fishhook areas. See Plates 7-9 (click to view).

AQUATIC

87. Wetlands that provide a maximum biological output have average depths of 2 feet with vegetation covering about 50 percent of the water surface. The primary objective is to implement functional design that will allow land managers to vary water levels in the project area to maximize the resources as a nursery for fish as well as plant and associated aquatic invertebrates.

WATER QUALITY

88. Water quality will be increased by the filtering effect of aquatic plant nutrient retention.

THREATENED AND ENDANGERED SPECIES

89. There are expectations for several state-listed endangered or threatened species and other wildlife will use this newly created habitat (great egret, osprey, Forester's tern, Bewick's wren, American bittern, northern harrier, black tern, little blue heron, least bittern, common tern, double-crested cormorant, pied-billed grebe, brown creeper, common moorhen, and black-crowned night heron).

SECTION 404

90. Compliance with Section 404 of the Clean Water Act will be achieved though the nationwide permitting program (Nationwide 27). Conditions for Section 401 water quality will be achieved by condition as part of this process. A preliminary 404(b)(1) evaluation is included in Appendix G.

HAZARDOUS, TOXIC, AND RADIOLOGICAL WASTE EVALUATION

91. A Phase I site assessment was conducted in April 2002 on the four management areas. The land use of this area is wildlife management. No indicators of hazardous waste were identified. An environmental data review record search was conducted of all applicable databases for known hazardous or potential hazardous waste sites within the project area. No known or potential hazardous waste sites were identified within a 2-mile radius of the proposed site. The Phase I and the record search conducted during this assessment has revealed no evidence of recognized environmental conditions in connection with the project location.

COMPLIANCE SCHEDULE

92. The recommended plan was subjected to a compliance review with applicable Federal environmental guidelines. The proposed action was found to be in partial or full compliance with the applicable guidelines as indicated in Table EA-2. Full compliance will be achieved as noted.

PUBLIC ACCESS

93. The four management areas are all accessible to the public by township maintained roads as well as by boat.

OPERATION AND MAINTENANCE

94. Operation and maintenance of the proposed project is the responsibility of the local sponsor. These activities could include vegetation control on the berm slopes, erosion control on slopes, replacement of riprap as required, operation and maintenance of the pumps and water control structures. An expected rehabilitation of pumps is planned at year 20 and year 40 of the project life.

REAL ESTATE REQUIREMENTS

95. The Real Estate Plan (REP) for the Shelbyville Wildlife Management is included as Appendix D. All lands necessary for the project are on Corps' property that is licensed to the Illinois Department of Natural Resources. No public or private facilities/utilities will be impacted as a result of the construction, operation, and maintenance of the project; therefore no relocations are anticipated.

FEDERAL RESPONSIBILITIES

96. Section 1135 of WRDA 1986, as amended, provides for project modifications for improvement of the environment. Project implementation under this authority includes requirements for the Federal government and the non-Federal sponsor. Federal responsibilities for the selected plan include project planning and design and construction of embankment sections, watering and dewatering pumps, ditching and water distribution, armoring of selected areas, tree plantings, and water control structures.

NON-FEDERAL RESPONSIBILITIES

97. The local sponsor for this project is the Illinois Department of Natural Resources. This section describes the sponsor’s required responsibilities in order to implement the plan in conjunction with the Federal Government. A detailed description of the project is contained in the draft Project Cooperation Agreement. The draft Project Cooperation Agreement will be coordinated with and reviewed and approved by the Illinois

Department of Natural Resources. The Project Cooperation Agreement will be signed and executed prior to project implementation. A letter of intent from the local sponsor is included in Appendix A.

98. The feasibility phase study and plans and specifications costs shall be included as part of the total project modification costs to be shared 75 percent Federal and 25 percent non-Federal. As required by Section 1135(b) of Public Law 99-662, as amended, the non-Federal share of the costs of the modification shall be 25 percent.

99. In meeting this responsibility, the non-Federal sponsor shall provide all lands, easements, rights-of-way, relocations, and suitable borrow and dredged or excavated material disposal areas (LER) required for the project modification which are not otherwise available due to the construction of the existing project. As all lands required for the modification are on project land, no LER have been identified.

100. Further, the non-Federal sponsor shall accomplish, or arrange for accomplishment at no cost to the Government, all relocations determined by the Government to be necessary for implementation of the project modification. At this point, no relocations have been identified within the project area.

101. If the value of the LER plus work-in-kind does not equal or exceed 25 percent of the project cost, the sponsor must pay in cash the additional amount necessary so the sponsor's total contribution equals 25 percent of the project cost. The estimated cash requirement for the Shelbyville Wildlife Management Area project modification is $1,331,550.

102. If the value of the LER contributions alone exceeds 25 percent of the total project modification costs, the Government shall reimburse the sponsor for the excess amount.

103. The non-Federal sponsor shall not receive any credit for LER previously provided as an item of cooperation for another Federal project. The non-Federal sponsor also shall not receive credit of the value of LER or other items to the extent that they are provided using Federal funds unless the Federal granting agency verifies in writing that such credit is expressly authorized by statute.

a. Work-in-kind is limited to 80 percent of the non-Federal share and may be accepted as long as it does not result in any reimbursement of the non-Federal sponsor. The work-in-kind when combined with the non-Federal provision of LER cannot exceed 25 percent of project costs.

b. Work-in-kind must be provided by the non-Federal project sponsor and can be accomplished by the staff of the non-Federal sponsor or by contract administered by the non-Federal sponsor.

c. Items eligible for work-in-kind as part of the non-Federal sponsor's share include post-feasibility phase design, including plans and specifications, provision of materials, and project construction.

d. With regard to work-in-kind, the non-Federal sponsor will comply with applicable Federal and state laws and regulations, including the requirements to secure competitive bids for all work to be performed by contract. Efforts credited as work-in-kind will be subject to audit.

e. The local sponsor desires to provide work-in-kind to satisfy a portion of their cost-sharing requirements. For the North Jonathan (Green Wing Teal impoundment area) management area, the sponsor will perform clearing of the site, loading, hauling, and placing compacted backfill for embankment, installation of a water control structure, and establishment of turf at an estimated cost of $80,000. For the Fishhook (Lost Pond area) management area, the sponsor will perform clearing, grubbing, stripping, and excavation to construct a 3-acre pothole and island (with the excavated material), and establish turf at an estimated cost of $85,000. A summary of the estimated initial project costs for the recommended plan is shown in Table 16. A breakdown of the non-Federal and Federal costs is shown in Table 17.

104. Contributions of cash, funds, materials, and services from other than the non-Federal sponsor may be accepted for the project modification under the provisions of Section 203 of WRDA of 1992. However, such contributions by other than the non-Federal sponsor including work by volunteers, will not be credited to the non-Federal share of the project, but rather be applied to the entire project and, therefore, reduce both the Federal and non-Federal share of the project cost.

105. Program funds will not be provided to local interests or be used to reimburse local interests for conducting studies or constructing projects nor shall contributions be made for features or benefits of projects constructed by another agency or by local interests. Local interests will not be reimbursed for work undertaken by them on an approved project except as approved by inclusion in the Project Cooperation Agreement.

106. By regulation (EC 1105-2-314), the non-Federal sponsor shall not use Federal funds to meet its share of the total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute. The Department of the Interior has been consulted, and Federal Aid in Wildlife Restoration Act (Pittman-Robertson), Federal Aid in Sport Fisheries Restoration Act (Dingel-Johnson) funds, and North American Wetlands Conservation Act funds (Mitchell Bill) may not be used by states as the non-Federal share of Section 1135 ecosystem restoration projects.

107. In addition, the local sponsor shall:

a. Pay 100 percent of project operation, maintenance, repair, rehabilitation, and replacement costs.
b. Hold and save the United States free from damages due to the construction and operation and maintenance of the project except where such damages are due to the fault or negligence of the United States or its contractors.

c. Comply with the provisions of the Uniform Relocations Assistance and Real property Acquisition Policies Act of 1970, Public Law 91-646.
d. Comply with provisions of Section 221, Public Law 91-611.
e. Comply with provisions of Section 601 of Title VI of the Civil Rights Act of 1964, Public Law 88-352.

Table 16. Recommended Plan Initial Costs

SELECTED ALTERNATIVE	Recommended Plan Estimated Initial Costs								
	Levees	Pumps	Revetment	Work-in-kind	Trees	Construction Total	Planning, Engineering and Design	Construction Management	Total Cost
McGee Alternative 5	77,000	73000	73,000	-	-	223,000	55,750	22,300	301,050
North and South Dunn Alternative 9	339,000	74,000	369,000	-	-	782,000	195,500	78,200	1,055,700
Jonathan Alternative 3	180,000	545,000	40,000	80,000	-	845,000	211,250	84,500	1,140,750
Fishhook Alternative 5	1,173,000	948,000	386,000	85,000	-	2,592,000	637,500	259,200	3,488,700
TOTAL	1,769,000	1,640,000	868,000	165,000	0	4,442,000	1,100,000	444,200	5,986,200

Table 17. Summary of Estimated First Costs and Allocation

Item	Allocation of Estimated First Costs		
	Federal Cost	Non-Federal Cost	Total
Constructed Facilities	3,331, 500	1,110,500	4,442,000
Planning, Engineering and Design	825,000	275,000	1,100,000
Construction Management	333,150	111,050	444,200
Total	4,489,650	1,496,550	5,986,200
Work-in-Kind	-	*165,000*	
Non-Federal Cash Required	-	*1,331,550*	

SUMMARY OF COORDINATION, PUBLIC VIEWS, AND COMMENTS

PUBLIC COORDINATION

108. Several measures were undertaken during the ecosystem restoration study to ensure public involvement. These measures include distribution of the draft Ecosystem Restoration Report to various individuals, private organizations and state and Federal agencies. In addition, a public meeting will be held during the review period of the draft report.

VIEWS OF FEDERAL AGENCIES

109. Coordination was conducted with the U.S. Fish and Wildlife Service. That agency has provided a draft Coordination Act Report, included in Appendix A. Federal agency responses to the draft report will be included in Appendix A of the final ecosystem restoration report.

VIEWS OF NON-FEDERAL AGENCIES AND OTHERS

110. Numerous meetings with the non-Federal sponsor and Lake Shelbyville staff were held during the preparation of this ecosystem restoration report. These meetings proved helpful to determine the desires of the sponsor and whether Federal actions under the Section 1135 program could satisfy these desires. The State Historic Preservation Officer was coordinated with by telephone. As the study progressed, the sponsor agreed that ecosystem benefits would be realized from improvements to the four wildlife management areas. Comments received on the draft Ecosystem Restoration Report, Environmental Analysis and Finding of No Significant Impact will be included in Appendix H of the final report.

FINDINGS AND CONCLUSIONS

111. The operation of Lake Shelbyville water management plan adversely impacts habitat at the McGee, North and South Dunn, Jonathan, and Fishhook wildlife management areas. Flooding and the inability to get rid of water impounded in these areas prevent optimum management of the areas for food production and habitat. Implementation of the proposed measures at the areas would result in positive benefits by allowing more control over water levels within the management areas. The long-term benefits of this proposed habitat restoration project outweigh the minor and temporary adverse impacts associated with project construction. The local sponsor has indicated that it wishes to pursue the project at this time.

RECOMMENDATION

112. I recommend that the ecosystem restoration plan for the Lake Shelbyville Wildlife Management Areas, Moultrie County, Illinois, as discussed in this report be approved for implementation as a Federal project under authority of Section 1135 of WRDA of 1986, as amended, at a total project cost of $5,986,200, provided that, prior to construction, local interests provide the assurances of local cooperation as stated previously.

113. The recommendations contained herein reflect the policies governing formulation of individual projects and the information available at this time. They do not necessarily reflect program and budgeting priorities inherent in the state programs or the formulation of a national Civil Works construction program. Consequently, the recommendations may be modified prior to approval and implementation funding.

C. Kevin Williams
Colonel, U.S. Army
District Engineer

Table 18. Study and Internal Technical Review (ITR) Team Members

Discipline	Study Team	ITR Team
Civil	Ted Moore, Tom Niedernhofer	Jay Fowler
Construction		Bruce Douglas
Cost Estimates	Dawayne Sanders	Greg Dyn
Cultural	Suzanne Harris	Terry Norris
Economics	Dave Kelly	Richard Andersen
Electrical	Paul Roberts	Gary Jones
Environmental	Ken Dalrymple	T. Miller
Geotechnical	Marilyn Kwentus, Moe Dirnberger	Joe Schwenk
Hydraulics	Ray Kopksy	Dennis Stephens
Legal	Angela Bonstead	
Mechanical	Janice Hitchcock	Walter Wagner
Regulatory	Sue Horneman	Charles Frerker
Structural	John Zacher	Tom Quigley
Plan Formulation	Tamara Atchley	David Gates
Real Estate	Angela Sanders	Harry Hamell
Value Engineering	Eugene Degenhardt	
Water Quality	Kevin Slattery	Ted Postol
Sponsor's Primary Team Members		
Jim Capel	Project Manager	
Arthur Neal	Civil Engineering and ITR	
Stan Duzan	Shelbyville Site Manager and ITR	

Table 19. Schedule of Accomplishments

Milestone	Date
Public Review of Draft Ecosystem Restoration Report	OCT 03
Ecosystem Report Approval	JAN 03
Begin Final Design	JAN 04
Award Construction Contract	MAY 05
Begin Construction	JUN 05

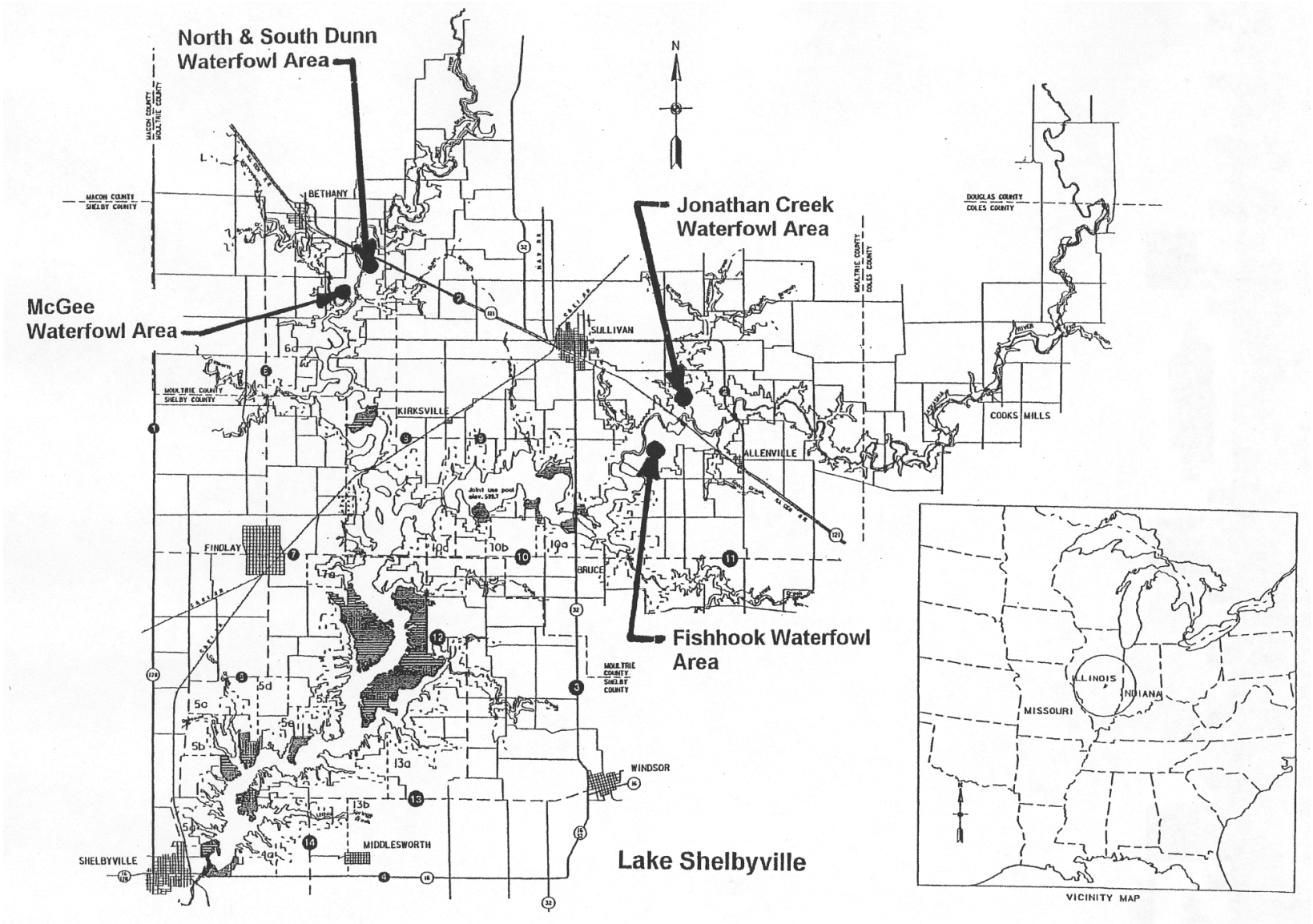
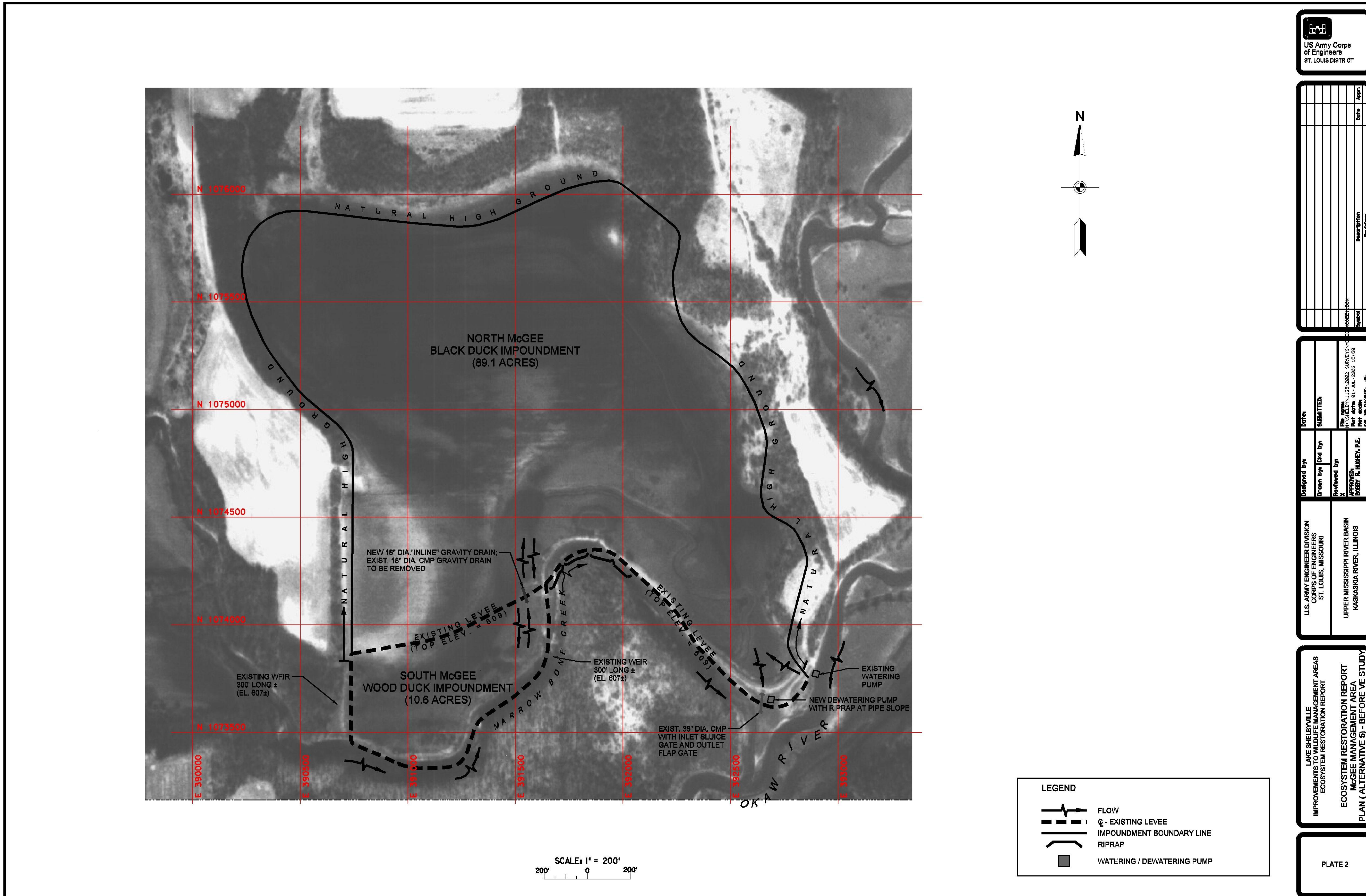
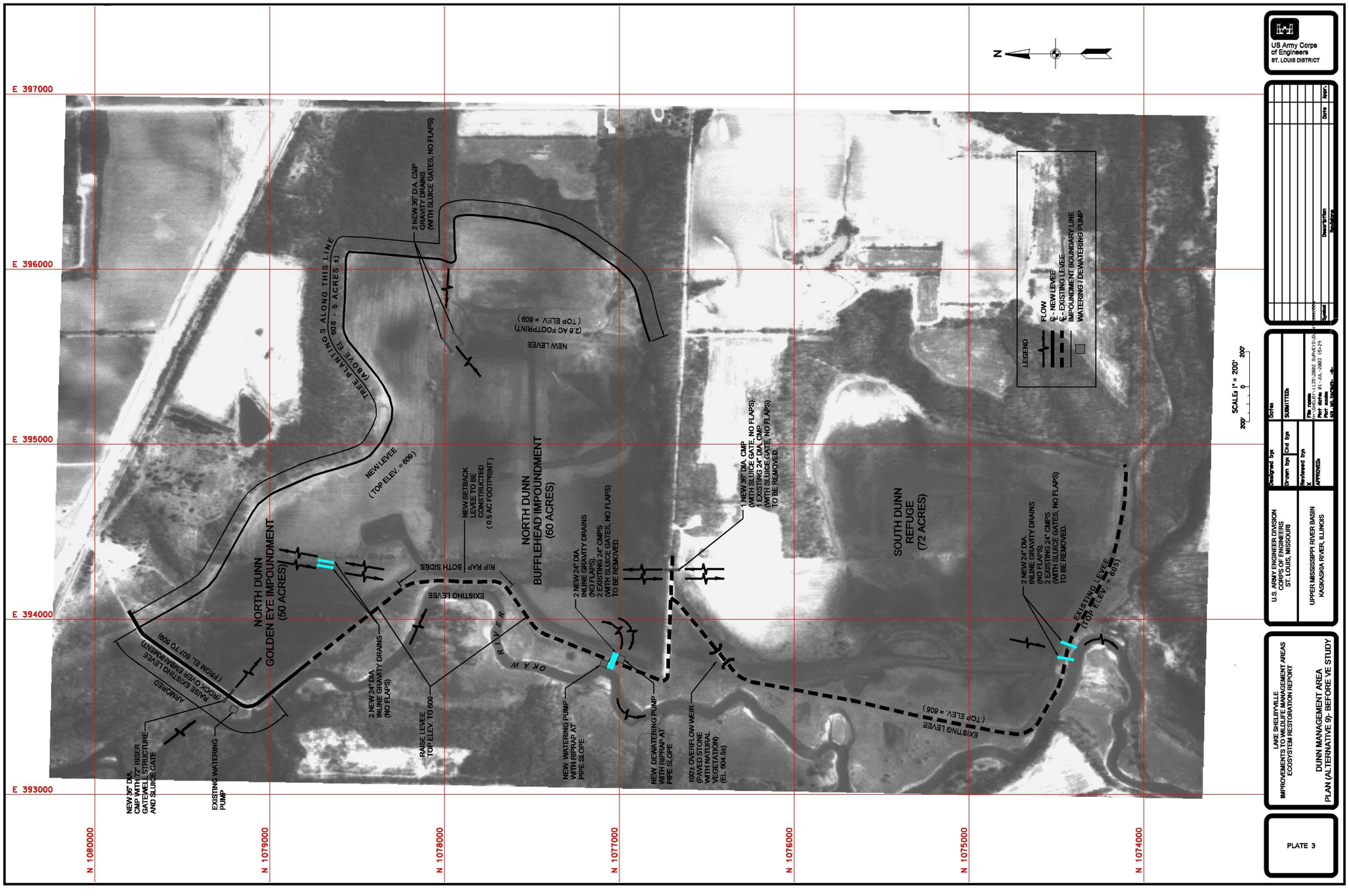


Plate 1. Project Vicinity and Study Area


NORTH McGEE
BLACK DUCK IMPOUNDMENT
(89.1 ACRES)
SOUTH McGEE
WOOD DUCK IMPOUNDMENT
(10.6 ACRES)
NATURAL HIGH GROUND
EXISTING LEVEE (TOP ELEV. = 609)
NEW 18" DIA."INLINE" GRAVITY DRAIN;
EXIST. 18" DIA. CMP GRAVITY DRAIN
TO BE REMOVED
EXISTING WEIR
300' LONG ±
(EL. 607±)
MARROW BONE CREEK
EXIST. 36" DIA. CMP
WITH INLET SLUICE
GATE AND OUTLET
FLAP GATE
EXISTING
WATERING
PUMP
NEW DEWATERING PUMP
WITH RIPRAP AT PIPE SLOPE
OKAW RIVER
N 1076000
N 1075500
N 1075000
N 1074500
N 1074000
N 1073500
E 390000
E 390500
E 391000
E 391500
E 392000
E 392500
E 393000
N
SCALE: 1" = 200'
200' 0 200'
LEGEND
FLOW
℄ - EXISTING LEVEE
IMPOUNDMENT BOUNDARY LINE
RIPRAP
WATERING / DEWATERING PUMP
US Army Corps of Engineers
ST. LOUIS DISTRICT
U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI
UPPER MISSISSIPPI RIVER BASIN
KASKASKIA RIVER, ILLINOIS
LAKE SHELBYVILLE
IMPROVEMENTS TO WILDLIFE MANAGEMENT AREAS
ECOSYSTEM RESTORATION REPORT
ECOSYSTEM RESTORATION REPORT
McGEE MANAGEMENT AREA
PLAN (ALTERNATIVE 5) - BEFORE VE STUDY
PLATE 2



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Symbol	Description	Date	Appr.
	Revisions		

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Reviewed by:
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SUBMITTED:
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Plot date:

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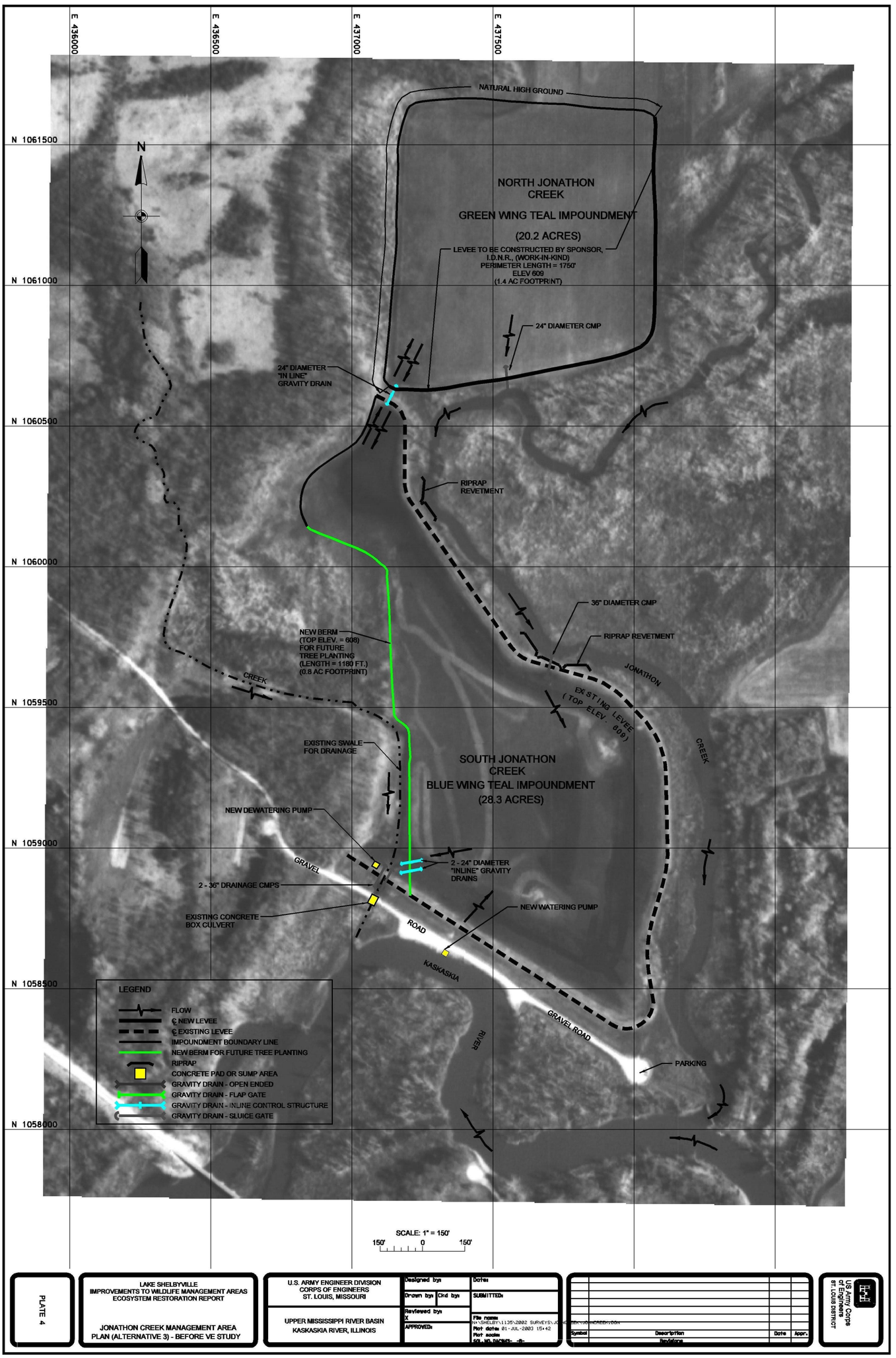
UPPER MISSISSIPPI RIVER BASIN
KASKASKIA RIVER, ILLINOIS

LAKE SHELBYVILLE
IMPROVEMENTS TO WILDLIFE MANAGEMENT AREAS
ECOSYSTEM RESTORATION REPORT

DUNN MANAGEMENT AREA
PLAN (ALTERNATIVE 9)- BEFORE VE STUDY

PLATE 3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N 1059500
N 1059000
N 1058500
N 1058000
N
NATURAL HIGH GROUND
NORTH JONATHON CREEK
GREEN WING TEAL IMPOUNDMENT
(20.2 ACRES)
LEVEE TO BE CONSTRUCTED BY SPONSOR, I.D.N.R., (WORK-IN-KIND)
PERIMETER LENGTH = 1750'
ELEV 609
(1.4 AC FOOTPRINT)
24" DIAMETER CMP
24" DIAMETER "IN LINE" GRAVITY DRAIN
RIPRAP REVETMENT
NEW BERM (TOP ELEV. = 608) FOR FUTURE TREE PLANTING (LENGTH = 1180 FT.) (0.8 AC FOOTPRINT)
36" DIAMETER CMP
RIPRAP REVETMENT
JONATHON CREEK
EXISTING LEVEE (TOP ELEV. 608)
CREEK
EXISTING SWALE FOR DRAINAGE
SOUTH JONATHON CREEK
BLUE WING TEAL IMPOUNDMENT
(28.3 ACRES)
NEW DEWATERING PUMP
GRAVEL
2 - 24" DIAMETER "INLINE" GRAVITY DRAINS
2 - 36" DRAINAGE CMPS
EXISTING CONCRETE BOX CULVERT
NEW WATERING PUMP
ROAD
KASKASKIA
GRAVEL ROAD
RIVER
PARKING
LEGEND
FLOW
℄ NEW LEVEE
℄ EXISTING LEVEE
IMPOUNDMENT BOUNDARY LINE
NEW BERM FOR FUTURE TREE PLANTING
RIPRAP
CONCRETE PAD OR SUMP AREA
GRAVITY DRAIN - OPEN ENDED
GRAVITY DRAIN - FLAP GATE
GRAVITY DRAIN - INLINE CONTROL STRUCTURE
GRAVITY DRAIN - SLUICE GATE
SCALE: 1" = 150'
150' 0 150'
PLATE 4
LAKE SHELBYVILLE
IMPROVEMENTS TO WILDLIFE MANAGEMENT AREAS
ECOSYSTEM RESTORATION REPORT
JONATHON CREEK MANAGEMENT AREA
PLAN (ALTERNATIVE 3) - BEFORE VE STUDY
U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI
UPPER MISSISSIPPI RIVER BASIN
KASKASKIA RIVER, ILLINOIS
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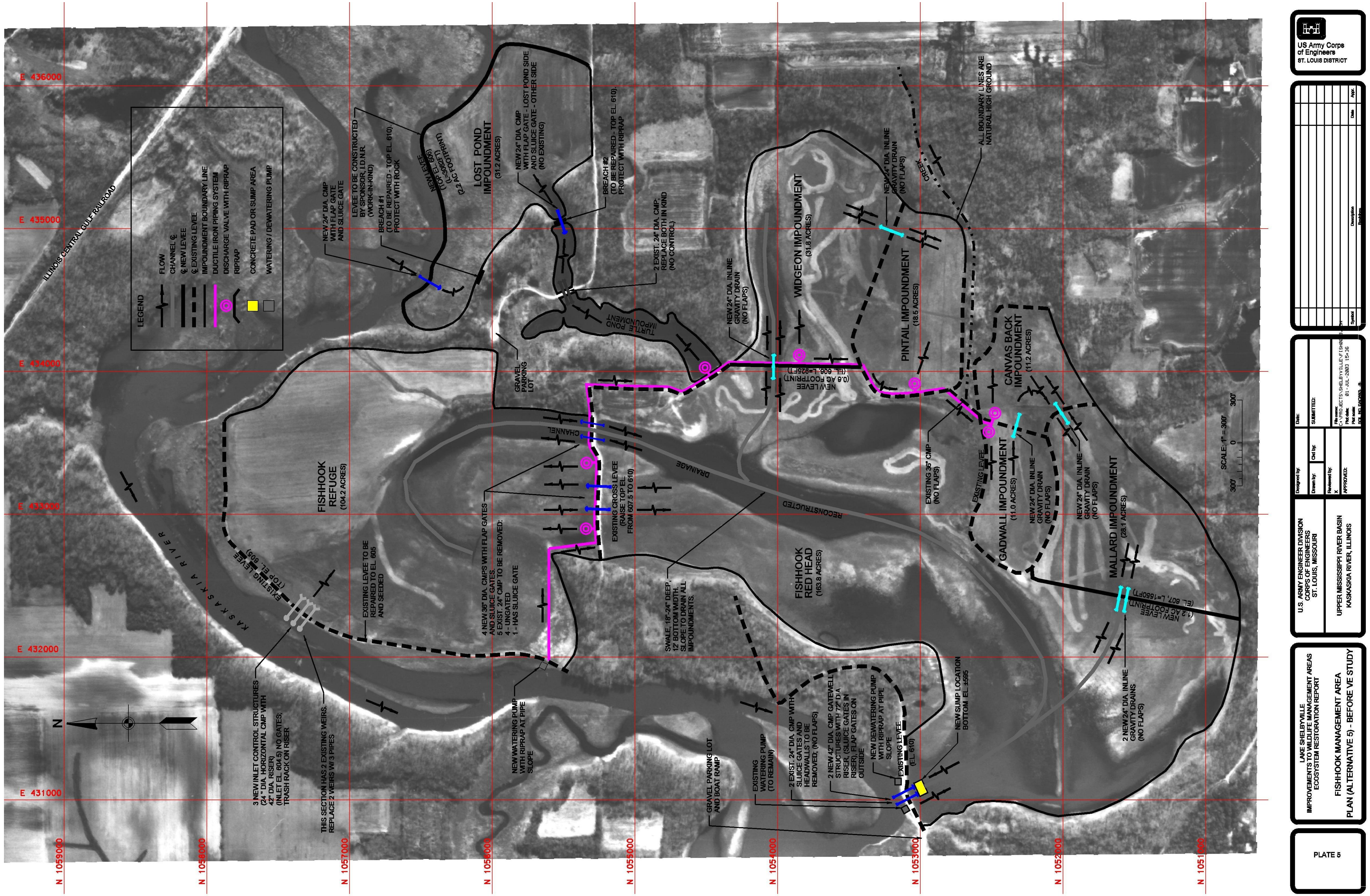
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FISHHOOK MANAGEMENT AREA
PLAN (ALTERNATIVE 5) - BEFORE VE STUDY
U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI
UPPER MISSISSIPPI RIVER BASIN
KASKASKIA RIVER, ILLINOIS
PLATE 5
LEGEND
FLOW
CHANNEL ℄
℄ NEW LEVEE
℄ EXISTING LEVEE
IMPOUNDMENT BOUNDARY LINE
DUCTILE IRON PIPING SYSTEM
DISCHARGE VALVE WITH RIPRAP
RIPRAP
CONCRETE PAD OR SUMP AREA
WATERING / DEWATERING PUMP
ILLINOIS CENTRAL GULF RAILROAD
KASKASKIA RIVER
LOST POND IMPOUNDMENT
(31.2 ACRES)
TURTLE POND IMPOUNDMENT
WIDGEON IMPOUNDMENT
(31.8 ACRES)
PINTAIL IMPOUNDMENT
(18.5 ACRES)
CANVAS BACK IMPOUNDMENT
(11.2 ACRES)
GADWALL IMPOUNDMENT
(11.0 ACRES)
MALLARD IMPOUNDMENT
(28.1 ACRES)
FISHHOOK REFUGE
(104.2 ACRES)
FISHHOOK RED HEAD
(163.8 ACRES)
RECONSTRUCTED DRAINAGE CHANNEL
GRAVEL PARKING LOT
GRAVEL PARKING LOT AND BOAT RAMP
ALL BOUNDARY LINES ARE NATURAL HIGH GROUND
SCALE: 1" = 300'
E 436000
E 435000
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E 431000
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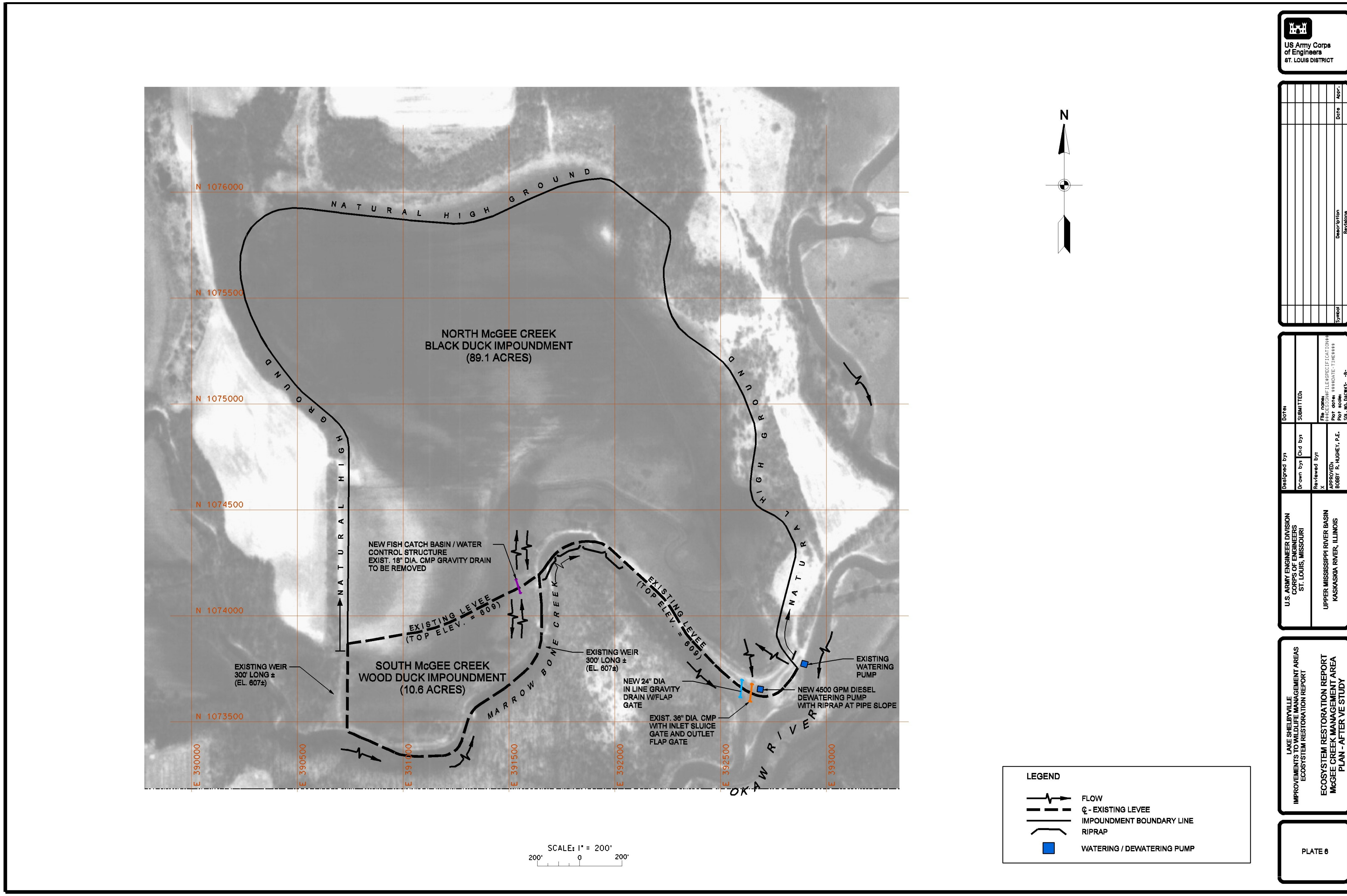
US Army Corps of Engineers
ST. LOUIS DISTRICT
N
NORTH McGEE CREEK
BLACK DUCK IMPOUNDMENT
(89.1 ACRES)
SOUTH McGEE CREEK
WOOD DUCK IMPOUNDMENT
(10.6 ACRES)
NATURAL HIGH GROUND
MARROW BONE CREEK
OKAW RIVER
EXISTING LEVEE (TOP ELEV. = 609)
NEW FISH CATCH BASIN / WATER CONTROL STRUCTURE
EXIST. 18" DIA. CMP GRAVITY DRAIN TO BE REMOVED
EXISTING WEIR 300' LONG ± (EL. 607±)
EXISTING WEIR 300' LONG ± (EL. 607±)
NEW 24" DIA IN LINE GRAVITY DRAIN W/FLAP GATE
EXIST. 36" DIA. CMP WITH INLET SLUICE GATE AND OUTLET FLAP GATE
NEW 4500 GPM DIESEL DEWATERING PUMP WITH RIPRAP AT PIPE SLOPE
EXISTING WATERING PUMP
N 1076000
N 1075500
N 1075000
N 1074500
N 1074000
N 1073500
E 390000
E 390500
E 391000
E 391500
E 392000
E 392500
E 393000
SCALE: 1" = 200'
200' 0 200'
LEGEND
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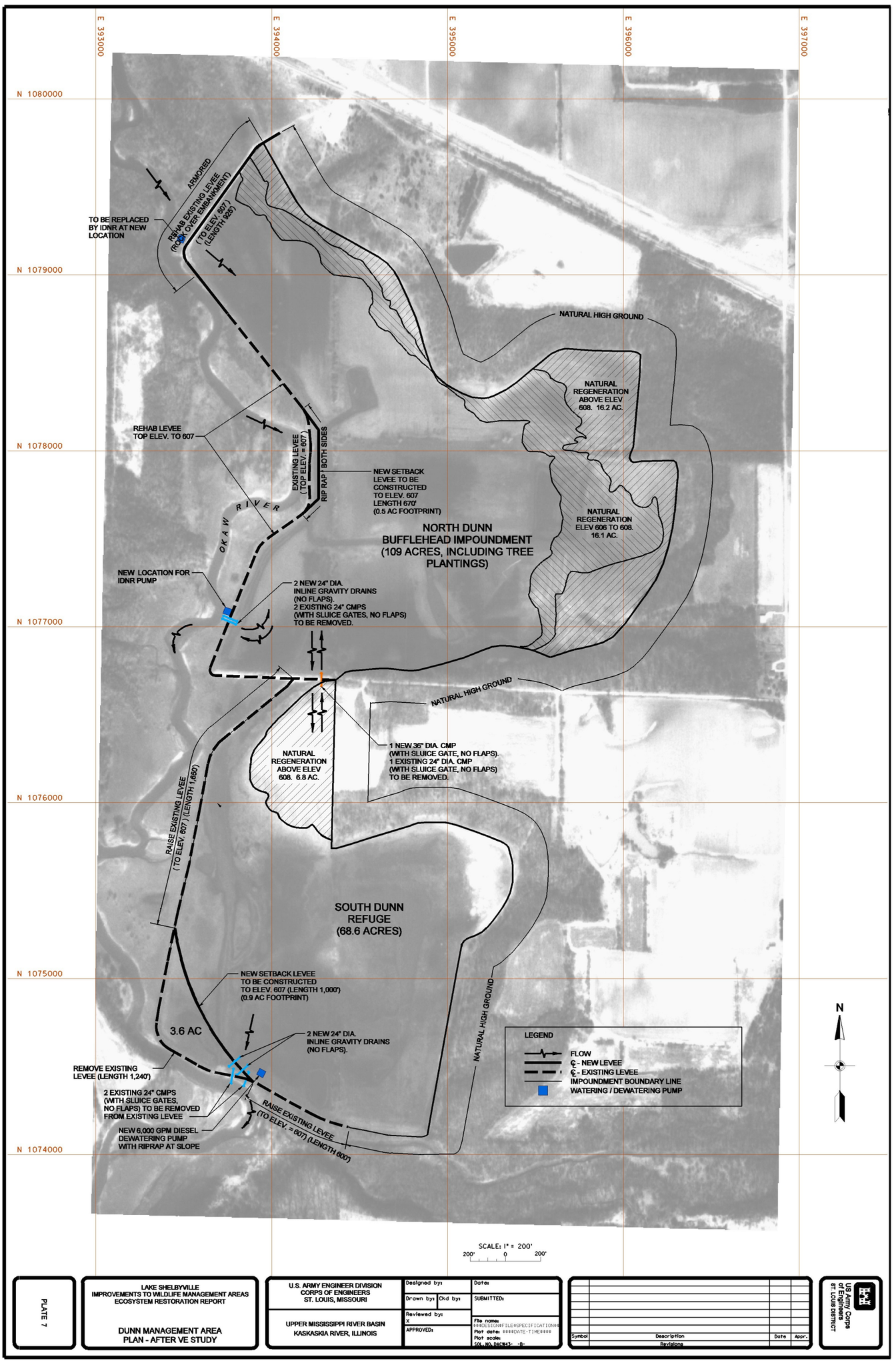
McGEE CREEK MANAGEMENT AREA
PLAN - AFTER VE STUDY
PLATE 6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N 1074000
TO BE REPLACED BY IDNR AT NEW LOCATION
REHAB EXISTING LEVEE (ROCK OVER EMBANKMENT) ARMORED (TO ELEV. 607') (LENGTH 1935')
NATURAL HIGH GROUND
NATURAL REGENERATION ABOVE ELEV 608. 16.2 AC.
REHAB LEVEE TOP ELEV. TO 607
EXISTING LEVEE (TOP ELEV. = 607')
RIP RAP BOTH SIDES
NEW SETBACK LEVEE TO BE CONSTRUCTED TO ELEV. 607 LENGTH 670' (0.5 AC FOOTPRINT)
OKAW RIVER
NORTH DUNN BUFFLEHEAD IMPOUNDMENT (109 ACRES, INCLUDING TREE PLANTINGS)
NATURAL REGENERATION ELEV 606 TO 608. 16.1 AC.
NEW LOCATION FOR IDNR PUMP
2 NEW 24" DIA. INLINE GRAVITY DRAINS (NO FLAPS). 2 EXISTING 24" CMPS (WITH SLUICE GATES, NO FLAPS) TO BE REMOVED.
NATURAL HIGH GROUND
1 NEW 36" DIA. CMP (WITH SLUICE GATE, NO FLAPS). 1 EXISTING 24" DIA. CMP (WITH SLUICE GATE, NO FLAPS) TO BE REMOVED.
NATURAL REGENERATION ABOVE ELEV 608. 6.8 AC.
RAISE EXISTING LEVEE (TO ELEV. 607') (LENGTH 1,880')
SOUTH DUNN REFUGE (68.6 ACRES)
NEW SETBACK LEVEE TO BE CONSTRUCTED TO ELEV. 607 (LENGTH 1,000') (0.9 AC FOOTPRINT)
3.6 AC
2 NEW 24" DIA. INLINE GRAVITY DRAINS (NO FLAPS).
REMOVE EXISTING LEVEE (LENGTH 1,240')
2 EXISTING 24" CMPS (WITH SLUICE GATES, NO FLAPS) TO BE REMOVED FROM EXISTING LEVEE
NEW 6,000 GPM DIESEL DEWATERING PUMP WITH RIPRAP AT SLOPE
RAISE EXISTING LEVEE (TO ELEV. = 607') (LENGTH 600')
NATURAL HIGH GROUND
LEGEND
FLOW
℄ - NEW LEVEE
℄ - EXISTING LEVEE
IMPOUNDMENT BOUNDARY LINE
WATERING / DEWATERING PUMP
N
SCALE: 1" = 200'
200' 0 200'
PLATE 7
LAKE SHELBYVILLE IMPROVEMENTS TO WILDLIFE MANAGEMENT AREAS ECOSYSTEM RESTORATION REPORT
DUNN MANAGEMENT AREA PLAN - AFTER VE STUDY
U.S. ARMY ENGINEER DIVISION CORPS OF ENGINEERS ST. LOUIS, MISSOURI
UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS
Designed by
Dates
Drawn by
Ckd by
SUBMITTED:
Reviewed by
X
APPROVED:
File name:
Plot date:
Plot scale:
SOL. NO. DACW43-
Symbol
Description
Date
Appr.
Revisions
US Army Corps of Engineers ST. LOUIS DISTRICT

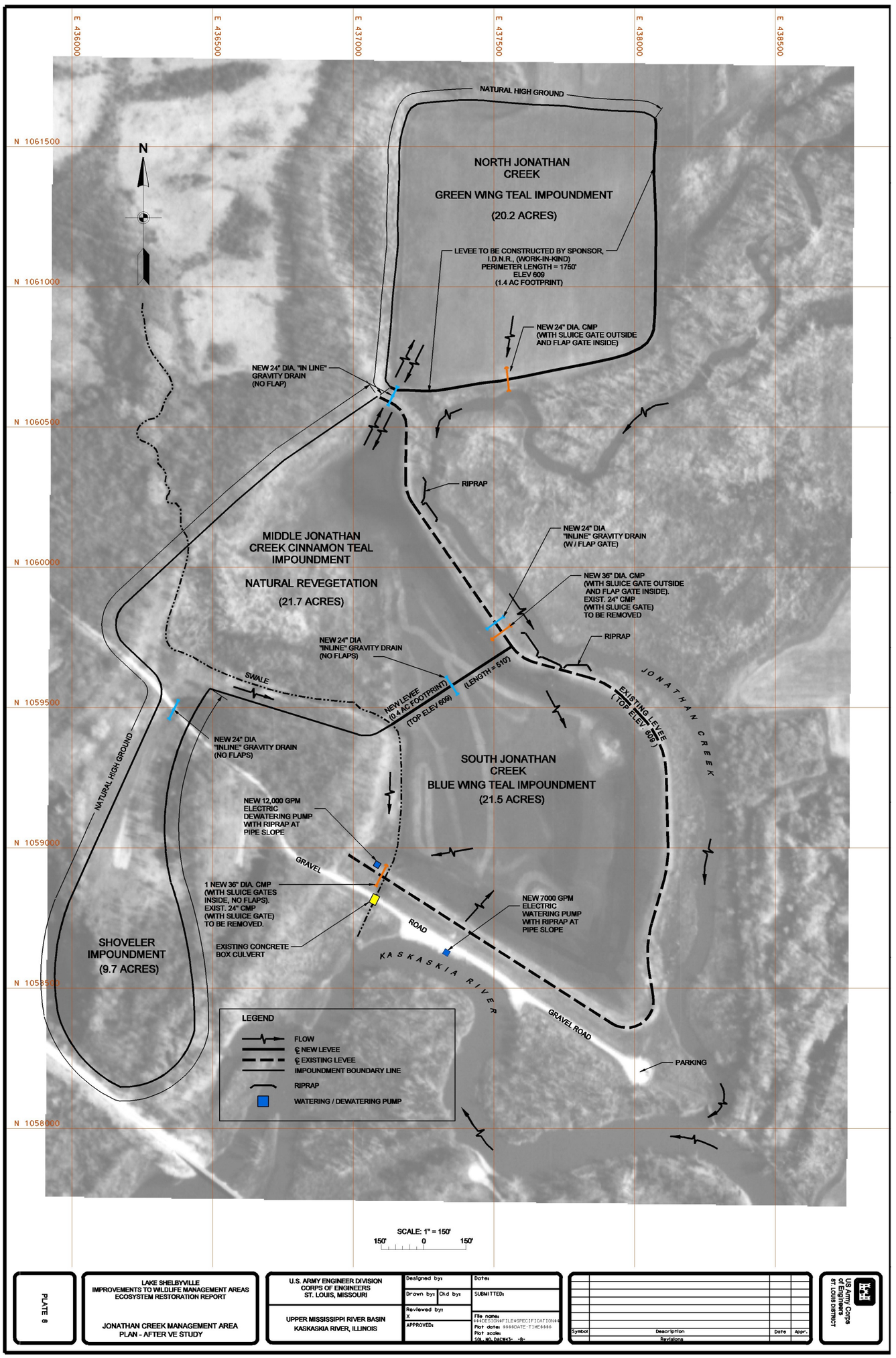

PLATE 8

LAKE SHELBYVILLE
IMPROVEMENTS TO WILDLIFE MANAGEMENT AREAS
ECOSYSTEM RESTORATION REPORT

JONATHAN CREEK MANAGEMENT AREA
PLAN - AFTER VE STUDY

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

UPPER MISSISSIPPI RIVER BASIN
KASKASKIA RIVER, ILLINOIS

Designed by: | Dates:
Drawn by: | Ckd by: | SUBMITTED:
Reviewed by: X
APPROVED:
File name: ##CDSIGNFILE#SPECIFICATION##
Plot date: ##DATE-TIME####
Plot scale:
SOL. NO. DACW43- -B-

Symbol	Description	Date	Appr.
	Revisions		

US Army Corps of Engineers
ST. LOUIS DISTRICT

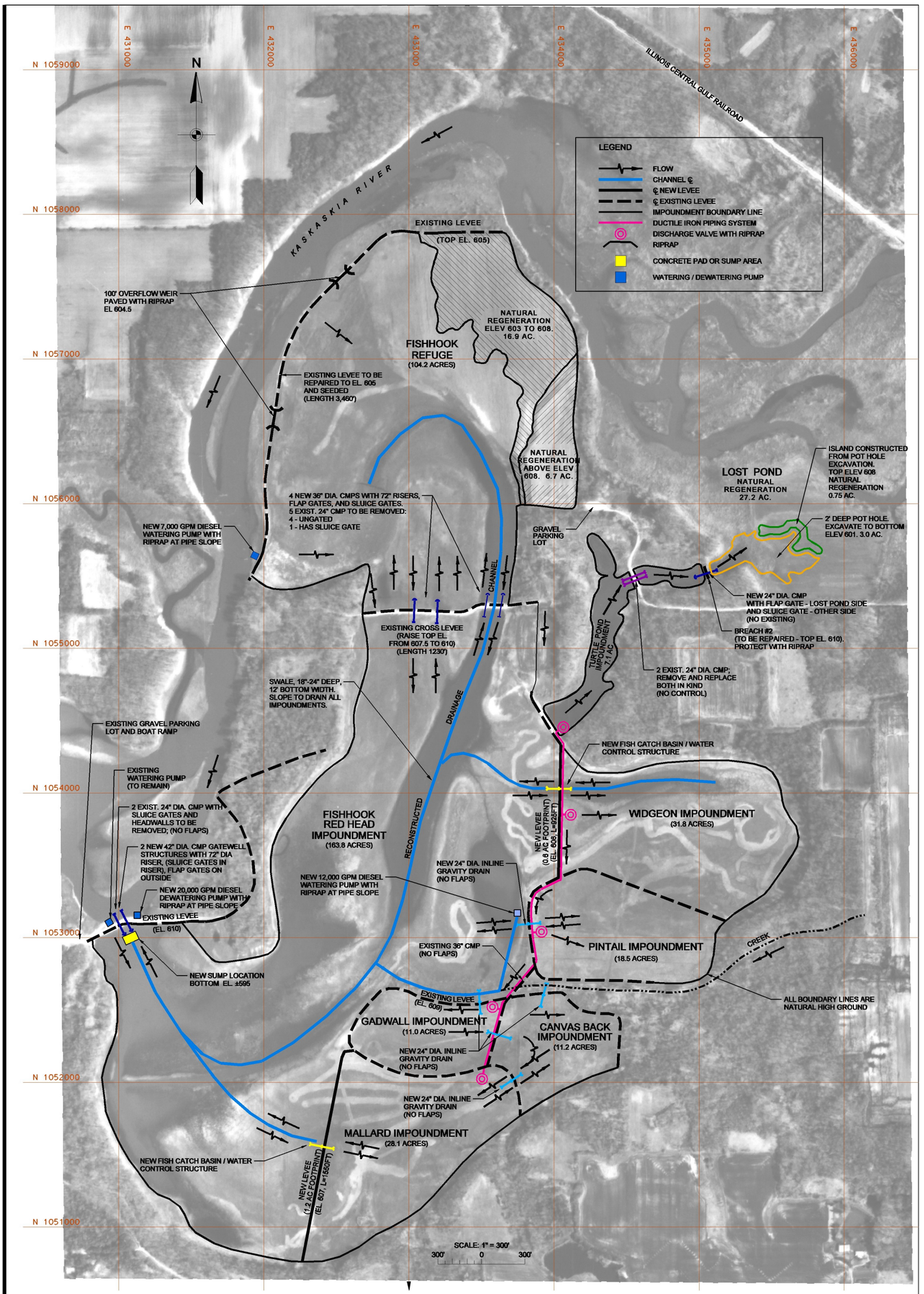

PLATE 9

LAKE SHELBYVILLE
IMPROVEMENTS TO WILDLIFE MANAGEMENT AREAS
ECOSYSTEM RESTORATION REPORT

FISHHOOK MANAGEMENT AREA
PLAN - AFTER VE STUDY

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

UPPER MISSISSIPPI RIVER BASIN
KASKASKIA RIVER, ILLINOIS

Designed by: | Date:
Drawn by: | Ckd by: | SUBMITTED:
Reviewed by:
X
APPROVED:
File name: ##DESIGNFILE#SPECIFICATION##
Plot date: ####DATE-TIME####
Plot scale:
SCL. NO. DACW43--B-

Symbol	Description	Date	Appr.
	Revisions		

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