RECONNAISSANCE REPORT

SECTION 205 FLOOD DAMAGE REDUCTION STUDY

MISSISSIPPI RIVER
HULL, ILLINOIS

AUGUST 1990

US Army Corps
of Engineers
Rock Island District

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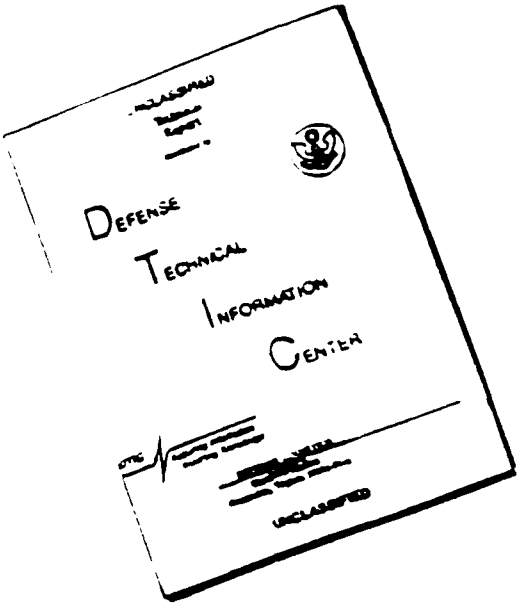

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RECONNAISSANCE REPORT
FOR
SECTION 205 FLOOD DAMAGE REDUCTION STUDY
MISSISSIPPI RIVER, HULL, ILLINOIS

AUGUST 1990

ACKNOWLEDGEMENT

Many members of the Rock Island District assisted in the preparation of this report. Primary study team personnel who are familiar with the technical aspects of the study are listed below:

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SYLLABUS

In a letter dated July 26, 1989, Village President John Lehr requested the Corps of Engineers to investigate possible solutions to reduce damages from Mississippi River flooding in Hull, Illinois. The study request was made in accordance with the continuing authority of Section 205 of the 1948 Flood Control Act, as amended.

Two study areas are involved for this reconnaissance level investigation of Mississippi River flooding. The first area is the village of Hull. The second area is bounded by the upper reach of the Sny Island Levee Drainage District (SILDD) levee from its upstream tie-off near Fall Creek, Illinois, through the Hadley-McCraney Diversion Channel levee. This levee was constructed to provide protection to the 50-year event level. Hull lies within this reach of SILDD.

This reconnaissance report presents the results of analyses of possible solutions to reduce damages from Mississippi River flooding in Hull. Plans considered include ring levee alignments around Hull, raising the upper reach SILDD main stem levee, and nonstructural flood damage reduction measures.

This reconnaissance study concludes that additional flood damage reduction measures for Hull are not economically feasible and that further Federal participation is not warranted.

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FOR
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SECTION 1 - INTRODUCTION

This report presents the results of an investigation of flooding problems affecting Hull, Illinois. Village officials requested this investigation in a letter dated July 26, 1989. A copy of this letter is included in Appendix D - Pertinent Correspondence.

STUDY AUTHORITY

The Corps of Engineers has authority to construct small flood control projects under certain conditions without the specific authorization of Congress. The authority for this report is Section 205 of the 1948 Flood Control Act, as amended, which is presented below:

> The Secretary of the Army is authorized to allot from any appropriations heretofore or hereafter made for flood control, not to exceed $40,000,000 for any one fiscal year, for the construction of small projects for flood control and related purposes not specifically authorized by Congress, which come within the provisions of Section 1 of the Flood Control Act of June 22, 1936, when in the opinion of the Chief of Engineers such work is advisable. The amount allotted for a project shall be sufficient to complete Federal participation in the project. Not more than $5,000,000 shall be allotted under this section for a project at any single locality. The provisions of local cooperation specified in Section 3 of the Flood Control Act of June 22, 1936, as amended, and in P.L. 99-662 (Water Resources Development Act of 1986) shall apply. The work shall be complete in itself and not commit the United States to any additional improvement to ensure its successful operation, except as may result from the normal procedure applying to projects authorized after submission of preliminary examination and survey reports.

STUDY PURPOSE AND SCOPE

The purpose of the reconnaissance phase is to determine whether or not planning should proceed further based on a preliminary appraisal of Federal

interest in flood damage reduction measures for Hull, and if potential solutions are in concert with current policies and budgetary priorities.

This reconnaissance study was initiated in response to a letter request dated July 26, 1989, from Mr. John Lehr, Village President. A subsequent on-site investigation of the study area was performed on August 31, 1989.

Hull is located in northwest Pike County, 15 miles south of Quincy, in western Illinois. Plate 1 displays the location and vicinity maps for the study area. This rural community lies within the 100-year floodplain of the Mississippi River and the Sny Island Levee Drainage District (SILDD).

Hull is an agricultural-based community, with both residential and commercial properties. The population is 529, based on the 1980 census. Hull is accessed via Illinois Highway 36, or the new Illinois Route 336 (Central Illinois Expressway). The Norfolk and Western Railroad passes through the southern portion of the village.

In addition to protection measures within the immediate Hull area, this study also evaluates the potential of an upper reach main stem levee raise of the SILDD. The levee raise expands the study area to include the agricultural basin from the upstream tie-off near Fall Creek, Illinois, through the right descending bank levee of the Hadley-McCraney Diversion Channel.

PRIOR STUDIES, REPORTS, AND EXISTING WATER PROJECTS

Mississippi River, Coon Rapids Dam to the Ohio River, Final Report, dated July 1986. This Corps of Engineers report presents the results of investigations into the feasibility of providing flood damage reduction measures and adding hydroelectric generating capabilities to the Mississippi River from Coon Rapids Dam, in Minnesota, to the Ohio River near Cairo, Illinois. A main stem levee raise of the SILDD was included in this study. A maximum benefit-to-cost ratio of 0.17 precluded further Federal participation at SILDD at that time.

Sny Island Levee Drainage District Project. The SILDD parallels the Mississippi River in Adams, Pike, and Calhoun Counties, Illinois. The Corps of Engineers improved this flood control system in the 1960's. This system was constructed to the 50-year level plus 2 feet of freeboard. The SILDD protects more than 110,000 acres of agricultural land and a number of rural communities. In addition to approximately 55 miles of main stem levee, the system contains three direct diversion channels, three pumping stations, and retarding/desilting reservoirs. Various Corps of Engineers reports address the planning and engineering of this project.

Flood Insurance Study, Village of Hull, Illinois. This Federal Emergency Management Agency (FEMA) report is dated September 18, 1986. The study purpose was to investigate the existence and severity of flood hazards in

Hull, and to aid in the administration of the Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. A flood insurance rate map (FIRM) was a product of the study. The FIRM is designed for flood insurance and floodplain management applications and depicts flood hazard areas within a community. Flood insurance studies also are available for Adams and Pike Counties, which includes the study area within SILDD.

SECTION 2 - PLAN FORMULATION

GENERAL

The plan formulation procedure is a process designed to identify and evaluate possible solutions to existing and projected problems and needs. Its goal is to select the most economically feasible solution. For a reconnaissance study, the procedure is to determine if there is a solution that is economically justified and engineeringly and environmentally sound that warrants further consideration. The Water Resources Development Act of 1986 (Public Law 99-662) requires that the Corps of Engineers identify a local cost-sharing and study partner for feasibility phase work. The feasibility study must be cost-shared 50 percent Federal and 50 percent local sponsor as established in a Feasibility Study Cost-Sharing Agreement.

ASSESSMENT OF WATER AND LAND RESOURCE PROBLEMS AND OPPORTUNITIES

EXISTING CONDITIONS

General Description

The Mississippi River floodplain extends about 5.5 miles to the east of its left descending bank at river mile (RM) 303.0. The village of Hull is located 4.0 miles from the Mississippi River.

Hull is presently protected by the SILDD main stem levee which was built to the 50-year event level plus 2 feet of freeboard. The flood of record occurred in April 1973, reaching an elevation of 474.2 feet National Geodetic Vertical Datum (NGVD) at RM 303.0. This flood approximated a 200-year event level. Intense flood-fighting efforts by the local community prevented overtopping of the main stem levee.

Hydrologic and Hydraulic Conditions

The Mississippi River drainage area at Hull is 135,000 square miles. Early spring poses the major flood threat as a result of long periods of rain combining with snowmelt runoff. Most precipitation occurs from April through July with average monthly precipitation at 4.28 inches. The April 1973 flood of record resulted in a flow of 386,600 cubic feet per second (cfs) at Quincy, Illinois. Plate 2 displays the Mississippi River 100-year floodplain boundary within the Hull community. Further discussion on hydrology and hydraulics is addressed in Appendix A - Hydrology and Hydraulics.

Economic Conditions

The village of Hull has a population of 529, as listed under the 1980 census. Hull is a rural-based community, with 90 percent of its village limits lying within the 100-year floodplain of the Mississippi River. Development in the community has been limited primarily to minor residential activity. The community hopes that the new Central Illinois Expressway will spur growth. The estimated average annual damages attributable to flooding in the Hull community is $92,800.

The SILDD main stem levee runs from Mississippi River Mile (RM) 315.6 downstream to the Hadley-McCraney Diversion Channel at RM 296.8. Agricultural lands and businesses, transportation facilities, and the communities of Hull, East Hannibal, Shepherd, and Fall Creek are in the upper reach of the SILDD. The total estimated average annual damages attributable to Mississippi River flooding in the SILDD upper reach is $214,800. Further discussion of the economic conditions is addressed in Appendix B - Economic Analysis.

Environmental Conditions

The area surrounding Hull is primarily agricultural land. Due to the expansive farming, wildlife cover and habitat is virtually nonexistent around Hull. Wildlife would be that adapted to the agricultural and urban environment.

The landward areas adjacent to the SILDD levee are primarily productive agricultural land and gravel roads. Scattered wooded areas and wetlands are present along the levee. The majority of the adjacent areas provide limited habitat because of lack of cover and human disturbance. Those areas of floodplain forest and aquatic habitat provide cover, nesting, and feeding habitat for a large number of wildlife. A complete discussion of environmental information is presented in Appendix C - Environmental and Cultural Analysis. A planning aid letter dated March 6, 1990, was

furnished by the U.S. Fish and Wildlife Service (USFWS), a copy of which is in Appendix D - Pertinent Correspondence.

The Illinois Historic Preservation Agency was queried regarding cultural site locations within the study area. No site locations were recorded for the Hull area; however, numerous sites are recorded along the SILDD main stem levee. Details are discussed in appendix C.

EXPECTED FUTURE CONDITIONS

If no action is taken, flooding of the Hull community will occur as a result of flood events exceeding the protection capabilities of the SILDD main stem levee. The village of Hull has participated in the National Flood Insurance Program since June 11, 1976. Since that time, new construction has primarily involved residential properties located in the northeast corner of the community.

If a flood damage reduction plan is developed and implemented in Hull, the social and financial hardships associated with the existing flood situation will be alleviated to the degree of flood protection provided by the project.

SPECIFIC PROBLEMS AND OPPORTUNITIES

The Hull community has expressed concern over Mississippi River flooding of their village properties. In response to their request, the Rock Island District will determine if there are feasible solutions to the Hull flooding situation.

PLANNING OBJECTIVES AND CONSTRAINTS

NATIONAL OBJECTIVE

The national objective of water and related land resources planning is to contribute to economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Contributions to the National Economic Development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits and costs that accrue in the planning area and the rest of the nation, and include increases in the net value of those goods and services that are marketed, and also of those that may not be marketed.

The plan formulation process to accomplish flood damage reduction is formulated and directed by the national planning objective:

> National Economic Development (NED). To enhance the national economic development by increasing the value of the Nation's output of goods and services and by improving the national economic efficiency.

SPECIFIC OBJECTIVE WITHIN THE STUDY AREA

The specific planning objective for this study is as follows:

> To reduce economic losses and social hardships associated with flooding of the developed area within the Mississippi River floodplain in Hull, Illinois.

PLANNING CONSTRAINTS

The planning process provides the basis for selecting one of the developed plans and, if appropriate, recommending Federal participation to implement the plan. The selected plan is the one that is in the best public interest regardless of whether or not it is within the existing authority of the Corps of Engineers to implement.

The planning constraints which have been developed for this study are as follows:

> This study is constrained by applicable laws of the United States and by the State of Illinois, all Executive Orders of the President, the Water Resources Council's Principles and Guidelines, and all engineering regulations of the Corps of Engineers.

DEVELOPMENT OF ALTERNATIVE MEASURES

AVAILABLE MEASURES

Improvements eligible for Federal participation are of two kinds: those intended to modify flood behavior (structural measures) and those intended to modify the ways in which people would otherwise occupy and use floodplain lands and waters (nonstructural measures).

Structural measures include dams and reservoirs, levees and floodwalls, and channel alterations and diversions. Nonstructural measures include

floodproofing, evacuation and/or relocation of structures, and flood forecasting and warning systems.

FORMULATION PROCEDURE

The objective of the formulation portion of this study is to fulfill the flood damage reduction needs of the village of Hull through the logical selection of a plan of action.

In developing a plan to reduce flood damage, standards and procedures have been followed which have been set forth in various flood control acts, policies, and related regulations established by the Corps of Engineers through experience in the flood protection field.

DESCRIPTION OF PLANS

Using the available measures, study team members conceptualized alternative plans. A preliminary screening methodology using the formulation criteria was applied to the plans to reduce the number of plans carried forward for more detailed analysis. All plans which were considered are explained below.

NONSTRUCTURAL ALTERNATIVE PLANS

Floodproofing, Evacuation, and Relocation

Floodproofing is a combination of structural changes and adjustments to properties subject to flooding which is used primarily to reduce or eliminate flood damage. This measure involves raising existing structures, properly elevating future structures, or providing panels that can be placed over building doors and windows to effectively keep out floodwaters.

Evacuation of homes and businesses is usually considered where floodwaters exceed a depth of 3 feet. This measure involves acquiring the homes or businesses and relocating the occupants and their possessions to homes or buildings located outside of the floodplain that are of similar worth and in decent, safe, and sanitary condition.

Relocation of homes and businesses involves physically lifting the structure off its present foundation, moving it, and then lowering it onto a suitable foundation outside of the floodplain. Relocation is considered where it is structurally feasible and economically justified.

A flood event overtopping the SILDD levee could result in 5- to 8-foot inundation levels throughout much of Hull. The only effective floodproofing measure for depths of this magnitude would be elevating the structures. In consideration of the infrequent flooding and the need to raise nearly every structure in Hull to achieve a community solution, the existing average annual damages of $92,800 do not warrant such extensive structural modification.

Evacuation and relocation also are not justified in consideration of average annual damages. As noted, the flood-prone structures lie in areas which are subject to flooding only during the most severe flood events. Evacuation and relocation are considered to be potentially viable when the structures lie in areas subject to frequent flooding.

Based on the above discussion, a nonstructural plan involving floodproofing, evacuation, and or relocation was not considered further.

Flood Forecasting and Flood-Warning Systems

Flood forecasting is provided on a regional basis by the National Oceanic and Atmospheric Administration (NOAA). NOAA issues frequent warnings of potential flood-producing storms. Often, the flood warnings are preceded by notification of "severe weather or a flood watch." The flood warnings and statements on flood conditions are transmitted to city officials, as well as to area newspapers and radio and television stations. The available services include flash flood warnings and major flood forecasts based on radar coverage of the area, numerous rainfall reporting stations, river gages, anticipated weather conditions, and hydrologic factors.

A flood-warning system is a water level sensing device or devices which are connected to an alarm. As water levels rise and reach a potentially threatening level, the alarm is activated. This would alert city officials of the imminent flood and prompt them to warn floodplain residents via the civil defense siren or some other public address system. These systems increase area residents' safety by providing evacuation time.

Mississippi River gages located at Locks and Dams Nos. 21 and 22 and Hannibal provide stage data and response time for the Hull area and for the upper reach of the SILDD. Table 1 displays gage data for these locations.

Flood-fighting efforts are associated with community action within the SILDD. Flood forecasting and warning procedures are well established along this reach of the Upper Mississippi River and, therefore, additional plans were not considered further.

TABLE 1

Gage Data

Gage Location	Mississippi River Mile	Gage Zero (MSL)	NWS Flood Stage	Major Flood Stage
Lock & Dam 21 (TW*)	324.8	457.80	17.0	25.7
Hannibal	309.9	449.43	16.0	23.0
Lock & Dam 22 (TW)	301.1	446.10	16.0	24.2

* Tailwater

STRUCTURAL ALTERNATIVE PLANS

Two primary structural alternatives are evident for the Hull situation: a ring levee around the existing Hull community; and raising the upper reach main stem levee of the SILDD.

Ring Levee

Two ring levee alignments were evaluated for Hull. Alternative A encompasses most of the community lying north of the Norfolk and Western Railroad tracks. Alternative B provides protection on both sides of the railroad tracks. The level of protection is for the 100-year event plus 3 feet of freeboard. Freeboard is a factor of safety intended to compensate for unknown factors which could increase design heights, such as debris and ice jams, other floodway obstructions, or future changes in the watershed.

Plate 3 depicts the general alignment for Alternative A. This alignment provides protection to businesses paralleling both sides of Highway 36, the town square and railroad business district, and the core residential community lying between the railroad tracks and Highway 36. Project features include: 11,200 lineal feet of impervious levee section, 6.0 to 15.0 feet high, with a 10-foot-wide crown, and 3 horizontal to 1 vertical side slopes; 2,070 lineal feet of concrete floodwall paralleling the north side of the railroad tracks; an east and west swing gate closure structure on Highway 36; a western ponding area with temporary pumping facilities and a gravity outlet with gatewell; an eastern gravity outlet with gatewell and temporary pumping facilities; miscellaneous utility modifications or relocations; county road modifications; and airstrip modifications. Total implementation cost for Alternative A is estimated at $3,928,485. Table 2, pages 10 through 12, displays a detailed cost estimate.

TABLE 2

Cost Summary
Hull, Illinois
Ring Levee - Alignment A 100-Year With Floodwall

Code of Accounts	Description	Qty	Unit	Unit Cost ($)	Total Cost ($)
11.0.1.-	Embankment:				
11.0.1.B	Stripping	15,026.0	CY	1.50	22,539
11.0.1.B	Explrtn. Trench Excvtn.	34,564.0	CY	2.20	76,041
11.0.1.B	Compacted Imperv. Embnk.	189,218.0	CY	3.70	700,107
11.0.1.B	Fertilize, Seed, Mulch	28.7	Acre	1,830.00	52,521
				SUM	851,207
11.0.2.-	Reinforced Concrete Floodwall:				
	Stripping and Seeding Included in Embnkmnt.				0
11.0.2.C	Concrete I-Wall	2,070.0	LF	505.00	1,045,350
				SUM	1,045,350
11.0.2.-	Closure Structures:				
11.0.2.-	Highway 36 - East	1.0	LS	124,500.00	124,500
11.0.2.-	Highway 36 - West	1.0	LS	218,000.00	218,000
				SUM	342,500
08.2.-.-	Other Road Raises:				
	North county Road:				
08.2.2.B	Stripping	844.0	CY	1.50	1,266
08.2.2.B	Remove Exst. Aggr. Surf.	298.0	CY	1.50	447
08.2.2.B	Compacted Imperv. Embk.	7,221.0	CY	3.70	26,718
08.2.3.B	Aggr. Surf. w/Shoulders	298.0	CY	30.60	9,119
08.2.2.B	Fertilize, Seed, Mulch	0.6	Acre	1,830.00	1,098
	South County Road:				
08.2.2.B	Stripping	520.0	CY	1.50	780
08.2.2.B	Remove Exst. Aggr. Surf.	227.0	CY	1.50	341
08.2.2.B	Compacted Imperv. Embk.	2,361.0	CY	3.70	8,736
08.2.3.B	Aggr. Surf. w/Shoulders	227.0	CY	30.60	6,946
08.2.2.B	Fertilize, Seed, Mulch	0.3	Acre	1,830.00	549
	West County Road:				
08.2.2.B	Stripping	794.0	CY	1.50	1,191
08.2.2.B	Remove Exst. Aggr. Surf.	289.0	CY	1.50	434
08.2.2.B	Compacted Imperv. Embk.	6,495.0	CY	3.70	24,032
08.2.3.B	Aggr. Surf. w/Shoulders	298.0	CY	30.60	8,843
08.2.2.B	Fertilize, Seed, Mulch	0.6	Acre	1,830.00	1,098
	Private Access Road:				
08.2.2.B	Stripping	40.0	CY	1.50	60
08.2.2.B	Remove Exst. Aggr. Surf.	26.0	CY	1.50	39
08.2.2.B	Compacted Imperv. Embk.	231.0	CY	3.70	855

TABLE 2 (Cont'd)

Code of Accounts	Description	Qty	Unit	Unit Cost ($)	Total Cost ($)
08.2.3.B	Aggr. Surf. w/Shoulders	26.0	CY	30.60	796
08.2.2.B	Fertilize, Seed, Mulch	0.0	Acre		0
				SUM	93,346
11.0.G.-	Interior Drainage:				
	West Ponding Area:				
11.0.G.B	Excavation	182,813.0	CY	Part of Levee Embk.	
11.0.G.B	Fertilize, Seed, Mulch	29.0	Acre	1,830.00	53,070
11.0.G.B	Gatewell - 48" RCP	1.0	LS	61,800.00	61,800
11.0.G.E	Gatewell - East Hwy. 36 (58")	1.0	LS	77,700.00	77,700
				SUM	192,570
19.-.-.-	Landing Strip Modification:				
19.0.3.B	Compacted Imperv. Embk.	4,969.0	CY	3.70	18,385
19.0.3.B	Fertilize, Seed, Mulch	1.6	Acre	1,830.00	2,928
				SUM	21,313
	Water Suppply Protection:				
11.0.1.B	Stripping	853.0	CY	1.50	1,280
11.0.1.B	Explrtn. Trench Excvtn.	3,467.0	CY	2.20	7,627
11.0.1.B	Compacted Imperv. Embk.	6,533.0	CY	3.70	24,172
19.0.3.Q	Water Line Valves (Install)	1.0	EA	1,340.00	1,340
11.0.1.B	Fertilize, Seed, Mulch	1.1	Acre	1,830.00	2,013
				SUM	36,432
	Utility Modifications:				
	Watermains:				
19.0.3.Q	Station 40+70, 6" Dia.	100.0	LF	18.95	1,895
19.0.3.Q	Station 66+30, 4" Dia.	100.0	LF	16.00	1,600
19.0.3.Q	Station 80+50, 8" Dia.	50.0	LF	22.50	1,125
	Sanitary Sewers:				
19.0.3.Q	Station 66+30, Valve	1.0	LS	3,020.00	3,020
19.0.3.Q	Station 80+30, Valve	1.0	LS	3,020.00	3,020
19.0.3.Q	Forcemain Gatewell	1.0	LS	14,500.00	14,500
	Miscellaneous:				
11.0.A.-	Mob/Demob	1.0	LS	20,000.00	20,000
				SUM	45,160

TABLE 2 (Cont'd)

Code of Accounts	Description	Qty	Unit	Unit Cost ($)	Total Cost ($)
01.-.-.-	Lands and Damages:				
	Levee	27.7	Acre	1,500.00	41,550
	West Ponding Area	29.0	Acre	1,500.00	43,500
	Road Raises:				
	North County Road	1.0	Acre	1,500.00	1,500
	South County Road	0.6	Acre	1,500.00	900
	West County Road	1.0	Acre	1,500.00	1,500
	Private Access Road	0.1	Acre	1,500.00	150
	Landing Strip	1.6	Acre	1,500.00	2,400
	Water Supply Protection	1.1	Acre	1,500.00	1,650
				SUM	93,150

Sum	2,721,028
Contingencies (25 percent)	680,257
Sum	3,401,285
Engineering & Design (8 percent)	272,103
Supervision & Administration (7.5 percent)	255,096
Total Cost	$3,928,485

Plate 3 depicts the general alignment of Alternative B. This alternative offers the same protection as Alternative A, plus protection to the residential, business, and public works facilities located south of the Norfolk and Western Railroad tracks. The public works facilities include the village water wells, water tower, and sewage treatment lagoons. Alternative B includes the same project features as Alterative A, excluding concrete floodwall sections. In addition, Alterative B features include: 16,300 lineal feet of impervious levee; an east and west railroad closure structure; and a south ponding area with temporary pumping facilities and gravity outlet with gatewell. Total implementation cost for Alternative B is estimated at $3,461,175. Table 3, pages 14 through 16, displays a detailed cost estimate.

Main Stem Levee Raise

The existing levee was built for a 50-year protection level plus 2 feet of freeboard. This alternative involves raising the upper reach SILDD main stem levee approximately 2 to 3 feet, depending on location. for a 200-year protection level plus 3 feet of freeboard. An approximate levee raise of 1.5 feet would be required for a 100-year level of protection plus 3 feet of freeboard. The levee raise would follow the same alignment of the existing levee. Plate 4 displays the main stem levee alignment.

The existing main stem levee is sand with an impervious core (old levee). The existing upstream tie-off and Hadley-McCraney Diversion Channel levee are constructed of impervious material. Levee materials and general details for the levee raise would match those of the existing system. In general, impervious levee sections would have a 10-foot-wide crown and 3 horizontal to 1 vertical side slopes. Previous levee sections would have a 10-foot-wide crown, 4 horizontal to 1 vertical riverside slope, and a 5 horizontal to 1 vertical landside slope. The levee raise would extend landward of the existing levee, except along the railroad tracks downstream of the Highway 36 bridge over the Mississippi River.

Additional work items include various county and private road relocations. Potential modifications to Pumping Station No. 1 and the Sny Aqueduct were not addressed in this study.

Implementation costs for the 200-year main stem raise are estimated at $15,620,950. Table 4, pages 17 and 18, displays a detailed cost estimate. Implementation costs for the 100-year raise are estimated at $9,147,859.

TABLE 3

Cost Summary
Hull, Illinois
Ring Levee - Alignment B 100-Year

Code of Accounts	Description	Qty	Unit	Unit Cost ($)	Total Cost ($)
11.0.1.-	Embankment:				
11.0.1.B	Stripping	22,711.0	CY	1.50	34,067
11.0.1.B	Explrtn. Trench Excvtn.	50,027.0	CY	2.20	110,059
11.0.1.B	Compacted Imperv. Embnk.	295,107.0	CY	3.70	1,091,896
11.0.1.B	Fertilize, Seed, Mulch	36.9	Acre	1,830.00	67,527
				SUM	1,303,549
11.0.2.-	Closure Structures:				
11.0.2.-	Highway 36 - East	1.0	LS	124,500.00	124,500
11.0.2.-	Highway 36 - West	1.0	LS	218,000.00	218,000
11.0.2.-	Railroad - East	1.0	LS	48,800.00	48,800
11.0.2.-	Railroad - West	1.0	LS	48,800.00	48,800
				SUM	440,100
08.2.-.-	Other Road Raises:				
	North County Road:				
08.2.2.B	Stripping	844.0	CY	1.50	1,266
08.2.2.B	Remove Exst. Aggr. Surf.	298.0	CY	1.50	447
08.2.2.B	Compacted Imperv. Embk.	7,221.0	CY	3.70	26,718
08.2.3.B	Aggr. Surf. w/Shoulders	298.0	CY	30.60	9,119
08.2.2.B	Fertilize, Seed, Mulch	0.6	Acre	1,830.00	1,098
	South County Road:				
08.2.2.B	Stripping	844.0	CY	1.50	1,266
08.2.2.B	Remove Exst. Aggr. Surf.	298.0	CY	1.50	447
08.2.2.B	Compacted Imperv. Embk.	7,221.0	CY	3.70	26,718
08.2.3.B	Aggr. Surf. w/Shoulders	298.0	CY	30.60	9,119
08.2.2.B	Fertilize, Seed, Mulch	0.6	Acre	1,830.00	1,098
	West County Road:				
08.2.2.B	Stripping	794.0	CY	1.50	1,191
08.2.2.B	Remove Exst. Aggr. Surf.	289.0	CY	1.50	434
08.2.2.B	Compacted Imperv. Embk.	6,495.0	CY	3.70	24,032
08.2.3.B	Aggr. Surf. w/Shoulders	289.0	CY	30.60	8,843
08.2.2.B	Fertilize, Seed, Mulch	0.6	Acre	1,830.00	1,098
	Private Access Road:				
08.2.2.B	Stripping	40.0	CY	1.50	60
08.2.2.B	Remove Exst. Aggr. Surf.	26.0	CY	1.50	39
08.2.2.B	Compacted Imperv. Embk.	231.0	CY	3.70	855
08.2.3.B	Aggr. Surf. w/Shoulders	26.0	CY	30.60	796
08.2.2.B	Fertilize, Seed, Mulch	0.0	Acre	1,830.00	0
				SUM	114,642

TABLE 3 (Cont'd)

Code of Accounts	Description	Qty	Unit	Unit Cost ($)	Total Cost ($)
11.0.G.-	Interior Drainage:				
	West Ponding Area:				
11.0.G.B	Excavation	192,217.0	CY	Part of Levee Embk.	
11.0.G.B	Fertilize, Seed, Mulch	30.0	Acre	1,830.00	54,900
11.0.G.E	Gatewell	1.0	LS	61,800.00	61,800
	South Ponding Area:				
11.0.G.B	Excavation	70,016.0	CY	Part of Levee Embk.	
11.0.G.B	Fertilize, Seed, Mulch	11.0	Acre	1,830.00	20,130
11.0.G.E	Gatewell	1.0	LS	37,200.00	37,200
	Gatewell - East Hwy. 36 (54")	1.0	LS	77,700.00	77,700
				SUM	251,730
11.0.G.-	Drainage Ditch Modification:				
11.0.G.B	Excavation	12,800.0	CY	3.30	42,240
	Railroad Culvert:				
11.0.G.B	Excavation	0.0	CY	Part of Channel Exc.	
11.0.G.B	Jack RCP - 36" Dia.	50.0	LF	520.00	26,000
11.0.G.C	RC Inlet Wing Wall	14.0	CY	410.00	5,740
11.0.G.C	RC Outlet Wing Wall	14.0	CY	410.00	5,740
11.0.G.B	Fertilize, Seed, Mulch	4.4	Acre	1,830.00	8,052
				SUM	87,772
19.-.-.-	Landing Strip Modification:				
19.0.3.B	Compacted Imperv. Embk.	4,969.0	CY	3.70	18,385
19.0.3.B	Fertilize, Seed, Mulch	1.6	Acre	1,830.00	2,928
				SUM	21,313
	Utility Modifications:				
	Watermains:				
19.0.3.Q	Highway 36 - East (6")	100.0	LF	18.95	1,895
	Miscellaneous:				
19.0.3.Q	Gatewell - Treatment Plant	1.0	LS	28,100.00	28,100
11.0.G.E	Mob/Demob	1.0	LS	20,000.00	20,000
				SUM	49,995
01.-.-.-	Lands and Damages:				
	Levee	35.5	Acre	1,500.00	53,250
	West Ponding Area	30.0	Acre	1,500.00	45,000
	South Ponding Area	11.0	Acre	1,500.00	16,500
	Drainage Ditch Modification	4.3	Acre	1,500.00	6,450

TABLE 3 (Cont'd)

Code of Accounts	Description	Qty	Unit	Unit Cost ($)	Total Cost ($)
	Road Raises:				
	North County Road	1.0	Acre	1,500.00	1,500
	South County Road	1.0	Acre	1,500.00	1,500
	West County Road	1.0	Acre	1,500.00	1,500
	Private Access Road	0.1	Acre	1,500.00	150
	Landing Strip	1.6	Acre	1,500.00	2,400
	Water Supply Protection	1.1	Acre	1,500.00	1,650
	SUM	85.5			128,250
	Sum				2,397,351
	Contingencies (25 percent)				599,338
	Sum				2,996,689
	Engineering & Design (8 percent)				239,735
	Supervision & Administration (7.5 percent)				224,752
	Total Cost				$3,461,175

TABLE 4

Cost Summary
Hull, Illinois
Sny Main Stem Levee Raise - 200-Year

Code of Accounts	Description	Qty	Unit	Unit Cost ($)	Total Cost ($)
11.0.1.-	Main stem Embankment:				
11.0.1.B	Stripping	172,925.0	CY	2.05	354,496
11.0.1.B	Dredged Sand Embnk., In-Place	1,372,909.0	CY	3.70	5,079,763
11.0.1.B	Compacted Imperv. Embnk.	19,063.0	CY	4.50	85,784
11.0.1.B	Fertilize, Seed, Mulch	6.3	Acre	1,920.00	12,096
				SUM	5,532,139
11.0.1.-	Hadley-McCraney Embankment:				
11.0.1.B	Stripping	70,033.0	CY	2.05	143,568
11.0.1.B	Compacted Imperv. Embnk.	563,621.0	CY	4.50	2,536,295
11.0.1.B	Fertilize, Seed, Mulch	108.2	Acre	1,920.00	207,744
				SUM	2,887,606
11.0.1.-	Seepage Berms:				
11.0.1.B	Stripping	37,861.0	CY	2.05	77,615
11.0.1.B	Dredged Sand, In-Place	404,611.0	CY	3.70	1,497,061
11.0.1.B	Compacted Impervious	11,855.0	CY	4.50	53,348
11.0.1.B	Fertilize, Seed, Mulch	1.3	Acre	1,920.00	2,496
				SUM	1,630,519
02.-.-.-	Road Relocations:				
	12-Foot-Wide Road (13,710 LF):				
02.1.2.B	Stripping	3,047.0	CY	2.05	6,246
02.1.2.B	Aggregate Surface	4,062.0	CY	32.00	129,984
	20-Foot-Wide Road (25,800 LF):				
02.1.2.B	Stripping	9,556.0	CY	2.05	19,590
02.1.2.B	Aggregate Surface	12,741.0	CY	32.00	407,712
				SUM	557,286
11.0.C.-	Ramp Modifications: (18 Ramps)				
11.0.C.B	Remove Existing Aggr. Srfc.	680.0	CY	2.05	1,394
11.0.C.B	Dredged Sand, In-Place	13,383.0	CY	3.70	49,517
11.0.C.B	Aggregate Surface	1,368.0	CY	32.00	43,776
				SUM	94,687

TABLE 4 (Cont'd)

Code of Accounts	Description	Qty	Unit	Unit Cost ($)	Total Cost ($)
	Miscellaneous:				
11.0.C.-	L/D #22 Parking Area Mod.:				
11.0.C.B	Stripping	113.0	CY	2.05	232
11.0.C.B	Aggregate Volume	151.0	CY	32.00	4,832
				SUM	5,064
01.-.-.-	Land and Damages:				
	Main Stem Levee	53.9	Acre	1,500.00	80,850
	Hadley-McCraney Levee	18.8	Acre	1,500.00	28,200
	Levee Borrow Sites	74.0	Acre	1,000.00	74,000
	Seepage Berms (Included in Main Stem Levee)				0
	Road Relocations	15.6	Acre	1,500.00	23,400
	L/D #22 Parking Area	0.3	Acre	1,500.00	450
	SUM	162.6			206,900

Sum	10,914,201
Contingencies (25 percent)	2,728,550
Sum	13,642,751
Engineering & Design (8 percent)	1,091,420
Supervision & Administration (7.5 percent)	886,779
Total Cost	$15,620,950

Hydraulic Effects

Upper Mississippi River Water Surface Profiles, dated November 1979, were prepared under the direction of the Technical Flood Plain Management Task Force of the Upper Mississippi River Basin Commission. The profiles were developed assuming complete confinement by all levees that were congressionally authorized as of 1965. Therefore, improvements to main stem levees will have no effect on the profiles. Similarly, the ring levee around Hull, which is located within an authorized levee district, would have no effect on the Mississippi River flood profiles. Further details associated with the ring levee and main stem alternatives are discussed in Appendix A - Hydrology and Hydraulics.

Current Illinois Department of Transportation, Division of Water Resource, regulations require analysis of lost floodplain storage and compensation of the same. This study does not address these issues.

Economic Effects

Cost, damage, and benefit data are displayed in table 5. Additional economic information is presented in Appendix B - Economic Analysis.

TABLE 5

Economic Summary ($1,000)

Alternative	Average Annual Cost	Average Annual Benefit	Benefit-to-Cost Ratio
Ring Levee: Alt. A	447.5	225.9	0.50
(100-Year) Alt. B	421.0	210.7	0.50
Main Stem Levee Raise:			
100-Year	942.3	803.6	0.85
200-Year	1,606.3	1,221.9	0.76

Social and Environmental Effects

The ring levees and main stem levee raise would effectively reduce flooding within the study area. Positive impacts would result for residential, commercial, industrial, and agricultural properties by reducing flood damages and the disruption of services and employment.

Riparian habitat would be impacted by the main stem levee raise. Of five federally endangered species listed for the study area, additional study

would be required to determine potential adverse impacts to the Higgins' eye pearly mussel and the fat pocket pearly mussel.

The potential for buried cultural deposits is evident in the project area. A Phase I survey and geomorphological testing would be required in feasibility phase studies.

Social, natural resource, and cultural resource evaluations are presented in detail in Appendix C - Environmental Analysis.

EVALUATION OF ALTERNATIVE PLANS

Table 6 summarizes the preliminary screening criteria applied to all alternative flood damage reduction measures considered. Only those alternatives which meet or exceed all criteria are considered in detail during a feasibility phase study.

With the exception of current procedures for flood forecasting and warning, no other alternatives met all the screening criteria in a satisfactory manner.

TABLE 6

Preliminary Screening Process

Plan	Technical	Economic	Environmental	Social
Floodproof and Evacuation	Unsatisfactory	Unsatisfactory	Minimal Impacts	Unsatisfactory
Flood Forecast & Warning	Currently Satisfactory	Currently Satisfactory	Minimal Impacts	Currently Satisfactory
Levees & Floodwalls	Satisfactory	Unsatisfactory	Moderate Impacts	Satisfactory

SECTION 3 - SUMMARY OF STUDY MANAGEMENT, COORDINATION, PUBLIC VIEWS, AND COMMENTS

Residents, businessmen, and community leaders have expressed their concern about the potential for costly flood damage within the Hull community. They believe their interests would be best served by investigating the potential for 100-year event level protection or greater.

A notice of study initiation was distributed in December 1989 to Federal, State, and local governmental agencies, and the general public. No significant comments were received.

SITE VISIT - AUGUST 31, 1989

Rock Island District representatives met with John Lehr, Village President, in Hull, Illinois. The Continuing Authorities Program and related procedures were explained. A field inspection was performed of the study area within Hull to identify any existing features which would require special attention during the reconnaissance study.

ECONOMIC FIELD INVENTORY - SEPTEMBER 1989

Corps of Engineers staff performed a field inventory of the study area to determine land use, structure types and values, ground and first-floor elevations, and flood damage estimates.

SECTION 4 - CONCLUSIONS

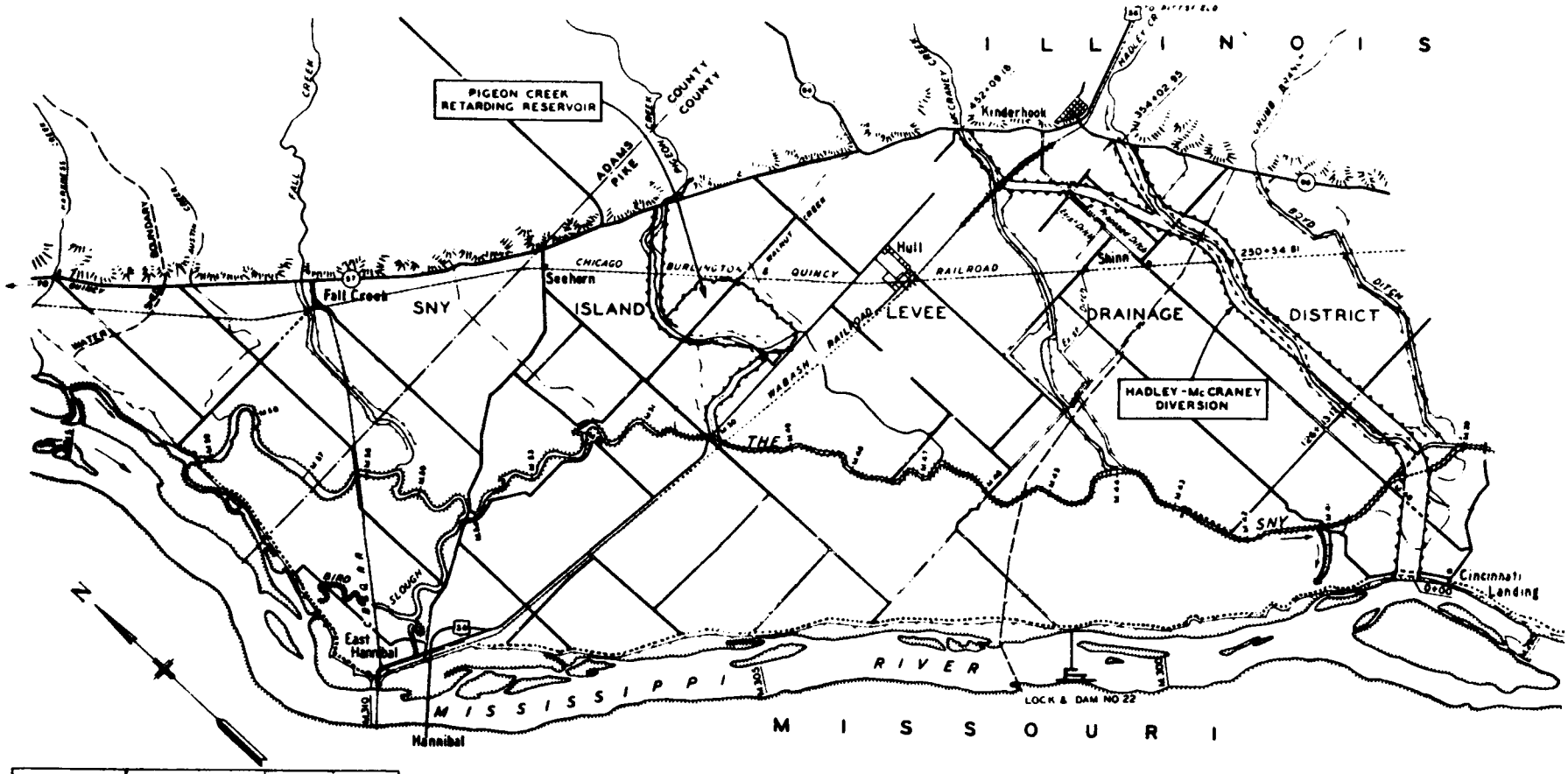
The primary flood potential in Hull exists from an overtopping or breaching of the existing SILDD main stem levee during high Mississippi River flows. The main stem levee was constructed to provide a 50-year protection level with 2 feet of freeboard. Structural and nonstructural measures were considered to reduce flood damages.

The results of this study, based upon the conditions which currently exist, indicate that Corps of Engineers' participation in a structural or nonstructural plan is not warranted because of economic infeasibility.

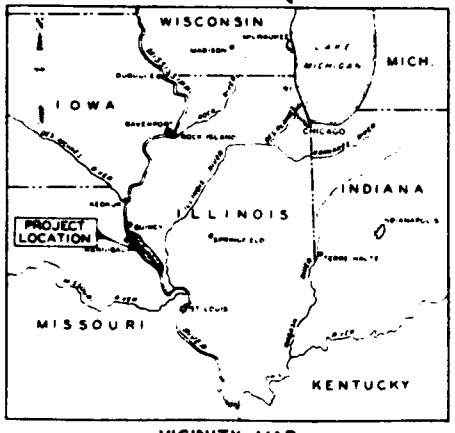
SECTION 5 - RECOMMENDATION

Based on the findings of this Reconnaissance Study, I recommend that further Federal action under Section 205 of the 1948 Flood Control Act, as amended, be terminated at this time for the Mississippi River at Hull, Illinois.

Dudley M. Hanson, P.E.
Chief, Planning Division



LOCATION MAP



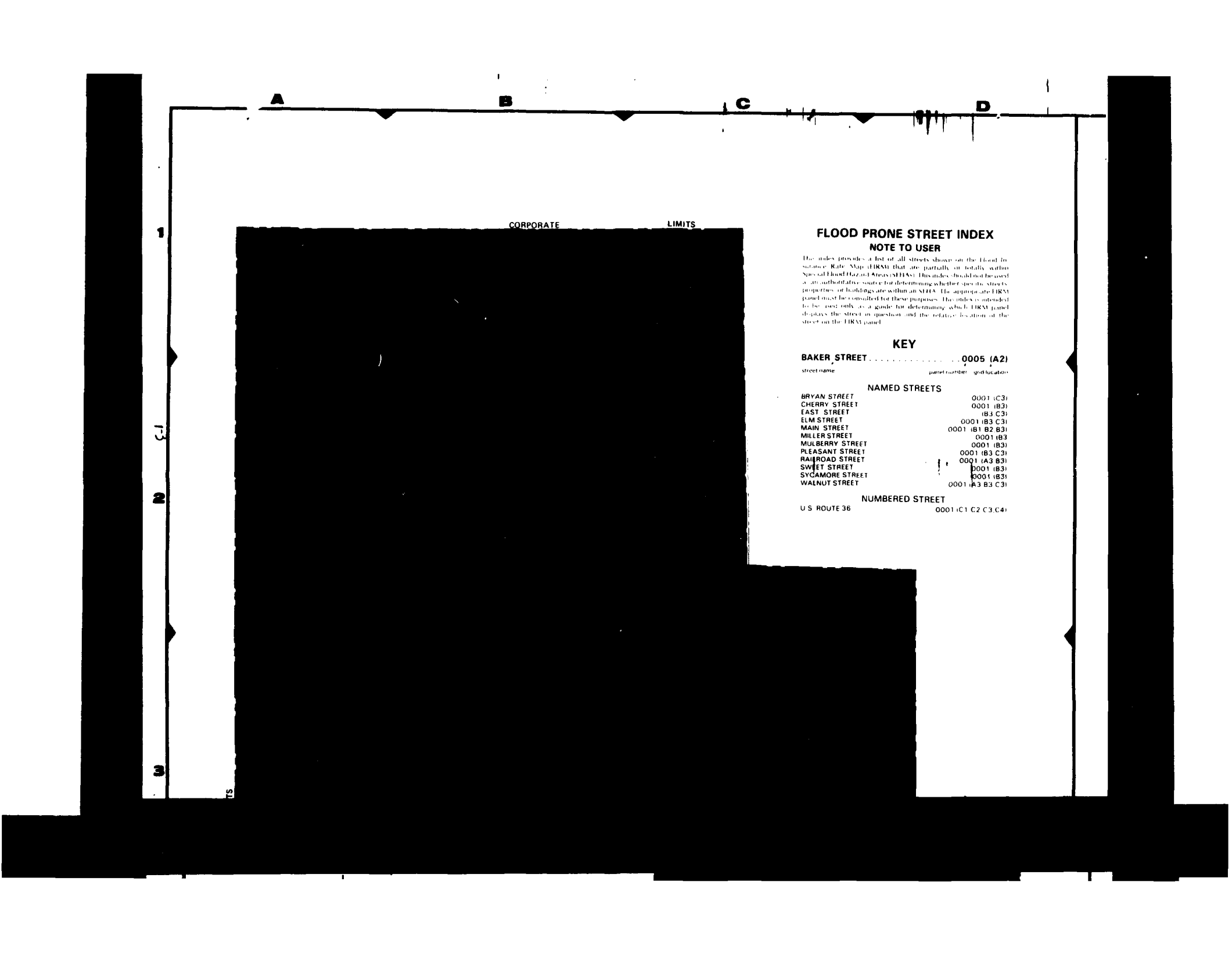
VICINITY MAP

MISSISSIPPI RIVER

HULL, ILLINOIS

LOCATION & VICINITY MAPS

PLATE 1



FLOOD PRONE STREET INDEX

NOTE TO USER

This index provides a list of all streets shown on the Flood Insurance Rate Map (FIRM) that are partially or totally within Special Flood Hazard Areas (SFHAs). This index should not be used as an authoritative source for determining whether specific streets, properties or buildings are within an SFHA. The appropriate FIRM panel must be consulted for these purposes. This index is intended to be used only as a guide for determining which FIRM panel depicts the street in question and the relative location of the street on the FIRM panel.

KEY

BAKER STREET 0005 (A2)

street name — panel number — grid location

NAMED STREETS

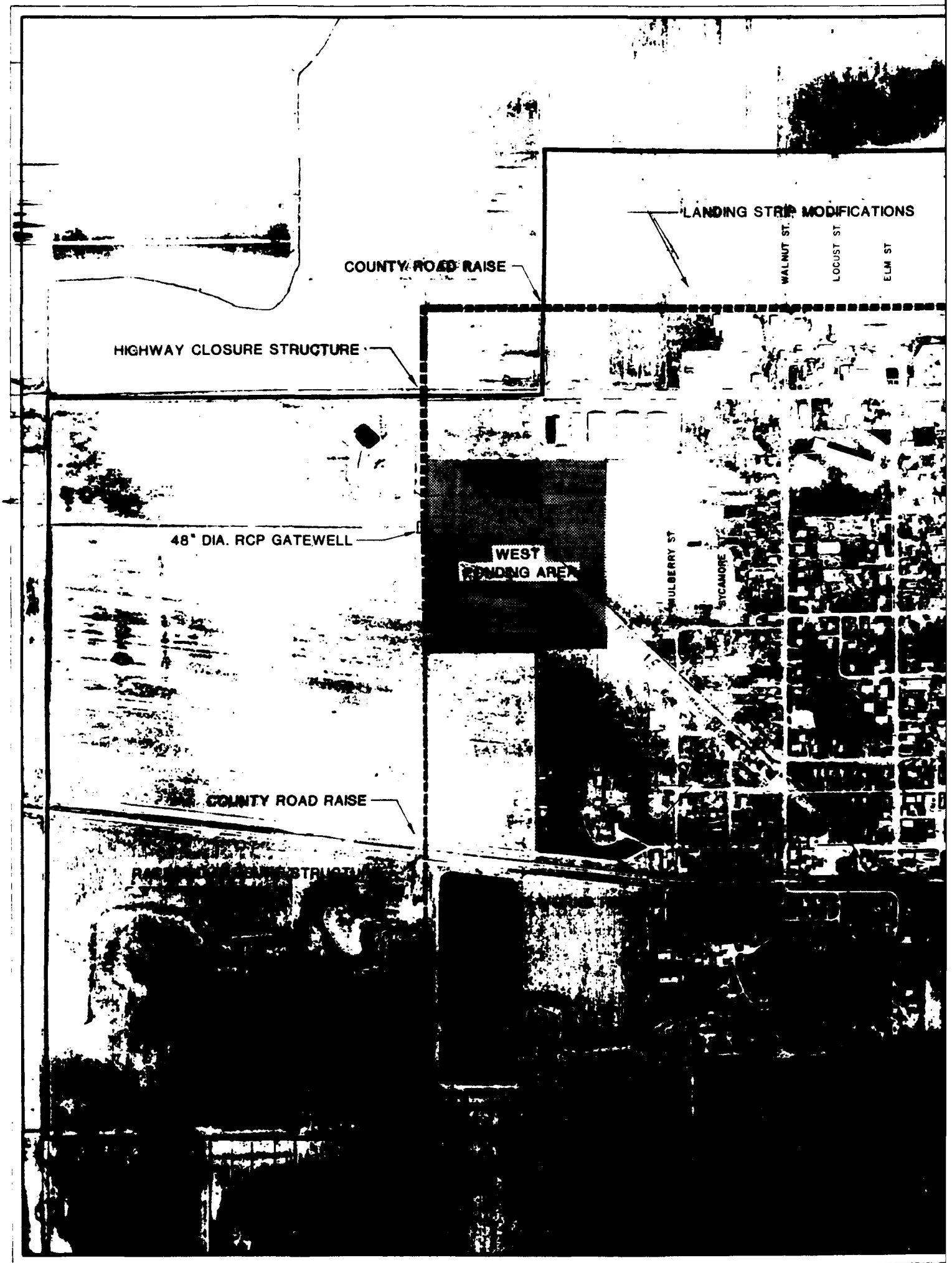
BRYAN STREET	0001 (C3)
CHERRY STREET	0001 (B3)
EAST STREET	(B3 C3)
ELM STREET	0001 (B3 C3)
MAIN STREET	0001 (B1 B2 B3)
MILLER STREET	0001 (B3
MULBERRY STREET	0001 (B3)
PLEASANT STREET	0001 (B3 C3)
RAILROAD STREET	0001 (A3 B3)
SWEET STREET	0001 (B3)
SYCAMORE STREET	0001 (B3)
WALNUT STREET	0001 (A3 B3 C3)

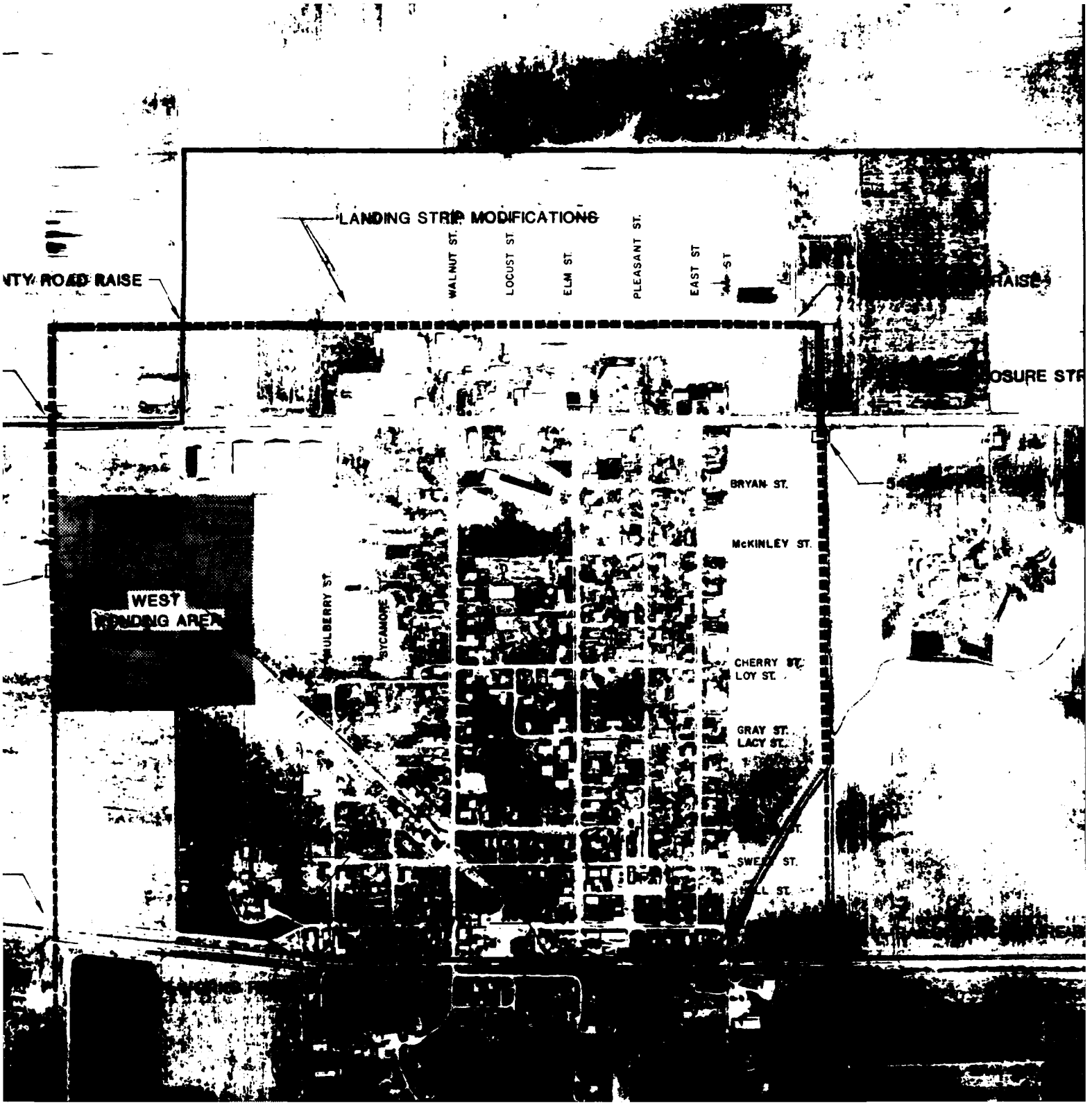
NUMBERED STREET

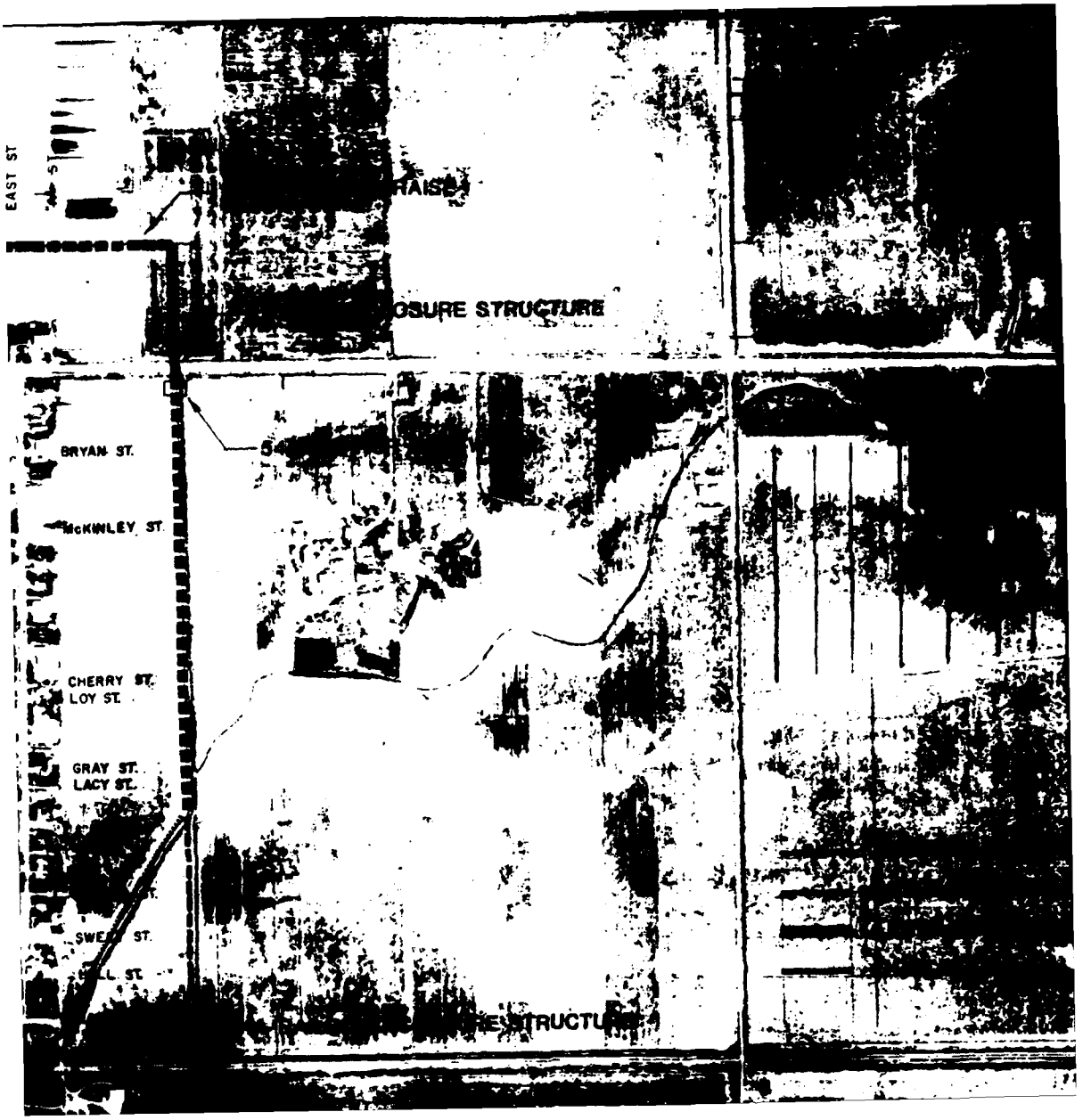
U S ROUTE 36	0001 (C1 C2 C3 C4)

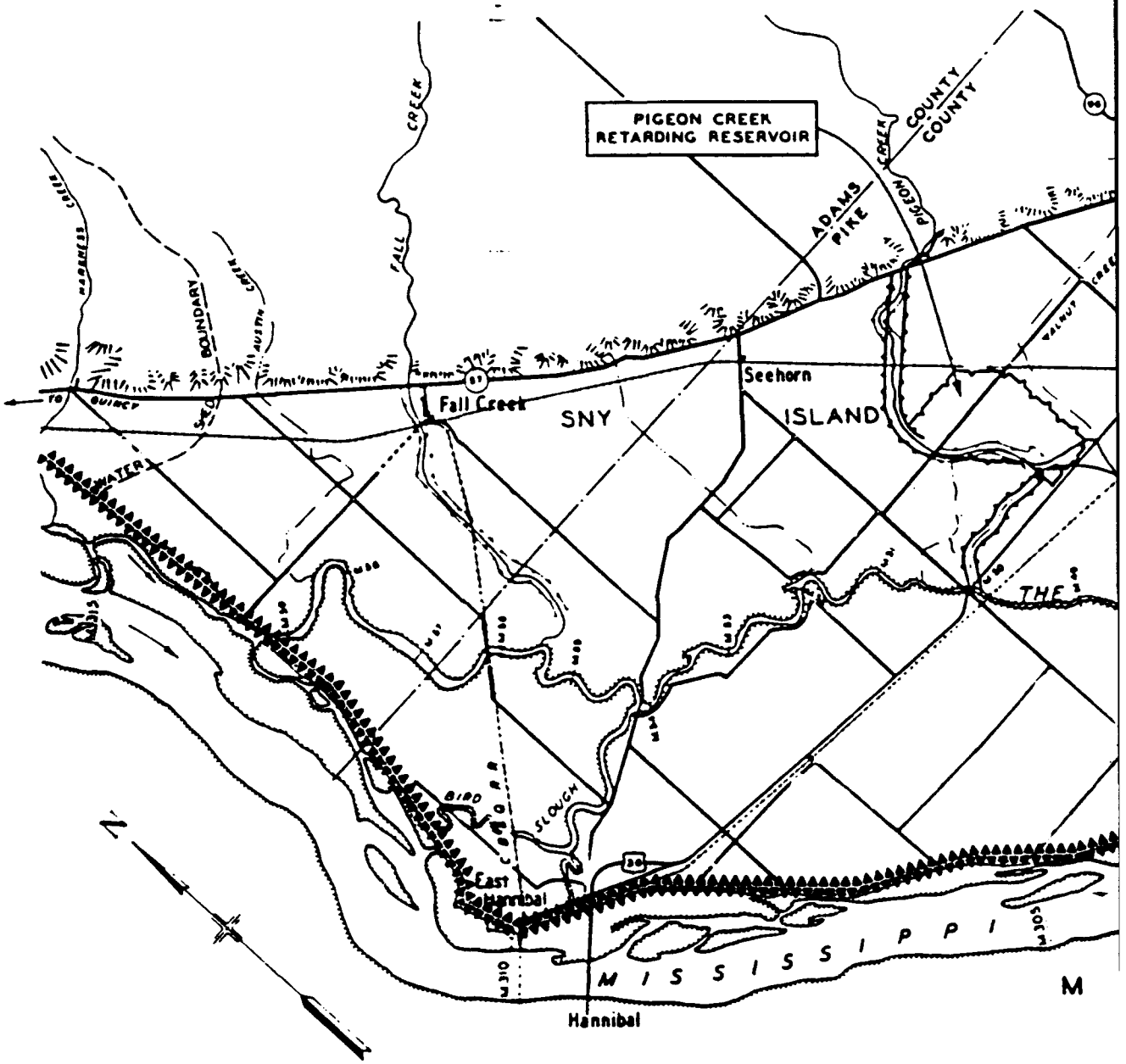

CORPORATE
LIMITS
CORPORATE

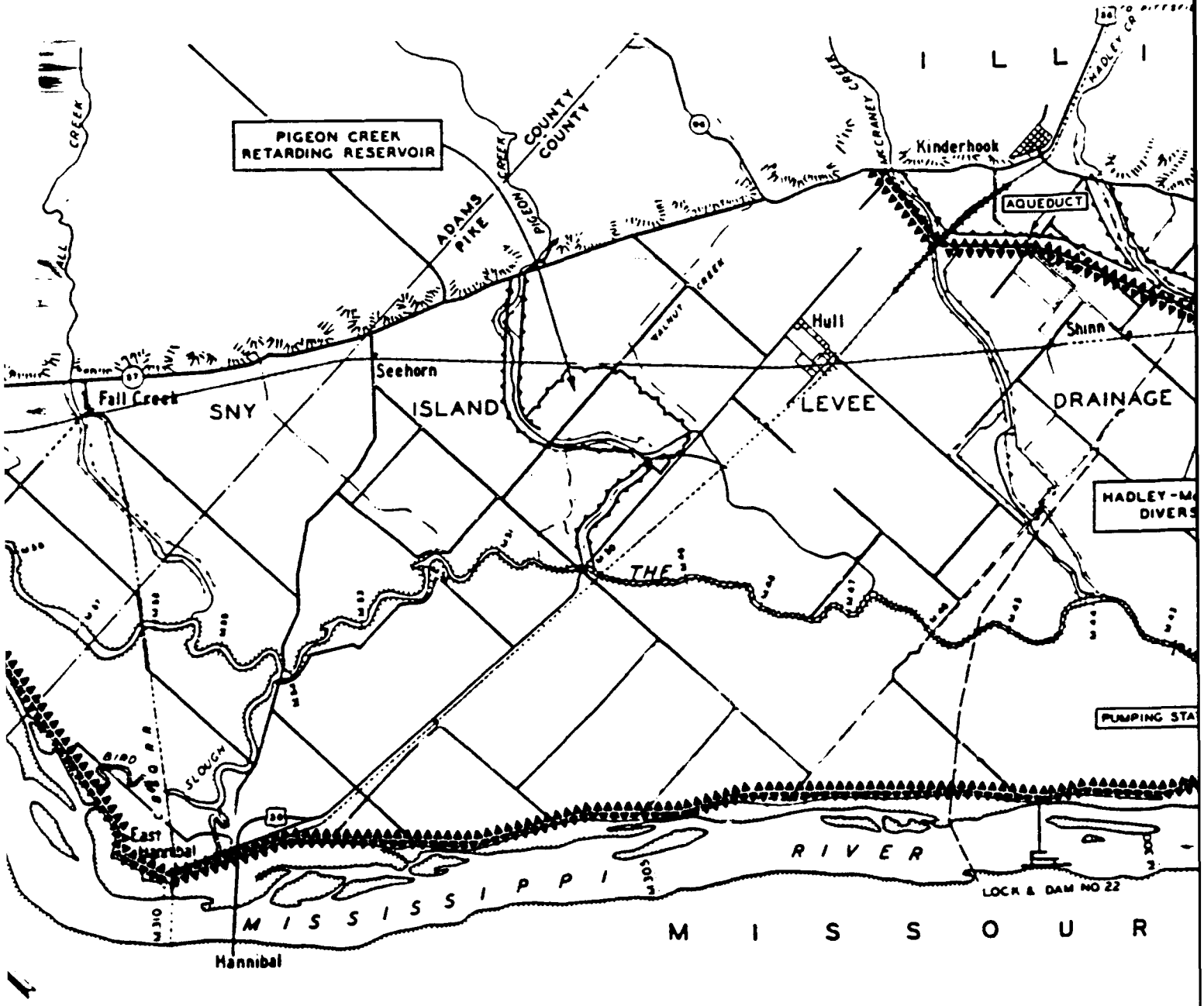
PLATE 2


LANDING STRIP MODIFICATIONS
COUNTY ROAD RAISE
WALNUT ST.
LOCUST ST
ELM ST
HIGHWAY CLOSURE STRUCTURE
48" DIA. RCP GATEWELL
WEST
MULBERRY ST
SYCAMORE
COUNTY ROAD RAISE

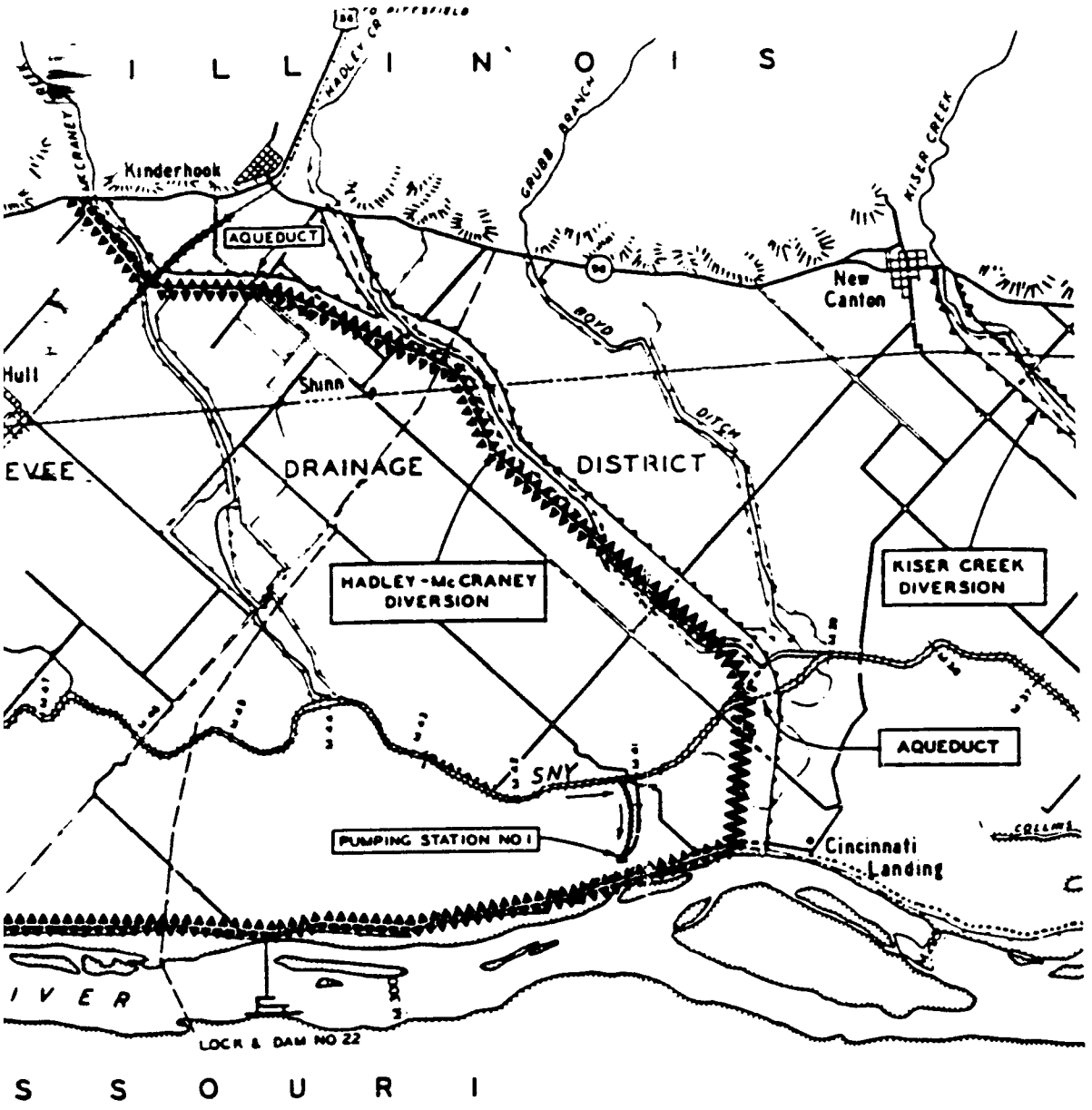

LANDING STRIP MODIFICATIONS
WALNUT ST.
LOCUST ST
ELM ST.
PLEASANT ST.
EAST ST
BRYAN ST.
McKINLEY ST.
MULBERRY ST.
SYCAMORE
CHERRY ST.
LOY ST.
GRAY ST.
LACY ST.


EAST ST
RAISED
OSURE STRUCTURE
BRYAN ST.
McKINLEY ST.
CHERRY ST.
LOY ST.
GRAY ST.
LACY ST.
SWE ST.
L ST.


PIGEON CREEK
RETARDING RESERVOIR
ADAMS
PIKE
PIGEON CREEK
COUNTY
COUNTY
FALL CREEK
BOUNDARY
CREEK
Seehorn
Fall Creek
SNY
ISLAND
TO QUINCY
SLOUGH
East Hannibal
Hannibal
M I S S I S S I P P I
M



LEVEE TO BE RAISED



LEVEE TO BE RAISED

MISSISSIPPI RIVER
HULL, ILLINOIS

MAINSTEM LEVEE RAISE ALTERNATIVE

PLATE 4

HYDROLOGY AND HYDRAULICS

APPENDIX A

RECONNAISSANCE REPORT

SECTION 205 FLOOD DAMAGE REDUCTION STUDY
MISSISSIPPI RIVER, HULL, ILLINOIS

APPENDIX A
HYDROLOGY AND HYDRAULICS

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APPENDIX A
HYDROLOGY AND HYDRAULICS

SECTION 1 - GENERAL

PURPOSE AND SCOPE

The purpose of this appendix is to provide hydrologic, hydraulic, and climatological support for the local flood protection project at Hull. This report supports investigations of the feasibility of two alternatives: (1) constructing a ring levee and providing attendant interior drainage facilities, and (2) raising the upper reach of the Sny Island Levee Drainage District (SILDD) levee to provide at least 100-year protection to the village of Hull. The SILDD levee raise is discussed at the end of this appendix.

CLIMATOLOGICAL DATA

Hull's climate is generally mid-continental, with hot summers and cold winters. Data for Hull are based upon records observed at a long-term National Weather Service (NWS) station at nearby Quincy, Illinois. Climatological data are summarized in the following paragraphs.

TEMPERATURE

The average temperature is 54.2 degrees Fahrenheit (F). Record extremes are a maximum of 114 degrees and a minimum of -19 degrees F. Table A-1 shows the average monthly temperatures.

TABLE A-1

Average Monthly Temperatures (Degrees Fahrenheit)

Month	Average Temperature	Month	Average Temperature
January	27.4	July	78.3
February	31.9	August	76.6
March	41.1	September	68.5
April	54.8	October	57.9
May	65.1	November	43.3
June	74.2	December	31.7

PRECIPITATION

The average annual precipitation is 36.87 inches, with most occurring during the months of April through July. Table A-2 shows monthly averages for precipitation.

TABLE A-2

Average Monthly Precipitation (Inches)

Month	Average Precipitation	Month	Average Precipitation
January	1.61	July	4.42
February	1.41	August	3.48
March	2.74	September	3.99
April	3.88	October	3.17
May	4.07	November	1.77
June	4.74	December	1.56

SECTION 2 - MISSISSIPPI RIVER CHARACTERISTICS

HYDROLOGY OF THE MISSISSIPPI RIVER

GENERAL

The Mississippi River indirectly affects the village of Hull. Hull is protected from the Mississippi River by the SILDD levee. The village would

experience Mississippi River flooding only in the event that the levee would fail. The levee was built to provide protection up to the 50-year level, so Hull is not considered to be flood-free for events larger than this magnitude flood. The proposed ring levee would function only in the event of a failure of the SILDD levee on the Mississippi River. Therefore, the blocked gravity features described below would function rarely, certainly less than 0.1 percent of the time.

BASIN HYDROLOGY

The drainage area of the Mississippi River at Hull is 135,000 square miles. The Flood of Record is the 1973 flood. The 1973 flood hydrograph is shown on plate A-1. Table A-3 shows the 10 highest flows on the Mississippi River at Quincy, Illinois.

Peak flow frequency for the Mississippi River at Quincy, Illinois, is shown on plate A-2. The flow duration curve for nearby Lock and Dam No. 21 is shown on plate A-3. The elevation duration curve for several nearby gages including Quincy, Illinois, is shown on plate A-4. Plates A-2 through A-4 are derived from the Rock Island District Corps of Engineers (CENCR) report entitled Upper Mississippi River Basin, Mississippi River-Nine Foot Channel, Appendix 21, Master Reservoir Regulation Manual, Lock and Dam No. 21, November 1980. Plate A-5 shows Mississippi River flood profiles. The development of the profiles is described in the CENCR report entitled South Quincy Drainage and Levee District, Illinois, General Design Memorandum, Local Flood Protection with Environmental Assessment, June 1986.

TABLE A-3

Summary of the 10 Highest Flood Stages
Mississippi River at Quincy, Illinois

Date	Crest Elevation (Feet)	Flow (cfs)
1973	28.9	386,600
1965	24.8	330,600
1960	24.3	324,500
1947	23.8	325,700
1947	23.0	302,000
1951	22.8	299,200
1979	22.5	294,200
1976	22.2	289,300
1952	21.9	284,200
1969	21.9	282,500

Gage zero = 458.9 NGVD (5th Adj.)

Hull lies at River Mile (RM) 303, just upstream of Lock and Dam No. 22. The 50-, 100-, 200-, and 500-year flood elevations are 471.4, 472.8, 474.1, and 476.2, respectively. Since there is no "upstream" end of the proposed isolated ring levee of Hull, freeboard is a uniform 3 feet. In a more advanced study, top of levee grades may be adjusted to force a preferred point of failure.

INTERIOR HYDROLOGY

The area comprising the village is generally flat with silty soils. With construction of the proposed ring levee, no outside areas will drain into the interior area of the village. Areas within the levee were subdivided via furnished topographical data and are delineated on plate A-6.

Rainfalls are based upon the 1988 reference, "Bulletin 70, State of Illinois, Frequency Distribution and Hydroclimatic Characteristics of Heavy Rainstorms in Illinois." The nearby Quincy gage was used. The rainfalls are tabulated in table A-4 below.

TABLE A-4

Accumulative Rainfalls (Inches/Hour)

Nth hour/Freq	1	2	5	10	25	50	100
1	1.33	1.65	2.06	2.32	2.82	3.15	3.58
2	1.66	2.08	2.59	2.91	3.53	3.95	4.50
3	1.80	2.24	2.82	3.15	3.83	4.29	4.88
4	1.95	2.40	3.03	3.40	4.08	4.60	5.20
5	2.05	2.50	3.15	3.60	4.28	4.80	5.45
6	2.12	2.64	3.30	3.71	4.49	5.03	5.72

Infiltration was set at a uniform loss rate of 0.05 inch per hour with no initial loss, because in this lowland area the water table rises virtually to the ground surface during high Mississippi River stages. The Clark Unit Hydrograph Method was selected since this method generates a complete hydrograph. Travel times of the subareas within the ring levee were computed using the reference "Soil Conservation Service Technical Release 55, Urban Hydrology for Small Watersheds," June 1986.

Conservatively, the more rapid velocity was selected to reduce attenuation of flows. Clark's Time of Concentration (Tc) was taken to equal the travel time. Also conservatively, Clark's Basin Storage Factor (R) was taken to be 0.6 x Tc. The Hydrologic Engineering Center program HEC-1 was used to

accomplish Clark Method unit hydrograph computations and any routings that were later required. Generally, the Hull interior subareas peaked well under 1 hour. With these short travel times, the value of peak flows is insensitive to large percentage changes in Tc and R.

INTERIOR HYDRAULICS--GRAVITY OUTLETS, PONDING, AND PUMPING

Generally, gravity structures were sized to pass at least a 6-hour 100-year event with no more than minimum damage. Provision of lesser facilities possibly would cause drainage problems where none existed before implementation of the project. Analyses were based on 1939 topography with a scale of 1 inch to 300 feet and a contour interval of 2.0 feet. Subareas are shown on plate A-6.

AREAS 1, 3, 4, AND 8

These areas were combined to share facilities. Ponding in this area amounts to 30 acres, 4 feet deep, or 120 acre-feet without flooding adjacent lands. This 120 acre-feet is equivalent to 7.78 inches of runoff.

GRAVITY CONDITIONS

Because of this huge storage, runoff removal was limited to 0.5 inch per hour, or 12 inches of runoff per day. Various analyses indicate that a single 48-inch RCP culvert will suffice. The peak velocity is 7.4 feet per second (fps) at a flow of 93 cubic feet per second (cfs). A gatewell is to be provided. The peak gravity inflow was 651 cfs.

Temporary pumping appears to be feasible at this site because of the extreme rarity of pumping, long warning times, acceptable delays in mobilizing facilities, and huge ponding. Because of these factors, pumping capacity was sized to remove 0.25 inch of runoff per hour and seepage. Removing 0.25 inch per hour of runoff requires 21,000 gallons per minute (gpm).

The seepage rate is based on the maximum rate because flood stages linger near the peak for several days; routing of the seepage hydrograph will accomplish no reduction in seepage pumping requirements. Because of the silty soils and underlying layers of clay and till, a seepage rate of 0.04 gpm/foot (levee)/foot (head) was selected. The length of levee protecting these areas is 5,400 feet, and the average head is 11 feet; maximum seepage is 2,800 gpm. Combined seepage and runoff pumping requirements are 23,800 gpm.

AREAS 2 AND 11

These areas comprise the northeast corner of the village of Hull, as shown on plate A-6. The longest flow length is 1,200 feet. A detailed runoff model is not required. Runoff concentrates in much less than 1 hour. If the most rapid movement were 3 feet per second, the Tc would be 6.9 minutes. The 1-hour unit hydrograph would be flat-topped, that is, yield would supply. If 100-year peak runoff were 3.05 inches per hour, the yield would be 101 cfs per hour. The full 100-year storm was used because of the relatively small volume of ponding available here.

In sizing the gravity outlet, height was again a controlling restriction. Several configurations were tested; all involved multiple pipes which would be expensive to provide with gatewells. Final selection was a 65-inch x 40-inch CMP arch pipe which will carry 48 cfs, or roughly half of the 100 cfs. This was taken to be acceptable without further analysis because the area contains about 20 percent of low-lying area which could accept brief backup without problems. In addition, this is about the capacity of the ditches feeding the proposed culvert.

Temporary pumping also appears to be feasible at this site because of the extreme rarity of pumping, long warning times, and acceptable delays in mobilizing facilities. Because of the large storage and relative little damage, pumping capacity was sized to remove 0.5 inch of runoff per hour and peak seepage. Removing 0.5 inch per hour of runoff requires 7,400 gpm. The seepage rate is based on the maximum rate because flood stages linger near the peak for several days; routing of seepage hydrograph will not reduce seepage pumping requirements.

Because of the silty soils and underlying layers of clay and till, a seepage rate of 0.04 gpm/foot (levee)/foot (head) was selected. The length of levee protecting the area is 3,000 feet and the average head is 10 feet; maximum seepage is 1,200 gpm. Combined seepage and runoff pumping requirements are 8,600 gpm.

AREAS 5, 6, 7, 9, 10, AND 12

These areas comprise that portion of the village of Hull south of the Norfolk and Western Railroad tracks. The areas total to 87.1 acres, and the longest length is 1,300 feet. Terrain slope in this area is very shallow to indistinct. Tc was based on a 1 fps average velocity which yielded 21.7 minutes. At this low velocity, even large percentage errors will have little effect on the peak. A Tc of 20 minutes was selected along with a Clark's R of 12 minutes.

GRAVITY DESIGN

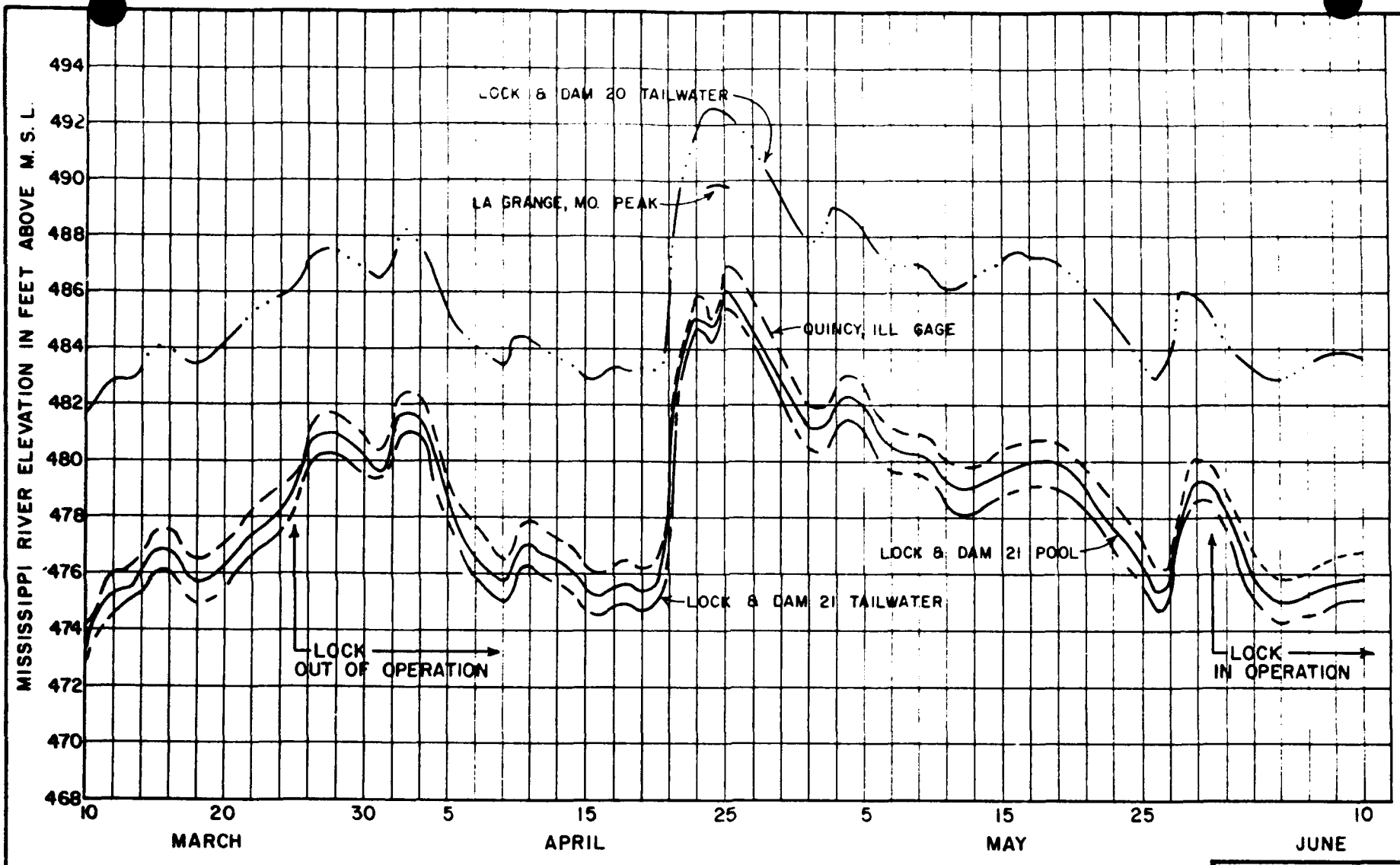
A relatively large volume of ponding is available because of borrow requirements. A ponding area of 11 acres that is 4 feet deep is available. Utilizing just this volume (44 acre-feet) provides 6.06 inches of runoff storage. Because of this huge storage, 0.5 inch of runoff removal was the design target, or 434 cfs.

Computations indicate that a 36-inch RCP with 1.2 feet of head will provide this capacity. This head is available.

Pumping requirements were estimated to be 12,500 gpm based upon removing 0.25 inch per hour of runoff plus peak seepage. Runoff of 0.25 inch per hour was selected because of abundant storage in this area. Seepage is based upon a rate 0.04-gpm/foot-levee/foot-head, average head of 13 feet, and a levee length of 4,800 feet. The seepage component of pumping is 2,500 gpm, and runoff component of pumping is 10,000 gpm. Total pumping capacity is thus 12,500 gpm.

RAISING THE SNY ISLAND LEVEE DRAINAGE DISTRICT LEVEE

This alternative consists of raising approximately 60 miles of main stem levees at least 1.5 feet to upgrade existing protection level from 50-year to at least 100-year. The principal beneficiary of this levee raise would be the agricultural interests of the district; benefits to Hull would be almost incidental. In the event of a break on the main stem levee, there would be approximately 12 to 24 hours before Hull would experience significant flooding.



1973

DAM OUT OF OPERATION MARCH 7 TO JUNE 27

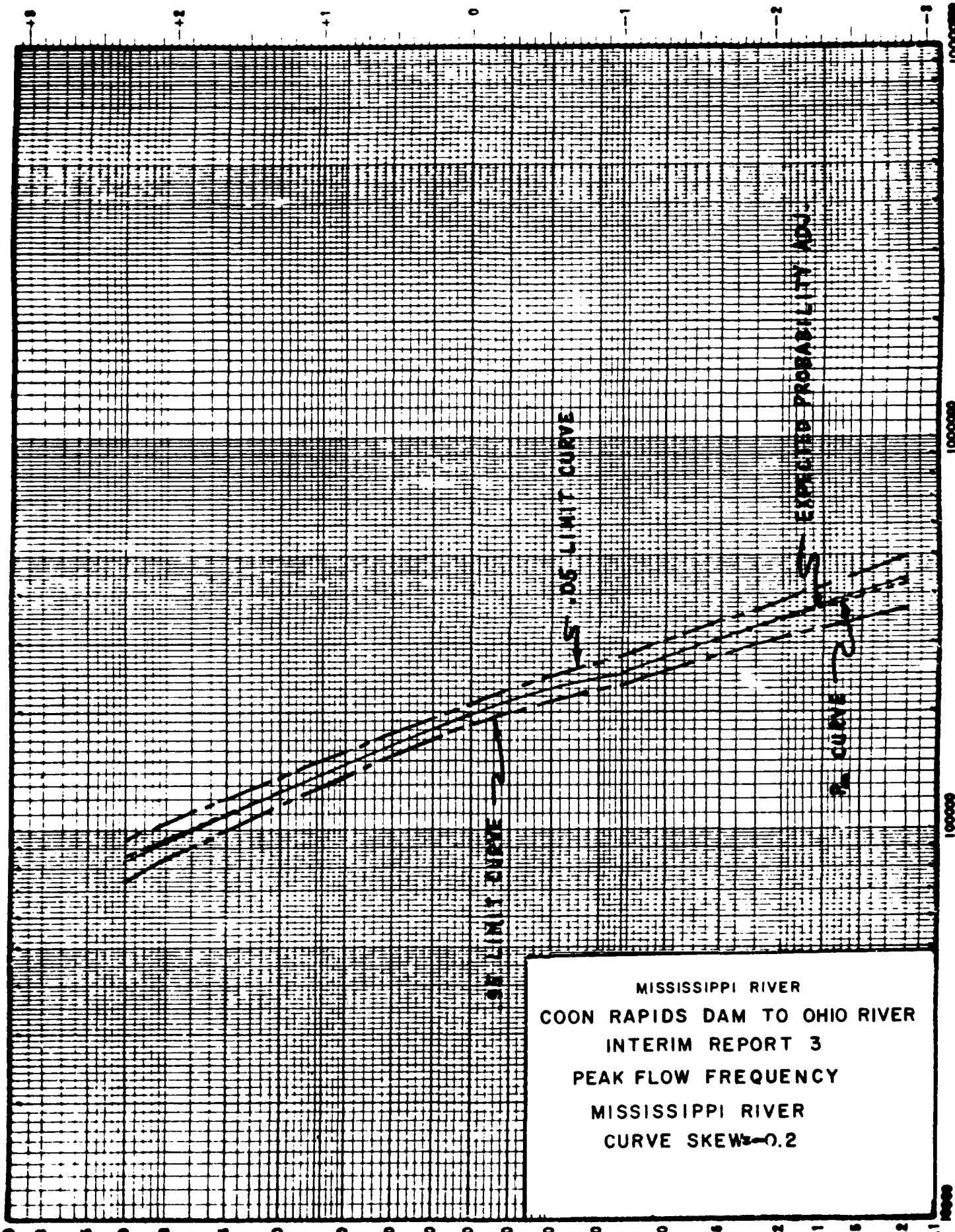
UPPER MISSISSIPPI RIVER BASIN
MISSISSIPPI RIVER
RESERVOIR REGULATION MANUAL
NINE FOOT CHANNEL
LOCK & DAM NO 21

MISSISSIPPI HYDROGRAPHS
POOL 21
1973 FLOOD

CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1974

PLATE A-1



MISSISSIPPI RIVER

COON RAPIDS DAM TO OHIO RIVER

INTERIM REPORT 3

PEAK FLOW FREQUENCY

MISSISSIPPI RIVER

CURVE SKEW = -0.2

PLATE A-2

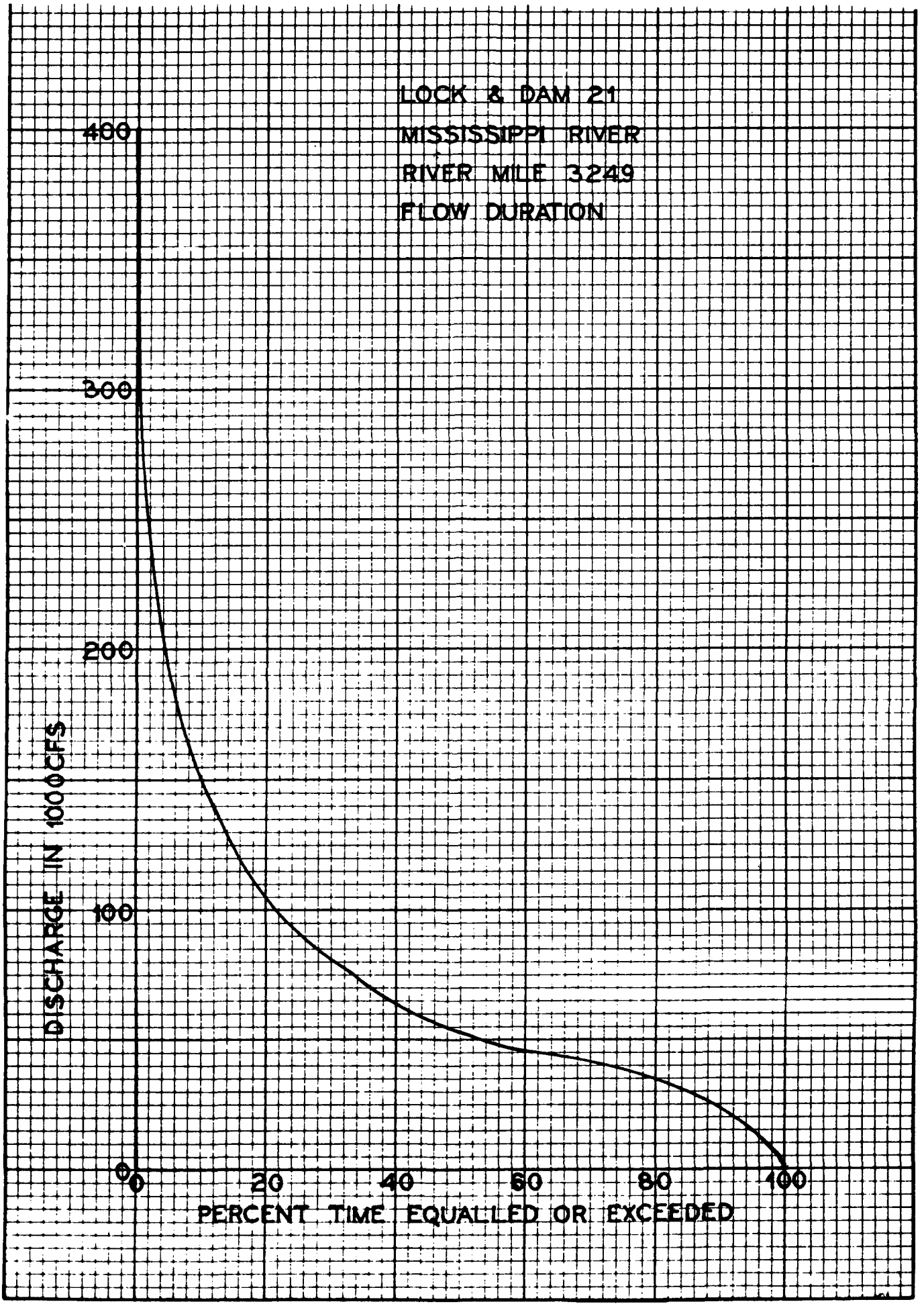
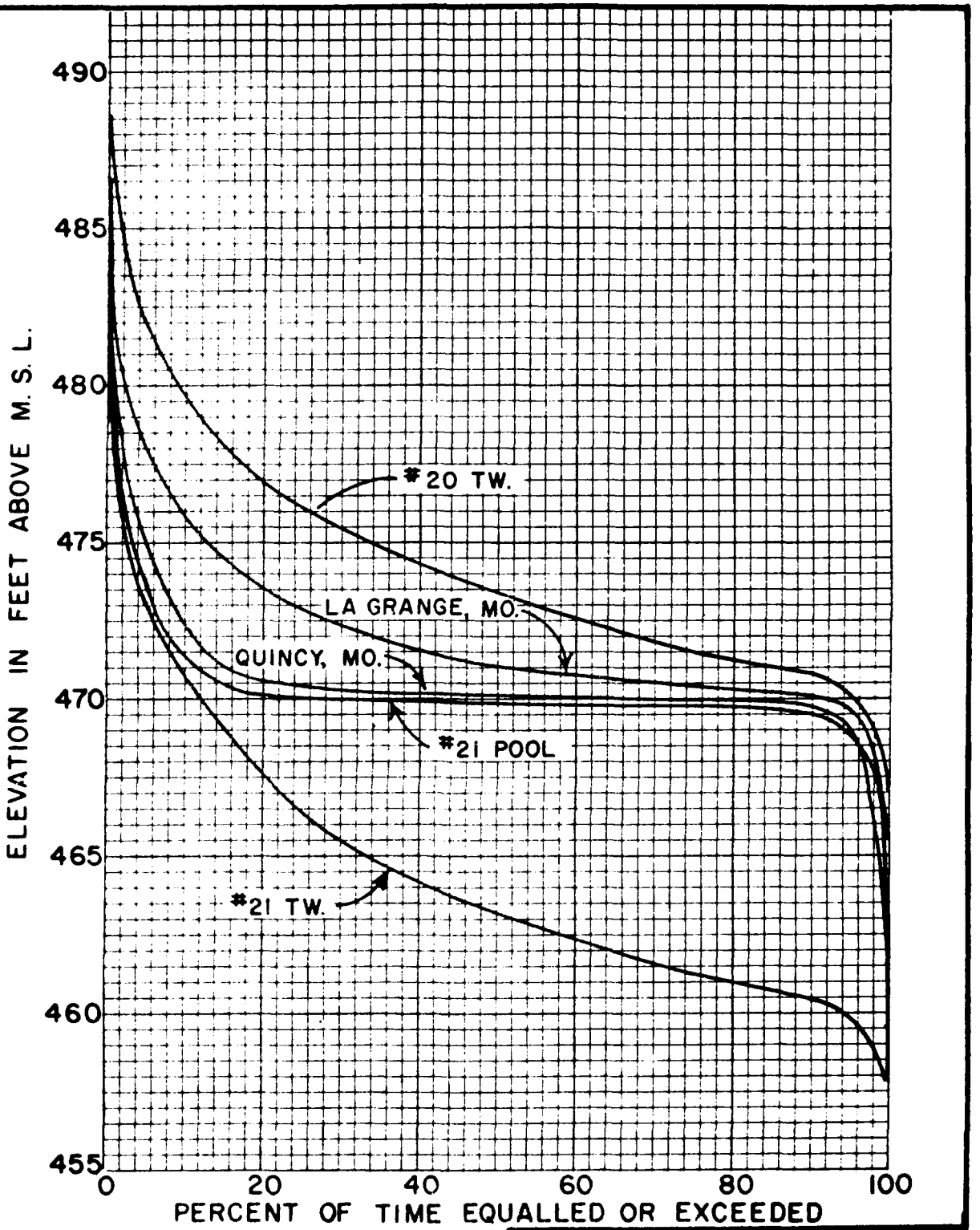

LOCK & DAM 21
MISSISSIPPI RIVER
RIVER MILE 3249
FLOW DURATION
400
300
200
100
0
20
40
60
80
100
DISCHARGE IN 1000 CFS
PERCENT TIME EQUALLED OR EXCEEDED

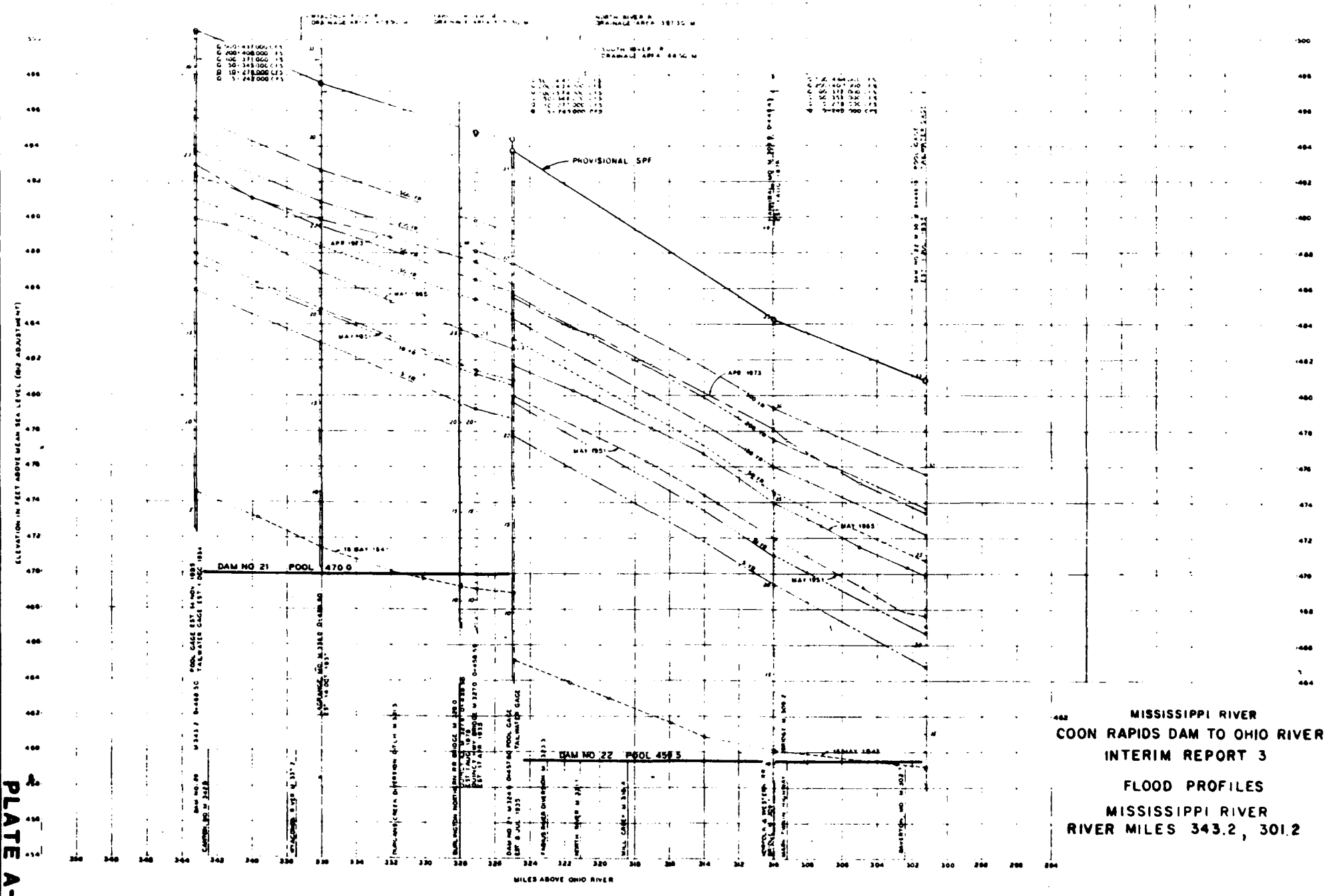
PLATE A-3



MISSISSIPPI RIVER
COON RAPIDS DAM TO OHIO RIVER
INTERIM REPORT 3

ELEVATION DURATION
MISSISSIPPI RIVER
LOCK AND DAM NO. 21
(RIVER MILE 324.9)

PLATE A-4



MISSISSIPPI RIVER
COON RAPIDS DAM TO OHIO RIVER
INTERIM REPORT 3

FLOOD PROFILES
MISSISSIPPI RIVER
RIVER MILES 343.2, 301.2

PLATE A-5

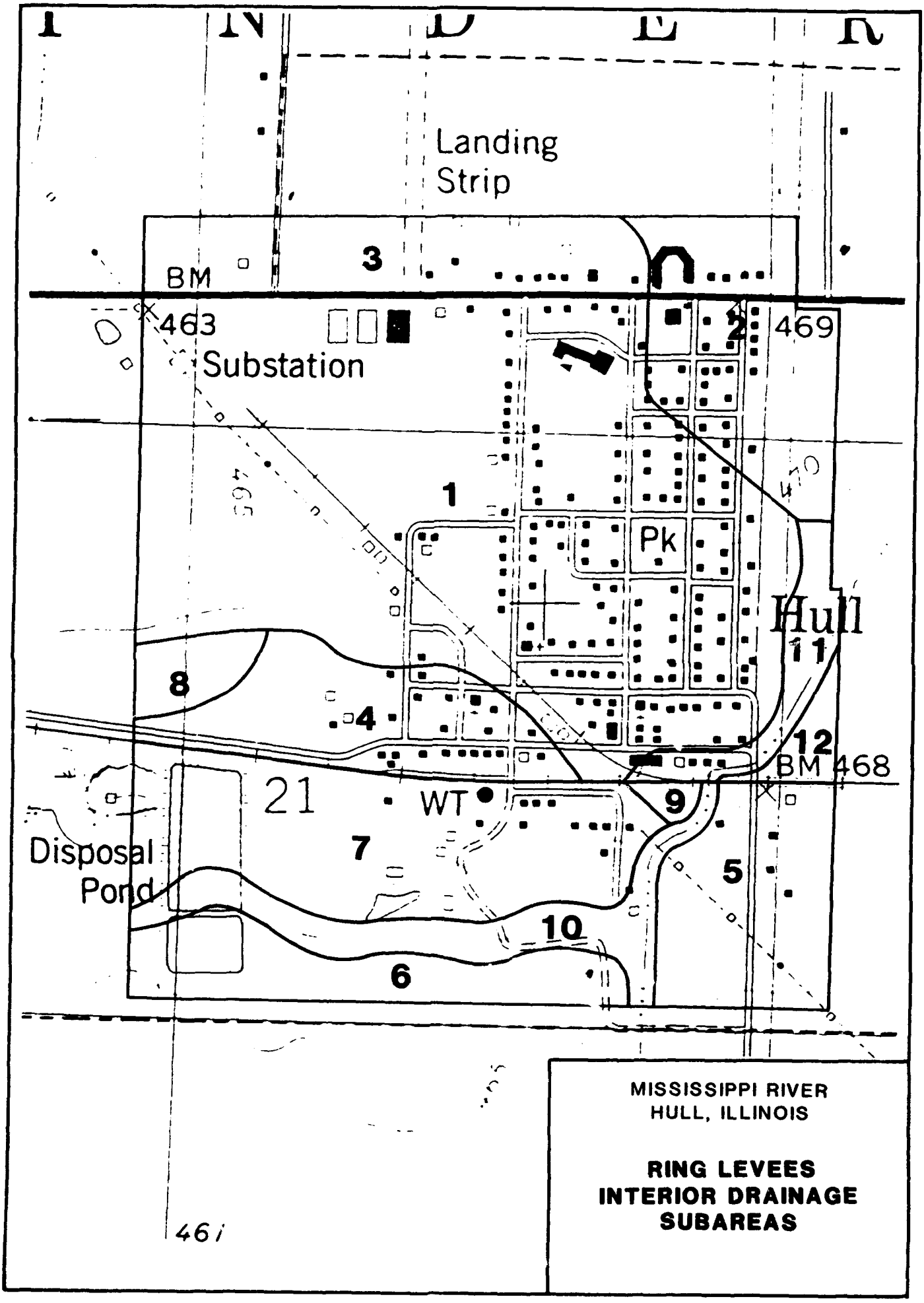

Landing
Strip
BM
463
Substation
469
Pk
Hull
BM 468
WT
Disposal
Pond
1
2
3
4
5
6
7
8
9
10
11
12
21
461
MISSISSIPPI RIVER
HULL, ILLINOIS
RING LEVEES
INTERIOR DRAINAGE
SUBAREAS

PLATE A-6

APPENDIX B

ECONOMIC AND SOCIAL ANALYSIS

RECONNAISSANCE REPORT

SECTION 205 FLOOD DAMAGE REDUCTION STUDY
MISSISSIPPI RIVER, HULL, ILLINOIS

APPENDIX B
ECONOMIC AND SOCIAL ANALYSIS

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MISSISSIPPI RIVER, HULL, ILLINOIS

APPENDIX B
ECONOMIC AND SOCIAL ANALYSIS

SECTION 1 - STUDY AREA CHARACTERISTICS

GENERAL

The village of Hull, Illinois, is located in the northwest corner of Pike County in west-central Illinois. Highway 36 traverses the northern portion of Hull, and the Norfolk and Western Railroad crosses the southern portion. Hull is located in a predominantly agricultural area. The nearest industrial centers are Quincy, Illinois (1985 pop. 55,440), approximately 20 miles northwest of Hull, and Hannibal, Missouri (1985 pop. 22,722), located approximately 10 miles west of Hull.

STUDY AREA

The study area is the village of Hull and its environs in the floodplain of the Mississippi River. Hull is a residential community with some general commercial establishments. The major commercial concentration is in agriculturally related establishments: farm implements and machinery, fertilizers, granaries, etc. Public properties in Hull include the city hall, post office, and West Pike Elementary School.

Hull is located within the Sny Island Levee Drainage District (SILDD). Other communities located in the upper reach of the SILDD are Fall Creek, Shepherd, and East Hannibal.

SOCIO-ECONOMIC CONDITIONS

Hull population and comparative historic population trends are shown in table B-1.

TABLE B-1

Population Trends 1/

	Pop. 1960	Pop. 1970	Pop. 1980	Pop. 1985
Hull, Illinois	535	585	529	529
Quincy, Illinois	43,793	45,288	42,554	55,440
Hannibal, Missouri	20,028	16,609	18,811	22,722
Pike County, Illinois	20,552	19,185	18,896	18,219

As shown in table B-2, employment in the Hull area is concentrated in agriculture, wholesale and retail trade, and manufacturing.

TABLE B-2

Labor Force Data - 1985 2/

	Percent Distribution
Agriculture	24.7
Wholesale and Retail Trade	22.2
Manufacturing	17.7
Professional and Related Services	16.0
Construction	7.5
Finance, Insurance, Real Estate and Personal Services	6.5
All Other	5.4

Sources:

1/ State of Illinois, Bureau of the Budget, Illinois Population Trends 1980 to 2025.

2/ Claritis Corporation, REZIDE 1985, The National Encyclopedia of Residential Zip Code Demography.

HISTORIC FLOODING

No data are available regarding historic flooding in Hull. Existing Sny Island agricultural levees presently provide protection for Hull.

METHODOLOGY

The economic analysis was performed in accordance with Public Law 89-80, Guidelines Sections III and IV.

The study area is defined as that area immediately or directly affected by the project. An inventory of the study area was made in September 1989. The survey indicated that 219 residences and 16 public and 23 commercial structures are within the 100-year flood elevation. The field inventory determined the ground and first floor elevations of all structures based on elevations provided by Hull. Business owners/managers, realtors, public officials, and residents were interviewed to obtain data for flood damage estimates. Structural values were determined for all properties in the study area. Ground and first floor elevations, structure type, and flood damage interview data were used in assessing depth-damage relationships. The average market value of the residential structures is $25,800. Agricultural damages were determined using the methodology described under "Agricultural Damage."

FLOOD DAMAGES

The study area has been analyzed with consideration being given to two possible methods of protection. The two alternatives are described in the following sections.

SECTION 2 - ALTERNATIVE 1

This alternative deals with constructing a ring levee around the village of Hull. Two alignments were considered. Alignment A encompasses most of the residential, commercial, and public structures, and approximately 300 acres of cropland. Alignment B encompasses all of the built up area of the village and about 860 acres of cropland. (See plate 3 for alignments.) The existing agricultural levee was constructed to provide protection to a 50-year flood event and has a crown elevation at Hull of 474.1 feet. Estimated average annual damages to Hull, after giving credit to the existing levee and freeboard, are shown in table B-3.

TABLE B-3

Estimated Average Annual Damages
October 1989 Price Levels
(In Thousands)

	Alignment A	Alignment B
Residential	$ 41.5	$ 44.5
Commercial	42.5	44.5
Public and Other	3.5	3.0
Agricultural	0.3	0.8
Total	$ 87.8	$ 92.8

FUTURE DAMAGES

Interviews conducted at the public and commercial establishments indicate there are no expansion plans in the foreseeable future because of the flooding potential. Floodplain building regulations restrict construction or expansion within the 100-year floodplain. Future damage increases to the study area residential contents were computed. With Alignment A, 202 of the 204 residential structures are affected at the 100-year flood event, while for Alignment B, 219 of 221 are affected. No future damage increases for the agricultural production were calculated as this damage category is a minimal part of total damages.

RESIDENTIAL GROWTH

Residential affluence refers to an increase over time of the value in accumulated housing contents. This increase in the value of housing contents would result in an increase in damages over time. Based on per capita income projections for the State of Illinois,[1/] and Pike County, Illinois,[2/] residential content value was projected to increase at a 1.125 percent annual growth rate. Residential content value will reach its maximum (50 percent of structural value) in 34 years. The average annual equivalent factor for this growth rate is 0.1973. Table B-4 shows the effect of future growth to residential contents on total average annual damage for the two alignments.

1/ 1985 OBERS, BEA Regional Projections, Vol. 1, U.S. Department of Commerce, Bureau of the Census.

2/ Survey of Current Business, Vol. 69, No. 4, April 1989, U.S. Department of Commerce, Bureau of the Census.

TABLE B-4

Average Annual Damage - October 1989 Price Levels
8-7/8 Percent Discount Rate - 100-Year Project Life
(In Thousands)

	Residential			
	Alignment A		Alignment B	
	Structure	Contents	Structure	Contents
1989	$31.1	$10.4	$33.4	$11.1
1995*	31.1	10.4	33.4	11.1
2015	31.1	14.8	33.4	15.9
2029	31.1	15.4	33.4	16.5
2095	31.1	15.4	33.4	16.5

*Base Year

AVERAGE ANNUAL BENEFITS

This section presents an assessment of benefits that would be associated with the reduction of flood damages in the study area. Benefits are calculated as the difference between "with project" and "without project" average annual damages. Benefit categories include existing flood damage reduction, future flood damage reduction, flood insurance savings, floodplain fill savings, and employment benefits.

FLOOD DAMAGE REDUCTION

Benefits accruing to the reduction of flood damages are calculated as the difference between "with project" and "without project" conditions. Table B-5 summarizes the benefits and residual damages for the two alignments. Benefits shown in the table are net benefits with credit given to the existing levee freeboard and to the proposed levee freeboard.

TABLE B-5

Average Annual Benefits and Residual Damages
8-7/8 percent Discount Rate, October 1989 Price Levels
(In Thousands)

Alignment A	Average Annual Benefits Existing (1995)	Future	Total	Average Annual Residual Damage	Damage
Residential	21.5	1.1	22.6	20.0	42.6
Commercial	23.5		23.5	19.0	42.5
Public and Other	1.0		1.0	2.5	3.5
Agriculture	0.2		0.2	0.1	0.3
Total	46.2	1.1	47.3	41.6	88.9

Alignment B	Average Annual Benefits Existing (1995)	Future	Total	Average Annual Residual Damage	Damage
Residential	22.5	1.2	23.7	22.0	45.7
Commercial	24.0		24.0	20.5	44.5
Public and Other	0.5		0.5	2.5	3.0
Agriculture	0.5		0.5	0.4	0.9
Total	47.5	1.2	48.7	45.4	94.1

SAVINGS IN FLOODPLAIN FILL

The levee would protect approximately 50 acres of vacant land within Alignment A and 125 acres within Alignment B. If no levee were built, in order to comply with floodplain building restrictions, the existing ground elevations would have to be raised from 4.5 to 10.5 feet before construction permits could be issued. A benefit can be derived from the savings associated with not having to purchase the fill necessary to raise the ground elevation for construction.

Fill for the South Quincy project, Stage I, was $9.50 per cubic yard for a 5.5-mile one-way haul to site. For the purpose of this analysis, the cost of fill was estimated to be $9 per cubic yard. It was assumed that the area requiring only 4.5 feet of fill would be developed first, and that development would be the same for both alignments. It was assumed that 10 acres would be developed within 25 years. Table B-6 shows the average annual cost computation.

TABLE B-6

Floodplain Fill Cost

Area to be filled	10 acres	
Depth to be filled	4.5 feet	
Amount of fill (area x depth x shrinkage factor [1])		
= 10 acres * 4.5 feet * 1.1		
= 2,156,220 cubic feet = 79,860 cubic yards		
Unit cost of fill = $9 per cubic yard		$718,740
Present value of constant annuity [2]	9.229	
Present value of fill [3]	$265,330	
Interest and amortization	0.08877	
Annualized cost of fill		$ 23,550

1/ Shrinkage factor of 10 percent
2/ 8-7/8 percent, year 25
3/ Cost of fill/25 x present value of constant annuity.

Savings in floodplain fill for each alignment is $23,550. The proposed project also would provide savings to present landowners who would need to use fill in order to build onto their existing structures. These savings were not estimated.

FLOOD INSURANCE SAVINGS

Benefits would result because flood insurance policies now in effect would not be necessary if the project were constructed. The benefit is derived from the decrease in the administrative costs of the policies which are $79 per policy for fiscal 1990. Alignment A has 202 residences and Alignment B has 219 residences within the 100-year floodplain. For this analysis, it was assumed that all properties within the 100-year floodplain participate in the National Flood Insurance Program and that coverage would be eliminated if flood protection for the 100-year event were provided. Annual insurance cost savings would be $18,000 for the properties in Alignment A and $19,400 for those in Alignment B.

EMPLOYMENT BENEFITS

This section presents an evaluation of benefits that would result from the direct use of otherwise unemployed or underemployed labor resources during project construction.

Pike County, Illinois, is an area with substantial and persistent unemployment (see table B-7). Pike County is eligible to claim employment

or redevelopment benefits in Fiscal Year 1990, pursuant to the Area Redevelopment Act (Public Law 87-27).

TABLE B-7

Pike and Adams Counties, Illinois
Annual Unemployment Rates 1984 - 1989
(In Percent)

Year	Pike County	Adams County	Nationwide
1989-Oct	8.0	5.6	5.3
1988	9.2	5.5	5.5
1987	12.1	7.0	6.2
1986	12.0	8.1	7.0
1985	12.7	9.5	7.2
1984	13.8		7.5

Employment benefits are based on project construction costs, exclusive of lands and damages, engineering and design, and supervision and administration. It is estimated that 40 percent of the project construction costs would be allocated to on-site labor. These labor costs would be divided between skilled, semi-skilled, and other personnel (with percentage allocations of 40, 50, and 10 percent, respectively).

Construction employment in the Pike and Adams County area is generally gained through union membership. Contractors seeking to hire labor contact the local unions involved for a referral list of workers. When contacted, unions refer unemployed workers on a priority basis. Therefore, the local hire rate for all labor categories was estimated at 90 percent. This percentage exceeds Principles and Guidelines standards, but is more realistic in highly unionized areas. For example, during construction of the Clinton, Iowa, Local Flood Protection project, payroll records and interviews indicated that more than 90 percent of hired labor was from the local area.

The calculation of employment benefits for Alignments A and B are detailed in tables B-8 and B-9.

The amount of wages to be paid to locally unemployed workers for Alignment A is $1,404,000, and for Alignment B is $1,224,000. The resulting redevelopment benefit was discounted at an 8-7/8 percent discount rate to represent average annual benefits. Annual employment benefits amount to $137,000 for A and $119,000 for B.

TABLE B-8

Employment Benefits - Alignment A
October 1989 Price Levels, 8-7/8 Percent Discount Rate

A. Estimated on-site labor costs:

Construction cost	$3,900,000
Percent to labor	40%
Total labor	$1,560,000

B. Allocation of on-site labor costs by category:

Labor Category	On-Site Labor Costs ($)	Percent Allocation	Amount of Wages ($)
Skilled	1,560,000	40	624,000
Semi-Skilled	1,560,000	50	780,000
Other	1,560,000	10	156,000

C. Allocation of wages to locally unemployed or underemployed:

Labor Category	Amount Wages ($)	% to Locally Unemployed/ Underemployed Labor	Wages to Previously Unemployed/ Underemployed Labor ($)
Skilled	624,000	90	561,600
Semi-Skilled	780,000	90	702,000
Other	156,000	90	140,400
TOTALS	1,560,000		1,404,000

D. Benefit computation:

Year	Local Wage Amount ($)	Periods to Base Year	Future Value of 1.00	Local Wage Value in Base Year($)
1994	702,000	3	1.13912	799,662
1995	702,000	1	1.04438	733,162
Amortized at 8-7/8 percent				* 0.08877
Annual employment benefit				$136,069
			Say:	$137,000

TABLE B-9

Employment Benefits - Alignment B
October 1989 Price Levels, 8-7/8 Percent Discount Rate

A. Estimated on-site labor costs:

Construction cost	$3,400,000
Percent to labor	40%
Total labor	$1,360,000

B. Allocation of on-site labor costs by category:

Labor Category	On-Site Labor Costs ($)	Percent Allocation	Amount of Wages ($)
Skilled	1,360,000	40	544,000
Semi-Skilled	1,360,000	50	680,000
Other	1,360,000	10	136,000

C. Allocation of wages to locally unemployed or underemployed:

Labor Category	Amount Wages ($)	% to Locally Unemployed/ Underemployed Labor	Wages to Previously Unemployed/ Underemployed Labor ($)
Skilled	544,000	90	489,600
Semi-Skilled	680,000	90	612,000
Other	136,000	90	122,400
TOTALS	1,360,000		1,224,000

D. Benefit computation:

Year	Local Wage Amount ($)	Periods to Base Year	Future Value of 1.00	Local Wage Value in Base Year($)
1994	612,000	3	1.13912	697,141
1995	612,000	1	1.04438	639,167
Amortized at 8-7/8 percent				* 0.08877
Annual employment benefit				$118,624
			Say:	$119,000

AVERAGE ANNUAL BENEFITS

Average annual benefits for the study area are derived from flood inundation reduction, floodplain fill cost savings, flood insurance savings, and employment benefits. Table B-10 gives the average annual benefits for the two alignments for protection to a 100-year flood event.

TABLE B-10

Average Annual Benefits
October 1989 Price Levels
(In Thousands)

	Alignment A	Alignment B
Inundation Reduction	$ 47.3	$ 48.7
Floodplain Fill Savings	23.6	23.6
Flood Insurance Savings	18.0	19.4
Employment Benefits	137.0	119.0
Total	$225.9	$210.7

AVERAGE ANNUAL COSTS

Construction costs and operation and maintenance costs detailed in this report are at October 1989 price levels. Interest during construction and annualized costs were computed using an 8-7/8 percent discount rate. A 100-year project life was used for the period of analysis. Table B-11 summarizes the calculations for the average annual costs for the two alignments.

TABLE B-11

Average Annual Costs
October 1989 Price Levels
(In Thousands)

	Alignment A	Alignment B
Project Costs	$3,900.0	$3,400.0
Interest During Construction	358.0	312.0
Total First Costs	$4,258.0	$3,712.0
Interest and Amortization	378.0	329.5
Operations and Maintenance	69.5	91.5
Total Average Annual Costs	$ 447.5	$ 421.0

SECTION 3 - ALTERNATIVE 2

This alternative would raise the existing upper reach main stem levee protecting the SILDD, beginning with the upstream flank and ending with the Northern Hadley-McCraney Diversion Levee (see plate 4).

The study area consists of the SILDD, zones A through H (see plate B-1). Of the 46,207 acres involved, approximately 10 percent are in Adams County and the remainder are in Pike County. Located within this area are the communities of Hull, Shepherd, and East Hannibal, 136 farmsteads, 80 miles of Sny drainage ditches, State Highways 36, 57, and 336, numerous roads and bridges, and grain storage facilities. Estimated cropping distribution for the 1989 season was: corn 45 percent, soybeans 45 percent, and wheat 10 percent.

This proposed alternative would raise the main stem levee to provide either 100- or 200-year flood event protection. There are no current data available on historic flooding of the upper reach of the Sny Drainage District. In 1973, the local communities expended considerable time and effort in raising 192,800 linear feet of the existing levee to prevent its breaching during the May 1973 high waters of the Mississippi River.

AGRICULTURAL DAMAGES

An estimated 35,160 acres of cropped land are in the study area. Damage per acre for the growing season was calculated by averaging the minimum and maximum potential damage which could occur during the growing season. Yield information was obtained from SILDD officials and the Agricultural

Stabilization and Conservation Service. Crop prices used were those required by regulation. A composite damage estimate was arrived at based on the percent distribution of corn, soybeans, and wheat. The composite damage per acre was multiplied by average annual acres flooded under with- and without-project conditions to determine average annual damages and benefits. Credit was given to protection afforded by the existing levee and its freeboard. Table B-12 shows the average dollar damage analysis for corn grown in Adams County. This analysis was done for wheat and soybeans in both Adams and Pike counties. The weighted average dollar damage for the study area is $83.53 per acre, as shown in table B-13.

RURAL RESIDENCES AND FARMSTEADS

Limited field inspection time necessitated developing an average ground elevation for farmsteads and outbuildings, versus actual on-site inspection of the 136 farmsteads in the 46,000 acres of the study area. An average ground elevation by zone as determined by the SILDD was used for rural residences and farmsteads. It was assumed that farmstead first floor elevations were 1 foot higher than the ground elevation. Ground elevations for structures in Fall Creek, Shepherd, and East Hannibal were taken from U.S. Geological Survey Quadrangle Maps, Illinois Department of Transportation road construction drawings for Highways 36 and 336, and on-site surveys. Interviews were conducted at commercial establishments for potential damage assessments. Damages for firms not interviewed were derived from similar establishments in Hull. Average annual damages are shown in table B-14, page B-18.

TRANSPORTATION DAMAGES

If the existing main stem levee is breached, Highways 36, 336, portions of 54, and the new Highway 36, presently under construction, would be impassible or unreachable. In 1987, the average daily traffic count on Highway 36 at Hull was 2,800 vehicles, as reported by the Illinois Department of Transportation. Average daily traffic counts at the Illinois side of the Hannibal bridge were 4,300 and at East Hannibal were 3,000. The overall breakdown of traffic was 7.4 percent multi-unit trucks, 3.2 percent other trucks, and 89.4 percent passenger vehicles. Traffic counts for 1988 and 1989 were dramatically increased at the above locations because of the on-going construction of new Highway 36 and the new Hannibal bridge. Traffic count at the Hannibal bridge in June of 1989 totalled 7,700. For the purpose of this analysis, the 1987 traffic count was used.

In a breach of the main stem levee, Highway 36 traffic would have to detour and use Routes 57 and/or 96. To cross into Missouri, traffic would have to detour to the Quincy, Illinois, bridge. If Highway 36 were flooded,

TABLE B-12

Corn - Adams County

AVERAGE ANNUAL DAMAGES: CORN

PROJECT: Hull
STATE: ILLINOIS COUNTY: Adams Zone A-100%; B-44%; C-10%

PRICE LEVEL: Oct 89 YIELD Per ACRE: 131 Bushels CURRENT PRICE: 1.80 per Bushel

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SPT	OCT	NOV	DEC	TOTAL
Total Variable Costs (1)	0.00	0.35	3.67	10.21	112.98	15.25	7.72	0.54	0.32	0.32	17.91	0.00	169.26
Expended	0.00	0.35	4.01	14.22	127.20	142.45	150.17	150.71	151.03	151.36	169.26	169.26	
Unexpended	169.26	168.92	165.25	155.04	42.06	26.81	19.09	18.55	18.23	17.91	0.00		
									(3)	(3)			
Gross Cash Yield (2)	-	-	-	235.80	235.80	235.80	235.80	235.80	176.85	47.16	-		
Acreage Planted				35%	95%	100%							
CROP LOSS:				(4)	(5)	(6)							
Expended for Replanting				3.57	63.36	130.81							
Expected reduced yield				0.00	35.37	106.11							
Total: Replanting + Reduced Yield				3.57	98.73	236.92							
ADJUSTED CROP LOSS (7) (N/A Not applicable)	N/A	N/A	N/A	N/A	N/A	N/A	216.71	217.25	158.62	29.25	-		
TOTAL CROP LOSS	0	0	0	3.57	98.73	236.92	216.71	217.25	158.62	29.25			
Damage Factor (8)	5%	4%	8%	10%	11%	13%	10%	10%	12%	7%	6%	5%	1.00
Damages per Acre	0	0	0	0.35	11.26	30.56	20.80	21.94	18.56	2.08	0.00	0.00	
AVERAGE ANNUAL DAMAGES PER ACRE													$105.55

(1) Firm Enterprise Data System, National Economic Div., ERS out of Oklahoma State University, Stillwater, OK: Total Costs for the State of Illinois: Costs of Production (1983 - updated to indicated price level).
(2) Average Yield in Bushels/Acre * Normalized Price.
(3) Five-year Average Harvest Times: 25% by Sept; 80% by Oct; 100% by Nov.
(4) Thirty-five percent Apr average variable costs
(5) 1/2 May + Apr average variable cost; crop yield reduced by 15%.
(6) 1/2 June + May + April average variable costs; crop reduced 45%. No replanting in July, so floods from July on result in Total Crop Loss.
(7) Cash Yield less Unexpended Costs
(8) Damage Factor is the percent of expected total runoff occurring in a given month.

TABLE B-13

Weighted Average Damage Value Per Acre

ADAMS COUNTY

		Corn	Soybeans	Wheat
Crop Support Price		$1.80	$4.80	$2.60
Average Yield per Acre	Zones A-C	131	36.5	59
Damage Value per Acre		$105.55	$66.74	$71.73
Cropping Pattern	Zones A-C	45%	45%	10%
		$47.50	$30.03	$7.17
Weighted Average Damage Value per Acre			$84.70	

PIKE COUNTY

		Corn	Soybeans	Wheat
Crop Support Price		$1.80	$4.80	$2.60
Average Yield per Acre	Zones B-H	128	35.6	60
Damage Value per Acre		$103.53	$65.21	$73.13
Cropping Pattern	Zones A-C	45%	45%	10%
		$46.59	$29.34	$7.31
Weighted Average Damage Value per Acre			$83.25	

Percent of Zone Acreage in Adams County Zone A = 100% Zone B = 44 Zone C = 10%

Percent of Zone Acreage in Pike County Zone B = 56%; Zone C = 90;
Zones D through H = 100%

Weighted Average Damage Value per Acre by Zone					Average Damage Value Per Acre for
Zone:	A	B	C	D - H	Eight Zones (A-H)
Value:	$84.70	$83.89	$83.39	$83.25	$83.53

Highway 54 also would be under water, and access across the river at the Louisiana, Missouri, bridge would not be possible. The most direct detour route would require an additional 32 miles be driven to reach the Hannibal metropolitan area. It is assumed that 80 percent of the normal Hannibal bridge traffic would need to take this detour. It also is assumed that all vehicles and trucks had one occupant, and that the average operating cost per mile for passenger cars was $0.21 and for all trucks was $0.44. Vehicles are assumed to be driven at an average of 45 mph, and detour time would be 0.71 hour.

If the main stem levee were breached, floodwaters would inundate the SILDD and remain for 30 days or longer. In 1973, when the area south of Quincy, Illinois, was flooded, floodwaters remained from 30 to 60 days. For this analysis, it was assumed that breaching by a 100-year event would make a detour necessary for a minimum of 30 days. Total detour mileage cost would be (3,440 v x 0.106 x 32 mi x $0.44 x 30d) $154,000 for all trucks and (3,440 v x 0.894 x 32 mi x $0.21 x 30d) $617,000 for all passenger vehicles. Annualized at 8-7/8 percent, average annual detour mileage cost for all vehicles is $68,400.

The opportunity cost of time is the value of work or leisure activities foregone for travel purposes. No breakdown of vehicles was made for school buses, emergency vehicles, or farm machinery. It was assumed that 25 percent of all traffic was leisure related, based upon total county population and total employed persons over the age of 18. Approximate hourly wage rates were used as values of time, based upon U.S. Department of Commerce October 1989 wage rates, adjusted by a factor determined by United States and Pike County per capita income. Wages for truck drivers were $10.78 per hour. Using the data from table B-2, a weighted hourly wage of $6.26 per hour was applied to 75 percent of passenger vehicles, and a minimum wage (October 1989) of $3.45 per hour for the remaining passenger vehicles. Total opportunity cost for truck drivers would be (3,440 v x .106 x $10.78 x 0.71h x 30d) $83,700, and for passenger vehicles would be (3,440 v x .894 x .75 x $6.26 x 0.71h x 30d) + (3,440 v x .894 x .25 x $3.45 x 0.71h x 30d) $364,000. Annualized at 8-7/8 percent, average annual detour opportunity cost for all drivers is $39,700.

An additional cost would be for repairing shoulders and embankments. At current price levels to repair shoulders and embankments, it would cost $500/mile for paved surface highways and $1,000/mile for township roads. There are 21 miles of State paved highways and 78 miles of township roads in the study area. Total cost of repair and grading would be $88,500, or $7,900 annualized at an 8-7/8 percent discount rate.

Total annualized transportation damages for a breach of the existing main stem levee by a 100-year event is $116,000. A breach by a 200-year event would result in floodwaters approximately 1.5 feet deeper than the 100-year event. For the purposes of this analysis, it is assumed the water would remain for more than 30 days and traffic would not be permitted on the highways for a total of 60 days. Using the methodology detailed above, annualized transportation damages would be $224,800.

The Illinois Department of Transportation estimates that in 2009 the average daily traffic count at the Hannibal bridge will be 12,300. Using the above analysis, future damages for detour mileage and opportunity costs are $201,700 for a 100-year event and $403,500 for a 200-year event. These values, taken to present day, are $36,800 and $73,700, respectively. These future growth values are reflected in the summary in table B-14, page B-18.

LOCATION BENEFITS

Location benefits are derived from the increased value of the land because of its location in the project area, separate and apart from any increase in value due to normal market increases. Local sources were consulted on the potential for an increase in agricultural land value because of an increased level of protection. It was felt that there would be no immediate effect, but that within 10 years, land value could increase from $0 to $300 (approximate average $170) per acre based upon the soil type and its location in the project area.

Present worth of the increase in value for a 100-year project are $2,615,000 and for a 200-year project are $2,651,300. Annualized at 8-7/8 percent, location benefits are $232,100 and $235,300, respectively.

EMPLOYMENT BENEFITS

As mentioned previously, Pike County, Illinois, is eligible to claim employment or redevelopment benefits. Adams County, Illinois, is not an area with substantial and persistent unemployment. Over 90 percent of the construction will occur in Pike County. Construction cost to provide 100-year protection at October 1989 price levels is $9,100,000 and to provide 200-year protection is $15,500,000. Benefits for the Pike County portion of the project area are shown in tables B-15 and B-16, pages B-19 and B-20.

AVERAGE ANNUAL DAMAGES AND BENEFITS

Estimated average annual damages and benefits for raising the main stem levee to provide protection for the 100-year and 200-year event are shown in table B-14. Credit has been given to protection afforded by the existing levee.

TABLE B-14

Average Annual Damages and Benefits
October 1989 Price Levels
(In Thousands)

	100-Year Project		200-Year Project	
	Average Annual Residual Damages	Average Annual Benefits	Average Annual Residual Damages	Average Annual Benefits
Inundation Reduction:				
Agriculture	$ 37.0	$ 24.0	$ 14.0	$ 47.0
Farmsteads	31.0	33.0	16.0	46.0
Hull	45.4	48.7	23.7	69.1
Local Communities	11.0	13.0	7.0	17.0
Transportation		116.0		224.8
Traffic Growth		36.8		73.7
Location Benefit		232.1		235.3
Employment Benefits		300.0		509.0
Total	$124.4	$803.6	$ 60.7	$1,221.9

TABLE B-15

Employment Benefits - Raise Main Stem to 100-Year Protection
October 1989 Price Levels, 8-7/8 Percent Discount Rate

A. Estimated on-site labor costs:

Construction cost	$9,100,000
Construction cost at 90 percent (Pike County portion)	8,190,000
Percent to labor	40%
Total labor	$3,276,000

B. Allocation of on-site labor costs by category:

Labor Category	On-Site Labor Costs ($)	Percent Allocation	Amount of Wages ($)
Skilled	3,276,000	40	1,310,400
Semi-Skilled	3,276,000	50	1,638,000
Other	3,276,000	10	327,600

C. Allocation of wages to locally unemployed or underemployed:

Labor Category	Amount Wages ($)	% to Locally Unemployed/ Underemployed Labor	Wages to Previously Unemployed/ Underemployed Labor ($)
Skilled	1,310,400	90	1,179,360
Semi-Skilled	1,638,000	90	1,474,200
Other	327,600	90	294,840
TOTALS	3,276,000		2,948,400

D. Benefit Computation:

Year	Local Wage Amount ($)	Periods to Base Year	Future Value of 1.00	Local Wage Value in Base Year($)
1993	884,520	5	1.24249	1,099,007
1994	1,179,360	3	1.13912	1,343,433
1995	884,520	1	1.04438	923,784
Amortized at 8-7/8 percent				* 0.08877
Annual employment benefit				$298,820
			Say:	$300,000

TABLE B-16

Employment Benefits - Raise Main stem to 200-Year Protection
October 1989 Price Levels, 8-7/8 Percent Discount Rate

A. Estimated on-site labor costs:

Construction Cost	$15,500,000
Construction Cost at 90% (Pike County portion)	13,950,000
Percent to labor	40%
Total Labor	$5,580,000

B. Allocation of on-site labor costs by category:

Labor Category	On-Site Labor Costs ($)	Percent Allocation	Amount of Wages ($)
Skilled	5,580,000	40	2,232,000
Semi-Skilled	5,580,000	50	2,790,000
Other	5,580,000	10	558,000

C. Allocation of wages to locally unemployed or underemployed:

Labor Category	Amount Wages ($)	% to Locally Unemployed/ Underemployed Labor	Wages to Previously Unemployed/ Underemployed Labor ($)
Skilled	2,232,000	90	2,008,800
Semi-Skilled	2,790,000	90	2,511,000
Other	558,000	90	502,200
TOTALS	5,580,000		5,022,000

D. Benefit Computation:

Year	Local Wage Amount ($)	Periods to Base Year	Future Value of 1.00	Local Wage Value in Base Year($)
1993	1,506,600	5	1.24249	1,871,935
1994	2,008,800	3	1.13912	2,288,264
1995	1,506,000	1	1.04438	1,573,478
Amortized at 8-7/8 percent				* 0.08877
Annual employment benefit				$508,979
			Say:	$509,000

AVERAGE ANNUAL COSTS

Construction costs and operation and maintenance costs detailed in this report are at October 1989 price levels. Interest during the 2.5-year construction period and annualized costs were computed at 8-7/8 percent. A 100-year project life was used for the period of analysis. Tables B-17 and B-18 summarize the calculations for interest during construction and average annual costs for a 100- and a 200-year protection levee, respectively.

TABLE B-17

Interest During Construction
October 1989 Price Levels
(In Thousands)

Year	Cost $	Time to Base Year	Period	Interest Factor	Interest $
100-Year Project					
1	2,730.0	2.5	(5)	0.24249	662.0
2	3,640.0	1.5	(3)	0.13912	506.4
2.5	2,730.0	0.5	(1)	0.04438	121.2
Total	9,100.0				1,289.6
200-Year Project					
1	4,635.0	2.5	(5)	0.24249	1,123.9
2	6,180.0	1.5	(3)	0.13912	859.8
2.5	4,635.0	0.5	(1)	0.04438	205.7
Total	15,450.0				2,189.4

TABLE B-18

Average Annual Costs ($)
October 1989 Price Levels
(In Thousands)

	100-Year	200-Year
Project Costs	9,100.0	15,450.0
Interest During Construction	1,289.6	2,189.4
Total First Cost	10,389.6	17,639.4
Interest and Amortization	922.3	1,565.8
Operations and Maintenance	20.0	40.5
Total Average Annual Cost	942.3	1,606.3

ECONOMIC SUMMARY

Table B-19 presents a summary economic analysis for the project alternatives considered in this report.

TABLE B-19

Economic Analysis Summary
October 1989 Price Levels
(In Thousands)

ALTERNATIVE 1 - Hull Ring Levee:

	Alignment A	Alignment B
Total First Costs	$4,300.0	$3,700.0
Average Annual Cost	447.5	421.0
Average Annual Benefit	225.9	210.7
Benefit-to-Cost Ratio	0.50	0.50

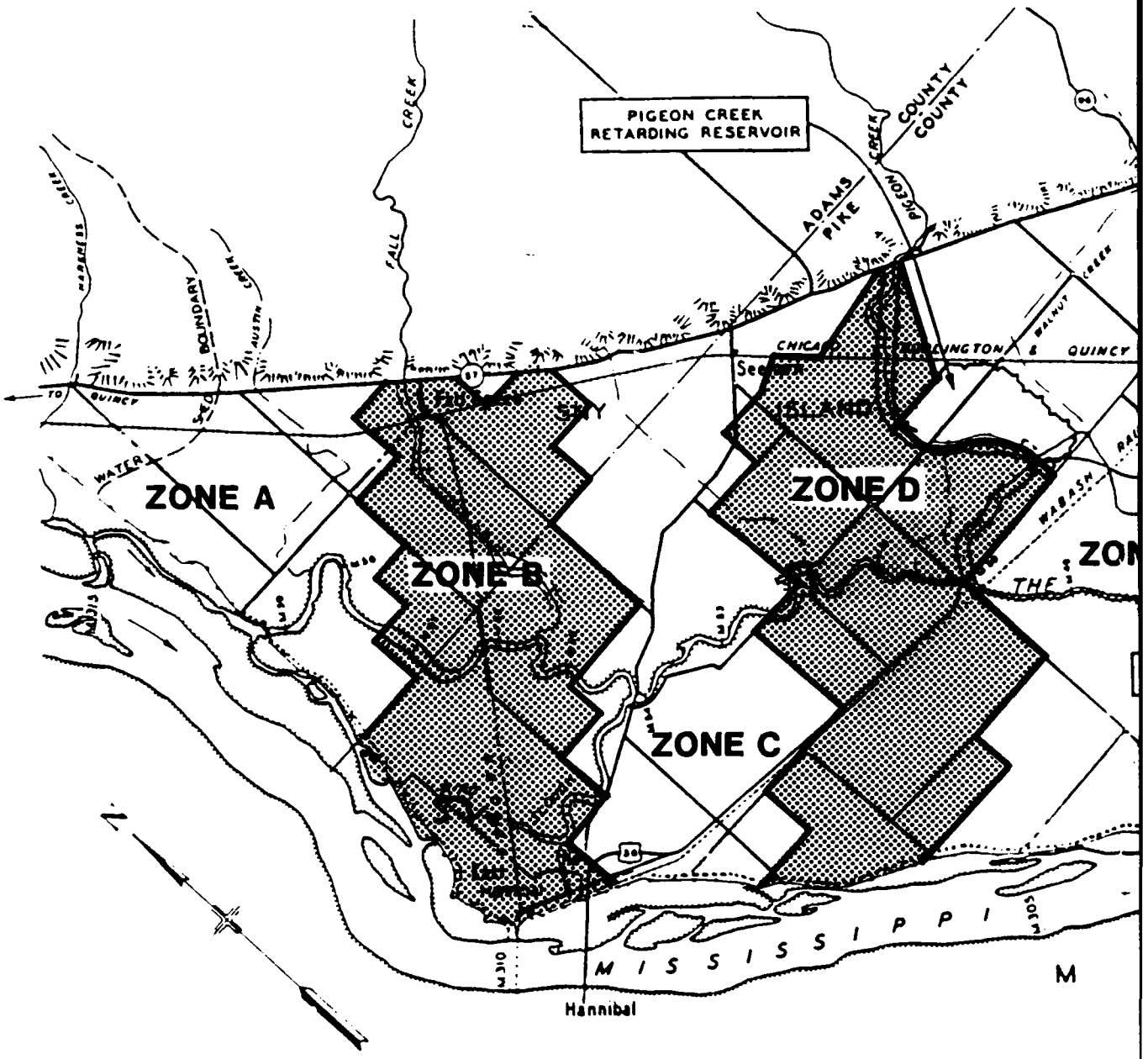
ALTERNATIVE 2 - Raise Existing Levee:

	100-Year Project	200-Year Project
Total First Costs	$9,100.0	$15,450.0
Average Annual Cost	942.3	1,606.3
Average Annual Benefit	803.6	1,221.9

TABLE B-19 (Cont'd)

	100-Year Project	200-Year Project
Benefit-to-Cost Ratio	0.85	0.76

As indicated by table B-19, none of the alternatives studied are economically feasible. Since a Federal interest has not been determined, a financial impact to local sponsors or ability to pay analysis are not included in this report.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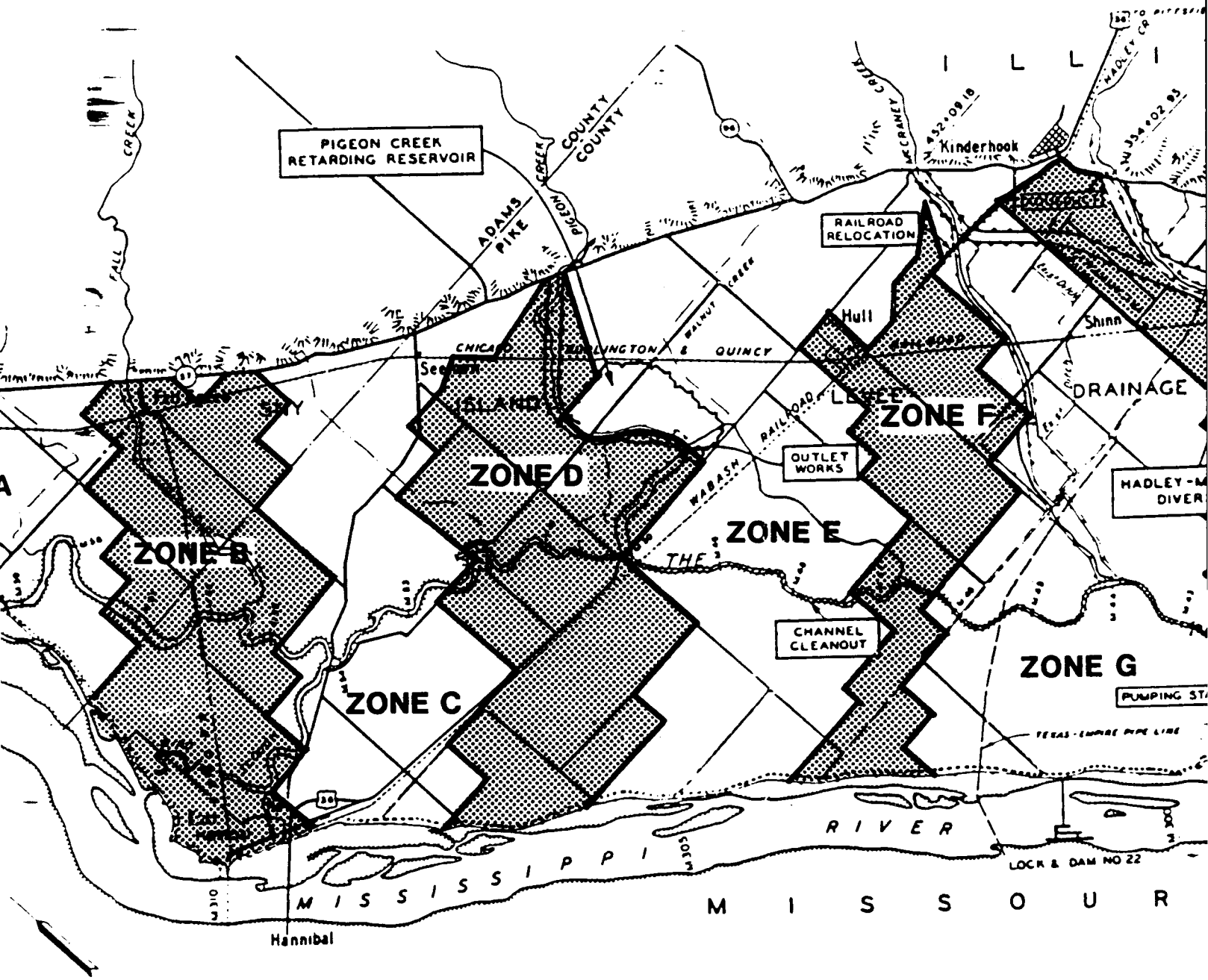
RETARDING RESERVOIR
ADAMS
PIKE
ZONE A
ZONE B
ZONE C
ZONE D
MISSISSIPPI
Hannibal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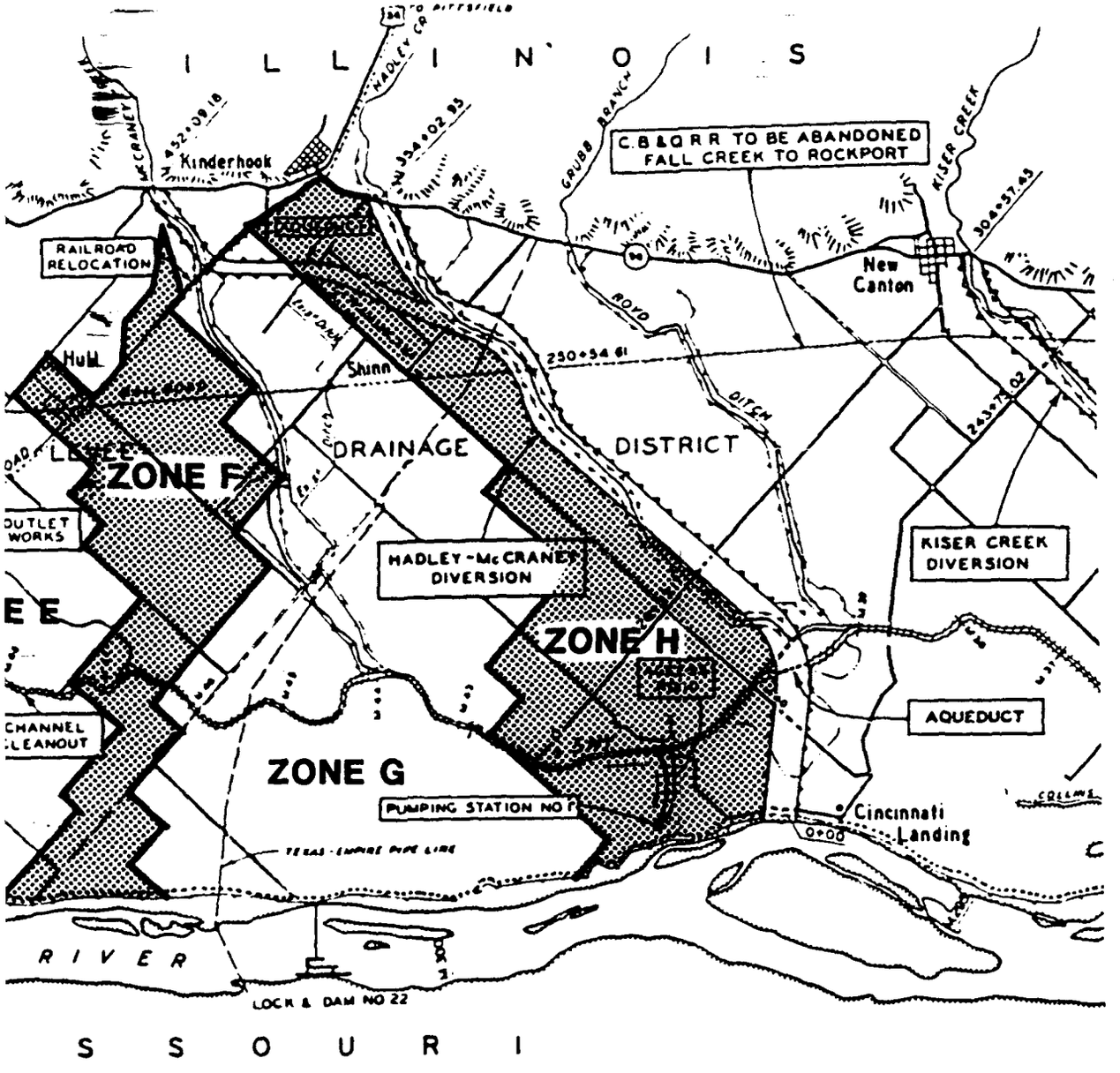
RETARDING RESERVOIR
ADAMS
PIKE
RAILROAD
RELOCATION
Kinderhook
Hull
Shinn
DRAINAGE
ZONE F
ZONE D
ZONE E
ZONE B
ZONE C
ZONE G
OUTLET
WORKS
CHANNEL
CLEANOUT
PUMPING ST
LOCK & DAM NO 22
RIVER
M I S S O U R
M I S S I S S I P P I
Hannibal



MISSISSIPPI RIVER
HULL, ILLINOIS

SNY ISLAND LEVEE DRAINAGE DISTRICT ZONE MAP

PLATE B-1

APPENDIX C

ENVIRONMENTAL ANALYSIS

RECONNAISSANCE REPORT

SECTION 205 FLOOD DAMAGE REDUCTION STUDY
MISSISSIPPI RIVER, HULL, ILLINOIS

APPENDIX C
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EXISTING CONDITIONS

NATURAL RESOURCES

Ring Levee Alternatives

The area surrounding Hull, including that through which the ring levees would cross, consists primarily of agricultural land. Most of this land is in row crops for corn or soybeans, with a very small amount in pasture or in fallow.

A small seasonal stream is located along the south and southeast sides of Hull. It has been channelized and functions mainly as a ditch. Its sides and bed are vegetated with a variety of annual forbs.

Approximately 2,500 feet of ring levee alternative A parallels the railroad tracks on the west side of town. This area consists of residences with mown lawns and planted trees and shrubs, and an industrial site with grain silos and gravel/concrete parking lots.

Because of intensive farming, wildlife cover and habitat are virtually nonexistent within the immediate vicinity of Hull. Wildlife likely to be found would be those adapted to the agricultural and urban environment, including songbirds and smaller mammals such as the squirrel, cottontail rabbit, opossum, skunk, mice, and shrews. The seasonal stream may provide marginal habitat for seasonal spawning of reptiles and amphibians.

Existing Agricultural Levee Raise

The existing agricultural levee would be raised an average of 2 feet, thereby increasing its width by 18 feet. About 28 miles of levee would be raised.

The main stem agricultural levee consists of sand dredged from the nearby Mississippi River. It is moderately vegetated with various grasses and forbs and is mown occasionally to prevent encroachment by trees and shrubs.

The majority of the 18-foot-wide increase in the levee would be to the landward side. Most of this land is rowcropped for corn and soybeans. Gravel roads and occasional houses are located adjacent to parts of the levee, particularly downstream of Lock and Dam 22.

Scattered wooded areas and wetlands also occur along the levee and would be affected by levee widening. The wooded areas consist of silver maple (Acer saccharinum), willow (Salix sp.), cottonwood (Populus deltoides), American elm (Ulmus americana), green ash (Fraxinus pennsylvanica), river birch (Betula nigra), and sycamore (Platanus occidentalis). Pecan (Carya illinoensis) and pin oak (Quercus palustris) also occur, but less frequently. The wetlands consist of low spots, sloughs, or old oxbows. They vary in their amount of open water and generally contain emergent aquatic vegetation and well-vegetated shorelines which are often tree-lined with the species listed above.

Two actions would affect the riverward side of the agricultural levee. Approximately 6,500 feet of levee near Hannibal, Missouri, would be raised to the riverward side, encroaching upon the floodplain forest and backwater sloughs which lie adjacent the levee. Borrow material, for that part of the levee adjacent the Mississippi River raise, would be obtained from dredging the river. This would require occasional openings through the floodplain forest for the placement of dredging pipe to reach the levee. Again, the more common tree species would include those listed previously.

Borrow for that part of the levee lying away from the river (at both ends along the Hadley-McCrane Diversion and Harkness Creek) would come from adjacent farmland paralleling the levee.

The majority of the affected area, which includes the existing levee and the adjacent cropland, provides limited habitat because of lack of cover and human disturbance (mowing or plowing). Some songbirds and small mammals may use the levee and its edges for nesting. Other wildlife would use it primarily as a travel corridor. The croplands provide an alternative feeding source and would be used by a number of avian and mammalian species from the nearby wooded or wetland sites.

The combinations of floodplain forest and aquatic areas provide cover, nesting, and feeding habitat for a large number of wildlife. Species include white-tailed deer, fox, coyote, skunk, raccoon, fox and grey squirrels, mice, shrews, voles, turkeys, woodpeckers, raptors, and numerous passerine birds.

The aquatic areas provide habitat for reptiles and amphibians such as frogs, toads, snakes, and turtles. They also provide important habitat for waterfowl, wading and shore birds, and aquatic mammals such as herons, egrets, sandpipers, ducks, geese, muskrat, and beaver.

The project area provides a good fishery resource. The Mississippi River throughout this stretch is used for both sport and commercial fishing. Primary sport fish include white bass, channel catfish, and drum. Parts of the Sny slough (a major drainage within the levee district) contain such sport fish as largemouth bass, catfish, bluegill, and crappie. Mussel beds also occur at numerous locations in the Mississippi River.

Two unique areas lie within the vicinity of the agricultural levee to be raised. The first area is Pin Oak Lake, which is located east of Lock and Dam 22, approximately 0.5 mile inland from the levee. This site is listed on the Illinois Natural Areas Inventory and contains essentially undisturbed or slightly disturbed wet-mesic floodplain forest, shrub swamp, and pond.

The second site is Armstrong Island, which is located on the riverward side of the levee between river miles 312.5 and 313.5. Armstrong Island is Corps of Engineers fee title land that is currently leased to the Illinois Department of Conservation. This site contains floodplain forest and a heron rookery. It is currently zoned as a natural area.

CULTURAL RESOURCES

Previous Investigations

Both geomorphological and cultural resource studies have been conducted in the project vicinity.

Geomorphological Studies

Conner, et al. (1984) and Leigh (1985) summarize the geomorphological work from the Illinois Department of Transportation FAP 408 highway project north of Hull. Hull lies entirely within Leigh's Alluvial Fan landform.

Leigh's (1985) Core No. 630 was taken within the village and revealed Holocene deposits to a depth of between 14 and 15 feet below the surface. His Core No. 630 lithostratigraphic units (LSU) LSU-6 and 9 are alluvial fan deposits, while LSU-7 is a slackwater deposit (Leigh 1985:18). Buried cultural remains would more likely occur in the alluvial fan units than in the slackwater unit.

Anderson (1989:Plate 1-E) maps the alluvial fan with more detail than Leigh (1985). The fan overlies main valley vertical accretion deposits throughout most of the village.

Virtually no post-settlement alluvium (PSA) is present in the vicinity of Hull. Anderson's (1989:Plate 2-E) mapping shows less than 10 centimeters (cm) of PSA.

Judging from the geomorphological evidence in both Leigh (1985) and Anderson (1989), the inspection trench for the new ring levee, the associated drainage ditch, and any borrow pits would have a high probability of encountering some type of buried remains. The existing levee raise would affect almost all of the various geomorphic units.

Cultural Resource Studies

A summary of site locations in the project area was obtained from the Illinois Historic Preservation Agency (IHPA). No site locations were recorded for the immediate vicinity of Hull; however, numerous sites were recorded along the levee raise portion of the project.

Investigations related to highway construction along the FAP 408 route (Conner, et al., 1984; Esarey, et al., 1982; McGimsey 1981; Stafford, et al., 1983) were conducted just north of the present project area.

Anderson (1989:Plates 2A-E), in the overview for the Mississippi River Pool 22 study, summarizes known site locations. He shows eight historic site locations taken from early plat maps (Anderson 1989:38 and Plate 2E) for the Hull area. None of these have been assigned official site numbers. Three of these historic sites are within areas of potential impact from the ring levee. No prehistoric sites are recorded for this area in Anderson (1989:Plate 2E) or in the IHPA records.

Both the IHPA and Anderson (1989:Plates 2A-E) record sites along the levee raise portion of the project. These sites undoubtedly represent only a fraction of the actual site locations in the area of impact from any potential levee raise.

Houart, et al., (1979) conducted an intensive, 206-acre, surface survey augmented by shovel testing in a 500-foot-wide by 3.4-mile-long corridor (Mississippi River Miles 301.7 to 305.1) along the interior margin of the Sny Island Levee and Drainage District levee in the present project area. Two historic sites and 28 prehistoric sites were located. The prehistoric sites include occupations ranging from Middle Archaic to Late Woodland times and "uniquely represent a segment of Mississippi River shoreline that has been preserved from destruction by river meander erosion cutting and alleviation" (Houart, et al., 1979:44). Houart, et al., continue by noting that these sites represent the "only known area of preserved archeological shoreline settlement in this entire region of the Mississippi River valley."

This area of "preserved shoreline settlement" may extend along nearly the whole reach of the Sny Island Levee Drainage District's levee given

Anderson's (1989:65) observation that "the southeast portion of Pool 22 near Fall Creek and Hull [has] escaped Holocene main channel reworking." Anderson's (1989:Plate 2C-E) maps of PSA depths show all of the interior margin of the levee to contain less than 10 cm of recent alluvium. Exceptions are small areas at the upstream and downstream tie-offs in the vicinity of Bluff Hall and Hull, respectively, where the levee meets the valley margin.

The potential for buried cultural remains dating from Paleo-Indian to Middle Woodland [valley margin deposits only (Anderson 1989:Plates 2A-E)] and from Early Archaic to Middle Woodland (main valley deposits) exists in the project area according to Anderson's (1989:Table 5) summary of the geomorphological evidence.

Previous cultural resource investigations have revealed a relatively unique preservation of prehistoric shoreline settlements along a short segment of the levee in the project area (Houart, et al., 1979). The geomorphological evidence points to the possibility that the entire Sny Island Levee and Drainage District lies within a zone of Mississippi River channel stability. If this is the case, the results of the Houart, et al., (1979) survey may be typical of the site density to be excepted for the majority of locations along the interior margin of the levee. In addition to the high potential for surface sites, the possibility of buried sites exists throughout the project area.

Field Reconnaissance

The field reconnaissance was limited to the area of possible new construction of the ring levee and associated drainage in the immediate vicinity of Hull.

All portions of the levee and drainage ditch alignments with acceptable ground visibility (greater than 25 percent) and with well rain-washed soil were surveyed by pedestrian walkover. No shovel testing was conducted during this preliminary reconnaissance survey. Six segments of the potential alignments were surveyed by walking the areas in approximately 8-meter intervals to cover a corridor 16 meters (50+ feet) wide. Together the segments were 4,640 feet long and, at 50 feet wide, totaled 5.3 acres. No collections were taken during the survey.

The portion of the levee alignment lying just north of the Norfolk and Western Railroad was inspected briefly. The alignment may be able to avoid disturbance of most nearby dwellings, but some commercial buildings may be impacted if this alignment is recommended.

Two historic sites and two isolated finds were recorded by the field reconnaissance. Site data sheets are on file at the Rock Island District, Corps of Engineers, and at the Illinois State Historic Preservation Agency.

PROJECT IMPACTS

Table C-1 lists the probable impacts associated with the alternatives.

TABLE C-1

Probable Impacts of the Proposed Alternatives

Item	Ring Levee Alt. A	Ring Levee Alt. B	Existing Agri. Levee Raise
1. Natural Resources	0 to -1	0 to -1	0 to -2
2. Cultural Resources	-1	-1	-1 to -2
3. Man-Made Resources	0	0	0
4. Water Quality	0 to -1	0 to -1	0 to -2
5. Air Quality	0 to -1	0 to -1	0 to -1
6. Endangered Species	0	0	0 to -2
7. Community-Regional Growth	0	0	0
8. Displacement of People	0	0	0 to -1
9. Community Cohesion	+1 to +2	0 to -1	+1 to +2
10. Property Values	0 to +1	0 to +1	0 to +2
11. Tax Revenues	0 to +1	0 to +1	0 to +2
12. Public Facilities & Services	+1 to +2	+1 to +2	+1 to +2
13. Life, Health, & Safety	+1 to +2	+1 to +2	+1 to +2
14. Employment & Labor Force	0 to +2	0 to +2	0 to +2
15. Business & Industrial Development	+1 to +2	+1 to +2	+1
16. Farm Displacement	-1	-1	-1 to +1
17. Noise Levels	-1	-1	-1
18. Aesthetics	-1	-1	-1

+2 = Significant positive effect.
+1 = Minor positive effect.
0 = No effect.
-1 = Minor adverse effect.
-2 = Significant adverse effect.

NATURAL RESOURCES

Increasing the size of the existing agricultural levee would cause the loss of adjacent wooded or wetland areas on either side of the levee. Additional bottom land forest also may be affected through the placement of dredge pipe from the Mississippi River to the levee. Further project details would be required to evaluate specific impacts.

Borrow material for a levee raise would come from dredging the Mississippi River main channel. Such an action would cause temporary disturbances to fish bottom sediments (mostly sand). Disturbances to significant spawning areas or vegetated wetlands are not likely to occur. Mussel beds located along various parts of the main channel may be affected, depending on the location of the dredging. Again, greater project details would be needed to address specific impacts.

ENDANGERED SPECIES

Five federally endangered species are listed for Pike and Adams Counties, Illinois. These are addressed below.

The gray bat (Myotis grisescens) uses caves for summer roosts and winter hibernation. It feeds over large bodies of water. No caves are within the project area, and no impacts are anticipated.

The Indiana bat (Myotis sodalis) uses large trees with loose or peeling bark near small- to medium-sized streams with an enclosed tree canopy as summer roosts. In the winter, the bat hibernates in caves. The agricultural levee raise would result in the loss of trees in selected areas adjacent the levee. These trees are generally young without loose or peeling bark and do not provide suitable habitat for the Indiana bat. The potential for suitable trees (particularly large dead or dying ones) does occur in the floodplain forest on the riverward side of the levee. Dredging pipe should avoid these trees, and there should be no impacts to the Indiana bat.

The bald eagle (Haliaeetus leucocephalus) is listed as breeding in Adams County and wintering in both Adams and Pike Counties. There are no known breeding sites within the project vicinity. Wintering bald eagles use large trees near open water as daytime feeding perches along various locations of this stretch of the Mississippi River. However, dredging operations for levee construction would cease prior to the formation of ice on the river and prior to the arrival of wintering eagles. Therefore, no impacts to the bald eagle are anticipated.

The Higgins' eye pearly mussel (Lampsilis higginsii) and the fat pocket pearly mussel (Potamilus capax) are large river species. The Higgins' eye is found in deep water, while the fat pocket has been known to occur on sand and mud bottoms from a few inches to 8 feet or more in depth. At present, there are no known living populations of either species in the affected stretch of the Mississippi River. However, the potential remains that either may occur, particularly within high quality mussel beds. Specific sites from which dredged material would be taken need to be identified in order to fully address the potential for impacts.

FARM LAND

Ring levee alternatives A and B around the town of Hull would displace approximately 43 and 66 acres of farm land, respectively. The alternative of raising the existing agricultural levee would displace about 76 acres of farm land adjacent to the levee.

CULTURAL

The need for an intensive Phase I survey combined with geomorphological testing has been documented for all portions of the project area.

The section of the Mississippi River in the vicinity of the Sny Island Levee and Drainage District has been identified as unique due to the relative stability of the river channel over time. This has allowed shoreline sites of considerable age to remain relatively undisturbed up to the present day. This is not the case for many parts of the Mississippi River Valley where active channel migration has destroyed numerous archeological sites.

The potential for buried cultural deposits has been amply documented in the project area by both direct archeological observation and by indirect evidence from the available geomorphological studies.

FUTURE STUDIES

NATURAL RESOURCES

Should a detailed project report be completed, an Environmental Assessment would be required to determine the extent of impacts. An agricultural levee raise would more than likely involve placing fill into waters or wetlands and would require a Section 404(b)(1) evaluation and State 401 certification under the Clean Water Act.

If borrow for a levee raise were to come from material dredged from the river, endangered species evaluations or surveys may be necessary, depending on the locations of the dredging. Water quality or elutriate testing also may be necessary, depending on the dredging location and nature of sediment.

CULTURAL RESOURCES

All proposed actions to reduce flood damages currently under study will require an intensive Phase I cultural resource survey combined with extensive geomorphological investigations.

The current level of study does not permit the precise location of proposed new levee alignments, borrow pits, or associated project impact zones. Nevertheless, general requirements for an eventual intensive Phase I cultural resource survey and geomorphological investigation are outlined below.

The nature and spacing of geomorphological tests must be appropriate for locating potentially significant resources. A combination of coring and backhoe trenches will be required to adequately assess potential cultural resource impacts. Noting the considerable variation in site sizes from the Houart, et al., (1979:Figures 7-10) survey, it is reasonable to assume that buried sites also will range from the very small to the moderately large in areal extent. The sampling problems involved in locating such sites should be taken into account.

Existing Levee Raise

Extension of the interior toe of the levee will disturb cultural resources as sod is cleared and the soil prepared prior to the placement of fill. In addition, the surficial cultural resource sites abutting the present toe will have to be identified because the extension of the toe over these sites constitutes site burial, an additional adverse impact.

All borrow pits, access roads, equipment staging areas, and any other potential ground disturbing activity areas will require investigation.

Geomorphological testing must extend to a depth sufficient to discover any buried cultural materials. For most impacts associated with the extension of the levee toe, access roads, etc., evaluation of soils to the depth of standard shovel testing techniques (approximately 50 cm) would be acceptable. For borrow areas, however, deep testing sufficient to reach the base or slightly below the base of the pit would be required.

New Ring Levee and Drainage Ditch

Complete surface survey (with evaluation of any affected standing structures) and deep testing of the eventual levee alignment, drainage ditch location, borrow pit areas, and any associated ground disturbances will be required

This preliminary field reconnaissance has documented the potential for historic sites, but has failed to locate unequivocal evidence of prehistoric occupations. These may exist on the surface or in buried deposits.

The impact on standing structures will require evaluation if the levee alignment north of the Norfolk and Western Railroad tracks is chosen. Borrow pits also may affect existing structures, depending on the eventual placement selected.

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APPENDIX D

PERTINENT CORRESPONDENCE

District Engineer
U.S. Army Engineer District, Rock Island
ATTN: Planning Division
Clock Tower Bldg. P.O. Box 2004
Rock Island, Illinois 61204-2004

24 Walnut St.
Hull, IL 62343
July 26,1989

Dear Sir:

In accordance with the provisions of Section 205 of the Flood Control Act of 1948, as amended, which authorizes the federal government to initiate investigations and studies to be made in the interest of flood control, the Village of Hull hereby makes formal application for a study of a flood control levee.

The investigations will be conducted in two phases; the first phase is the reconnaissance study which will be funded by the Corps of Engineers.

The Village of Hull can provide 50 percent of the cost of the second phase, the feasibility study, and one-half of our share may consist of in-kind service. The Village of Hull can provide the following local cooperation and participation.

1. Provide without cost to the United States all land, easements and rights-of-way necessary for the construction of the project.

2. Provide without cost to the United States all necessary relocations and alterations of buildings, utilities, highways, bridges, sewers and related and special facilities.

3. Hold and save the United States free from damages due to the construction and and subsequent maintenance of the project, except damages due to the fault or negligence of the United States or its contractors.

4. Maintain and operate the project works after completion without cost to the United States in accordance with regulations prescribed by the Secretary of the Army.

5. Prevent future encroachment which might interfere with proper functioning of the project for flood control.

6. Assume responsibility for all costs in excess of federal cost limitations of $5 million.

7. Provide guidance and leadership in preventing unwise future development of the flood plain by use of appropriate flood plain management techniques to reduce flood loss.

8. Provide a minimum cash contribution of 5 percent of the project cost.

9. If the value of the sponsor's contribution above does not exceed 25 percent of the project, cost, provide a cash contribution to make the sponsor's total contributions equal to 25 percent.

Sincerely,

John J. Lehr
President of Village Board
Village of Hull
Hull, Illinois 62343

Illinois Historic Preservation Agency

Old State Capitol • Springfield, Illinois 62701 • (217) 782-4836

217/785-4997

PIKE COUNTY
LEVEE WORK AND RING LEVEE
Hull

October 18, 1989

Dudley M. Hanson, P.E.
Chief, Planning Division
District Engineer
U.S. Army Engineer District, Rock Island
Attn: Planning Division
Clock Tower Building - P.O. Box 2004
Rock Island, Illinois 61204-2004

Dear Sir:

Thank you for requesting comments from our office concerning the possible effects of the project referenced above on cultural resources. Our comments are required by Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties".

The USGS 7.5' quadrangle maps you sent to our office is enclosed along with attributes of the sites noted on these maps. There is a possibility that more sites exist in the project area. Accordingly, a Phase I archaeological reconnaissance survey to locate, identify, and record all archaeological resources within the Hull vicinity and the levee route will be required.

If you have any further questions, please contact Ms. Joyce A. Williams, Staff Archaeologist, Illinois Historic Preservation Agency, Old State Capitol, Springfield, Illinois 62701, 217/785-1279.

Sincerely,

Theodore W. Hild

Theodore W. Hild
Deputy State Historic
Preservation Officer

TWH:jaw

cc: Ron Pulcher/w maps

Illinois Historic Preservation Agency

Old State Capitol • Springfield, Illinois 62701 • (217) 782-4836

217/785-4997

PIKE & ADAMS COUNTIES
Flood Control Project
Village of Hull & Vicinity
Sny Island Levee & Drainage District

January 19, 1990

Dudley M. Hanson, P.E.
Chief, Planning Division
Department of the Army
Rock Island District, Corps of Engineers
Clock Tower Building-P.O. Box 2004
Rock Island, Illinois 61204-2004

Dear Mr. Hanson:

Thank you for the opportunity to comment on the report titled "Preliminary Cultural Resources Reconnaissance for the Section 208 Flood Control Project, Village of Hull and Vicinity, Adams & Pike Counties, Illinois prepared by the Rock Island District, U. S. Army Corps of Engineers.

This preliminary cultural resource assessment conducted by the Corps of Engineers - Rock Island District adequately documents the very high potential for historic resources within the two proposed levee construction projects. As recommended in the report, intensive Phase I cultural resource surveys combined with geomorphological investigations will be required for the chosen project area. In response to paragragh 5, page 7 of the report, our office does not have general guidelines for geomorphological investigations. We feel this type of investigation is very site specific. We will be happy to work with your office to develop a testing strategy which is adequate for this project area.

If you have any further questions, please contact Paula G. Cross, Staff Archaeologist, Illinois Historic Preservation Agency, Old State Capitol, Springfield, Illinois 62701, 217/785-4998.

Sincerely,

Theodore W. Hild
Deputy State Historic
Preservation Officer

TWH:PGC:ks

United States Department of the Interior

FISH AND WILDLIFE SERVICE
ROCK ISLAND FIELD OFFICE (ES)
1830 Second Avenue, Second Floor
Rock Island, Illinois 61201

IN REPLY REFER TO:
COM: 309/793-5800
FTS: 782-5800

March 6, 1990

Colonel John R. Brown
District Engineer
U.S. Army Engineer District
Rock Island
Clock Tower Building, P.O. Box 2004
Rock Island, Illinois 61204-2004

Dear Colonel Brown:

This constitutes our planning aid letter for the Hull, Illinois Local Flood Protection Reconnaissance Study. The study is being carried out under the authority of Section 205 of the Flood Control Act of 1948. The authority for this report is Section 2 of the Fish and Wildlife Coordination Act of 1958.

DESCRIPTION OF THE PROJECT

The City of Hull is subject to flooding from the Mississippi River. Your study will investigate the feasibility of increasing the level of protection to the residences and businesses in Hull, as well as surrounding agricultural lands. Two alternatives have been identified to date. The first alternative involves the construction of a ring levee around the city. Material for the ring levee would be obtained from lands immediately adjacent to the structure.

The second alternative consists of improving the level of protection provided by an existing agricultural levee system along the Hadley-McCraney Diversion Ditch and the Mississippi River, which was constructed by the Sny Island Drainage District. The existing levee system would be raised an average of two feet along the entire reach. The fill material needed to raise the levee along the diversion ditch would be obtained from adjacent lands on the landward side of the levee, while fill needed to raise that portion of the levee along the Mississippi would be obtained primarily from channel dredging in the Mississippi River. The fill for the levee raise would be deposited primarily on the landward side of the existing levee. This alternative would provide protection not only to Hull, but also East Hannibal, a significant area of agricultural lands and farms, and a portion of the newly improved U.S. Highway 36, which runs just to the north of Hull.

DESCRIPTION OF THE STUDY AREA

The study areas for this project (map attached) include the City of Hull itself, and the agricultural lands immediately surrounding the town. It also includes the lands along the west bank of the Hadley- McCraney Diversion Ditch, from the junction of U.S. Highway 36 and Illinois Highway 57/96, approximately 3/4 mile east of Hull, to its confluence with the Mississippi River at river mile 297. Also included is the Mississippi River from river mile 297 to 316, and the lands along its east bank in the immediate vicinity of the Sny Island Drainage District Levee.

FISH AND WILDLIFE RESOURCES

We investigated the fish and wildlife resources of the study areas in January of this year, and the following information summarizes our findings.

Ring Levee Alternatives

The area surrounding Hull, including the lands upon which the majority of the ring levees would be built, is primarily agricultural. Most is intensively farmed row crops, both corn and soybeans. Only a small portion is in pasture, trees, or idle lands.

A small seasonal stream is located along the east side of Hull. This stream has been channelized and acts mainly as a drainage ditch. The lands adjacent to this stream are cropped to its banks, and the stream itself is vegetated primarily with grasses and scattered small brush/trees.

A portion of one of the proposed ring levee alinements follows the railroad tracks on the south side of town. This area consists of residential properties, with mown lawns and a few ornamental shrubs and trees, and commercial property consisting of grain silos, and gravel and concrete parking lots.

Along the west side of Hull, the ring levee would pass through an area that appears to be an abandoned industrial site comprised mainly of grasses, annual forbs and scattered young shrubs/trees. One of the proposed alinements along this west side would also encompass the town's sewage lagoon. The levee, as proposed would parallel the west and south sides of the lagoon. The lagoon berms are mowed grass. A small forested wetland also exists just west of the sewage lagoon.

With the exception of the small forested wetland and the abandoned industrial site, wildlife habitat values in the immediate vicinity of Hull appear to be very low. Wildlife likely to utilize the majority of the areas through which the proposed ring levees would pass are those species adapted to

intensively farmed and urban/suburban areas. This includes animals such as some songbirds and small mammals such as squirrels, rabbits and mice. The abandoned industrial site may also provide habitat for other more grassland dependent songbirds, rabbits, mice, and other similar species. The small forested wetland may provide additional habitat for more woodland dependent songbirds, waterfowl, raccoons, squirrel and other similar species.

Agricultural Levee Improvement Alternative

Approximately eight miles of existing levee along the west bank of the Hadley-McCraney Diversion Ditch, from the Junction of U.S. Highway 36 and Illinois Highway 57/96 to its confluence with the Mississippi River, will be raised. This levee is constructed of materials excavated from the diversion channel and lands immediately adjacent to the levee. It is vegetated with grasses, and is mowed periodically to prevent invasion by trees, and to control weeds. Along the majority of this reach the levee has been constructed at some distance from the diversion channel, and for the most part the lands along both sides of the levee are cropped from its toe.

The diversion channel is lined by medium-aged trees on both sides for the first (upstream) three miles. These are mostly maple and boxelder, between 20 to 30 feet in height. Below this point the trees become thinner in density, and in some areas scattered. These trees are much younger, ranging from 10 to 20 feet in height. They did appear to be similar species as the larger trees upstream. A small agricultural drainage ditch also runs along a portion of the landward toe of the levee. This small ditch is primarily vegetated with grasses and herbaceous aquatic vegetation, and scattered young willows and other brushy species. The land adjacent to it is cropped to its bank. Local gravel roads also run along the landward toe of this levee at scattered locations.

This reach of the project area provides wildlife habitat values primarily to species adapted to agricultural environments. This would include species such as some songbirds, rabbits, deer, mice and other small mammals, raccoons and other similar species. It may also provide seasonal habitat values for aquatic wildlife such as waterfowl, wading and shorebirds, muskrat, beaver, and various amphibians and reptiles. No fisheries data is available for the diversion, but, it probably provides seasonal and spawning habitats for several species of fish, such as carp, catfish, largemouth bass, bluegill and crappie, as well as smaller forage fish.

Approximately 18 miles of existing levee will be raised along the east bank of the Mississippi River, from the confluence of the Hadley-McCraney Diversion Ditch, at approximate river mile 297 to a point about one mile east of the main channel at approximate river mile 316. This levee is constructed primarily of sands dredged from the main river channel. It is vegetated with grasses and is mowed periodically to prevent invasion by trees, and to control weeds.

The river side of the levee along this entire reach is comprised primarily of bottomland floodplain forest/wetland. It extends from the toe of the levee to the river in most areas. The width of the floodplain forest varies throughout the reach. Downstream of East Hannibal, Illinois, the wooded area is generally fairly narrow, ranging from a couple hundred feet in many areas to over a quarter mile in a few locations. Upstream from East Hannibal, the floodplain forest/wetland complex becomes more extensive, approaching 1/2 to 3/4 mile wide in many areas. These wooded areas are comprised of silver maple, willow, cottonwood, river birch, sycamore, and other similar species. The wetlands intermixed through the floodplain forest include low areas, detached oxbows, sloughs and remnant side channels. These areas vary in the amount of open water present, and generally have emergent aquatic vegetation and well vegetated shorelines. Scattered along the reach are recreational cabin sites. These sites make up only a small portion of the area, however.

The lands on the landward side of the levee along the entire reach is primarily agricultural, much of it plowed to the toe of the levee. Remnant floodplain forest and wetland areas are scattered along the levee also. Many of these areas abut the levee toe, while some are separated by county roads or cropland of varying distances. These areas have the same characteristics as the areas on the river side of the levee. County roads run along portions of the landward toe of the levee and scattered farmsteads also occur along the levee.

The combination of floodplain forest, wetland, and cropland provide a variety of habitats for many species of wildlife. Species include white-tailed deer, fox, coyote, raccoon, opossum, fox and gray squirrels, turkey, raptors, numerous passerine birds, waterfowl, herons, egrets, shorebirds, muskrat, beaver, and various amphibians and reptiles.

The Mississippi River also provides important sport and commercial fisheries values. A list of fish species reported from this reach of the river is included in Table 1.

Threatened and Endangered Species

Our information indicates there are five federally listed endangered species that may occur in the vicinity of the project. These are:

The gray bat (Myotis grisescens) utilizes caves for summer roosts and winter hibernation. It feeds over rivers, streams and lakes within one kilometer of their caves. No caves are located within the project area, and no impacts to this species are anticipated.

The Indiana bat (Myotis sodalis) utilizes large trees with loose or peeling bark along riparian corridors with a closed canopy as summer roosts. It feeds along these same riparian corridors. Winter habitat consists of caves and mines. No caves are located within the project area, but the potential for suitable roost trees does exist within the floodplain forest on the river side of the Sny Island Drainage District levee. Additional information is needed to evaluate the extent to which dredging activities may affect the floodplain forest. However, potentially suitable roosting trees should be identified and avoided to minimize any potential impacts.

The bald eagle (Haliaeetus leucocephalus) is listed as breeding and wintering in both Adams and Pike Counties. There are no known nesting sites in the vicinity of the project area. Wintering bald eagles use large trees near open water as daytime feeding perches. Dredging activities would cease prior to the formation of ice on the river and the arrival of wintering eagles. As such no impacts are expected from those activities. Additional information is needed to evaluate the extent of dredging impacts on the floodplain forest. However, the removal of large potential roosting trees should be avoided to the extent possible to minimize any potential impacts.

The fat pocketbook pearly mussel (Potamilus capax) and Higgins' eye pearly mussel (Lampsilis higginsii) are both large river mussels. Habitat requirements for these species have not been very well defined, but both tend to be found in lotic environments and have a preference for medium fine sand substrates. At present there are no known living populations of either species within the project area. Several surveys conducted within the project area during the late 1970's have verified historical populations of the fat pocketbook mussel, by the presence of shells, some of which were fairly recently dead.

In addition, two populations of fat pocketbook mussels were transplanted in the vicinity of the project area in 1989. In August and September 1989 a population of 1252 individual mussels was transplanted to the Fox Island Chute at approximate river mile 356. Another population of 1149 individual mussels was transplanted to the south side of Blackbird Island at approximate

river mile 291 to 292, also in August and September 1989. These populations are outside the realm of influence of activities proposed as part of this project, but are included in this discussion for informational purposes.

The potential exists that both species may occur within the project area. Specific dredging locations will need to be identified and mussel surveys conducted in those locations to fully evaluate the potential impacts of the project proposal on these species.

Natural Areas

Our information also indicates the presence of three natural areas in the vicinity of the project area. Pin Oak Lake is listed in the Illinois Natural Areas Inventory, and is located just downstream and about one-half mile inland from the Sny Island Drainage District levee. It consists primarily of undisturbed or slightly disturbed wet-mesic floodplain forest and shrub swamp/pond. No impacts to this area are anticipated.

Drift Island is also listed in the Illinois Natural Areas Inventory. It is located along the east bank of the Mississippi River from approximate river mile 290 to 295, and consists primarily of undisturbed or slightly disturbed wet floodplain forest. No impacts to this area are anticipated.

Armstrong Island is not listed in the Illinois Natural Areas Inventory, but is identified as a natural area in the Corps of Engineers draft Land Use Allocation Plan for the Mississippi River, pools 11 through 22. This island is located along the east bank of the Mississippi River within the project area, from approximate river mile 312 to 314.8. It consists primarily of bottomland floodplain forest, and contains a great blue heron rookery. In 1983, approximately 40 heron nests were documented. Specific dredging sites need to be identified to fully evaluate potential impacts to this site and its associated heron rookery. Dredging activities in the vicinity of the rookery should be avoided during the nesting period (late March through mid-July).

PROJECTED PROJECT IMPACTS

The proposed ring levee alternative has the potential to result in minor impacts to the fish and wildlife resources in the vicinity of Hull. The majority of the levee construction will be completed on existing agricultural ground, resulting in minimal impacts in those areas. Those portions located within the urbanized area of Hull and along the seasonal stream on the east side of town have the potential to result in some loss of habitat, primarily grass and a few scattered trees and shrubs. With proper planning, however, these losses can be minimized.

The levee raise alternative has the potential for far greater and more long-term impacts to the fish and wildlife resources in that area. The majority of the lands located along the landward toe of the levee on the Hadley-McCraney Diversion Ditch is intensively farmed. The potential does exist for some impacts resulting from the loss of habitats associated with the small agricultural drainages which run along its toe in portions of this area. With proper planning, these impacts can be minimized.

The activities proposed to raise the portion of the levee that parallels the Mississippi River have the potential to result in significant adverse impacts to the fish and wildlife resources in that area. Dredging activities will require occasional openings through the floodplain forest for the placement of dredging pipe to reach the levee. Also, approximately one mile of levee just downstream from the Norfolk and Western Railroad bridge at East Hannibal will have to be raised by placing fill material on the riverward side of the levee. Along this reach, the railroad bed parallels the landward side of the levee at its toe making raising to that side a problem. This will result in the loss of floodplain forest and associated wetlands located in this area. In addition the several isolated floodplain forest and wetland remnants located adjacent to the levee on the landward side would be encroached upon to some extent by the levee raising. Finally, channel dredging has the potential to result in significant impacts to fisheries and mussel resources along this reach of the river. Additional site specific information is needed for each proposed activity to fully evaluate the extent of all of these potential impacts.

CONCLUSIONS

As a result of these field investigations, we have concluded that there are several areas of concern with regard to fish and wildlife resources in the Hull, Illinois, Local Flood Protection study area. The ring levee alternative has the potential to result in minor adverse impacts, and the levee raise alternative has the potential to result in significant adverse impacts to the fish and wildlife resources within the study areas. Should a feasibility study of this project be initiated, we recommend that a more detailed habitat evaluation of the riparian and aquatic habitats within the study areas be completed. This would provide the basis for determining aquatic and terrestrial habitat losses, and mitigation requirements should impacts be determined to be significant.

If you have any questions regarding this report please contact Mr. Jack Arnold of my staff.

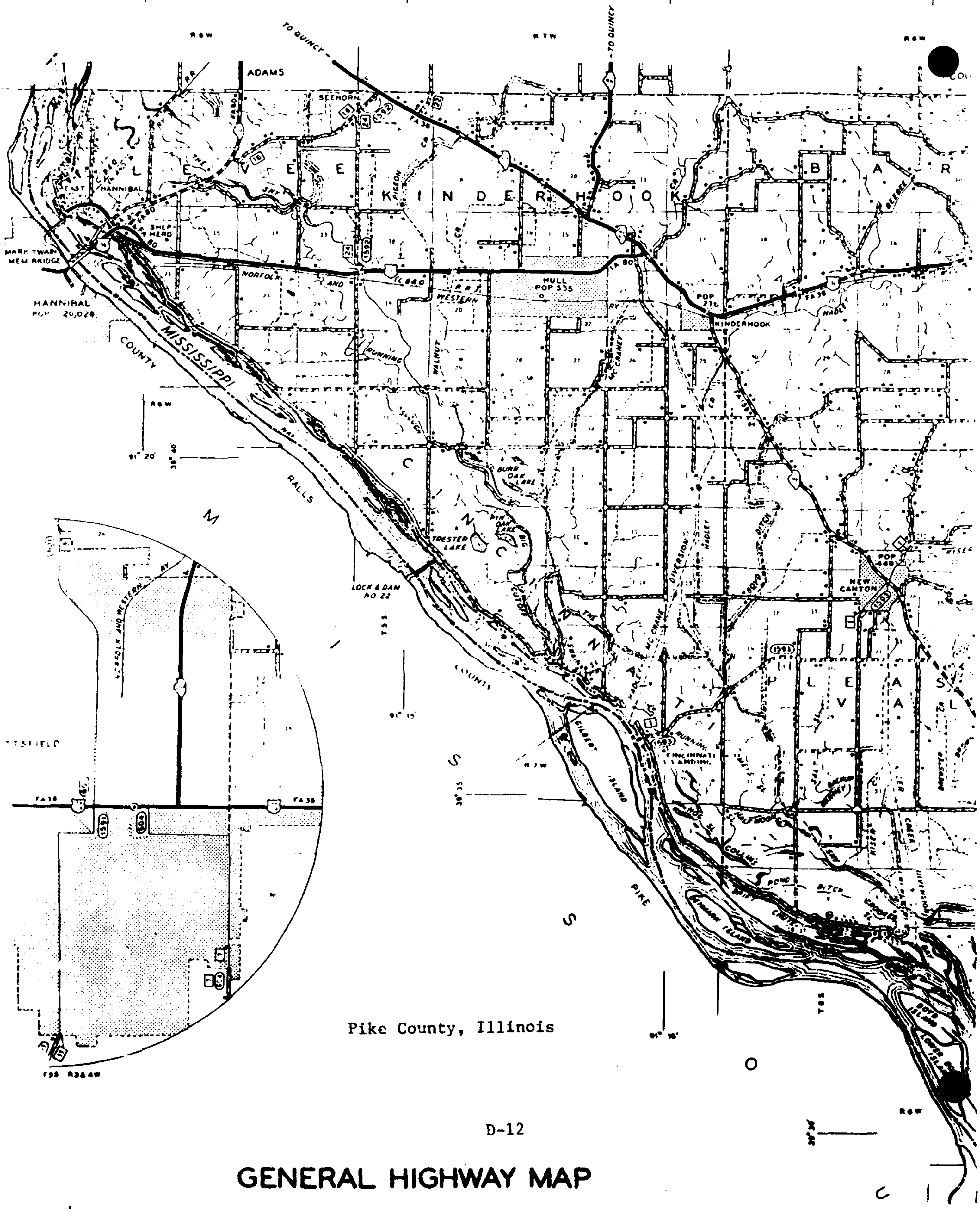
Sincerely,

Richard C. Nelson
Field Supervisor

Attachments

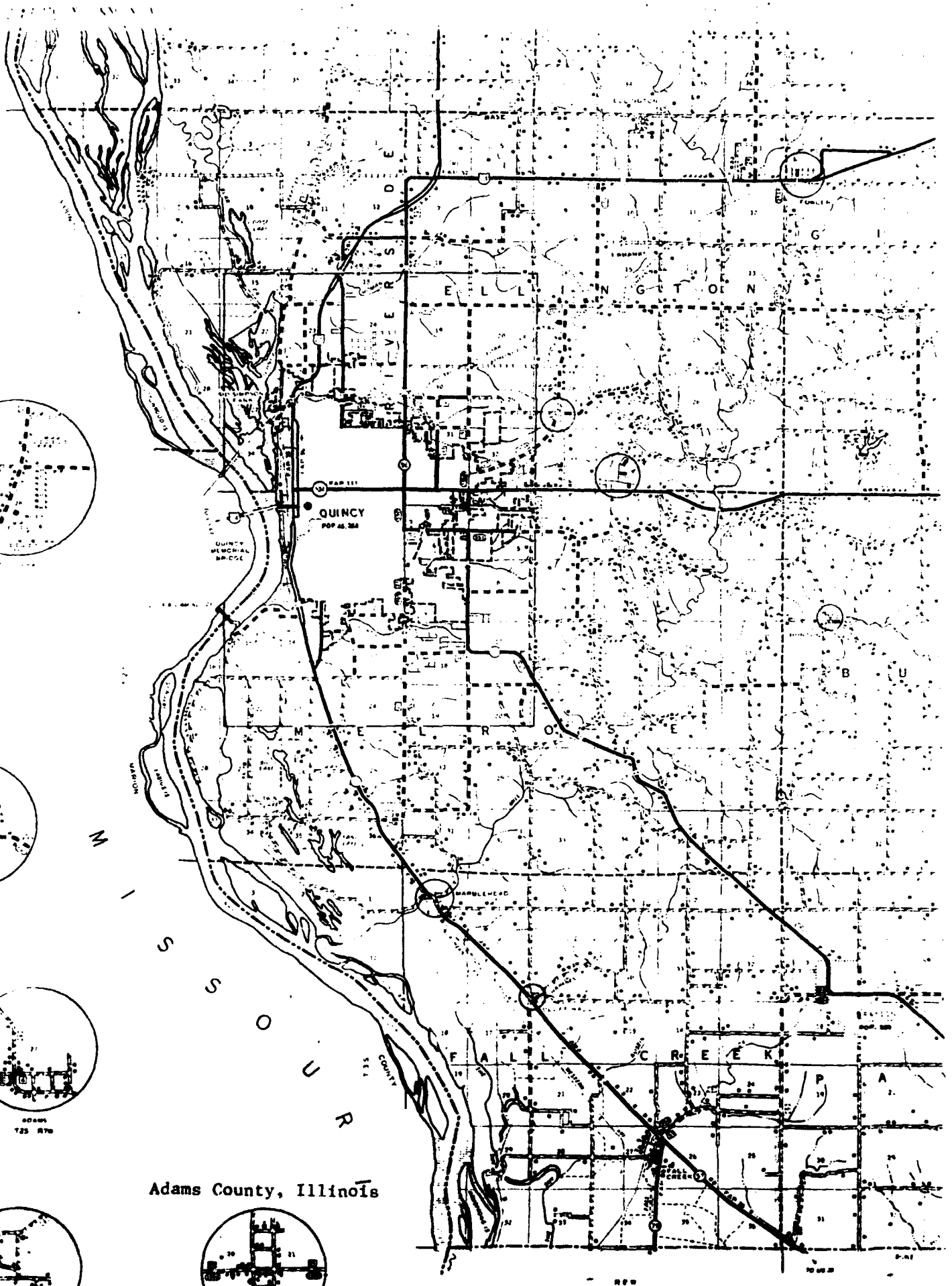
cc: IDOC (Lutz)

JA:sjg



Pike County, Illinois

GENERAL HIGHWAY MAP



Adams County, Illinois

Table 1.—Distribution and relative abundance of Upper Mississippi River fish species by pools. [1]
Pools are identified by the number of the lock and dam which impounds them.

Species	POOL NUMBER									
	16	17	18	19	20	21	22	24	25	26
Bull shark (Carcharhinus leucas)										X
Chestnut lamprey (Ichthyomyzon castaneus)	U	U	U	U	O	O	O	O	O	O
Silver lamprey (Ichthyomyzon unicuspis)	O	O	O	O	U	U	U	U	U	U
Lake sturgeon (Acipenser fulvescens)	R	R	R	H	H	R	H	H	R	R
Pallid sturgeon (Scaphirhynchus albus)					R	R	R	R	R	R
Shovelnose sturgeon (Scaphirhynchus platorynchus)	O	O	O	O	O	O	O	O	O	O
Paddlefish (Polyodon spathula)	O	O	O	O	O	O	O	O	O	O
Spotted gar (Lepisosteus oculatus)					U	U	U	U	O	O
Longnose gar (Lepisosteus osseus)	C	C	C	C	C	C	C	C	C	C
Shortnose gar (Lepisosteus platostomus)	C	C	C	C	C	C	C	C	C	C
Alligator gar (Lepisosteus spatula)										R
Bowfin (Amia calva)	C	C	C	C	C	C	C	C	C	C
American eel (Arguilla rostrata)	U	U	U	U	O	O	O	O	O	O
Alabama shad (Alosa alabamae)										
Skipjack herring (Alosa chrysochloris)	H	H	H	H	O	O	O	O	O	O
Gizzard shad (Dorosoma cepedianum)	A	A	A	A	A	A	A	A	A	A
Threadfin shad (Dorosoma petenense)									U	U
Goldeneye (Hiodon alosoides)	U	U	U	O	O	O	O	O	O	O
Mooneye (Hiodon tergisus)	C	C	C	C	O	O	O	O	O	O
Rainbow smelt (Osmerus mordax)										
Rainbow trout (Salmo gairdneri)										
Brown trout (Salmo trutta)										
Brook trout (Salvelinus fontinalis)										
Mudminnow (Umbra limi)										
Grass pickerel (Esox americanus)		X	X						X	X
Northern pike (Esox lucius)	O	O	O	O	O	O	O	O	O	O
Muskellunge (Esox masquinongy)										
Central stoneroller (Campostoma anomalum)	X	H		X		X	X	X	X	X
Largescale stoneroller (Campostoma oligolepis)										
Common carp (Cyprinus carpio)	A	A	A	A	A	A	A	A	A	A
Goldfish (Carrassius auratus)			X		X		X			
Grass carp (Ctenopharyngodon idella)		X	X		X	X	X	X	X	X
Silverjaw minnow (Ericymba buccata)										
Western silvery minnow (Hybognathus argyritis)					R		U			
Brassy minnow (Hybognathus hankinsoni)										
Silvery minnow (Hybognathus nuchalis)										
Plains minnow (Hybognathus placitus)										
Speckled chub (Hybopsis aestivalis)	C	C	C	C	C	C	C	C	C	C
Sturgeon chub (Hybopsis gelida)										
Flathead chub (Hybopsis gracilis)										
Sicklefin chub (Hybopsis meeki)										
Silver chub (Hybopsis storeriana)	C	C	C	C	C	C	C	C	C	C
Gravel chub (Hybopsis x-punctata)										
Hornyhead chub (Nocomis biguttatus)										
Golden shiner (Notemigonus crysoleucas)	C	O	O	O	H	O			O	O
Pallid shiner (Notropis amnis)						H				
Pugnose shiner (Notropis anogenus)										
Emerald shiner (Notropis atherinoides)	A	A	A	A	A	A	A	A	A	A
River shiner (Notropis blennius)	A	A	A	A	A	A	A	A	A	A
Bigeye shiner (Notropis boops)			X			X				
Ghost shiner (Notropis buchanani)	C	C	C	C	C	C	C	C	C	C
Striped shiner (Notropis chrysocephalus)										
Common shiner (Notropis cornutus)		R	U				R			
Bigmouth shiner (Notropis dorsalis)	O	O	O	O	O	O	O	O	O	O
Pugnose minnow (Notropis emiliae)	U	O	U							
Blacknose shiner (Notropis heterolepsis)										
Spottail shiner (Notropis hudsonius)	C	C	C	C	C	C	C	C	C	C
Red shiner (Notropis lutrensis)	U		C	C	C	C	C	C	C	C
Ozark minnow (Notropis nubilus)										
Rosyface shiner (Notropis rubellus)										
Silverband shiner (Notropis shumardi)							R		O	O
Spotfin shiner (Notropis spilopterus)	C	C	C	O	O	O	O	O		
Sand shiner (Notropis stramincus)	O	O	O	O	O	O	O	O	O	O
Weed shiner (Notropis texanus)										
Redfin shiner (Notropis umbratilis)			X							
Blacktail shiner (Notropis venustus)										
Mimic shiner (Notropis volucellus)										
Suckermouth minnow (Phenacobius mirabilis)	U		U	U		U	U	U	U	U
Southern redbelly dace (Phoxinus erythrogaster)										
Bluntnose minnow (Pimephales notatus)	O	O	O	O	O	O	O	O	O	O
Flathead minnow (Pimephales promelas)	U	U	U	U	U	U	U	U	U	U
Bullhead minnow (Pimephales vigilax)	A	A	A	A	A	A	A	A	A	A
Creek chub (Semotilus atromaculatus)									X	
Pearl dace (Semotilus margarita)										
Blacknose dace (Rhinichthys atratulus)										
River carpsucker (Carpiodes carpio)	C	C	C	C	C	C	C	C	C	C
Quillback (Carpiodes cyprinus)	C	C	C	C	C	C	C	C	C	C
Highfin carpsucker (Carpiodes velifer)	U	U	U	U	U	O	O	O	O	O
White sucker (Catostomus commersoni)	X	X	X	X	X	X		X	X	X
Blue sucker (Cycleptus elongatus)	U		U	U	U	U	U	U	U	U

List obtained from UMRCC publication: 1983. Distribution and Relative Abundance of Upper Mississippi River Fishes

Table 1.—Continued

Species	POOL NUMBER									
	16	17	18	19	20	21	22	24	25	26
Northern hog sucker (Hypentelium nigricans)	X			X						
Smallmouth buffalo (Ictiobus bubalus)	C	C	C	C	C	C	C	C	C	C
Bigmouth buffalo (Ictiobus cyprinellus)	C	C	C	C	C	C	C	C	C	C
Black buffalo (Ictiobus niger)	U	U	H	H	U	U	U	U	U	U
Spotted sucker (Minytrema melanops)	U	U	U	U						
Silver redhorse (Moxostoma anisurum)	R	R	R	R	R	U	R	U	U	U
River redhorse (Moxostoma carinatum)										
Golden redhorse (Moxostoma erythrurum)	R	R	R	R	R	U	R	R	U	U
Shorthead redhorse (Moxostoma macrolepidotum)	O	O	C	O	O	U	C	O	O	O
Greater redhorse (Moxostoma valenciennesi)										
White catfish (Ictalurus catus)	X									
Blue catfish (Ictalurus furcatus)	H	H	H	H	H	H	H	H	H	H
Black bullhead (Ictalurus melas)	O	O	O	O	O	O	O	O	O	O
Yellow bullhead (Ictalurus natalis)	O	O	O	O	O	O		O	O	O
Brown bullhead (Ictalurus nebulosus)		R	R	R						R
Channel catfish (Ictalurus punciatus)	C	C	C	C	C	C	C	C	C	C
Stonecat (Noturus flavus)	H		U	U	O	O	O	O	O	O
Tadpole madtom (Noturus gyrinus)	U		U		U	H	U	U	U	U
Freckled madtom (Noturus nocturnus)					U	U				
Flathead catfish (Pylodictis olivaris)	O	O	O	O	C	C	C	C	C	C
Pirate perch (Aphredoderus sayanus)				H						
Trout-perch (Percopsis omiscomaycus)			U							
Burbot (Lota lota)	R						R		H	H
Northern studfish (Fundulus catenatus)										
Blackstripe topminnow (Fundulus notatus)	O	U	O	U	O	O	O	O	O	O
Starhead topminnow (Fundulus notti)										X
Blackspotted topminnow (Fundulus olivaceus)										
Mosquitofish (Gambusia affinis)			R		C	C	C	C	C	C
Brook silverside (Labidesthes sicculus)	O	O	O	O	O	O	O	O	O	O
Inland silverside (Menidia beryllina)										
Brook stickleback (Culaea inconstans)										
White bass (Morone chrysops)	C	C	C	C	C	C	C	C	C	C
Yellow bass (Morone mississippiensis)	U	U	U	O	U	O	O	O	O	O
Striped bass (Morone saxatilis)										
Rock bass (Ambloplites rupestris)	R	R	R	R	R	R	R	R	R	R
Flier (Centrachus macropterus)										
Green sunfish (Lepomis cyanellus)	O	O	O	O	O	O	O	O	O	O
Pumpkinseed (Lepomis gibbosus)	U	H	R	U						
Warmouth (Lepomis gulosus)	U	O	O	O	U	O	O	O		
Orange-spotted sunfish (Lepomis humilis)	C	C	C	C	C	C	C	C	C	C
Bluegill (Lepomis macrochirus)	A	A	A	A	A	A	A	A	A	A
Longear sunfish (Lepomis megalotis)					X	X	X	X	X	X
Redear sunfish (Lepomis microlophus)										X
Smallmouth bass (Micropterus dolomieui)	U	U	U	U	U	U	U	U	U	U
Spotted bass (Micropterus punctulatus)										
Largemouth bass (Micropterus salmoides)	C	C	C	C	C	C	C	C	C	C
White crappie (Pomoxis annularis)	C	C	C	C	C	C	C	C	C	C
Black crappie (Pomoxis nigromaculatus)	C	C	C	C	C	C	C	C	C	C
Crystal darter (Ammocrypta asprella)										
Western sand darter (Ammocrypta clara)	R	O	R	O	O	O	O	O	O	O
Mud darter (Etheostoma asprigene)										
Rainbow darter (Etheostoma caeruleum)									X	
Bluntnose darter (Etheostoma chlorosomum)										
Iowa darter (Etheostoma exile)										
Fantail darter (Etheostoma flabellare)										X
Johnny darter (Etheostoma nigrum)	U	U	U	U	U	U	U	U	U	U
Orangethroat darter (Ethestoma spectabile)									X	
Banded darter (Etheostoma zonale)										
Yellow perch (Perca flavescens)	O	O	O	C			H			
Logperch (Percina caprodes)	O	O		O	O	O	O	C	C	
Blackside darter (Percina maculata)										X
Slenderhead darter (Percina phoxocephala)					R	R				R
Dusky darter (Percina sciera)										
River darter (Percina shumardi)	C	C	C	C	C	C	C	C	C	C
Sauger (Stizostedion canadense)	C	C	C	C	C	C	C	C	C	C
Walleye (Stizostedion vitreum)	C	C	C	C	C	O	O	O	O	O
Freshwater drum (Aplodinotus grunniens)	C	C	C	C	A	A	A	A	A	A
Banded sculpin (Cotus carolinae)										

*Key to the status of a species:

X - Probably occurs only as a stray from a tributary or inland stocking.
H - Records of occurrence are available, but no collections have been documented in the last ten years.
R - Considered to be rare. Some species in this category may be on the verge of extirpation.
U - Uncommon, does not usually appear in sample collections, populations are small, but the species in this category do not appear to be on the verge of extirpation.
O - Occasionally collected, not generally distributed, but local concentrations may occur.
C - Commonly taken in most sample collections; can make up a large portion of some samples.
A - Abundantly taken in all river surveys.

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