UPPER MISSISSIPPI RIVER SYSTEM-ENVIRONMENTAL MANAGEMENT PROGRAM (UMRS-EMP)

POST-CONSTRUCTION EVALUATION REPORT

FOR

CLARKSVILLE REFUGE HABITAT REHABILITATION AND ENHANCEMENT PROJECT (HREP)

POOL 24
MISSISSIPPI RIVER
PIKE COUNTY, MISSOURI

FINAL

July 1996

US Army Corps of Engineers
St. Louis District

02 AUG 1996

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MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Final Post Construction Performance Evaluation Report for the Clarksville Refuge Habitat Rehabilitation and Enhancement Project (HREP)

1. Enclosed is the final Post Construction Performance Evaluation Report for the Clarksville Refuge Habitat Rehabilitation and Enhancement Project (HREP). This HREP is a component part of the Upper Mississippi River System Environmental Management Program and is located in Pool 24, Upper Mississippi River, Pike County, Missouri.

2. Thank you for any past involvement you have had with the earlier phases of the planning process and review of the draft Post Construction Performance Evaluation Report. For comments or questions concerning this report, please direct your calls to Mr. Lynn Neher, of the Environmental Planning Branch, at telephone number 314-331-8880 or facsimile number 314-331-8806.

3. A copy of this final document has been sent to Federal and state agencies.

Encl

OWEN D. DUTT
Chief, Planning Division

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HABITAT REHABILITATION AND ENHANCEMENT PROJECT (HREP)
POOL 24, UPPER MISSISSIPPI RIVER
PIKE COUNTY, MISSOURI

POST CONSTRUCTION EVALUATION

1. Introduction

a. Purpose

The purposes of this report are as follows:

1. To summarize the performance of the Clarksville Refuge EMP project based on the project goals and objectives.

2. To review the site management plan for possible revisions.

3. To summarize project operation and maintenance efforts to date.

4. To review engineering performance criteria to aid in design of future projects.

b. Scope

This report summarizes all available monitoring data, project inspections, and project observations made by the U.S. Army Corps of Engineers-St. Louis (COE) and the Missouri Department of Conservation (MDOC) for the period from 1990 to 1994.

2. Project Goals, Objectives, and Management Plan

a. General

The Clarksville Refuge consists of approximately 325 acres of Federal land, managed by MDOC. The site is located along the right bank of the Mississippi River in navigation Pool 24, between approximate river miles 275 and 276.

The Clarksville Refuge HREP was initiated primarily to rehabilitate an area that was once heavily utilized by waterfowl. Due to the effects of sedimentation, usage at the refuge had dropped to 500 ducks per day by 1983.

b. Goals and Objectives

Table 1 provides a summary of project goals and objectives developed for this project..

TABLE 1. PROJECT GOALS AND OBJECTIVES

Goal	Objective	Project Feature
Enhance Wetland Habitat for Migratory Waterfowl	Decrease sedimentation into refuge wetlands.	Levee
	Provide a means to control water levels on refuge independent of river stage.	Levee, Gated Drain, Pumps
	Increase reliable food production for waterfowl.	Waterfowl Management Unit, Cooperative Agreement
	Increase total wetland values for waterfowl.	All

c. Management Plan

The Refuge is managed by MDOC. The basic management plan for the Refuge is as follows:

i. Keep the area watered (about 449 N.G.V.D.) through late winter to provide stop over areas for migrating waterfowl.

ii. Dewater the area from late spring to early summer (from about 449 down to 447 N.G.V.D.) so grain crops can be planted and moist soil plants allowed to grow. Remove any undesirable woody vegetation at this time.

iii. Keep the area dry throughout the summer (about 447 N.G.V.D.) to allow the waterfowl foods to mature. Use pumps if necessary to remove seepage during high river pool stages.

iv. Open gates and allow the river to back flood the area in early fall. Use the pumps, if necessary, to further fill the Refuge to at least flat pool (449 N.G.V.D.). This provides a stop over area and an available food source for migrating waterfowl.

3. Project Features and Construction Summary

The constructed project includes (Figure 1): 1) A levee with a 20-year level of flood protection that is tied into high ground on both the north and south ends. 2) Borrow sites

FIGURE 1. COMPONENT FEATURES FOR CLARKSVILLE REFUGE HREP

created when approximately 26,000 cubic yards of material was removed to construct the levee. 3) Two 48-inch diameter gravitydrains with sluice gates. 4) Two 16-inch portable pumps and motor systems.

The levee borrow material sites provide additional deep water habitat, and a greater diversity of water depths on the refuge. The project was completed in early 1990.

4. Operation, Maintenance and Project Monitoring

a. General

The Post Construction Monitoring Plan is presented in Appendix B. The success of the project relative to the to original project objectives has been measured using physical and field observations by MDOC and COE. The COE has had the overall responsibility for measuring and documenting the project's performance.

b. Corps of Engineers

The St. Louis Corps District contracted with an AE firm to gather elevation data along four transects within the refuge. The physical locations of these transects are presented in Figure 2. Measurements were taken immediately after the project was completed in 1990 and again in 1995. The Corps also collected daily river stage data.

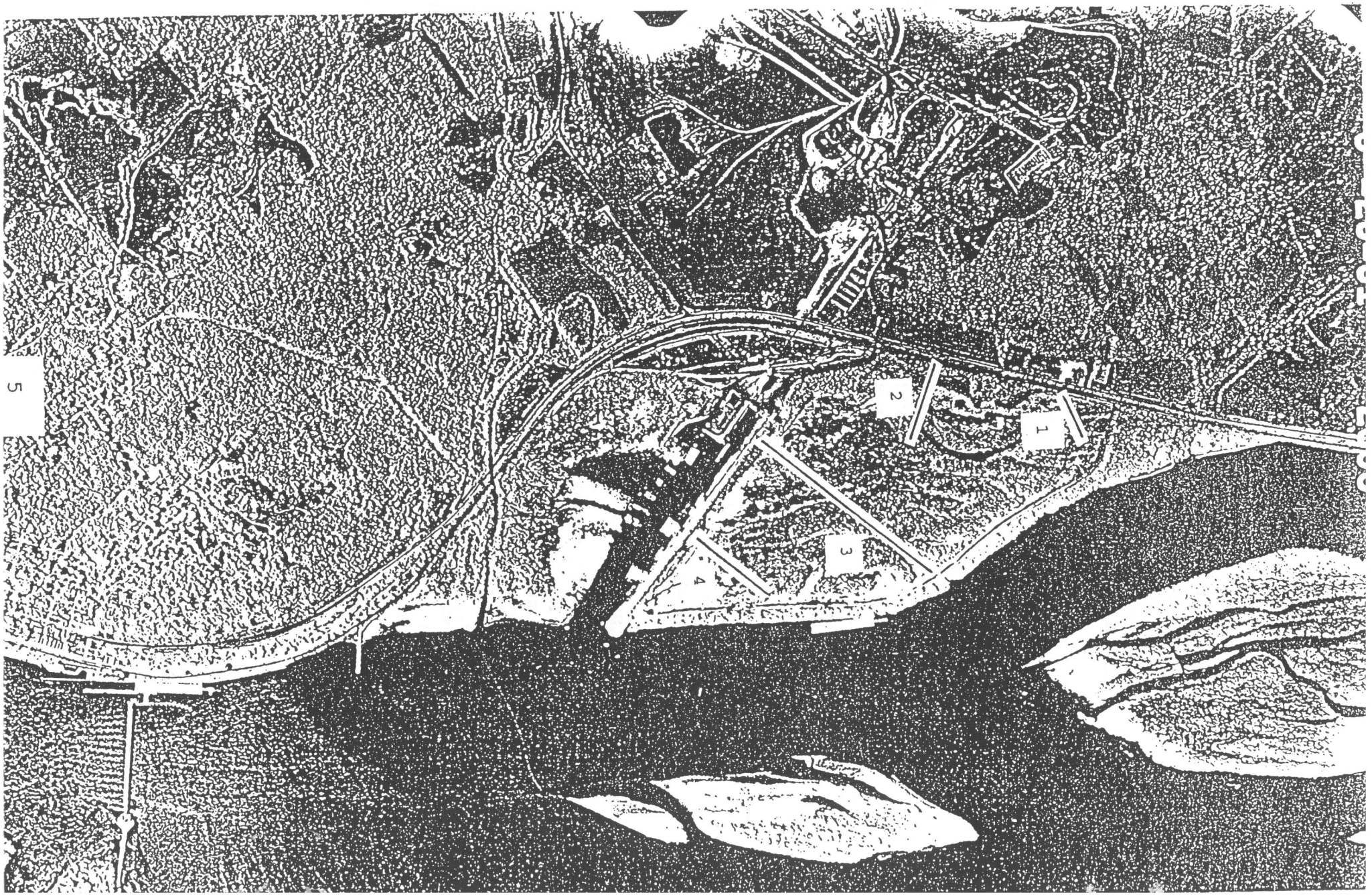
c. Missouri Department of Conservation

The MDOC is responsible for operating and maintaining the Clarksville Refuge HREP. The Department collected water stage data inside and outside the Refuge. It conducted waterfowl ground surveys during the fall and winter (1990-1994) and reported the condition of the available foods (1990-1994). This information, along with the past year's habitat renovations and other observations concerning the Refuge have been published annually in the Department's Annual Management Plan for the Nine-Foot Channel Project General Plan Lands. Habitat analyses have been conducted by MDOC using the Missouri Wildlife Habitat Appraisal Guide (WHAG) for the pre-construction year 1988, and post-construction years 1990, and 1994.

5. Related Studies and Reports

Published reports which relate to the Clarksville Refuge HREP or which were used as references in the production of this document are presented in Appendix A.

FIGURE 2. SEDIMENTATION MONITORING TRANSECTS FOR CLARKSVILLE REFUGE



6. Evaluation of Wetland Habitat Objectives

a. Reduce Sedimentation

1. Monitoring Results

To determine the post-project rate of sedimentation, four transects were laid out across the Clarksville Refuge (Figure 2). Elevation profiles along these transects were measured immediately after the project was completed in 1990 and again in early 1995 (Figures 3 and 4). Readings were taken at 100' intervals along each transect. The precision of the readings were to meet COE standards for fourth-order-construction layout of $\pm 0.100 * M^{0.5}$, with $M^{0.5}$ equalling the square root of the transect distance in miles.

The following assumptions were made concerning sedimentation at the Clarksville Refuge HREP: (1) Sediment deposition occurs only when the levee is overtopped, allowing sediment-laden flood waters to enter the refuge; (2) Low points in the original levee would have allowed the river to flood the refuge at or above a river stage of 449.1; (3) Levee improvements would allow the refuge to flood at or above a river stage of 454 (flood weir height); and (4) Deposition rate/day is the same with or without project for each day of inundation.

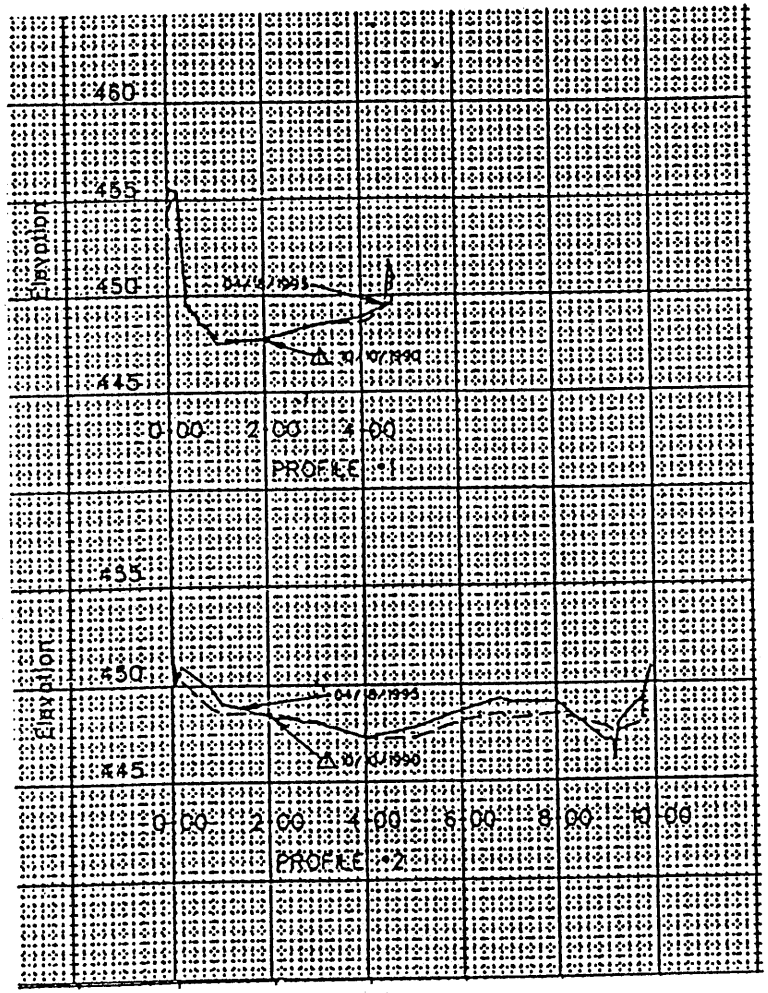
Sediment deposition (Table 2) was calculated for each transect using the following formula:

$$A = (B - C) \div D$$

A = Average depth of sediment deposited along transect N
B = Bottom elevation at station X along transect N measured in 1995
C = Bottom elevation at station X along transect N measured in 1990
D = Number of stations along transect N.

A daily sedimentation rate was calculated by dividing the average depth of sediment along each transect by the number of days (84) the river stage was above 454 N.G.V.D. A single sedimentation rate (0.067 inches per flood day) was then calculated by averaging the sedimentation rates for the four transects and used in Table 3.

FIGURE 3. ELEVATION READINGS FOR TRANSECTS 1 AND 2 ON CLARKSVILLE REFUGE (1990 AND 1995).



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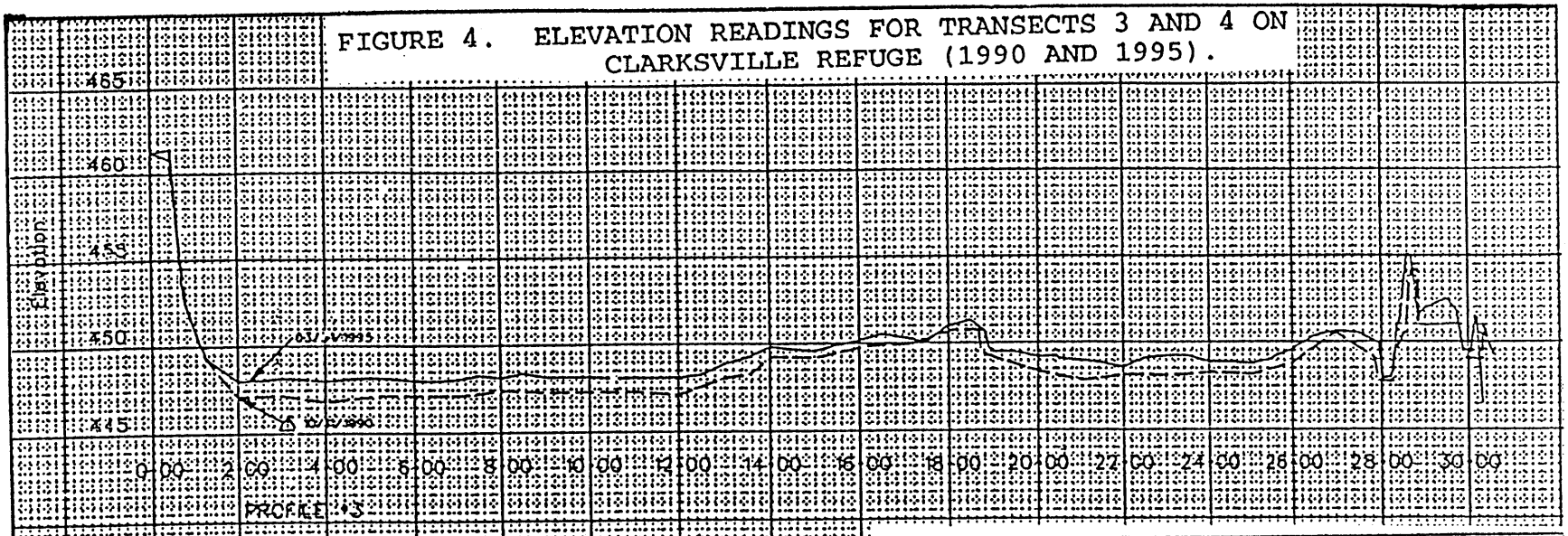
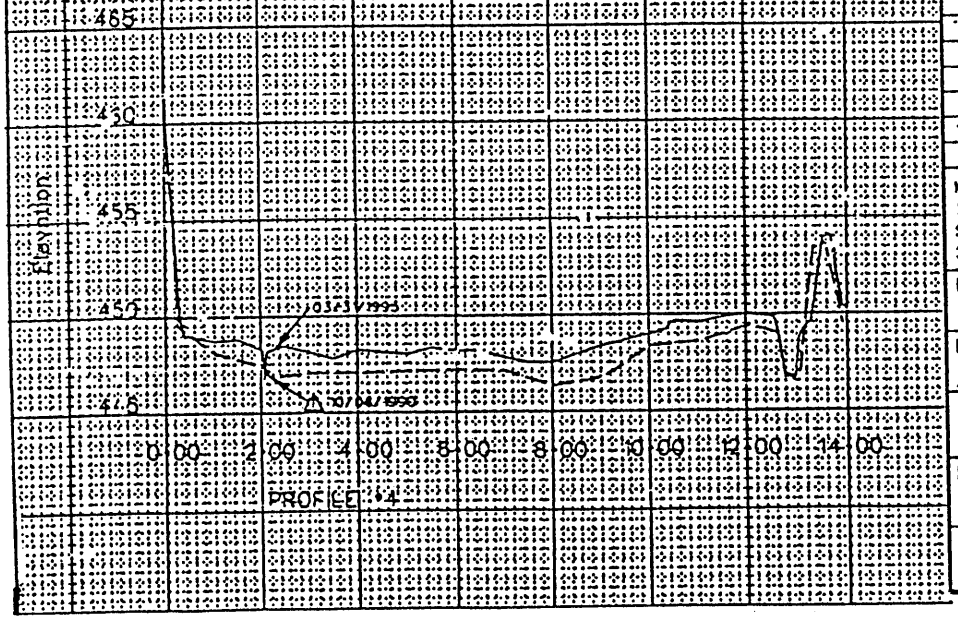
SEDIMENTATION MONITORING RANGES
CLARKSVILLE, MISSOURI
REFUGE AREA

SCALE: HORIZ.: 1"=200'
VERT.: 1"=5'
DATE: 3/31/1995
DRAWING CODE:
SHEET REFERENCE NUMBER:
SHEET 1 OF 1

FIGURE 4. ELEVATION READINGS FOR TRANSECTS 3 AND 4 ON CLARKSVILLE REFUGE (1990 AND 1995).





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SEDIMENTATION MONITORING RANGES
CLARKSVILLE, MISSOURI
REFUGE AREA

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TABLE 2. AVERAGE SEDIMENT DEPOSITION AND YEARLY DEPOSITION RATES ALONG MONITORING TRANSECTS ON CLARKSVILLE REFUGE (1990-1995).

Survey Transect	Average Sediment Depth (in.)	Sediment Deposition rate (in./flood day)
1	1.3	0.015
2	4.8	0.015
3	8.5	0.101
4	7.7	0.092
Average	5.6	0.067

2. Conclusions

River gage levels at the Refuge were above 454.0 for 0 days in 1990-1992 and 1994 and 84 days in 1993, therefore all sedimentation (avg. = 5.6") within the project area occurred during the great flood of 1993 (Table 3). The project benefits were determined using the 1993 flood deposition rate per day (0.067) and extrapolating the yearly deposition rates for the without project levee condition. Had the project not been completed, the Refuge would have been inundated for 245 days in 1990-1994, 163 of those days occurring in 1993. The reduction in flood days caused by the project's levee raise has decreased the amount of sedimentation by an estimated 67% for the period 1990-1994 (Table 3). Average yearly sedimentation rates of the project without levee improvements for the non-flood years of 1990-92 and 1994 would have been 1.4 inches which is within the sedimentation range of 1-2 inches that has been previously estimated for Upper Mississippi backwater areas (Great II 1980, SCWG).

The estimated number of flood days for the 50-year life of the project was determined using a stage duration curve for Lock and Dam 24. It is estimated that the levee raise will decrease future sedimentation by 83%.

b. Provide Water Level Control

1. Monitoring Results

River and interior water stage data were recorded from permanent gauges located on each side of the water control structure. Stage data was recorded at the beginning, during, and end of interior water level manipulations. Observations by MDOC

TABLE 3. SEDIMENTATION RATE COMPARISONS BETWEEN WITH AND WITHOUT PROJECT LEVEE CONDITIONS.

	W/O LEVEE			W/ LEVEE			NET % REDUCTION SEDIMENT DEPOSITION
Year	Total Flood Days[1] (≥ 449.1)	Deposition/ day (in.)	Deposition (in.)	Total Flood Days[1] (≥ 454.0)	Deposition/ day (in.)	Deposition (in.)	
1990	***40***	0.067	2.8	***0***	0.067	***0.0***	
1991	***32***	0.067	2.2	***0***	0.067	***0.0***	
1992	***7***	0.067	0.5	***0***	0.067	***0.0***	
1993	***163***	0.067	11.4	***84***	***0.067***	***5.6***	
1994	***3***	0.067	0.2	***0***	0.067	***0.0***	
1990-1994	***245***	0.067	17.1	***84***	0.067	***5.6***	67.0
50-year total	913	0.067	95.8	146	0.067	***10.2***	83.0

*Note: All table figures that are **bolded** and italicized* are known, the rest have been estimated or extrapolated.

[1]The number of flood days were determined from actual river stage readings for the years 1990-1994. The 50-year projected days were determined using a stage duration curve for Lock and Dam 24. Since that curve is fairly insensitive over the range 448-450 N.G.V.D., we selected a percent time exceeded from the lowest end of this elevation range. Our results thus estimated a without levee deposition that is on the low side.

personnel of the water level fluctuations are printed in the Annual Management Plans for the Upper Mississippi Conservation Area. Yearly stage data for 1990-1994 is shown in Figures 5-8. Important elevation statistics needed to fully understand the results are listed in Table 4.

TABLE 4. REFUGE AND POOL 24 ELEVATION STATISTICS

Flat Pool	449.0 N.G.V.D.
Maximum drawdown	445.5 N.G.V.D.
Refuge Flood Weir Height	454.0 N.G.V.D.
Dry refuge	447.0 N.G.V.D.

Due to the inconsistency of recording stage data, many monthly averages were estimated from the yearly narratives in the Annual Management Plans (Table 5). When the narratives referred to a "dry" Refuge, a Refuge stage of 447.0 N.G.V.D. (level at which most of the Refuge would be dry) was used. Monthly averages for missing river stages were estimated by adjusting daily stage data collected at Lock and Dam 24 by the COE.

During 1990, Pool 24 was drawn down in early spring and the Refuge dewatered. Dry conditions allowed final construction and planting to be completed. Refuge managers began keeping monthly water stage data on 21 June (Figure 5). Heavy rains during the middle of June caused the first Mississippi River flood since 1986. The refuge gates were closed in an attempt to keep out the flood water. The river crested on 24 June at 453.75 N.G.V.D.. The area filled with clear seep water but the silt laden flood waters were kept out. Once the river fell, the area was drawn down and kept dry most of the summer. Reflooding of the refuge began 18 September and on 26 October, pumping began and the refuge was brought to an elevation of one foot over river stage.

Refuge managers recorded 1991 stage data monthly during February - June and in October (Figure 6). High river elevations during the spring of 1991 prevented the area from being dewatered. The river was lowered throughout June, allowing the interior flood gates to be opened and the area dewatered. The area was kept dry throughout the summer and reflooded in late September.

Stage data for 1992 was recorded for the months of January - March, August, October and November (Figure 7). The area was dewatered starting in late May and continued through June. It was kept dry during most of the summer and allowed to fluctuate with the river. In late September, when the river was drawn

TABLE 5. MONTHLY STAGE ELEVATIONS USED IN FIGURE 9

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1990	River	**449.0**	**449.0**	**448.0**	**449.6**	**447.8**	450.9	448.0	448.8	449.2	449.3	449.4	449.3
	Refuge	**449.0**	**449.0**	**447.0**	**447.0**	**447.0**	448.0	**447.0**	**447.0**	448.4	449.5	450.2	450.0
1991	River	**449.3**	449.5	448.1	449.3	450.5	448.6	**447.6**	**449.0**	**449.0**	449.4	**448.7**	**447.7**
	Refuge	450.0	449.8	449.3	449.3	449.1	448.5	**447.0**	**447.0**	**447.0**	449.4	**449.0**	448.8
1992	River	448.8	448.9	446.0	**447.2**	**448.4**	**449.0**	**448.2**	449.2	**448.6**	449.6	448.7	447.9
	Refuge	448.6	449.2	448.0	**448.0**	**447.0**	**447.0**	**447.0**	448.0	**447.0**	449.0	449.3	449.3
1993	River	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*
	Refuge	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*
1994	River	**449.1**	447.0	**447.0**	448.0	**447.1**	**448.8**	**448.2**	**449.0**	449.2	448.3	449.0	449.0
	Refuge	**449.1**	449.0	**449.0**	448.0	**447.1**	**448.8**	**448.2**	**449.0**	449.4	448.9	449.8	449.8
AVG.	River	449.1	448.6	447.3	448.5	448.5	449.3	448.0	449.0	449.0	449.2	448.9	448.5
	Refuge	449.2	449.3	448.3	448.1	447.6	448.1	447.3	447.8	447.9	449.2	449.6	449.5

*N/A = Monthly averages for 1993 were not included due to the extreme flooding circumstances.
[1]Bolded figures were obtained from sources other than direct measurements taken with Refuge gauges. River elevations were estimated using gauge readings from Lock and Dam 24 and Refuge elevations (447 = Dry) were estimated from narratives in the Annual Management Plan.

FIGURES 5-8. YEARLY POOL ELEVATION DATA FOR CLARKSVILLE REFUGE

FIGURE 5. 1990 Pool Elevation Data
Clarksville Refuge

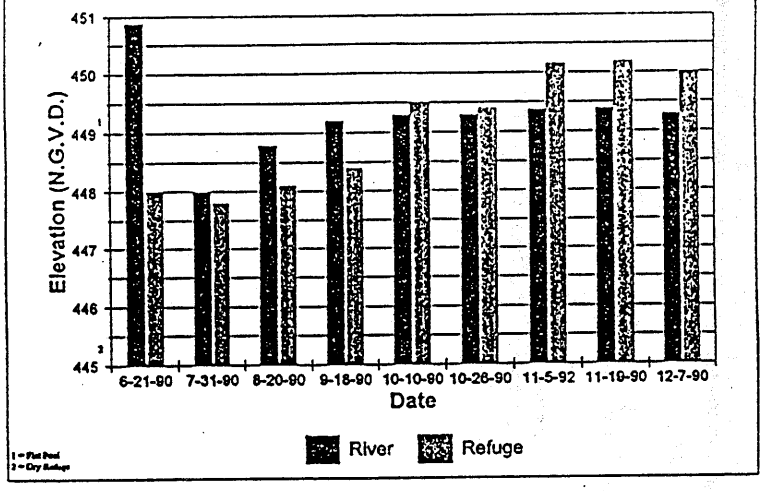


FIGURE 6. 1991 Pool Elevation Data
Clarksville Refuge

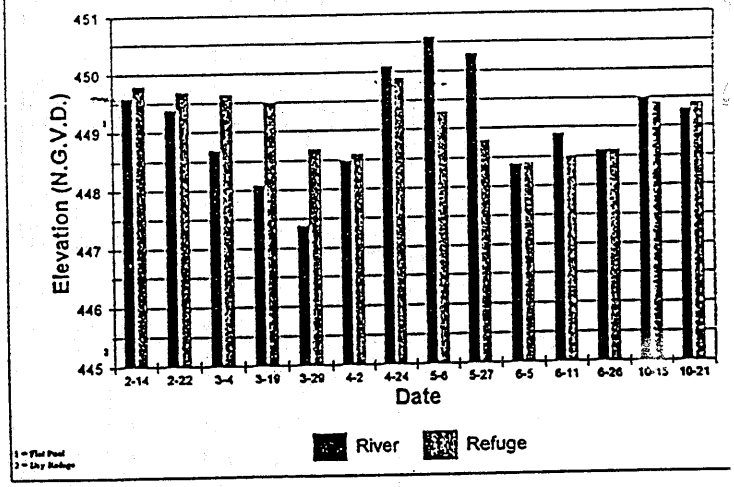


FIGURE 7. 1992 Pool Elevation Data
Clarksville Refuge

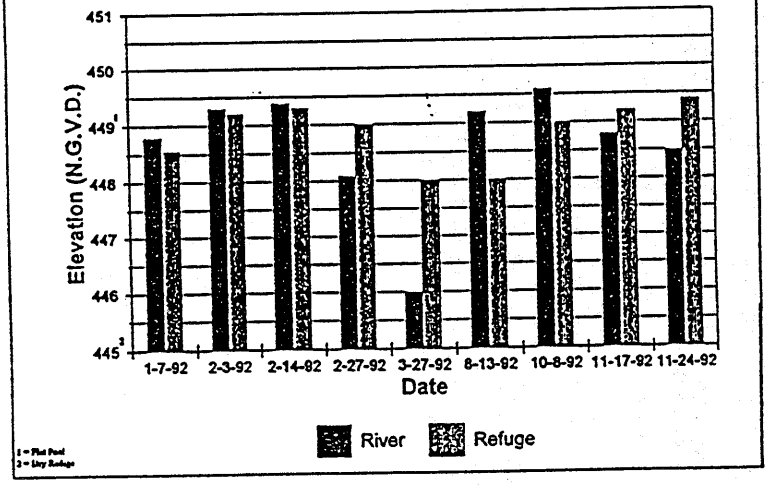
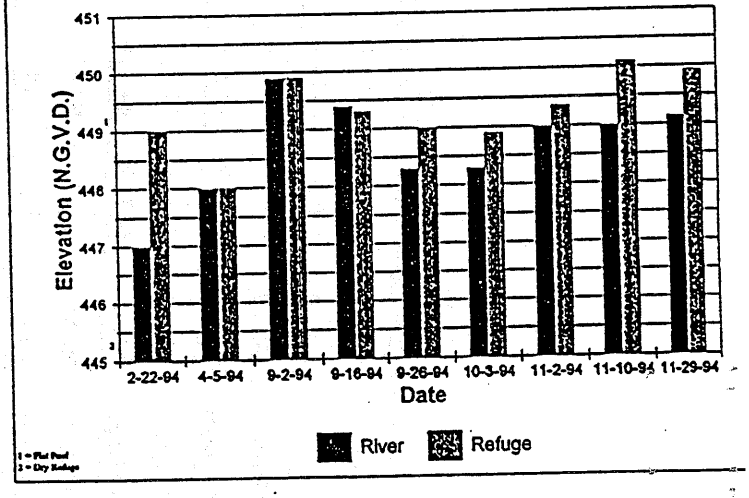


FIGURE 8. 1994 Pool Elevation Data
Clarksville Refuge



down, the refuge was allowed to dewater so 25 acres of cattails could be mowed. The area was reflooded in early October and remained so throughout the winter.

Stage data for 1993 is not shown due to flood conditions. During the flood of 1993, Pool 24 went to open river stage on 24 March. The Refuge was backflooded in April to avoid damaging the structural integrity of the levee. The River crested at 460.13 N.G.V.D. and the open river stage was maintained until 7 October.

Stage data for 1994 was recorded for the months of February, April, and September - November (Figure 8). Gauge damage caused by the 1993 flood resulted in few elevation readings in 1994. Dewatering started in mid-May and continued through June. The area was allowed to fluctuate with the river to provide irrigation for the moist soil plants. Partial flooding occurred in early September and gradually continued through October and November.

2. Conclusions

The project objective to control interior water levels independent of the river stage was accomplished. The Refuge had been inundated at a river stage of ≥ 449.1 before the project was constructed, therefore the Refuge was constantly fluctuating with the river. The success of the water control structures is graphically depicted in Figure 9. The figure shows the management goals of keeping water on the area through fall - winter and allowing the Refuge to dry out during the growing season. Refuge stage elevations roughly follow the proposed management plan. Summer (June-August) water levels show that the monthly averages never dropped to 447.0 N.G.V.D. (Dry). This is due to the June flood in 1990 and the change in protocol in 1994 to allow the Refuge to fluctuate with the river and not to plant cultivated crops. The Refuge was dry during the summers of 1990, 1991, and 1992. The dip in the Refuge stage levels in March followed a large dip in river stage levels in anticipation of spring rains, but still retained a yearly average of at least 1.3 feet of water.

c. Increase Reliable Food Production

1. Monitoring Results

Every two weeks during the fall and winter MDOC personnel have recorded the number of ducks, geese, American coots, eagles and other migrating wetland bird species using the Refuge (Table 6). They have also recorded the condition of the Refuge's agricultural crops and moist soil plants on a two week interval. A summary of the yearly food production is provided in Table 7. A copy of the field data sheets is provided in Appendix C. This information is published yearly in the Annual Management Plan for

FIGURE 9.

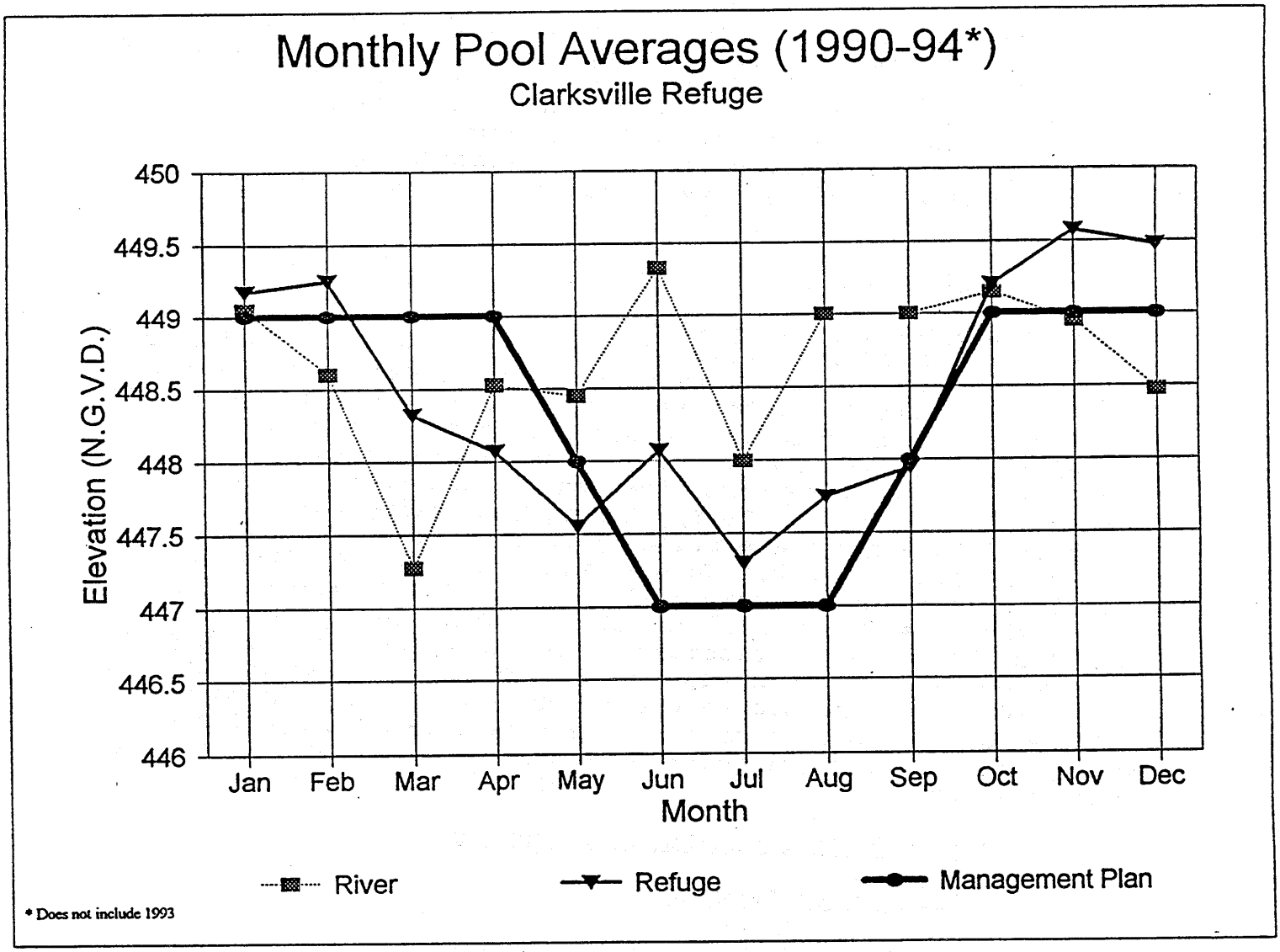

Monthly Pool Averages (1990-94*)
Clarksville Refuge
Elevation (N.G.V.D.)
450
449.5
449
448.5
448
447.5
447
446.5
446
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
River
Refuge
Management Plan
* Does not include 1993

TABLE 6. WATERFOWL SURVEY DATA FOR CLARKSVILLE REFUGE

		DUCKS				GEESE	OTHER		
Year	Survey Date	Mallard	Woodduck	Other	Total	Total	American Coot	Eagle	Other
1990	10/29	3,000	800	200	4,000	0	500	1	0
	11/13	4,000	0	1,000	5,000*	0	0	7	0
	11/26	1,500	2,000	1,500	5,000	0	500	5	0
	12/10	800	0	200	1,000	0	500	3	0
	01/07	0	0	0	0	0	0	0	0
1991	10/01	5	145	350	500	0	0	0	0
	10/15	50	200	250	500	0	0	0	0
	10/29	1,800	0	1,200	3,000*	0	200	0	0
	11/12	800	0	200	1,000	0	0	1	0
	11/25	1,350	0	150	1,500	0	0	2	0
	12/09	950	0	50	1,000	0	0	8	0
	12/23	100	0	0	100	0	0	12	0
	01/06	500	0	0	500	0	0	9	0
1992	10/14	200	49	0	249	0	42	0	0
	10/26	1,875	625	0	2,500	32	0	1	0
	11/09	3,600	225	675	4,500*	40	500	3	10
	11/23	3,600	200	200	4,000	50	200	2	0
	12/07	100	0	0	100	50	0	3	0
	12/14	25	0	0	25	50	0	1	0
	01/04	0	0	0	0	250*	0	5	0
1993	10/04	0	0	0	0	0	0	0	0
	10/18	2	8	0	10	0	0	0	0
	11/01	600	0	0	600*	30	0	3	0
	11/16	225	25	0	250	0	0	0	0
	11/29	0	0	0	0	0	0	4	0
	12/21	25	0	0	25	25**	0	8	0
	01/04	8	0	0	8	0	0	0	0

*Yearly high.
**The week previous there were 1,000 geese using the Refuge.

TABLE 6. WATERFOWL SURVEY DATA FOR CLARKSVILLE REFUGE - CONTINUED

		DUCKS				GEESE	OTHER		
Year	Survey Date	Mallard	Woodduck	Other	Total	Total	American Coot	Eagle	Other
1994	10/03	27	1	0	28**	0	0	2	0
	10/17	100	0	0	100	0	0	0	0
	10/31	450	50	0	500	0	0	0	0
	11/14	1,000	0	0	1,000	0	25	0	0
	11/28	585	65	0	650	0	0	0	0
	01/02	2,475	25	0	2,500*	600*	50	0	0
All years (Excluding 1993)	26 Survey Days	28,892	4,385	5,975	39,252	1,072	2,517	65	10
Average Use Per Survey Day		1,111	169	230	1,510	41	97	3	0.4
Estimated Total Use During 90 Day Waterfowl Season (Oct. - Dec.)		99,990	15,210	20,700	135,900	3,690	8,730	270	36

*Yearly high.
**The week previous there were 1,000 geese using the Refuge.

TABLE 7. CONDITIONS OF WATERFOWL FOODS AT THE BEGINNING OF FALL MIGRATION ON CLARKSVILLE REFUGE.

	MOIST SOIL PLANTS		AGRICULTURAL CROPS	
YEAR	Condition	Year's accomplishments	Condition	Year's accomplishments
1990	Good	200 acres of undesirable vegetation was removed.	Poor	corn: 12 acres jap. millet: 100 acres aerial seeded Flood destroyed all plantings.
1991	Good	5 acres of cattails were mowed and over-seeded with millet/milo.	Good	milo: 12 acres jap. millet: 5 acres
1992	Good	20-25 acres of cattails were mowed.	Good	milo: 24 acres jap. millet: 5 acres
1993	Poor	Flood	Poor	Flood
1994	Excellent	Production was highest ever recorded.	Poor	No crop plantings

the Upper Mississippi Wildlife Area. Also included in the Annual Management Plan are the number of acres that were planted in agricultural crops and the number of acres that were renovated (Table 7).

Flooding in 1990 destroyed the agricultural crops but because flood waters receded after only ten days, the moist soil plants were not harmed and were able to produce a plentiful food supply. The water level conditions in 1991 and 1992 allowed the refuge managers to plant food plots and allowed moist soil plants to germinate and produce a good crop of seeds. The Refuge was inundated during the entire growing season of 1993. This was the only year that no waterfowl foods were produced. A decision was made in 1994 to not plant any agriculture crops, and to let the area revert completely to moist soil plants. The previous year's flood set back unwanted vegetation (such as cattails, willows and silver maple seedlings) on the area. Water levels were allowed to fluctuate with the river which provided the moist soil plants with adequate irrigation during the growing season. The moist soil plant production in 1994 was the highest ever recorded on the Refuge.

2. Conclusions

The Clarksville Refuge EMP Project provided migrating waterfowl with an abundant food source consisting of a combination of moist soil plants and agricultural crops, four out of the five years since its completion (Table 7). Water level manipulations and the removal of cattails allowed quality moist soil plants to grow and the opportunity to plant food plots for waterfowl. Annual waterfowl numbers show that when food is not available, as in 1993, ducks and geese do not use the Refuge for an extended time (Table 6). Conversely, when food is available, as in 1990 - 1992, and 1994, extensive numbers of waterfowl use the refuge for four to six weeks during fall migration (Table 6). Duck use averaged 1510 ducks per day - a considerable increase over the reported 1983 count of 500 ducks per day.

d. Increase Wetland Values for Waterfowl

1. Monitoring Results

The habitat values on the Clarksville Refuge EMP Project were quantified using the Wildlife Habitat Appraisal Guide (WHAG) by MDOC personnel. A single analysis was done pre-project based on 1988 habitat conditions and two post-project analyses were done based on 1990 and 1994 habitat conditions. The analysis provides a Habitat Suitability Index (HSI) and Average Annual Habitat Units (AAHU) for each species and respective habitat type (forested or non-forested) evaluated. The AAHU is calculated by multiplying the HSI by the number of acres of habitat being evaluated. A copy of the WHAG analysis worksheets are in

Appendix D. A summary of the results for Refuge target species (mallard and Canada goose) is given in Table 8 and a summary for non-target species is given in Table 9. Post-project AAHUs for non-forested wetlands increased an average of 192% and 376% for mallard and Canada goose, respectively. Forested wetland values for mallard increased by 510%. Non-target, non-forested and forested wetland species had an average increase in AAHU of 16% and 162%, respectively. Only one species, American coot, had a decrease in AAHUs.

2. Conclusions

Based on the net change statistics, the AAHUs went up significantly for all but one species (American coot). The increase in AAHUs for the target and non-target species indicate that the habitat improvements have created substantial benefits for many species.

The calculation of an HSI for the American coot considers only the life requisite value calculated for reproductive habitat (HSI MODEL). A key assumption is that semipermanently flooded wetlands provide optimum reproductive habitat. Since the refuge is kept dry during the nesting season to allow for planting and moist soil germination, the area provides little benefits to nesting American coots. Even though the AAHU values decreased for the American coot, winter usage was high in 1990-1992 (Table 6).

TABLE 8. AVERAGE HABITAT SUITABILITY INDEXES AND AVERAGE ANNUAL HABITAT UNITS BY HABITAT TYPE FOR TARGET SPECIES

	Pre-Project		Post-Project						Net Change	
Habitat Type/ Species	1988		1990		1994		Average		Avg. - 1988	
Non-Forest Wetland (178 ac.)	HSI	AAHU	HSI	AAHU	HSI	AAHU	HSI	AAHU	AAHU	%
Mallard	0.24	42.7	0.66	117.5	0.74	131.7	0.70	124.6	81.9	+192
Canada Goose	0.21	37.4	0.47	83.7	0.66	117.5	0.57	178.0	140.6	+376
Forested Wetland (147 ac.)	HSI	AAHU	HSI	AAHU	HSI	AAHU	HSI	AAHU	AAHU	%
Mallard	0.1	14.7	0.53	77.9	0.69	101.4	0.61	89.7	75.0	+510

TABLE 9. AVERAGE HABITAT SUITABILITY INDEXES AND AVERAGE ANNUAL HABITAT UNITS BY HABITAT TYPE FOR NON-TARGET SPECIES

	Pre-Project		Post-Project						Net Change	
Habitat Type/ Species	1988		1990		1994		Average		Avg. - 1988	
Non-Forest Wetland (178 ac.)	HSI	AAHU	HSI	AAHU	HSI	AAHU	HSI	AAHU	AAHU	%
Least Bittern	0.62	110.4	0.75	133.5	0.63	112.1	0.69	122.8	12.4	+11
Lesser Yellowlegs	0.19	33.8	0.19	33.8	0.63	112.1	0.41	72.9	39.1	+116
Muskrat	0.13	23.1	0.11	19.6	0.12	21.4	0.12	21.4	1.7	+7
King Rail	0.59	105.0	0.59	105.0	0.65	115.7	0.62	110.4	5.4	+5
Green-backed Heron	0.46	81.9	0.54	96.1	0.69	122.8	0.62	110.4	28.5	+35
American Coot	0.51	90.8	0.10	17.8	0.10	17.8	0.10	17.8	-73.0	-80
Forested Wetland (147 ac.)	HSI	AAHU	HSI	AAHU	HSI	AAHU	HSI	AAHU	AAHU	%
Green-backed Heron	0.10	14.7	0.10	14.7	0.81	119.1	0.46	67.6	52.9	+360
Wood Duck	0.67	98.5	0.76	111.7	0.76	111.7	0.76	111.7	13.2	+13
Beaver	0.47	69.1	0.81	119.1	0.81	119.1	0.81	119.1	50.0	+72
Northern Parula	0.58	85.3	0.70	102.9	0.70	102.9	0.70	102.9	17.6	+21
Prothonotary Warbler	0.16	23.5	0.71	104.4	0.71	104.4	0.71	104.4	80.9	+344

7. Project Operation and Maintenance

Operation and maintenance (O&M) is the responsibility of MDOC. A summary of the annual costs associated with O&M is presented in Table 10. These figures are taken from the Annual Management Plan for the Upper Mississippi Wildlife Area.

Since the completion of the project there has been no major structural damage that has needed repair. The Great Flood of 1993 did very little structural damage to the levee. The long flood duration did kill the vegetation cover on the levee.

TABLE 10. SUMMARY OF O&M COSTS FOR CLARKSVILLE REFUGE HREP-EMP.

	1991	1992	1993	1994
Wetland Management				
Manipulate Waterlevels (Labor)	$461	$436	$320	$320
Habitat Manipulation (Labor)	$1,257	$1,090	0	0
General Area Maintenance				
Operational Expense	$1,150	$1,150	$600	$600
Labor	$342	$327	$320	$320
Waterfowl Surveys				
Labor	$91	$65	$112	$112
Area Administration				
Labor	$347	$480	$480	$480
Total				
Cost	$1,150	$1,150	$600	$800
Labor	$2,498	$2,398	$1,232	$1,232
Sum total	**$3,648**	**$3,548**	**$1,832**	**$2,032**

8. Conclusions and Recommendations

The post-construction evaluation showed that the Clarksville HREP met the intended goals and objectives of the project. This conclusion has been reached after an analysis of sedimentation, water level control, vegetation response, and habitat unit output.

The levee was successful in excluding sediment from the refuge 4 out of 5 years. During the 1993 "Flood of the Century", it reduced sedimentation by two-thirds, and for the 50-year project life it is expected to reduce sedimentation by four-fifths. This sediment reduction will greatly extend the functional life of the refuge as migratory waterfowl habitat. Refuge water levels were managed nearly independent of river stage, and closely followed the desired or "ideal" management plan for the area. Except for the year of flood, the refuge provided migrating waterfowl with an abundant food source every year since project completion. The habitat evaluation analysis showed a 2- to 5-fold habitat unit increase for target species, and lesser increases for nearly all non-target species. Except for clean-up operations following the 1993 flood, O&M labor and costs were found to be reasonable.

The Clarksville Refuge levee-gate-pump system has proven to be a successful tool for waterfowl related habitat restoration. This restoration strategy is recommended for application to other Mississippi River backwater locations.

Appendix A

LITERATURE CITED

LITERATURE CITED

Great II. 1980. Sediment and Erosion Work Group Appendix, U.S. Corps of Engineers, Rock Island District, Illinois. 83 pp.

Missouri Department of Conservation. 1991. Annual Management Plan, General Plan Lands, Part I Upper Mississippi Wildlife Area. 38 pp.

Missouri Department of Conservation. 1992. Annual Management Plan, General Plan Lands, Part I Upper Mississippi Wildlife Area. 40 pp.

Missouri Department of Conservation. 1993. Annual Management Plan, General Plan Lands, Part I Upper Mississippi Wildlife Area. 45 pp.

Missouri Department of Conservation. 1994. Annual Management Plan, General Plan Lands, Part I Upper Mississippi Wildlife Area. 39 pp.

Missouri Department of Conservation. 1995. Annual Management Plan, General Plan Lands, Part I Upper Mississippi Wildlife Area. 31 pp.

Parks, R. 1995. Evaluation of Environmental Management Program Habitat Rehabilitation Projects 1990-1994. U.S. Army Corps of Engineers-St. Louis. 7 pp.

Appendix B

POST MONITORING PLAN

TABLE 1
POST-CONSTRUCTION MONITORING PLANS

KREP Project	Goal	Objective	Enhancement Feature	Unit of Measure	Enhancement Potential			Feature Measurement	Annual Field Observation By Site Manager 1/
					Existing	Without Project	With Project		
Clarksville Refuge	Enhance Wetland Habitat for Migratory Waterfowl	Decrease sedimentation into refuge wetlands	Levee	Inches/Year	1-2	1-2	0.1	Perform survey cross-sections for sedimentation	Evidence of a recent sediment deposition
		Provide a means to control water levels on refuge independent of river stage	Levee, Gated Drain, Pumps	Graphed comparison between river stage and actual interior water levels achieved	No difference (wetlands & river fluctuate together)	No Difference	Difference (wetlands management level held independent of river stage)	Corps river stage data to be plotted against sponsor provided actual interior water stage data, and against project expected interior stage data	Evidence of a water stage differential based on recorded stage data at the site
		Increase reliable food production for waterfowl	Waterfowl Management Unit, Cooperative Agreement	Acres	TBD	TBD	TBD	Perform vegetation survey	Presence of waterfowl, survival of plantings
		Increase total wetlands values for migratory waterfowl	All	Habitat Units (HU)	TBD	TBD	TBD	With assistance from MCOOC, the Corps will perform a habitat analysis using the Missouri WHAG methodology	Annual presence of waterfowl

Appendix C

FIELD DATA SHEETS FOR VEGETATION AND WATERFOWL SURVEYS

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 10/29/90

DUCKS 4000 (number)

Species Composition (% of each species) 75 % Mallard 5 % Mixed
20 % Wood Duck ___ %

GEESE

0 Canada geese (% giant, interior, Richardson)
0 Snow geese
0 White-fronted geese

OTHER

500 Coot 1 Eagles Other ___
___ Pelicans ___ Swans ___

MIGRATIONS (primary species & dates)

10/25/90
10/26/90 Mallard

HABITAT – PRIVATE LANDS

80 % private crops harvested -- 75 corn 85 beans
Status of wheat planting 75 Done
60 % fall plowing

HABITAT — WILDLIFE AREA

Water levels Normal
Waterfowl food conditions: natural: Good crops: Poor
Flooding? None

HUNTING (general)

Pressure: N/A

Success: N/A

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 11/13/90

DUCKS 5000 (number)

Species Composition (% of each species) 80 % Mallard ___ %
20 % Mixed ___ %

GEESE

0 Canada geese (% giant, interior, Richardson)
0 Snow geese
0 White-fronted geese

OTHER

___ Coot 7 Eagles Other ___
___ Pelicans ___ Swans ___

MIGRATIONS (primary species & dates)

11/07/90 Mallard

HABITAT – PRIVATE LANDS

100 % private crops harvested -- 100 corn 100 beans
Status of wheat planting 95 Done
90 % fall plowing

HABITAT — WILDLIFE AREA

Water levels Normal
Waterfowl food conditions: natural: Good crops: Poor
Flooding? None

HUNTING (general)

Pressure:

Success:

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 11/26/90

DUCKS 5000 (number)

Species Composition (% of each species) 40 % Ring-neck 30 % Mixed
30 % Mallard ___ %

GEESE

0 Canada geese (% giant, interior, Richardson)
0 Snow geese
0 White-fronted geese

OTHER

500 Coot 5 Eagles Other ___
___ Pelicans ___ Swans ___

MIGRATIONS (primary species & dates)

Small push of mallards over 24th and 25th

HABITAT – PRIVATE LANDS

100 % private crops harvested -- 100 corn 100 beans
Status of wheat planting 100 complete
95 % fall plowing

HABITAT — WILDLIFE AREA

Water levels Normal
Waterfowl food conditions: natural: Good crops: Poor
Flooding? None

HUNTING (general)

Pressure: N/A

Success: N/A

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 12/10/90

DUCKS 1000 (number)

Species Composition (% of each species) 80 % Mallard ___ %
20 % Divers ___ %

GEESE

0 Canada geese (% giant, interior, Richardson)
0 Snow geese
0 White-fronted geese

OTHER

500 Coot 3 Eagles Other ___
___ Pelicans ___ Swans ___

MIGRATIONS (primary species & dates)

None

HABITAT – PRIVATE LANDS

100 % private crops harvested -- 100 corn 100 beans
Status of wheat planting 100 Complete
100 % fall plowing

HABITAT — WILDLIFE AREA

Water levels Normal
Waterfowl food conditions: natural: Poor crops: Poor
Flooding? None

HUNTING (general)

Pressure: N/A

Success: N/A

WATERFOWL & HABITAT SURVEYS

AREA: -- Clarksville Refuge DATE: 01/07/91

DUCKS 0 (number)

Species Composition (% of each species) ____% _____ ____% _____
____% _____ ____% _____

GEESE

0 Canada geese (% giant, interior, Richardson)

20 Snow geese

20 White-fronted geese

OTHER

369 below Lock & Dam 24
100 below Lock & Dam 22

_____ Coot _____ Eagles Other _____

_____ Pelicans _____ Swans _____

MIGRATIONS: (primary species & dates)

HABITAT -- PRIVATE LANDS

100 % private crops harvested -- 100 corn 100 beans

Status of wheat planting 100

100 % fall plowing

HABITAT -- WILDLIFE AREA

Water levels Froze solid

Waterfowl food conditions: natural: _____ crops: _____

Flooding? _____

HUNTING (general)

Pressure: N/A

Success: N/A

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 10-01-91

DUCKS 500 (number) " "

Species Composition (% of each species) 70 % Blue wing teal 1 % Mallard
29 % Woodduck % _____

GEESE

_____ Canada Geese (% giant, interior, Richardson)

_____ Snow Geese

_____ White-fronted Geese

OTHER

_____ Coot _____ Eagles Other _____

_____ Pelicans _____ Swans _____

MIGRATIONS (Primary species & Dates)

No major flights

HABITAT - PRIVATE LANDS

60 % private crops harvested -- 50 % corn 10 % beans

Status of wheat planting 10 % planted

10 % fall plowing

HABITAT - WILDLIFE AREA

Water levels Normal

Waterfowl food conditions: natural: Good crops: Good

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 10-15-91

DUCKS 500 (number)

Species Composition (% of each species) 50 % Blue wing teal 10 % Mallard
40 % Woodduck % _____

GEESE

_____ Canada Geese (% giant, interior, Richardson)

_____ Snow Geese

_____ White-fronted Geese

OTHER

_____ Coot _____ Eagles Other _____

_____ Pelicans _____ Swans _____

MIGRATIONS (Primary species & Dates)

Small movement of birds on the 4th of October, primarily mallards

HABITAT - PRIVATE LANDS

80 % private crops harvested -- 60 % corn 20 % beans

Status of wheat planting 50 % planted

40 % fall plowing

HABITAT - WILDLIFE AREA

Water levels Normal

Waterfowl food conditions: natural: Good crops: Good

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 10-29-91

DUCKS 3,000 (number)

Species Composition (% of each species) 60 % Mallard 10 % Mixed
30 % Green wings % _____

GEESE

_____ Canada Geese (% giant, interior, Richardson)

_____ Snow Geese

_____ White-fronted Geese

OTHER

200 Coot _____ Eagles Other _____

_____ Pelicans _____ Swans _____

MIGRATIONS (Primary species & Dates)

October 18 and 24 - Primarily mallard & Green-wings

HABITAT - PRIVATE LANDS

90 % private crops harvested -- 95 % corn 85 % beans

Status of wheat planting 90% completed

75 % fall plowing

HABITAT - WILDLIFE AREA

Water levels Normal

Waterfowl food conditions: natural: Good crops: Good

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 11-12-91

DUCKS 1,000 (number)

Species Composition (% of each species) 80 % Mallard ____ % ____
20 % Mixed Divers ____ % ____

GEESE

____ Canada Geese (% giant, interior, Richardson)

____ Snow Geese

____ White-fronted Geese

OTHER

____ Coot 1 Eagles Other ____

____ Pelicans ____ Swans ____

MIGRATIONS (Primary species & Dates)

HABITAT - PRIVATE LANDS

90 % private crops harvested -- 90 % corn 90 % beans

Status of wheat planting 90% complete

90 % fall plowing

HABITAT - WILDLIFE AREA

Water levels Normal

Waterfowl food conditions: natural: Good crops: Good

Flooding? ____

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 11-25-91

DUCKS 1,500 (number)

Species Composition (% of each species) 90 % Mallard ____ % ____
10 % Mixed ____ % ____

GEESE

____ Canada Geese (% giant, interior, Richardson)

____ Snow Geese

____ White-fronted Geese

OTHER

____ Coot 2 Eagles Other ____

____ Pelicans ____ Swans ____

MIGRATIONS (Primary species & Dates)

None

HABITAT - PRIVATE LANDS

100 % private crops harvested -- 100 % corn 100 % beans

Status of wheat planting Completed

100 % fall plowing

HABITAT - WILDLIFE AREA

Water levels Low - River on tilt

Waterfowl food conditions: natural: Good crops: Good

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 12-09-91

DUCKS 1,000 (number)

Species Composition (% of each species) 95 % Mallard ____ % ____
5 % Mixed ____ % ____

GEESE

____ Canada Geese (% giant, interior, Richardson)

____ Snow Geese

____ White-fronted Geese

OTHER

____ Coot 0 Eagles Other ____

____ Pelicans ____ Swans ____

MIGRATIONS (Primary species & Dates)

HABITAT - PRIVATE LANDS

100 % private crops harvested -- 100 % corn 100 % beans

Status of wheat planting Completed

100 % fall plowing

HABITAT - WILDLIFE AREA

Water levels Low - River on tilt

Waterfowl food conditions: natural: Good crops: Good

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 12-23-91

DUCKS 100 (number)

Species Composition (% of each species) 100 % Mallard ____ % ____
% ____ % ____

GEESE

____ Canada Geese (% giant, interior, Richardson)

____ Snow Geese

____ White-fronted Geese

OTHER

____ Coot 12 Eagles Other ____

____ Pelicans ____ Swans ____

MIGRATIONS (Primary species & Dates)

20,000 ducks observed moving south over River on the 19th

HABITAT - PRIVATE LANDS

100 % private crops harvested -- 100 % corn 100 % beans

Status of wheat planting ____

% fall plowing

HABITAT - WILDLIFE AREA

Water levels Low - River on tilt

Waterfowl food conditions: natural: Good crops: Good

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 01-06-92

DUCKS 500 (number)

Species Composition 100 % Mallard ____ % ____
(% of each species) ____ % ____ % ____ % ____

GEESE

____ Canada Geese (% giant, interior, Richardson)

____ Snow Geese

____ White-fronted Geese

OTHER

____ Coot 9 Eagles Other ____

____ Pelicans ____ Swans ____

MIGRATIONS (Primary species & Dates)

HABITAT - PRIVATE LANDS

100 % private crops harvested -- 100 % corn 100 % beans

Status of wheat planting ____

____ % fall plowing

HABITAT - WILDLIFE AREA

Water levels Low - but returning to normal

Waterfowl food conditions: natural: Good crops: Good

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 10-14-92

DUCKS 249 (number)

Species Composition 80 % Mallard ____ % ____
(% of each species) 20 % Woodduck ____ % ____

GEESE

____ Canada Geese (% giant, interior, Richardson)

____ Snow Geese

____ White-fronted Geese

OTHER

42 Coot ____ Eagles Other ____

____ Pelicans ____ Swans ____

MIGRATIONS (Primary species & Dates)

Small migration on weekend of the 10th and 11th.-mainly mallard.

HABITAT - PRIVATE LANDS

50 % private crops harvested -- 20 % corn 90 % beans

Status of wheat planting 50 % completed ____

30 % fall plowing

HABITAT - CONSERVATION AREA

Water levels Currently being flooded. ____

Waterfowl food conditions: natural: Good crops: Good

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 10-26-92

DUCKS 2500 (number)

Species Composition 75 % Mallard ____ % ____
(% of each species) 25 % Woodduck ____ % ____

GEESE

32 Canada Geese (% giant, interior, Richardson)

____ Snow Geese

____ White-fronted Geese

OTHER

____ Coot 1 Eagles Other ____

____ Pelicans ____ Swans ____

MIGRATIONS (Primary species & Dates)

10-19-92- Mallard - ringneck
10-26-92- Mallard - ringneck

HABITAT - PRIVATE LANDS

75 % private crops harvested -- 75 % corn 100 % beans

Status of wheat planting 80 % complete ____

60 % fall plowing

HABITAT - CONSERVATION AREA

Water levels Normal - will flood 6" this week. ____

Waterfowl food conditions: natural: Very Good crops: Good

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 11-09-92

DUCKS 4,500 (number)

Species Composition 80 % Mallard 5 % Woodduck
(% of each species) 15 % Mixed Dabblers ____ % ____

GEESE

40 Canada Geese (% giant, interior, Richardson)

____ Snow Geese

____ White-fronted Geese

OTHER

500 Coot 3 Eagles Other ____

10 Pelicans ____ Swans ____

MIGRATIONS (Primary species & Dates)

11-2,3,7 - mostly mallard - some pintail, gadwall and widgeon.

HABITAT - PRIVATE LANDS

85 % private crops harvested -- 85 % corn 100 % beans

Status of wheat planting 95% completed ____

80 % fall plowing

HABITAT - CONSERVATION AREA

Water levels Normal ____

Waterfowl food conditions: natural: Good crops: Good

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 11-23-92

DUCKS 4,000 (number)

Species Composition 90 % Mallard 5 % Woodduck
(% of each species) 5 % Mixed Dabblers % _____

GEESE

50 Canada Geese (% giant, interior, Richardson)

_____ Snow Geese

_____ White-fronted Geese

OTHER

200 Coot 2 Eagles Other _____

_____ Pelicans _____ Swans _____

MIGRATIONS (Primary species & Dates)

No flights

HABITAT - PRIVATE LANDS

90 % private crops harvested -- 90 % corn 100 % beans

Status of wheat planting 100% complete

95 % fall plowing

HABITAT - CONSERVATION AREA

Water levels Normal

Waterfowl food conditions: natural: Good crops: Good

Flooding? River is at flood stage.

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 12-07-92

DUCKS 100 (number)

Species Composition 100 % Mallard % _____
(% of each species) % _____ % _____

GEESE

50 Canada Geese (% giant, interior, Richardson)

_____ Snow Geese

_____ White-fronted Geese

OTHER

_____ Coot 3 Eagles Other _____

_____ Pelicans _____ Swans _____

MIGRATIONS (Primary species & Dates)

None

HABITAT - PRIVATE LANDS

99 % private crops harvested -- 99 % corn 100 % beans

Status of wheat planting Completed

95 % fall plowing

HABITAT - CONSERVATION AREA

Water levels Low - Due to drawdown on the river.

Waterfowl food conditions: natural: Good crops: Good

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 12-14-92

DUCKS 25 (number)

Species Composition 100 % Mallard % _____
(% of each species) % _____ % _____

GEESE

50 Canada Geese (% giant, interior, Richardson)

_____ Snow Geese

_____ White-fronted Geese

OTHER

_____ Coot 1 Eagles Other _____

_____ Pelicans _____ Swans _____

MIGRATIONS (Primary species & Dates)

HABITAT - PRIVATE LANDS

100 % private crops harvested -- 100 % corn 100 % beans

Status of wheat planting Completed

100 % fall plowing

HABITAT - CONSERVATION AREA

Water levels Normal

Waterfowl food conditions: natural: Fair crops: Good

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 01-04-93

DUCKS _____ (number)

Species Composition % _____ % _____
(% of each species) % _____ % _____

GEESE

250 Canada Geese (% giant, interior, Richardson)

_____ Snow Geese

_____ White-fronted Geese

OTHER

_____ Coot 5 Eagles Other _____

_____ Pelicans _____ Swans _____

MIGRATIONS (Primary species & Dates)

HABITAT - PRIVATE LANDS

100 % private crops harvested -- % corn % beans

Status of wheat planting Completed

100 % fall plowing

HABITAT - CONSERVATION AREA

Water levels Normal - River is on drawdown.

Waterfowl food conditions: natural: Fair crops: Fair

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 10-04-93

DUCKS 0 (number)

Species Composition (% of each species) ____% Mallard ____% ____
____% Woodduck ____% ____

GEESE

0 Canada Geese (% giant, interior, Richardson)

0 Snow Geese

0 White-fronted Geese

OTHER

____ Coot ____ Eagles Other____

____ Pelicans ____ Swans ____

MIGRATIONS (Primary species & Dates)

No migrations.

HABITAT - PRIVATE LANDS

____% private crops harvested ____% corn ____% beans

Status of wheat planting ____ % completed____

0 % fall plowing Most crops lost to flood of 93.

HABITAT - CONSERVATION AREA

Water levels High - due to flood - water levels are dropping.

Waterfowl food conditions: natural: 0 crops: 0

Flooding? ____

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 10-18-93

DUCKS 10 (number)

Species Composition (% of each species) 2 % Mallard ____% ____
8 % Woodduck ____% ____

GEESE

____ Canada Geese (% giant, interior, Richardson)

____ Snow Geese

____ White-fronted Geese

OTHER

____ Coot ____ Eagles Other____

____ Pelicans ____ Swans ____

MIGRATIONS (Primary species & Dates)

None

HABITAT - PRIVATE LANDS

____% private crops harvested ____% corn ____% beans

Status of wheat planting 10%____

15 % fall plowing

HABITAT - CONSERVATION AREA

Water levels Normal____

Waterfowl food conditions: natural: Poor crops: Poor

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 11-01-93

DUCKS 600 (number)

Species Composition (% of each species) 100 % Mallard ____% ____
____% ____ ____% ____

GEESE

30 Canada Geese (% giant, interior, Richardson)

____ Snow Geese

____ White-fronted Geese

OTHER

____ Coot 3 Eagles Other____

____ Pelicans ____ Swans ____

MIGRATIONS (Primary species & Dates)

October 19th - Mallard.

HABITAT - PRIVATE LANDS

85 % private crops harvested ____85_% corn 100 % beans

Status of wheat planting 90%____

25 % fall plowing

HABITAT - CONSERVATION AREA

Water levels Normal____

Waterfowl food conditions: natural: Poor crops: Poor

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 11-16-93

DUCKS 250 (number)

Species Composition (% of each species) 90 % Mallard ____% ____
10 % Mixed ____% ____

GEESE

____ Canada Geese (% giant, interior, Richardson)

____ Snow Geese

____ White-fronted Geese

OTHER

____ Coot ____ Eagles Other____

____ Pelicans ____ Swans ____

MIGRATIONS (Primary species & Dates)

HABITAT - PRIVATE LANDS

90 % private crops harvested -- 90 % corn 100 % beans

Status of wheat planting 90%____

25 % fall plowing

HABITAT - CONSERVATION AREA

Water levels Normal____

Waterfowl food conditions: natural: Poor crops: Poor

Flooding? None

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

REA: Clarksville Refuge DATE: 11-29-93

UCKS 0 (number)

pecies Composition ____% _____ ____% _____
% of each species) ____% _____ ____% _____

EESE

_____ Canada Geese (% giant, interior, Richardson)

_____ Snow Geese

_____ White-fronted Geese

THER

_____ Coot ____4____ Eagles Other_____

_____ Pelicans _____ Swans _____

IGRATIONS (Primary species & Dates)

HABITAT - PRIVATE LANDS

__100__% private crops harvested _____% corn _____% beans

Status of wheat planting _____100%_____

__100__% fall plowing

HABITAT - CONSERVATION AREA

Water levels _____Normal_____

Waterfowl food conditions: natural: __Poor____ crops: __Poor__

Flooding? ___None_____

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

AREA: Clarksville Refuge DATE: 12-21-93

DUCKS 25 (number)

Species Composition _100_% ___Mallard___ _____% _____
(% of each species) ____% _____ ____% _____

GEESE

____25____ Canada Geese (% giant, interior, Richardson)

_____ Snow Geese

_____ White-fronted Geese

OTHER

_____ Coot ____8____ Eagles Other_____

_____ Pelicans _____ Swans _____

MIGRATIONS (Primary species & Dates)

Approximately 2 weeks prior to this count there were 1000 geese using refuge.

HABITAT - PRIVATE LANDS

_____% private crops harvested -- _____% corn _____% beans

Status of wheat planting _____

_____% fall plowing

HABITAT - CONSERVATION AREA

Water levels _____

Waterfowl food conditions: natural: _____ crops: _____

Flooding? _____

HUNTING (general)

Pressure: NA

Success: NA

WATERFOWL & HABITAT SURVEYS

REA: Clarksville Refuge DATE: 01-04-94

UCKS 8 (number)

pecies Composition __100% _Mallard____ _____% _____
% of each species) ____% _____ ____% _____

EESE

_____ Canada Geese (% giant, interior, Richardson)

_____ Snow Geese

_____ White-fronted Geese

THER

_____ Coot _____ Eagles Other_____

_____ Pelicans _____ Swans _____

IGRATIONS (Primary species & Dates)

ots of eagles around Lock and Dam 24.

ABITAT - PRIVATE LANDS

_____% private crops harvested -- _____% corn _____% beans

status of wheat planting _____

_____% fall plowing

ABITAT - CONSERVATION AREA

ater levels _____

aterfowl food conditions: natural: _____ crops: _____

looding? _____

UNTING (general)

ressure: NA

uccess: NA

CLARKSVILLE REFUGE WATERFOWL & HABITAT SURVEY (1994)

DATE	10/03	10/17	10/31	11/14	11/28	01/02
DUCK COUNT	28	100	500	1000	650	2500
MALLARD %	99	100	90	100	90	99
WOODDUCK %	1		10		10	
OTHER %						1
GEESE	0	0	0	0	0	600
OTHER						
COOT				25		50
EAGLE	2					
OTHER	1					
MIGRATION			10/30			
PRIVATE LAND HABITAT						
CROP HARVEST %	30	50	70	100	100	100
CORN HARVEST %	30	50	80	100	100	100
WHEAT PLANTING %	0	0	0	0	100	100
FALL PLOWING %	0	0	0	0	50	60
AREA HABITAT						
WATER LEVEL	LOW	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
NATURAL FOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
CROP	POOR	POOR	POOR	POOR	POOR	POOR
FLOODING ?	NONE	NONE	NONE	NONE	NONE	NONE

Appendix D

WHAG WORKSHEETS

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

1	N	NONFOREST WETLAND
2	B	BOTTOMLAND HARDWOODS-WETLAND
3	C	CROPLAND-WETLAND
4	G	GRASSLAND-WETLAND

SPECIES ABREVIATIONS

1	MALL	MALLARD	7	HERO	GREEN-BACKED HERON
2	GOOS	CANADA GOOSE	8	DUCK	WOOD DUCK
3	BITT	LEAST BITTERN	9	BEAV	BEAVER
4	YLEG	LESSER YELLOWLEGS	10	COOT	AMERCIAN COOT
5	MUSK	MUSKRAT	11	PARU	NORTHERN PARULA
6	RAIL	KING RAIL	12	PROT	PROTHONOTARY WARBLER

PROJECT NAME CLARKSVILLE REFUGE

MATRIX NAME WETLAND
DATA FILE NAME CLARK2

PLANNING CONDITION PRES

DATE FIELD WORK 10-13-88
TODAYS DATE 03-02-1991

SAMPLE SITE HABITAT INDEXES

HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
B	1	.1					
		HERO	DUCK	BEAV	COOT	PARU	PROT
		.1	.65	.51		.6	.17
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
B	5	.1					
		HERO	DUCK	BEAV	COOT	PARU	PROT
		.1	.69	.43		.55	.15
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	3	.38	.32	.67	.1	.14	.49
		HERO	DUCK	BEAV	COOT	PARU	PROT
		.55			.64		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	2	.33	.29	.71	.1	.11	.64
		HERO	DUCK	BEAV	COOT	PARU	PROT
		.58			.58		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	4	.21	.18	.8	.1	.14	.61
		HERO	DUCK	BEAV	COOT	PARU	PROT
		.49			.6		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	8	.1	.1	.8	.53	.15	.6
		HERO	DUCK	BEAV	COOT	PARU	PROT
		.59			.63		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	6	.19	.17	.1	.1	.12	.6
		HERO	DUCK	BEAV	COOT	PARU	PROT
		.1			.1		

C CROPLAND-WETLAND SAMPLE SITES
O GRASSLAND-WETLAND SAMPLE SITES

AVERAGE HABITAT INDEXES BY HABITAT TYPE

HAB	MALL	GOOS	BITT	YLEG	MUSK	RAIL	HERO	DUCK	BEAV	COOT	PARU	PROT
N	.24	.21	.62	.19	.13	.59	.46			.51		
B	.1						.1	.67	.47		.58	.16
C												
G												

DIFFERENCE BETWEEN MEAN HSI'S AND OBJECTIVE HSI'S

PROJECT NAME CLARKSVILLE REFUGE DATA FILE NAME CLARK2

PLANING CONDITION (PRES)

TODAYS DATE 03-02-1991 DATE FIELD WORK 10-13-88

HAB	MALL	GOOS	BITT	YLEG	MUSK	RAIL	HERO	DUCK	BEAV	COOT	PARU	PROT
N	-.64	-.66	-.29	-.62	-.73	-.14	-.35			-.32		
B	-.65						-.72	-.19	-.38		-.21	-.54
C												
G												

NONFOREST WETLAND	178
BOTTOMLAND HARDWOODS-WETLAND	147
CROPLAND-WETLAND	0
GRASSLAND-WETLAND	0

AVAILABLE HABITAT (ACRES) BY SPECIES AND MAXIMUM NUMBER IF HABITAT RATED 1.

SPECIES	ACRES	MAXIMUM NUMBER
MALLARD	325	1,300.0
CANADA GOOSE	178	712.0
LEAST BITTERN	178	89.0
LESSER YELLOWLEGS	178	356.0
MUSKRAT	178	178.0
KING RAIL	178	17.8
GREEN-BACKED HERON	325	65.0
WOOD DUCK	147	7.4
BEAVER	147	7.4
AMERCIAN COOT	178	35.6
NORTHERN PARULA	147	73.5
PROTHONOTARY WARBLER	147	58.8

PROJECTED ANIMAL NUMBERS AND MEAN HSI's

SPECIES	ANIMAL NUMBERS	MEAN HSI	TOTAL HABITAT UNITS
MALLARD	231.4	0.18	57.8
CANADA GOOSE	150.4	0.21	37.6
LEAST BITTERN	54.9	0.62	109.9
LESSER YELLOWLEGS	66.2	0.19	33.1
MUSKRAT	23.5	0.13	23.5
KING RAIL	10.5	0.59	104.8
GREEN-BACKED HERON	19.4	0.30	97.0
WOOD DUCK	4.9	0.67	98.2
BEAVER	3.4	0.47	68.9
AMERCIAN COOT	18.1	0.51	90.3
NORTHERN PARULA	42.3	0.58	84.5
PROTHONOTARY WARBLER	9.2	0.16	23.0

IF MEAN HSI EQUALS .1, THEN HABITAT QUALITY IS TOO LOW TO MAKE RELIABLE DEI
PROJECTIONS

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

1	N	NONFOREST WETLAND
2	B	BOTTOMLAND HARDWOODS-WETLAND
3	C	CROPLAND-WETLAND
4	G	GRASSLAND-WETLAND

SPECIES ABREVIATIONS

1	MALL	MALLARD	7	HERO	GREEN-BACKED HERON
2	GOOS	CANADA GOOSE	8	DUCK	WOOD DUCK
3	BITT	LEAST BITTERN	9	BEAV	BEAVER
4	YLEG	LESSER YELLOWLEGS	10	COOT	AMERCIAN COOT
5	MUSK	MUSKRAT	11	PARU	NORTHERN PARULA
6	RAIL	KING RAIL	12	PROT	PROTHONOTARY WARBLER

PROJECT NAME CLARKSVILLE REFUGE-PLANNED

MATRIX NAME WETLAND
DATA FILE NAME CLARKPLN

PLANNING CONDITION PLAN1

DATE FIELD WORK 12-30-88
TODAYS DATE 03-02-1991

SAMPLE SITE HABITAT INDEXES

HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
B	1	.53					
		HERO	DUCK	BEAV	COOT	PARU	PROT
		.1	.65	.51		.6	.17
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
B	5	.53					
		HERO	DUCK	BEAV	COOT	PARU	PROT
		.1	.69	.43		.55	.15
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	3	.67	.47	.7	.1	.11	.56
		HERO	DUCK	BEAV	COOT	PARU	PROT
		.55			.1		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	2	.66	.47	.74	.1	.1	.6
		HERO	DUCK	BEAV	COOT	PARU	PROT
		.52			.1		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	4	.67	.47	.77	.1	.12	.63
		HERO	DUCK	BEAV	COOT	PARU	PROT
		.52			.1		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	6	.65	.46	.76	.1	.11	.56
		HERO	DUCK	BEAV	COOT	PARU	PROT
		.56			.1		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	8	.66	.47	.8	.56	.12	.63
		HERO	DUCK	BEAV	COOT	PARU	PROT
		.55			.1		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
C	9	.94	.57				

THIS DATA SET CONTAINS:
5 NONFOREST WETLAND SAMPLE SITES
2 BOTTOMLAND HARDWOODS-WETLAND SAMPLE SITES
1 CROPLAND-WETLAND SAMPLE SITES
0 GRASSLAND-WETLAND SAMPLE SITES

AVERAGE HABITAT INDEXES BY HABITAT TYPE

HAB	MALL	GOOS	BITT	YLEG	MUSK	RAIL	HERO	DUCK	BEAV	COOT	PARU	PROT
N	.66	.47	.75	.19	.11	.59	.54			.1		
B	.53						.1	.67	.47		.58	.16
C	.94	.57										
G												

DIFFERENCE BETWEEN MEAN HSI'S AND OBJECTIVE HSI'S

PROJECT NAME CLARKSVILLE REFUGE-PLANNED

DATA FILE NAME CLARKPLN

PLANING CONDITION PLAN1

TODAYS DATE 03-02-1991

DATE FIELD WORK 12-30-88

HAB	MALL	GOOS	BITT	YLEG	MUSK	RAIL	HERO	DUCK	BEAV	COOT	PARU	PROT
N	-.22	-.4	-.16	-.62	-.75	-.14	-.27			-.73		
B	-.22						-.72	-.19	-.38		-.21	-.54
C	.11	-.29										
G												

NONFOREST WETLAND	166
BOTTOMLAND HARDWOODS-WETLAND	147
CROPLAND-WETLAND	12
GRASSLAND-WETLAND	0

AVAILABLE HABITAT (ACRES) BY SPECIES AND MAXIMUM NUMBER IF HABITAT RATED 1.

SPECIES	ACRES	MAXIMUM NUMBER
MALLARD	325	1,300.0
CANADA GOOSE	178	712.0
LEAST BITTERN	166	83.0
LESSER YELLOWLEGS	166	332.0
MUSKRAT	166	166.0
KING RAIL	166	16.6
GREEN-BACKED HERON	313	62.6
WOOD DUCK	147	7.4
BEAVER	147	7.4
AMERCIAN COOT	166	33.2
NORTHERN PARULA	147	73.5
PROTHONOTARY WARBLER	147	58.8

PROJECTED ANIMAL NUMBERS AND MEAN HSI's

SPECIES	ANIMAL NUMBERS	MEAN HSI	TOTAL HABITAT UNITS
MALLARD	799.4	0.61	199.9
CANADA GOOSE	337.6	0.47	84.4
LEAST BITTERN	62.6	0.75	125.2
LESSER YELLOWLEGS	64.1	0.19	32.0
MUSKRAT	18.7	0.11	18.7
KING RAIL	9.9	0.59	98.7
GREEN-BACKED HERON	20.9	0.33	104.5
WOOD DUCK	4.9	0.67	98.2
BEAVER	3.4	0.47	68.9
AMERCIAN COOT	0.0	0.10	0.0
NORTHERN PARULA	42.3	0.58	84.5
PROTHONOTARY WARBLER	9.2	0.16	23.0

IF MEAN HSI EQUALS .1, THEN HABITAT QUALITY IS TOO LOW TO MAKE RELIABLE DEN- PROJECTIONS

MISSOURI DEPARTMENT OF CONSERVAION

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

1	N	NONFOREST WETLAND
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SPECIES ABREVIATIONS

1	MALL	MALLARD	7	HERO	GREEN-BACKED HERON
2	GOOS	CANADA GOOSE	8	DUCK	WOOD DUCK
3	BITT	LEAST BITTERN	9	BEAV	BEAVER
4	YLEG	LESSER YELLOWLEGS	10	COOT	AMERICAN COOT
5	MUSK	MUSKRAT	11	PARU	NORTHERN PARULA
6	RAIL	KING RAIL	12	PROT	PROTHONOTARY WARBLER

PROJECT NAME CLARKSVILL REFUGE 95

MATRIX NAME WETLAND
DATA FILE NAME CLARKSVL

PLANNING CONDITION PRES

DATE FIELD WORK 083095
TODAYS DATE 09-08-1995

SAMPLE SITE HABITAT INDEXES

HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
B	1	0.69					
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.81	0.76	0.81		0.70	0.71
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
B	2	0.69					
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.81	0.76	0.81		0.70	0.71
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	3	0.75	0.67	0.70	0.64	0.12	0.66
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.67			0.10		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	4	0.71	0.63	0.76	0.61	0.12	0.66
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.60			0.10		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	5	0.75	0.67	0.49	0.64	0.11	0.59
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.71			0.10		

HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	6	0.75	0.67	0.57	0.64	0.12	0.67
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.74			0.10		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	7	0.75	0.67	0.61	0.64	0.12	0.67
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.74			0.10		

THIS DATA SET CONTAINS:
5 NONFOREST WETLAND SAMPLE SITES
2 BOTTOMLAND HARDWOODS-WETLAND SAMPLE SITES
0 CROPLAND-WETLAND SAMPLE SITES
0 GRASSLAND-WETLAND SAMPLE SITES

AVERAGE HABITAT INDEXES BY HABITAT TYPE

HAB	MALL	GOOS	BITT	YLEG	MUSK	RAIL	HERO	DUCK	BEAV	COOT	PARU	PROT
N	0.74	0.66	0.63	0.63	0.12	0.65	0.69			0.10		
B	0.69						0.81	0.76	0.81		0.70	0.71
C												
G												

DIFFERENCE BETWEEN MEAN HSI'S AND OBJECTIVE HSI'S

PROJECT NAME CLARKSVILL REFUGE 95 DATA FILE NAME CLARKSVL

PLANING CONDITION PRES

TODAYS DATE 09-08-1995 DATE FIELD WORK 083095

HAB	MALL	GOOS	BITT	YLEG	MUSK	RAIL	HERO	DUCK	BEAV	COOT	PARU	PROT
N	-0.14	-0.21	-0.28	-0.18	-0.74	-0.08	-0.12			-0.73		
B	-0.06					-0.01	-0.10	-0.04		-0.09	0.01	
C	-0.83	-0.86										
G		-0.86										

MISSOURI DEPARTMENT OF CONSERVAION
USDA SOIL CONSERVATION SERVICE

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

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3	C	CROPLAND-WETLAND
4	G	GRASSLAND-WETLAND

SPECIES ABREVIATIONS

1	MALL	MALLARD	7	HERO	GREEN-BACKED HERON
2	GOOS	CANADA GOOSE	8	DUCK	WOOD DUCK
3	BITT	LEAST BITTERN	9	BEAV	BEAVER
4	YLEG	LESSER YELLOWLEGS	10	COOT	AMERICAN COOT
5	MUSK	MUSKRAT	11	PARU	NORTHERN PARULA
6	RAIL	KING RAIL	12	PROT	PROTHONOTARY WARBLER

PROJECT NAME CLARKSVILL REFUGE 95 MATRIX NAME WETLAND

PLANNING CONDITION PRES DATE FIELD WORK 083095 TODAYS DATE 09-08-1995

AVERAGE CHARACTERISTIC SCORES FOR THE

NONFOREST WETLAND HABITAT TYPE

THIS DATA SET CONTAINS 5 SAMPLE SITES FOR THIS HABITAT TYPE

	CHARACTERISTIC ABREVIATION	AVE. CAT. SCORE	CHARACTERISTIC AVERAGES SPECIES MALL	GOOS	BITT	YLEG	MUSK	RAIL	HERO	COOT
1	%NONFOR WETLND	3.0			6	6	6	6		6
2	%NONF WET&WATR	1.0		10						
3	%BHRDWDS&NFWET	2.0	8						8	
4	FALL-WINTR WATR	1.0	10	10						
5	FALL-WINTR FLD	2.0	8	8						
6	F-W WATER 18	1.0	10	10						
7	WATER <4 IN	3.0				6				4
8	WAT 4-18 AUG	3.6			6.4		2.2	6.4	2.2	2.2
9	PER WAT E YEAR	5.0					1			
10	%PER VEG 2YDS	3.0			4					4
11	WOODY INVASION	3.4			4.6		2.6	3	2.8	
12	EMER VEG COVER	3.8			4.8	5.6			8.8	
13	CAT BULR COVER	5.0					1	10		1
14	WETLAND SIZE	1.0			10	10	10	10	10	10
15	WETLAND EDGE	1.0							10	
16	WATER REGIME	4.0			8	8	2	8	2	2
17	FOOD PLNT COVER	1.0	10	10						
18	PLANT DIVERSITY	1.0	5	5						
19	PERST EM&WOODY	1.6	4.2	4.2						
20	SUBSTRATE-WATER	2.0				1				
21	% OPEN WATER	3.0	1	1			6			8
22	WINT WAT DEPTH	1.0					10			
23	SEDGE CAN COV	5.0						2		
24	WETLAND SUBSTRA	1.0				5				
25	WATERLOG SUBSTR	1.0				10				
26	EXPOSED WET SUB	5.0				2				
49	DIST BOT HARDWS	1.0	10						5	
50	DIST CROPLAND	5.0	4	4						
51	DIST GRASSLAND	3.0		4						
52	DIST STREAM	1.0							10	
53	DIST MAJ RIVER	1.0		10						
54	D GOOSE FALL	4.0		1						

BLANK SPACES IN THE TABLE MEAN THAT THE CHARACTERISTIC DOES NOT APPLY TO THE SPECIES
AVE. CAT. SCORE = AVERAGE CATEGORY SCORE FROM THE FIELD SHEETS
CHARACTERISTIC AVERAGES = THE AVERAGE POINT VALUE FROM THE SPECIES MATRIX

LIMITING FACTOR CHARACTERISTICS APPICABLE TO THESE SPECIES AND THIS HABITAT TYPE

SPECIES	SPECIES NUMBER	CHARACTERISTIC NUMBER	FACTOR TYPE
CANADA GOOSE	2	2	LIMITING FACTOR
MALLARD	1	3	LIMITING FACTOR
MALLARD	1	4	LIMITING FACTOR
CANADA GOOSE	2	4	LIMITING FACTOR
MALLARD	1	5	MULTIPLIER
CANADA GOOSE	2	5	MULTIPLIER
AMERCIAN COOT	10	7	LIMITING FACTOR
MUSKRAT	5	9	MULTIPLIER
LEAST BITTERN	3	12	LIMITING FACTOR
LESSER YELLOWLEGS	4	12	LIMITING FACTOR
KING RAIL	6	13	LIMITING FACTOR
AMERICAN COOT	10	13	LIMITING FACTOR
LEAST BITTERN	3	14	LIMITING FACTOR
LESSER YELLOWLEGS	4	14	LIMITING FACTOR
GREEN-BACKED HERRON	7	14	LIMITING FACTOR
AMERICAN COOT	10	14	LIMITING FACTOR
LEAST BITTERN	3	16	LIMITING FACTOR
LESSER YELLOWLEGS	4	16	LIMITING FACTOR
MUSKRAT	5	16	LIMITING FACTOR
KING RAIL	6	16	LIMITING FACTOR
GREEN-BACKED HERON	7	16	LIMITING FACTOR
AMERCIAN COOT	10	16	LIMITING FACTOR
MALLARD	1	17	MULTIPLIER
CANADA GOOSE	2	17	MULTIPLIER
KING RAIL	6	23	LIMITING FACTOR
LESSER YELLOWLEGS	4	26	LIMITING FACTOR
CANADA GOOSE	2	54	MULTIPLIER

THESE CHARACTERISTICS ARE THE MOST IMPORTANT IN DETERMINING THE HABITAT INDEX AND SHOULD SCORE AT OR NEAR THE MAXIMUM VALUE FOR THE APPLICABLE SPECIES TO ACHIEVE A HIGH INDEX

MISSOURI DEPARTMENT OF CONSERVAION
USDA SOIL CONSERVATION SERVICE

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4	G	GRASSLAND-WETLAND

SPECIES ABREVIATIONS

1	MALL	MALLARD	7	HERO	GREEN-BACKED HERON
2	GOOS	CANADA GOOSE	8	DUCK	WOOD DUCK
3	BITT	LEAST BITTERN	9	BEAV	BEAVER
4	YLEG	LESSER YELLOWLEGS	10	COOT	AMERICAN COOT
5	MUSK	MUSKRAT	11	PARU	NORTHERN PARULA
6	RAIL	KING RAIL	12	PROT	PROTHONOTARY WARBLER

PROJECT NAME CLARKSVILL REFUGE 95 MATRIX NAME WETLAND

PLANNING CONDITION PRES DATE FIELD WORK 083095 TODAYS DATE 09-08-1995

AVERAGE CHARACTERISTIC SCORES FOR THE

NONFOREST WETLAND HABITAT TYPE

THIS DATA SET CONTAINS 5 SAMPLE SITES FOR THIS HABITAT TYPE

	CHARACTERISTIC ABREVIATION	AVE. CAT. SCORE	CHARACTERISTIC AVERAGES SPECIES MALL	GOOS	BITT	YLEG	MUSK	RAIL	HERO	COOT
1	%NONFOR WETLND	3.0			.6	.6	.6	.6		.6
2	%NONF WET&WATR	1.0		1					.8	
3	%BHRDWDS&NFWET	2.0	.8							
4	FALL-WINTR WATR	1.0	1	1						
5	FALL-WINTR FLD	2.0	.8	.8						
6	F-W WATER 18	1.0	1	1						
7	WATER <4 IN	3.0				.6				.4
8	WAT 4-18 AUG	3.6			.6		.2	.6	.2	.2
9	PER WAT E YEAR	5.0					.1			
10	%PER VEG 2YDS	3.0			.4					.4
11	WOODY INVASION	3.4			.5		.5	.3	.3	
12	EMER VEG COVER	3.8			.5	.6			.9	
13	CAT BULR COVER	5.0					.1	1		.1
14	WETLAND SIZE	1.0			1	1	1	1	1	1
15	WETLAND EDGE	1.0							1	
16	WATER REGIME	4.0			.8	.8	.2	.8	.2	.2
17	FOOD PLNT COVER	1.0	1	1						
18	PLANT DIVERSITY	1.0	1	1						
19	PERST EM&WOODY	1.6	.8	.8						
20	SUBSTRATE-WATER	2.0				.1				
21	% OPEN WATER	3.0	.2	.2			.6			.8
22	WINT WAT DEPTH	1.0					1			
23	SEDGE CAN COV	5.0						.2		
24	WETLAND SUBSTRA	1.0				1				
25	WATERLOG SUBSTR	1.0				1				
26	EXPOSED WET SUB	5.0				.2				
49	DIST BOT HARDWS	1.0	1						1	
50	DIST CROPLAND	5.0	.4	.4						
51	DIST GRASSLAND	3.0		.4					1	
52	DIST STREAM	1.0								
53	DIST MAJ RIVER	1.0		1						
54	D GOOSE FALL	4.0		.1						

BLANK SPACES IN THE TABLE MEAN THAT THE CHARACTERISTIC DOES NOT APPLY TO THE SPECIES
AVE. CAT. SCORE = AVERAGE CATEGORY SCORE FROM THE FIELD SHEETS
CHARACTERISTIC AVERAGES = THE AVERAGE POINT VALUE FROM THE SPECIES MATRIX

LIMITING FACTOR CHARACTERISTICS APPICABLE TO THESE SPECIES AND THIS HABITAT TYPE

SPECIES	SPECIES NUMBER	CHARACTERISTIC NUMBER	FACTOR TYPE
CANADA GOOSE	2	2	LIMITING FACTOR
MALLARD	1	3	LIMITING FACTOR
MALLARD	1	4	LIMITING FACTOR
CANADA GOOSE	2	4	LIMITING FACTOR
MALLARD	1	5	MULTIPLIER
CANADA GOOSE	2	5	MULTIPLIER
AMERCIAN COOT	10	7	LIMITING FACTOR
MUSKRAT	5	9	MULTIPLIER
LEAST BITTERN	3	12	LIMITING FACTOR
LESSER YELLOWLEGS	4	12	LIMITING FACTOR
KING RAIL	6	13	LIMITING FACTOR
AMERICAN COOT	10	13	LIMITING FACTOR
LEAST BITTERN	3	14	LIMITING FACTOR
LESSER YELLOWLEGS	4	14	LIMITING FACTOR
GREEN-BACKED HERRON	7	14	LIMITING FACTOR
AMERICAN COOT	10	14	LIMITING FACTOR
LEAST BITTERN	3	16	LIMITING FACTOR
LESSER YELLOWLEGS	4	16	LIMITING FACTOR
MUSKRAT	5	16	LIMITING FACTOR
KING RAIL	6	16	LIMITING FACTOR
GREEN-BACKED HERON	7	16	LIMITING FACTOR
AMERCIAN COOT	10	16	LIMITING FACTOR
MALLARD	1	17	MULTIPLIER
CANADA GOOSE	2	17	MULTIPLIER
KING RAIL	6	23	LIMITING FACTOR
LESSER YELLOWLEGS	4	26	LIMITING FACTOR
CANADA GOOSE	2	54	MULTIPLIER

THESE CHARACTERISTICS ARE THE MOST IMPORTANT IN DETERMINING THE HABITAT INDEX AND SHOULD SCORE AT OR NEAR THE MAXIMUM VALUE FOR THE APPLICABLE SPECIES TO ACHIEVE A HIGH INDEX

MISSOURI DEPARTMENT OF CONSERVAION
USDA SOIL CONSERVATION SERVICE

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SPECIES ABREVIATIONS

1	MALL	MALLARD	7	HERO	GREEN-BACKED HERON
2	GOOS	CANADA GOOSE	8	DUCK	WOOD DUCK
3	BITT	LEAST BITTERN	9	BEAV	BEAVER
4	YLEG	LESSER YELLOWLEGS	10	COOT	AMERICAN COOT
5	MUSK	MUSKRAT	11	PARU	NORTHERN PARULA
6	RAIL	KING RAIL	12	PROT	PROTHONOTARY WARBLER

PROJECT NAME CLARKSVILL REFUGE 95 MATRIX NAME WETLAND

PLANNING CONDITION PRES DATE FIELD WORK 083095 TODAYS DATE 09-08-1995

AVERAGE CHARACTERISTIC SCORES FOR THE

BOTTOMLAND HARDWOODS-WETLAND HABITAT TYPE

THIS DATA SET CONTAINS 2 SAMPLE SITES FOR THIS HABITAT TYPE

	CHARACTERISTIC ABREVIATION	AVE. CAT. SCORE	CHARACTERISTIC AVERAGES SPECIES MALL	HERO	DUCK	BEAV	PARU	PROT
3	%BHRDWDS&NFWET	2.0	.8	.8	.8	.8		
4	FALL-WINTR WATR	1.0	1					
5	FALL-WINTR FLD	2.0	.8					
6	F-W WATER 18	2.0	.8					
12	EMER VEG COVER	6.0		.1				
14	WETLAND SIZE	1.0		1				
15	WETLAND EDGE	1.0		1				
17	FOOD PLNT COVER	2.0	.8					
18	PLANT DIVERSITY	1.0	1					
27	AQ VEG CHANNEL	1.0			1	1		
28	WAT FLUCT CHANN	2.0				.7		
35	WOODL TREE SP	1.0	.1		.8	1		
36	PER WAT IN WOOD	4.0	.6	.2	.2			.2
37	FOREST OPENINGS	1.0	.2	1	1	1		
38	WOOD SIZE CLASS	3.0	.6	1	.6	.6	.7	.7
39	OLD GROWTH	2.0			.8	.4		
40	OVERST CAN HT	2.0					.7	.7
41	SUBCAN CLOSURE	4.0					.1	.7
42	WOODLAND SIZE	1.0					1	1
43	FOREST ADJ WATR	1.0						1
44	SNAGS/AC	1.0			1			1
45	CAVITY TREE/AC	3.0			.4			.4
46	STEMS/SQ YD	2.0			.6	.7	.7	.4
47	WOOD W/IN 600 W	1.0		1	1	1	1	1
48	DIST NONFOR WET	1.0	1	1	1	1		
50	DIST CROPLAND	5.0	.4					
52	DIST STREAM	1.0		1				

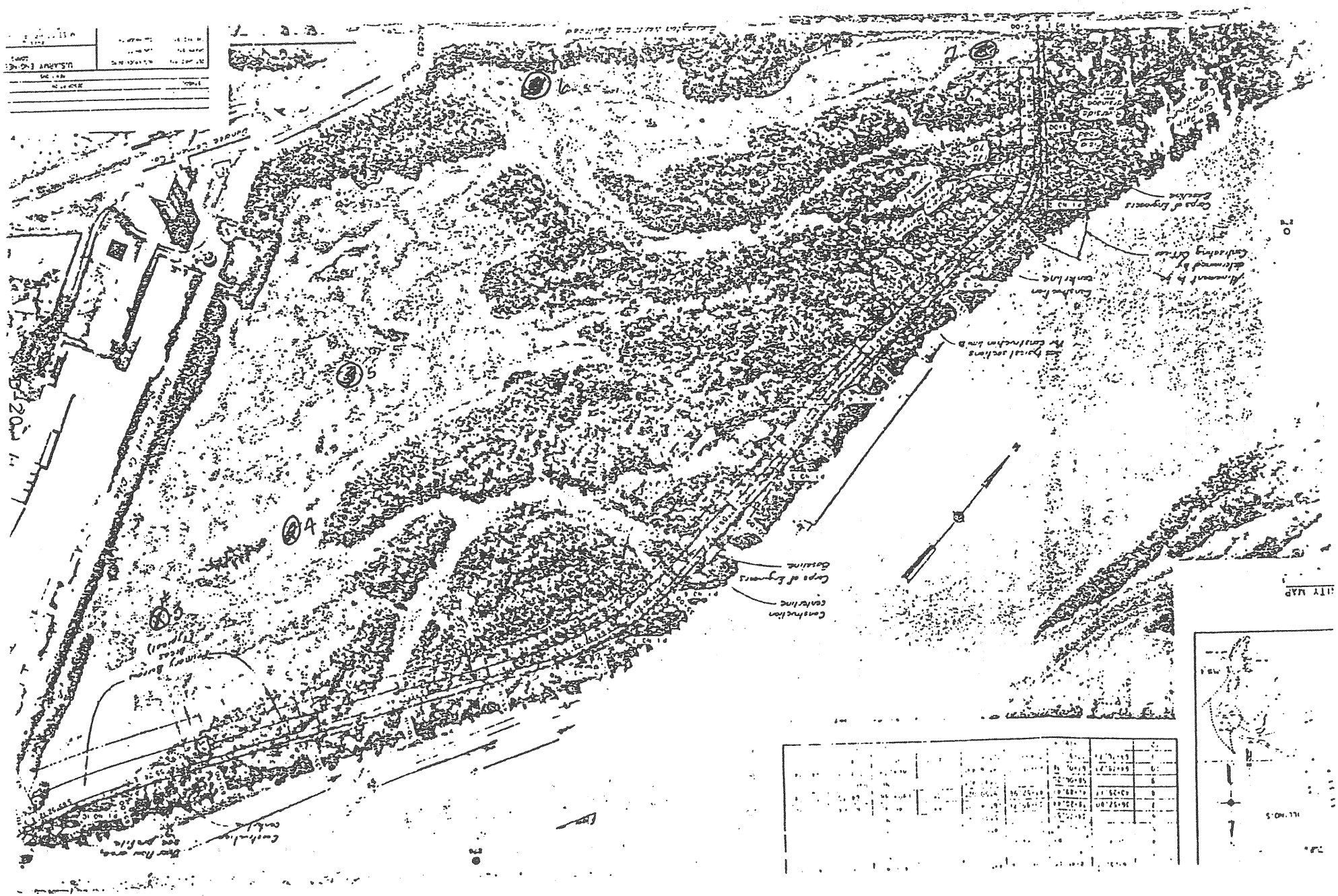
BLANK SPACES IN THE TABLE MEAN THAT THE CHARACTERISTIC DOES NOT APPLY TO THE SPECIES
AVE. CAT. SCORE = AVERAGE CATEGORY SCORE FROM THE FIELD SHEETS
CHARACTERISTIC AVERAGES = THE AVERAGE POINT VALUE FROM THE SPECIES MATRIX

LIMITING FACTOR CHARACTERISTICS APPICABLE TO THESE SPECIES AND THIS HABITAT TYPE

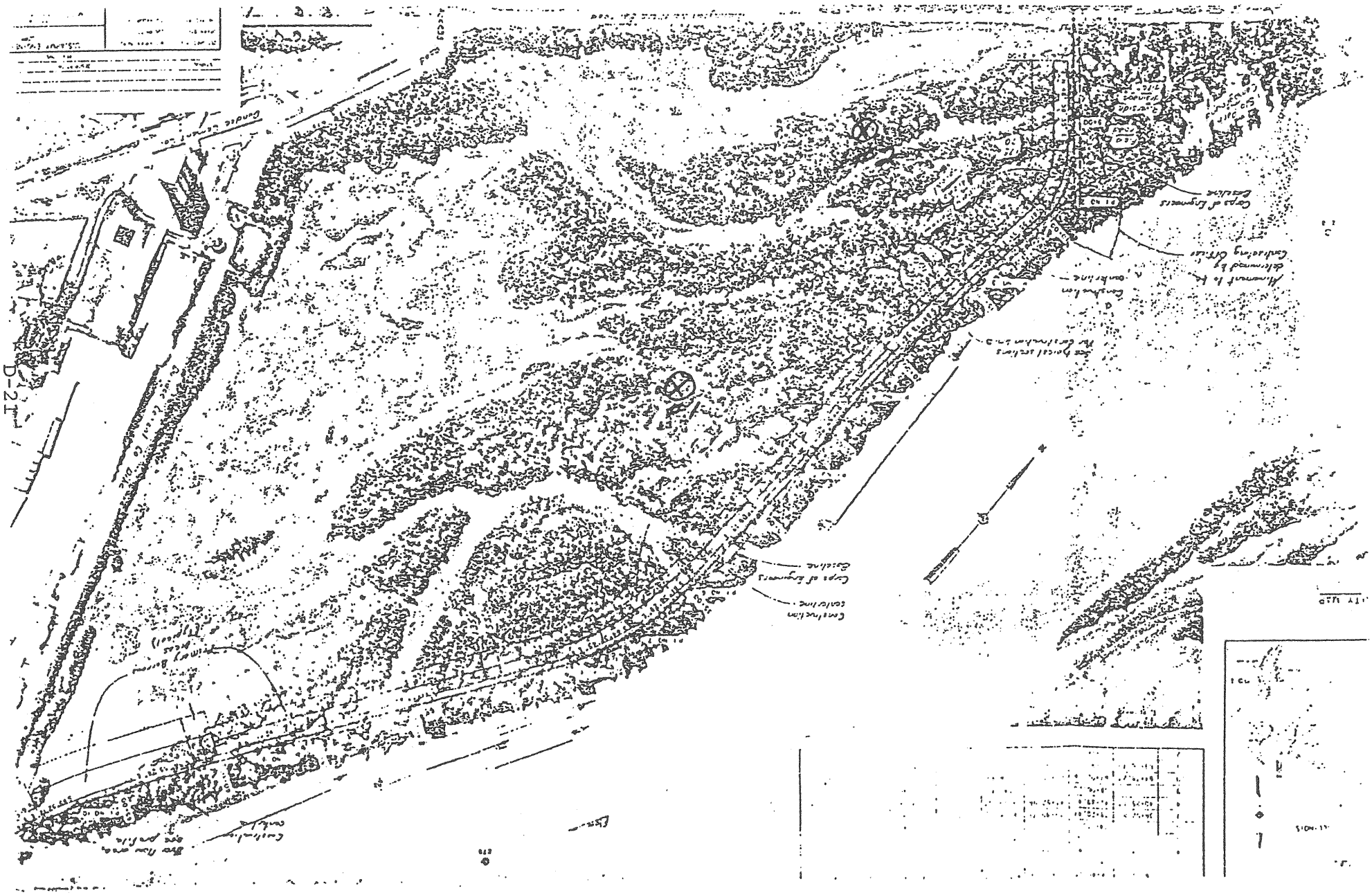
SPECIES	SPECIES NUMBER	CHARACTERISTIC NUMBER	FACTOR TYPE
MALLARD	1	3	LIMITING FACTOR
MALLARD	1	4	LIMITING FACTOR
GREEN-BACKED HERRON	7	14	LIMITING FACTOR
WOOD DUCK	8	38	LIMITING FACTOR
NORTHERN PARULA	11	38	LIMITING FACTOR
PROTHONOTARY WARBLER	12	38	LIMITING FACTOR
PROTHONOTARY WARBLER	12	43	MULTIPLIER
WOOD DUCK	8	45	LIMITING FACTOR
GREEN-BACKED HERON	7	47	MULTIPLIER
WOOD DUCK	8	47	MULTIPLIER
BEAVER	9	47	MULTIPLIER

THESE CHARACTERISTICS ARE THE MOST IMPORTANT IN DETERMINING THE HABITAT INDEX AND SHOULD SCORE AT OR NEAR THE MAXIMUM VALUE FOR THE APPLICABLE SPECIES TO ACHIEVE A HIGH INDEX

⑧ Nonforest Wetland Whag Sites



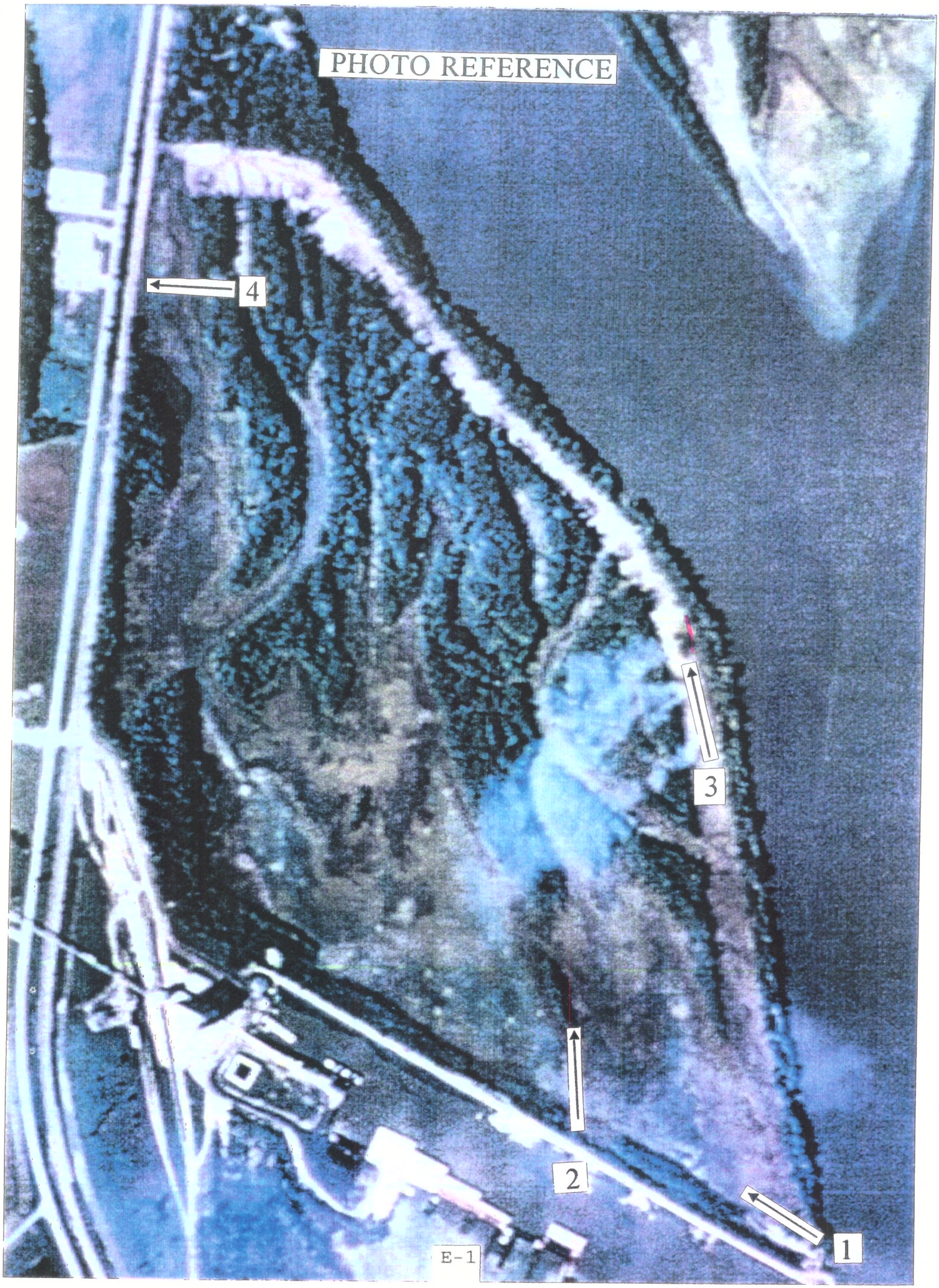
⊗ – Forested Wetland WHAG Sites



D-21

Appendix E

PHOTOGRAPHS OF CLARKSVILLE REFUGE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E-1

Photograph 1: View of shallow water habitat near the gravity-drain structure.

Photograph 2: An example of emergent wetlands located along the southern edge of the Refuge.

Photograph 3: View of water-filled borrow site and associated emergent plants adjacent to levee.

Photograph 4: Photograph of waterfowl usage of emergent wetlands in northern portions of the Refuge.

Appendix F

WATER QUALITY

Clarksville Refuge Habitat Rehabilitation and Enhancement Project Water Quality Results

The project was completed before any water quality monitoring began. Post project water quality monitoring was carried out through the fall of 1994 by the COE. The data was published in a 1995 Water Quality Evaluation Report of EMP-HREP's and is included in Appendix F. The report concluded that the water quality was excellent for plant growth.

ENVIRONMENTAL MANAGEMENT PROGRAM

Clarksville Island

SITE 1 (CV-1)

PERIOD	FALL, 1990	SPRING, 1991	SUMMER, 1991	FALL, 1991	SPRING, 1992	SUMMER, 1992	FALL, 1992
DATE	9-Oct-90	2-Apr-91	27-Aug-91	14-Nov-91	H	16-Jul-92	20-Sep-92
TIME	1545	1445		1005	I	1220	1030
AIR TEMP. (C)		19	31	12	G	30	16
CLOUD COVER	RAIN	50% CLDY	PT. CLDY	OVRCST	H	PT CLDY	RAIN
WIND (MPH)			4-5 SSW	5-7 SSW		5 S	12 N
DEPTH (m)					F	N.A.	9
WAVE HT. (cm)		23	5	8-May	L	15	25
SECCHI (cm)		13	45	22	O	20	8
H2O TEMP. (C)	16.8	9.9	27.3	1.7	W	25.6	20.7
PH (units)	7.4	7.4	7.9	7.8		7.8	7.5
D.O. (mg/l)	8.2	10.8	8.8	15.1		6	6.7
COND. (umhos/cm)	407	437	464	430		417	377
ORP (mV)	254	171	197	203		238	251
CHLOROPHYL-A (mg/l)		9	38.09	10.65		0.83	<4.0
TOT. ALKALINITY (mg/l)		148	166	151		140	137

ENVIRONMENTAL MANAGEMENT PROGRAM

Clarksville Island

SITE 1 (CV-1)

PERIOD	SPRING, 1993	SUMMER, 1993	FALL, 1993	WINTER, 1994	SPRING, 1994	SUMMER, 1994	FALL, 1994
DATE	H	18-Jun-93		6-Jan-94	26-May-94	13-Jul-94	12-Oct-94
TIME	I	1630	G	1102	1040	1324	1000
AIR TEMP. (C)	G	30	R	10	19	32	17
CLOUD COVER	H	CLEAR	E	OVRCST	CLDY	PT. CLDY	SUNNY
WIND (MPH)		5-10 S	A	4 NE	10-12 N	6-9 S	0
DEPTH (m)	F	9.5	T				1.2
WAVE HT. (cm)	L	13		0	35	10	0
SECCHI (cm)	O	26	F	50	40	30	83
H2O TEMP. (C)	W	24	L	0.2	22.6	27.3	14.3
PH (units)		7.7	O	8.2	8.2	7.9	7.4
D.O. (mg/l)		7.4	O	16.2	8.3	7.2	4.3
COND. (umhos/cm)		450	D	482	406	504	391
ORP (mV)		234		263	137	111	283
CHLOROPHYL-A (mg/l)		3		11	<2.3	8.1	3.7
TOT. ALKALINITY (mg/l)		165		151	139	186	156

ENVIRONMENTAL MANAGEMENT PROGRAM

Clarksville Island

SITE 2 (CV-2)

PERIOD	FALL, 1990	SPRING, 1991	SUMMER, 1991	FALL, 1991	SPRING, 1992	SUMMER, 1992	FALL, 1992
DATE	9-Oct-90	2-Apr-91	27-Aug-91	14-Nov-91	H	16-Jul-92	20-Sep-92
TIME	1540	1450	1345	1010	I	1300	1045
AIR TEMP. (C)		19	31	12	G	30	16
CLOUD COVER	RAIN	50% CLDY	CLDY	OVRCST	H	PT CLDY	RAIN
WIND (MPH)			0	0		3 SE	0
DEPTH (m)		0.52	1.5	0.38	F	0.45	0.28
WAVE HT. (cm)		0	0	0	L	0	0
SECCHI (cm)		46	30	38	O	25	10
H2O TEMP. (C)	13.5	15.1	27.9	6.8	W	24.1	19.8
PH (units)	7	7.4	7.7	7.3		7	7.6
D.O. (mg/l)	2.7	9.1	7.1	11.8		1.4	6.7
COND. (umhos/cm)	410	416	481	611		543	378
ORP (mV)	266	181	151	205		65	256
CHLOROPHYL-A (mg/l)		3.8	18.07	136.4		11.6	13.1
TOT. ALKALINITY (mg/l)		150	166	271		262	134

ENVIRONMENTAL MANAGEMENT PROGRAM

Clarksville Island

SITE 2 (CV-2)

PERIOD	SPRING, 1993	SUMMER, 1993	FALL, 1993	WINTER, 1994	SPRING, 1994	SUMMER, 1994	FALL, 1994
DATE	H	18-Jun-93		6-Jan-94	26-May-94	13-Jul-94	12-Oct-94
TIME	I	1620	G	1113	1025	1317	930
AIR TEMP. (C)	G	30	R	20		32	12
CLOUD COVER	H	CLEAR	E	OVRCST	S	PT. CLDY	SUNNY
WIND (MPH)		'5-10 S	A	.7 NE	I	2-6 S	4.5 S
DEPTH (m)	F	0.4	T	0.5	T		
WAVE HT. (cm)	L	0		0	E	0	0
SECCHI (cm)	O	40	F	30		33	33
H2O TEMP. (C)	W	29.5	L	1.3	D	27	15.7
PH (units)		7.5	O	7.9	R	7.5	7.9
D.O. (mg/l)		1.5	O	14.1	Y	3.3	8.2
COND. (umhos/cm)		419	D	507		518	392
ORP (mV)		229		261		116	274
CHLOROPHYL-A (mg/l)		4.6		<2.3		<.83	<2.3
TOT. ALKALINITY (mg/l)		168		159			156

ENVIRONMENTAL MANAGEMENT PROGRAM

Clarksville Island

SITE 3 (CV-3)

PERIOD	FALL, 1990	SPRING, 1991	SUMMER, 1991	FALL, 1991	SPRING, 1992
DATE	9-Oct-90	2-Apr-91	27-Aug-91	14-Nov-91	
TIME	1700	1600			
AIR TEMP. (C)		19	31	13	
CLOUD COVER	RAIN	25% CLDY	CLDY	RAIN	
WIND (MPH)			1-2 SSW	0	
DEPTH (m)		0.18	0.25	0.32	
WAVE HT. (cm)		0	0	0	
SECCHI (cm)		18	25	32	
H2O TEMP. (C)	11.4	18.6	24.7	5.1	
PH (units)	7.1	8.2	7	7.1	
D.O. (mg/l)	6	15	1.5	3	
COND. (umhos/cm)	505	568	672	622	
ORP (mV)	254	140	36	71	
CHLOROPHYL-A (mg/l)		<.1	18.39	1.95	
TOT. ALKALINITY (mg/l)		192	312	232	

HIGH FLOW

ENVIRONMENTAL MANAGEMENT PROGRAM

Clarksville Island

SITE 4 (CV-4)

PERIOD	FALL, 1990	SPRING, 1991	SUMMER, 1991	FALL, 1991	SPRING, 1992
DATE	9-Oct-90	2-Apr-91	27-Aug-91	14-Nov-91	H
TIME	1715				I
AIR TEMP. (C)		D	D	D	G
CLOUD COVER	RAIN	R	R	R	H
WIND (MPH)		Y	Y	Y	
DEPTH (m)					F
WAVE HT. (cm)		M			L
SECCHI (cm)		U			O
H2O TEMP. (C)	10.2	D			W
PH (units)	6.9				
D.O. (mg/l)	4.4	F			
COND. (umhos/cm)	876	L			
ORP (mV)	169	A			
CHLOROPHYL-A (mg/l)		T			
TOT. ALKALINITY (mg/l)					

ENVIRONMENTAL MANAGEMENT PROGRAM

Clarksville Island

SITE 5 (CV-5)

PERIOD	FALL, 1990	SPRING, 1991	SUMMER, 1991	FALL, 1991	SPRING, 1992
DATE	9-Oct-90	2-Apr-91	27-Aug-91	14-Nov-91	H
TIME	1530	1430	1400	1000	I
AIR TEMP. (C)		19	31	12	G
CLOUD COVER	RAIN	50% CLDY	PT. CLDY	OVRCST	H
WIND (MPH)			4-5 SSW	5-7 SSW	
DEPTH (m)					F
WAVE HT. (cm)		7	5	8-May	L
SECCHI (cm)		12	45	22	O
H2O TEMP. (C)	16	10	27.3	2	W
PH (units)	7.4	7.4	7.9	7.7	
D.O. (mg/l)	8.4	11.4	8.8	14.4	
COND. (umhos/cm)	420	431	473	431	
ORP (mV)	252	161	168	208	
CHLOROPHYL-A (mg/l)		104	45.42	12.68	
TOT. ALKALINITY (mg/l)		144	167	157	

ENVIRONMENTAL MANAGEMENT PROGRAM

Clarksville Island

SITE 6 (CV-6)

PERIOD	FALL, 1990	SPRING, 1991	SUMMER, 1991	FALL, 1991	SPRING, 1992	SUMMER, 1992	FALL, 1992
DATE	9-Oct-90	2-Apr-91	27-Aug-91	14-Nov-91	H	16-Jul-92	20-Sep-92
TIME	1600	1530	1400	1020	I	1230	1100
AIR TEMP. (C)		19	31	12	G	30	16
CLOUD COVER	RAIN	50% CLDY	PT. CLDY	OVRCST	H	PT CLDY	RAIN
WIND (MPH)			5 SSW	5-7 SSW		3 S	11 N
DEPTH (m)					F	N.A.	11.5
WAVE HT. (cm)		23	8-May	8-May	L	6	25
SECCHI (cm)		12	45	22	O	12	8
H2O TEMP. (C)	16.9	10	27	1.7	W	25.5	20.7
PH (units)	7.4	7.4	7.9	7.8		7.7	7.5
D.O. (mg/l)	8.1	10.6	8.2	15.1		6.1	6.7
COND. (umhos/cm)	407	434	465	430		433	377
ORP (mV)	251	181	210	203		230	251
CHLOROPHYL-A (mg/l)		7.3	31.37	11.9		5	15.7
TOT. ALKALINITY (mg/l)		156	160	150		146	144

ENVIRONMENTAL MANAGEMENT PROGRAM

Clarksville Island

SITE 6 (CV-6)

PERIOD	SPRING, 1993	SUMMER, 1993	FALL, 1993
DATE	H	18-Jun	
TIME	I	1645	G
AIR TEMP. (C)	G	30	R
CLOUD COVER	H	CLEAR	E
WIND (MPH)		15-Oct	A
DEPTH (m)	F	S	T
WAVE HT. (cm)	L	10.8	
SECCHI (cm)	O	10	F
H2O TEMP. (C)	W	25	L
PH (units)		23.8	O
D.O. (mg/l)		7.8	O
COND. (umhos/cm)		7.4	D
ORP (mV)		458	
CHLOROPHYL-A (mg/l)		225	
TOT. ALKALINITY (mg/l)		5.7	

Appendix G

QUALITY CONTROL/ASSURANCE

APPENDIX G

QUALITY CONTROL/ASSURANCE

PROCEDURE--

The Post Construction Evaluation Report is not a document subject to quality control/assurance guidance. However, in the spirit of achieving a quality product, we have utilized an abbreviated version of the Planning Division Quality Control Checklist (Table G-1) and Checklist Certification Sheet (Table G-2).

TABLE G-1 .

QUALITY CONTROL/ASSURANCE CHECKLIST

GENERAL	
Authority	
a. Conformity with study authority	YES
Scope of Investigation	
a. Problems adequately addressed	YES
Objective of Investigation	
a. Planning objectives clearly stated	YES
Risk and Uncertainty-Sensitivity Analysis	N/A
Chart of Accounts	N/A
Project Cost Sharing	N/A
Coordination	
a. State/local/Federal coordination adequate, views considered	YES
b. Conformed with law, orders, and agency agreements	YES
c. Preservation/conservation/historical/ scientific interests consulted, views considered	YES
Public Involvement	N/A
Policy Aspects	
a. Conformity with applicable policies	YES
b. Consideration of Administration policies/ decisions	YES
Legal/Institutional	N/A
PLAN FORMULATION	
Scoping	N/A
Existing Conditions/Plan Development	N/A
Alternative Screening	N/A

Plan Selection	N/A
PLAN FORMULATION (CONTINUED)	
Report Review	
a. Consistency with recent guidance	YES
b. Major tech review issues/resolutions documented	YES
c. Tech review certification signature page included	YES
ECONOMIC AND SOCIAL ANALYSIS	
General	N/A
ENVIRONMENTAL ANALYSIS	
General	
a. Adequate coordination conducted between Envir., Engineering, and Real Estate	YES
NEPA and Related Documents	
a. Future benefits assessed by habitat evaluation methodology	YES
b. Coordination conducted with USFWS	YES
c. Appropriate envir. appendices included	YES
d. Monitoring plan prepared	YES
e. Draft document submitted for SLD review, and revisions made	YES
HTRW	N/A
Mitigation	N/A
Cultural Resources	N/A
Recreation/Aesthetic	N/A
ENGINEERING DIVISION	
General	
a. Adequate field investigations were conducted	YES
b. Is project operable	YES
c. Are annual OM&R costs reasonable	YES
d. Adequate coordination conducted between Envir., Engineering, and Real Estate	YES

TABLE G-2.

CHECKLIST CERTIFICATION SHEET

I certify that the Post Construction Evaluation Report for the Clarksville Habitat Rehabilitation Project has been reviewed and that sound technical practices and procedures have been followed. The document conforms to pertinent regulations, guidance, and sound professional practices.

ANALYST	REVIEWER	FUNCTIONAL AREA
Lynn Neher	for Tim George	Envir. Analysis
Bob Mesko	Charles Turlin	Survey/Mapping
Dennis Stephens	Gary Dyhouse	H&H
for Roger Myhre	Ted Postol	Water Quality
Dave Gates	Ben Hawickhorst	Plan Formulation

NOTES:

1. Other individuals not directly apart of the technical team, but also invited to give their comments were: Claude Strauser (ED-HP), T. Miller (PD-A), Mike Rector (ED-DC), Gary Lee (ED-DC), Mike Hamm (ED-DC), Pat McGinnis (CO-NM), and Jim Lynch (CO-TO).

2. The specific inputs provided by the District analysts were as follows:

Lynn Neher	Data Compilation/Integration Graphic Displays Report writing
Dave Gates	Study Goals/Objectives Technical Guidance Report Format and Editing
Bob Mesko	Bottom Profiles Survey
Dave Busse	River Stage Data
Roger Myhre	Water Quality Analysis

3. MDOC provided data to the evaluation were:

Habitat Analysis Data (WHAG)
Waterfowl Ground Survey Data
Site Gage Readings
Vegetation Surveys

COMMENTS/RESPONSES--

The Draft Performance Evaluation Report for Clarksville Refuge was circulated for review to various agency staff familiar with the Environmental Management Program. The agencies and individuals participating in the review are listed below.

Agency	Individual
USFWS--MTNWR	K.L. Drews Ross Adams Dick Steinbach Jerry Olmsted Kieth Beseke
USFWS--Regional	William Hartwig John Blankenship Sue Haseltine
USFWS--ES Office	Joyce Collins Rick Nelson Jon Duyvejonck
USFWS--Fisheries Assist.	Chuck Surprenant
USFWS--EMTC	John Barkow Bob Delaney Ken Labinski
UMRBA--	Holly Stoerker
IDNR--	Brent Manning Marvin Hubbell Neil Booth Butch Atwood Rick Messinger Deck Major Dave Harper
NRCS--Calhoun County	Martha Shepard
SIU--Carbondale	Bob Sheehan Bob Gates
U. Mo. --Puxico	Murray Laubahn
INHS--	Steve Havera Rick Cronin
MDOC--	Norm Stuckey Dave Neuswanger Ken Dalrymple

	Ken Brummett Tim Brooks
Corps--St. Paul	Dan Wilcox
Corps--Rock Island	Jerry Skalak
Corps--NCD	Don Williams Joan Albert Tom Hempfling
Corps--LMVD	Tom Pullen William Arnold

Based on the above review, comments were received from LMVD and the Missouri Department of Conservation (Kenneth Dalrymple). The comments and the District's responses are as follows:

LMVD Comment #1. The subject report clearly documents the benefits of the HREP project to waterfowl and to preservation of open water habitats by reducing sedimentation.

SLD Response to LMVD Comment #1. Comment noted.

LMVD Comment #2. Page 19, paragraph 2. This paragraph indicates that extensive numbers of waterfowl use the refuge for four to six weeks during the fall migration. Table 6 on page 16-17 provides a summary of this data. The estimated total use numbers presented in the last column of the table are based on a 90-day period. The District should reconsider presentation of the data in this manner. Also, the evaluation fails to recognize the benefits of the refuge to migrating waterfowl and shorebirds during the spring migration. The evaluation should include a discussion of these benefits, particularly in view of the recent emphasis on such benefits.

SLD Response to LMVD Comment #2. The data presented in Table 6 represents the entire data set collected by MDOC personnel during the monitoring of the Clarksville Refuge EMP Project. The District concurs with the recent acknowledgement of the importance of shallow areas such as Clarksville Refuge to spring migrant waterfowl. The monitoring schedule for Clarksville was developed before such knowledge was available, therefore spring monitoring was not done. Future EMP-HREP projects that are designed to benefit waterfowl will include spring counts.

LMVD Comment #3. Although the subject report is not a decision document and would not be subject to LMVD guidance on Quality Control and Quality Assurance as such, it would add to the strength of the document if, when finalized, an appendix were

added that summarizes all comments received on the draft and provides a response to them. Accordingly, it would also add to the document if a technical review checklist were included along with a signature page to be signed by the individuals reviewing the document.

SLD Response to LMVD Comment #3. The District concurs, the suggested appendix, checklist and signature page has been included.

MDOC (Dalrymple) Comment #1. I have reviewed the draft document and believe the summary of monitoring data, project inspections, and project observations for the period from 1990 to 1994 are correct.

SLD Response to MDOC (Dalrymple) Comment #1. Comment noted.

MDOC (Dalrymple) Comment #2. Since construction, the Clarksville sediment protection levee has been overtopped in 1993, 1996 and was nearly overtopped in 1991. Future sediment deflection levees should be constructed with a greater protection level than at a 20 year flood event.

SLD Response to MDOC (Dalrymple) Comment #2. Comment noted. While the District concurs with the need for greater protection, problems arise when levee heights are raised to a high level of protection. The potential for the flooding nearby property must be considered (including Floodplain Management Regulations). Cost is another consideration. The costs of levee construction increase geometrically with each additional foot of levee height.

MDOC (Dalrymple) Comment #3. The levee should be constructed with an armored emergency spillway to reduce the damage of overtopping and outflow during an overtopping event. This spillway would also be beneficial, should such an event occur, because backfilling the area under protection could be accomplished from the top of the column instead the lower part of the water column. This will reduce the possibility of bedload influx through the sluice gates.

SLD Response to MDOC (Dalrymple) Comment #3. The District concurs. More recently designed UMRS-EMP projects include a rocked spillway.

MDOC (Dalrymple) Comment #4. Future projects should include a watering and dewatering system using the same pumping equipment. Submergible electric pumps would be the best choice at all projects to reduce operation and maintenance costs in managing the water levels independent of river stage. Portable pumps with diesel power are expensive to operate and maintain, have short operational life, need maintenance twice daily, must be removed if any possibility of flooding exists, and cannot be

reset until the area has undergone a drying out period.

SLD Response to MDOC (Dalrymple) Comment #4. In the past we have tended to place portable pumps at site locations with relatively smaller pumping requirements (i.e. sites < 400 acres), and fixed pumps for greater requirements. However, due to program constraints on construction dollars, there is a tendency now to shift to portable pumps even at larger sites. Whether or not a fixed pumps should be a submergible electric pump would have to be evaluated on a site by site basis.

END OF DOCUMENT