APPENDIX D

HEP ANALYSIS

HABITAT EVALUATION PROCEDURES (HEP) ANALYSIS
PLEASANT CREEK WILDLIFE AREA
POOL 13, MISSISSIPPI RIVER MILES 548.7 THROUGH 552.8
JACKSON COUNTY, IOWA

INTRODUCTION

Purpose of the Project

The purpose of this investigation was to utilize Habitat Evaluation Procedures (HEP) to evaluate the potential benefits of alternative habitat improvement features at the Pleasant Creek Wildlife Area in Jackson County, Iowa. Active participants included biologists and engineers from the Rock Island District, U.S. Army Corps of Engineers (USCOE), the U.S. Fish and Wildlife Service (USFWS), the Iowa Department of Natural Resources (DNR) and Earth Tech.

Project Location and Goals

The project area consists of 69 acres located in the Pleasant Creek Wildlife Area within the Upper Mississippi River National Wildlife and Fish Refuge, at Mississippi River Miles 548.7-552.8 in Jackson County, Iowa (Figure 1).

Primary project goals include enhancement of wetland and aquatic habitat through the construction of a moist soil management unit (MSMU). The goal of the HEP analysis is to evaluate the MSMU and mast tree planting features.

Background

The need for quantification of Habitat Rehabilitation and Enhancement Project (HREP) outputs as a project performance evaluation tool, a project ranking tool and a project planning tool has been discussed by various agencies associated with the Upper Mississippi River System Environmental Management Program (UMRS-EMP). This application involves quantification solely for the purpose of project planning.

HEP is a method which can be used to document the quality and quantity of available habitat for selected fish and wildlife species. Methods for performing HEP analysis are described in USFWS 102 ESM (USFWS, 1980). Two types of wildlife comparisons can be made utilizing HEP:

- The relative value of different areas at the same point in time.
- The relative value of the same area at different points in time.

HEP is based on the assumption that habitat for selected fish and wildlife species can be described by a Habitat Suitability Index (HSI). The HSI is a numerical index that represents the capacity of a given habitat to support a selected fish or wildlife species. The index value is dimensionless and ranges from 0.0 to 1.0, with 1.0 representing optimum habitat and 0.0 representing totally unsuitable habitat. The HSI is calculated by dividing an estimate or measure of habitat conditions in the study area by the optimum habitat conditions for the same evaluation species (USFWS, 1981). HSI models, which are constructed using basic life history information for an evaluation species, are used to derive HSI values during the HEP analysis.

HSI values are multiplied by the area of available habitat to obtain Habitat Units (HUs), which are a measure of habitat quality and the value used to make comparisons. Annualization of HUs can then be used to determine changes brought about by project features/alternatives over time. This annualization computes Average Annual Habitat Units (AAHUs).

Once construction begins and a project matures, habitat changes occur and habitat benefits may change. Many features, such as tree planting, may not begin to show benefits until well into the life of the project. The particular dynamics of the ecosystem under study determine the target years chosen for analysis. With or without a project, habitat conditions change over time; therefore, the overall value of a proposed project depends upon the comparison of with-project benefits to without-project benefits.

METHODOLOGY

The primary objective of the project is to improve migratory waterfowl habitat through the creation of additional emergent wetland and enhancement of existing forested wetland. Management of the MSMU would be directed toward migratory waterfowl, with emphasis on dabbling ducks. However, benefits may accrue to other migratory birds as well as other game and nongame species. The evaluation team's objective was to evaluate the impact of the project on a variety of wetland species.

Two HEP procedures were used to meet this objective:

- Wildlife Habitat Appraisal Guide (WHAG) Wetland Model (Missouri Department of Conservation et al., 1991)

- Great Blue Heron Habitat Suitability Index (HSI) Model (Short and Cooper, 1985)

The WHAG was developed by the Missouri Department of Conservation as a field evaluation procedure designed to estimate habitat quality and account for changes due to land management practices. Checklist-type field appraisal guides are used for both upland and wetland habitats, and computer programs are used to analyze field data in terms of habitat suitability for various evaluation species.

The great blue heron was chosen as an evaluation species because an active great blue heron rookery is located adjacent to the proposed MSMU. The great blue heron HSI model (Short and Cooper, 1985) was designed to evaluate treeland habitats near water as potential heronry sites and aquatic habitats near potential heronry sites as foraging habitats.

HSIs and estimated total HUs were calculated for each of the evaluation species listed below. The project is expected to have a life of 50 years; therefore, target years of 0, 1, 10, 25 and 50 were chosen for evaluation. Habitat Units were annualized for target years, as described in USFWS 102 ESM (USFWS, 1980), in order to evaluate habitat changes at the study area over the life of the project.

Target Species

The WHAG wetland model contains a set number of wetland species that are used as evaluation species to represent land management issues and habitat components. For the present study, target species were chosen from the list to evaluate the impact of the project on specific types of wetland habitat. The species chosen as target species and the specific habitat type each evaluates are shown below:

Target Species	Habitat Type
• Mallard	Dabbling Duck Habitat
• Canada Goose	Dabbling Duck Habitat
• Green-Backed Heron	Nonforested Wetland
• Wood Duck	Riparian Habitat, Dabbling Duck Habitat
• American Coot	Permanent Summer Wetland
• Prothonotary Warbler	Riparian Habitat
• Great Blue Heron	Great Blue Heron Habitat

Each species represents a guild of similar species that utilize the habitat in similar ways. Therefore, each target species serves as an indication of how other species with similar life history traits may respond to the proposed project.

Alternatives Considered

Five alternatives, including two proposed dike alignments, were compared. These alternatives are described below.

No Action

The No Action Alternative would be the continuation of existing habitat conditions. No physical changes, habitat improvements or management changes would be made at the site.

Alignment 1 With Water Control

This alternative would involve the construction of a low dike, with a top elevation of 594 feet, around 42 acres of the existing cropland (Figure 2). Water levels inside of the MSMU would be controlled through the use of a well to pump water into the MSMU and a water control structure that would allow water to be released from the MSMU. Natural flooding, resulting from overtopping of the existing Mississippi River dike, is expected to inundate the unit less than 5 percent of the time during the growing season. In addition, this alternative would include planting 7 acres of existing cropland to mast producing trees (Figure2).

Alignment 1 Without Water Control

This alternative would involve construction of a dike in the same location as the previous alternative, but water levels in the MSMU would not be controlled. The MSMU would be inundated only when the existing Mississippi River dike is overtopped (approximately 5 percent of the time during the growing season) and would remain inundated until water levels drop naturally. In addition, this alternative would include planting 7 acres of existing cropland to mast producing trees (Figure 2).

Alignment 2 With Water Control

This alternative would involve construction of a low dike, with a top elevation of 594 feet, around 42 acres of existing cropland and 20 acres of existing bottomland hardwood forest (Figure 2). Water levels inside of the MSMU would be controlled through the use of a well to pump water into the MSMU and a water control structure that would allow water to be released from the MSMU. Natural flooding, resulting from overtopping of the existing Mississippi River dike, is expected to inundate the unit less than 5 percent of the time during the growing season. In addition, this alternative would include planting 7 acres of existing cropland to mast producing trees (Figure 2).

Alignment 2 Without Water Control

This alternative would involve construction of a dike in the same location as the previous alternative, but water levels in the MSMU would not be controlled. The MSMU would be inundated only when the existing Mississippi River dike is overtopped (approximately 5 percent of the time during the growing season) and would remain inundated until water levels drop naturally. In addition, this alternative would include planting 7 acres of existing cropland to mast producing trees (Figure 2).

Assumptions

Several assumptions have been made regarding the study area, model performance, changes in habitat conditions over time and future management practices.

Study Area

Because HUs are calculated by multiplying the HSI by the area of the study site, any alternative that has a larger area will usually have a larger number of HUs for a given species just by virtue of its larger size. In order to present an equal comparison of alignment alternatives, the study area in this study was considered to be the 62 acres located inside of the proposed Alignment 2 dike, plus the 7 acres of cropland that will be planted to mast producing trees. This does include 20 acres of bottomland forest that would not be directly affected by any of the Alignment 1 alternatives, but it is assumed that this 20 acres would be indirectly affected by construction of the Alignment 1 dike.

Model Performance

The Great Blue Heron HSI Model has been designed to be a general model applicable throughout the United States. In order to more accurately reflect the conditions present at the Pleasant Creek Wildlife Area, the potential foraging habitat variable in the model was adjusted.

In the model, the HSI score for potential foraging habitat is assigned based on the presence or absence of suitable potential foraging areas (HSI = 1.0 if suitable potential foraging areas are present and HSI = 0.0 if they are not) (Short and Cooper, 1985). In the current study, under any of the four build alternatives, suitable great blue heron foraging habitat would be present for part of the year only; therefore, an HSI score of 0.5 for the potential foraging habitat variable was used to calculate the total HSI score for each of the build alternatives.

Changes in Habitat Conditions Over Time

Either through natural or human-induced processes, changes in habitat quality and/or quantity occur over time. As a result, change has been factored into the models used in the evaluation. To assess the change over the period of analysis, target years have been identified. Noticeable changes through time can be characterized by a change in habitat benefit output.

Target years of 0, 1, 10, 25 and 50 are sufficient to annualize HUs and characterize habitat changes over the estimated life of the project.

An active great blue heron rookery is located immediately outside of the study area. Short and Cooper (1985) report that great blue herons tend to use the same rookery for many years if it continues to provide suitable nesting habitat, and that they may temporarily vacate a rookery, establish a new rookery or even eventually reoccupy an old rookery. It is therefore assumed that an active great blue heron rookery will be present within 1.25 miles of the study area throughout the life of the project.

Future Management Use

It is assumed that the USFWS will retain ownership of the area for the entire project life. Without the project, management of the area will remain as it is at present. The existing bottomland forest will continue to mature slowly over time.

The existing Mississippi River dike has a top dike elevation of 594 feet, it is assumed, based on Pool 13 historical hydrographs, that the dike would be overtopped less than 5 percent of the time during the growing season, with a year-round frequency of overtopping of 1.5 percent.

Regardless of the dike alignment, management of the MSMU under the water control alternatives will be the same. It is assumed that the MSMU would be managed in the following manner:

1 September	Begin filling gradually.
1 October	50 percent of the area filled with water.
1 November	100 percent of the area filled with water.
Late Fall	Water control structure will be opened just before the fall freeze, and the area will be allowed to drain throughout the winter.
Spring	Natural flooding will occur, and the area will be drawn down in late spring to allow vegetation growth.

Ideal water levels during fall and winter will be 18 - 24 inches.

RESULTS

Habitat Suitability Index scores and HUs for evaluation species are shown in Tables 1 and 2.

Existing Conditions

Currently, the site consists of 49 acres of cropland and 20 acres of bottomland hardwood forest (Figure 2). No water control structures are present on the site, but the site is subject to annual natural flooding from the Mississippi River. The cropland is in row crop production, with approximately 40 percent of the crop left

unharvested each year. Dominant tree species in the wooded portion of the site include pin oak and silver maple.

The site currently provides adequate habitat for dabbling ducks and lower quality habitat for the remainder of the target species. HSI scores are the lowest for those species requiring permanent summer wetland.

No Action Alternative

Under the No Action Alternative, no habitat changes would take place; therefore, no additional habitat benefits would accrue above the existing conditions. Available future habitat without the project is shown in Table 3.

Alignment 1

Under Alignment 1, 42 acres of cropland would be converted to nonforested wetland and the remaining 7 acres of cropland would be planted to mast producing trees. Available future habitat for Alignment 1 is shown in Table 3.

With Water Control

With water control, HSI scores would remain essentially the same with or without the project for mallards and American coots and would decrease for green-backed herons (Table 1). Initial decreases, followed by an increase in HSI scores, would be seen for wood ducks and prothonotary warblers. Substantial increases in HSI scores would be seen for Canada geese and great blue herons.

Without Water Control

Without water control, HSI scores would substantially decrease for mallards and Canada geese (Table 1). In addition, a small decrease would be seen for green-backed herons. Initial decreases, followed by an increase in HSI scores, would be seen for wood ducks and prothonotary warblers. Substantial increases in HSI scores would be seen for American coots and great blue herons.

Alignment 2

Under Alignment 2, 42 acres of cropland would be converted to nonforested wetland and the remaining seven acres of cropland would be planted to mast producing trees. The 20 acres of existing bottomland hardwood forest would remain, but would possibly be subject to more frequent and longer duration flooding under the With Water Control Alternative. Available future habitat for Alignment 2 is shown in Table 3.

With Water Control

With water control, HSI scores would remain essentially the same with or without the project for American coots and would substantially decrease for green-backed herons (Table 1). Initial decreases, followed by an increase in HSI scores, would be seen for wood ducks and prothonotary warblers. Substantial increases in HSI scores would be seen for Canada geese and great blue herons and a smaller increase for mallards.

Without Water Control

Without water control, HSI scores would substantially decrease for mallards and Canada geese. In addition, a decrease would be seen for green-backed herons (Table 1). Initial decreases, followed by an increase in HSI scores, would be seen for wood ducks and prothonotary warblers. Substantial increases in HSI scores would be seen for American coots and great blue herons.

Net Impact

The four build alternatives were compared to the No-Build Alternative to determine the net impact on each of the target species (Tables 4-7). The overall AAHU calculation is positive for each of the four comparisons, indicating that the build alternatives would all produce net gains in available habitat for the target species.

The results of the comparison of the Alignment 1 With Water Control Alternative to the No Action Alternative are shown in Table 4. Positive impacts result for all of the target species, suggesting that more HUs would be available for each of the target species each year during the life of the project. However, in all but one instance the net increase in AAHUs is small, ranging from approximately 2.0 to 5.8. The one exception is the great blue heron, for which the net increase in AAHUs is 45.27.

The results of the comparison of the Alignment 1 Without Water Control Alternative to the No Action Alternative are shown in Table 5. Positive impacts result for all of the target species, except for mallards and Canada geese. The negative result for mallards and Canada geese indicates that an average of 24.26 and 19.53 fewer HUs would be available, respectively, each year for these species. Wood duck HUs show a relatively small increase. Large increases in AAHUs occur for green-backed herons, American coots and great blue herons.

The results of the comparison of the Alignment 2 With Water Control Alternative to the No Action Alternative are shown in Table 6. Relatively small positive impacts result for all of the target species, with the exception of green-backed herons which show a small decrease (-4.18 HUs) and great blue herons which show a large increase (45.27 HUs).

The results of the comparison of the Alignment 2 Without Water Control Alternative to the No Action Alternative are shown in Table 7. Positive impacts would result for all of the target species, except for mallards and Canada geese. The negative result for mallards and Canada geese indicates that an average of 30.41 and 19.53 fewer HUs would be available, respectively, each year for these species. Wood duck HUs show a relatively small increase. Large increases in AAHUs occur for green-backed herons, American coots and great blue herons.

DISCUSSION

The results of the HEP analysis suggest that dike alignment will have little impact on the target species. However, substantial differences are seen between the With Water Control and Without Water Control Alternatives. All four of the build alternatives show increases in overall AAHUs over the No Build Alternative.

The site currently provides adequate dabbling duck habitat, and either of the two With Water Control Alternatives would slightly increase the quality of dabbling duck habitat (Table 1). An average of 4.6 more

HUs would be available for dabbling ducks each year during the life of the project (Tables 4 and 6). The quality of nonforested wetland habitat would decrease with either of the two With Water Control Alternatives (Table 1). Currently, no permanent summer wetland habitat is found at the site, and essentially none would be created with either of the With Water Control Alternatives (Table 1).

Under either of the two Without Water Control Alternatives, dabbling duck habitat would substantially decrease (Tables 1 and 2), resulting in an average of 24.0 fewer HUs available for dabbling ducks each year during the life of the project (Tables 5 and 7). Permanent summer wetland habitat would substantially increase with either of the two Without Water Control Alternatives, with over 20 more HUs available each year during the life of the project for species such as American coots and least bitterns (Tables 5 and 7).

Habitat quality for great blue herons would increase equally with any of the four build alternatives (Table 1). This results from the conversion of the cropland to emergent wetland, thus providing additional foraging areas for the herons in proximity to active and potential rookery areas.

The primary objective of the project is to improve habitat for migratory waterfowl and dabbling ducks in particular. The HEP analysis indicates that either of the two With Water Control Alternatives would improve dabbling duck habitat slightly over the existing conditions, and would provide substantially more benefits to dabbling ducks than either of the two Without Water Control Alternatives.

LITERATURE CITED

Missouri Department of Conservation and U.S.D.A. Soil Conservation Service. 1991. Wildlife Habitat Appraisal Guide (WHAG). Columbia, MO.

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TABLE 1

HABITAT SUITABILITY INDICES FOR WETLAND EVALUATION SPECIES [1]

	Habitat Suitability Index [2]													
	Present	Future Without Project					Future Without Water Control				Future With Water Control			
Species	YR 0	Alignment	YR 1	YR 10	YR 25	YR 50	YR 1	YR 10	YR 25	YR 50	YR 1	YR 10	YR 25	YR 50
Mallard	0.57	1	0.57	0.57	0.57	0.57	0.19	0.19	0.19	0.19	0.58	0.58	0.58	0.58
		2	0.57	0.57	0.57	0.57	0.10	0.10	0.10	0.10	0.61	0.62	0.62	0.62
Canada Goose	0.62	1	0.52	0.52	0.52	0.52	0.10	0.10	0.10	0.10	0.71	0.71	0.71	0.71
		2	0.52	0.52	0.52	0.52	0.10	0.10	0.10	0.10	0.74	0.71	0.71	0.71
Least Bittern	0.00	1	0.00	0.00	0.00	0.00	0.74	0.74	0.74	0.74	0.10	0.10	0.10	0.10
		2	0.00	0.00	0.00	0.00	0.74	0.74	0.74	0.74	0.10	0.10	0.10	0.10
Muskrat	0.00	1	0.00	0.00	0.00	0.00	0.27	0.27	0.27	0.27	0.10	0.10	0.10	0.10
		2	0.00	0.00	0.00	0.00	0.27	0.27	0.27	0.27	0.10	0.10	0.10	0.10
King Rail	0.00	1	0.00	0.00	0.00	0.00	0.61	0.61	0.61	0.61	0.10	0.10	0.10	0.10
		2	0.00	0.00	0.00	0.00	0.61	0.61	0.61	0.61	0.10	0.10	0.10	0.10
Green-Backed Heron	0.56	1	0.56	0.56	0.56	0.56	0.52	0.52	0.52	0.52	0.19	0.19	0.19	0.19
		2	0.56	0.56	0.56	0.56	0.43	0.43	0.42	0.43	0.10	0.10	0.10	0.10
Wood Duck	0.61	1	0.61	0.61	0.61	0.61	0.35	0.35	0.61	0.67	0.35	0.35	0.61	0.67
		2	0.61	0.61	0.61	0.61	0.35	0.32	0.57	0.62	0.39	0.35	0.60	0.65
Beaver	0.52	1	0.52	0.52	0.52	0.52	0.67	0.69	0.71	0.68	0.67	0.69	0.71	0.68
		2	0.52	0.52	0.52	0.52	0.67	0.72	0.71	0.71	0.71	0.76	0.76	0.76
American Coot	0.00	1	0.00	0.00	0.00	0.00	0.49	0.49	0.49	0.49	0.10	0.10	0.10	0.10
		2	0.00	0.00	0.00	0.00	0.49	0.49	0.49	0.49	0.10	0.10	0.10	0.10
Northern Parula	0.40	1	0.40	0.40	0.40	0.40	0.25	0.50	0.53	0.55	0.25	0.50	0.53	0.55
		2	0.40	0.40	0.40	0.40	0.25	0.50	0.55	0.58	0.25	0.50	0.55	0.58
Prothonotary Warbler	0.26	1	0.26	0.26	0.26	0.26	0.18	0.36	0.42	0.50	0.18	0.36	0.42	0.50
		2	0.26	0.26	0.26	0.26	0.18	0.35	0.40	0.48	0.18	0.35	0.40	0.48
Great Blue Heron	0.00	1	0.00	0.00	0.00	0.00	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
		2	0.00	0.00	0.00	0.00	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70

[1] Shading denotes target species.
[2] Wildlife Habitat Appraisal Guide (WHAG) Wetland Model and Great Blue Heron Habitat Suitability Index Model (Short and Cooper, 1985).

TABLE 2

HABITAT UNITS FOR WETLAND EVALUATION SPECIES [1]

	Present		Future Without Project					Future Without Water Control					Future With Water Control				
Species	YR 0	Alignment	YR 1	YR 10	YR 25	YR 50	AAHUs	YR 1	YR 10	YR 25	YR 50	AAHUs	YR 1	YR 10	YR 25	YR 50	AAHUs
Mallard	37.90	1	37.90	37.90	37.90	37.90	37.62	13.40	13.40	13.40	13.40	13.36	20.30	30.30	40.30	40.30	40.00
		2	37.90	37.90	37.90	37.90	37.62	6.90	6.90	6.90	6.90	7.20	41.90	42.10	42.40	42.60	42.27
Canada Goose	24.10	1	24.10	24.10	24.10	24.10	23.92	4.20	4.20	4.20	4.20	4.14	29.90	29.90	29.90	29.90	29.76
		2	24.10	24.10	24.10	24.10	23.92	4.20	4.20	4.20	4.20	4.14	29.90	29.90	29.90	29.90	29.76
Least Bittern	0.00	1	0.00	0.00	0.00	0.00	0.00	31.20	31.20	31.20	31.20	30.67	4.20	4.20	4.20	4.20	4.14
		2	0.00	0.00	0.00	0.00	0.00	31.20	31.20	31.20	31.20	30.67	4.20	4.20	4.20	4.20	4.14
Muskrat	0.00	1	0.00	0.00	0.00	0.00	0.00	11.40	11.40	11.40	11.40	11.19	4.20	4.20	4.20	4.20	4.14
		2	0.00	0.00	0.00	0.00	0.00	11.40	11.40	11.40	11.40	11.19	4.20	4.20	4.20	4.20	4.14
King Rail	0.00	1	0.00	0.00	0.00	0.00	0.00	25.80	25.80	25.80	25.80	25.28	4.20	4.20	4.20	4.20	4.14
		2	0.00	0.00	0.00	0.00	0.00	25.80	25.80	25.80	25.80	25.28	4.20	4.20	4.20	4.20	4.14
Green-Backed Heron	11.20	1	11.20	11.20	11.20	11.20	11.20	35.60	35.60	35.60	35.60	35.64	13.10	13.10	13.10	13.10	13.05
		2	11.20	11.20	11.20	11.20	11.20	29.40	29.40	29.40	29.40	29.51	6.90	6.90	6.90	6.90	7.20
Wood Duck	12.10	1	12.10	12.10	12.10	12.10	12.20	9.50	9.50	16.50	18.00	14.45	10.50	9.50	16.50	18.00	14.45
		2	12.10	12.10	12.10	12.10	12.20	9.50	8.50	15.30	16.80	13.49	10.40	9.50	16.10	17.50	14.32
Beaver	10.40	1	10.40	10.40	10.40	10.40	10.40	18.00	18.70	19.10	18.40	18.64	18.00	18.70	19.10	18.40	18.64
		2	10.40	10.40	10.40	10.40	10.40	18.00	19.30	19.10	19.00	19.04	19.10	20.50	20.50	20.40	20.28
American Coot	0.00	1	0.00	0.00	0.00	0.00	0.00	20.50	20.50	20.50	20.50	20.31	4.20	4.20	4.20	4.20	4.14
		2	0.00	0.00	0.00	0.00	0.00	20.50	20.50	20.50	20.50	20.31	4.20	4.20	4.20	4.20	4.14
Northern Parula	8.00	1	8.00	8.00	8.00	8.00	8.00	6.80	13.50	14.20	14.90	13.44	6.80	13.50	14.20	14.90	13.44
		2	8.00	8.00	8.00	8.00	8.00	6.80	13.50	14.80	15.50	13.85	6.80	13.50	14.80	15.50	13.85
Prothonotary Warbler	5.30	1	5.30	5.30	5.30	5.30	5.20	4.90	9.80	11.40	13.40	10.78	4.90	9.80	11.40	13.40	10.78
		2	5.30	5.30	5.30	5.30	5.20	4.90	9.50	10.90	13.00	10.57	4.90	9.50	10.90	13.00	10.37
Great Blue Heron	0.00	1	0.00	0.00	0.00	0.00	0.00	42.60	42.60	42.60	48.99	45.27	42.60	42.60	42.60	48.99	45.27
		2	0.00	0.00	0.00	0.00	0.00	42.60	42.60	42.60	48.99	45.27	42.60	42.60	42.60	48.99	45.27

* Shading denotes target species.

TABLE 3

FUTURE AVAILABLE HABITAT

Acres of Available Habitat			
Habitat Type	Future Without Project	Future With Project	Gain/Loss
Cropland	49	0	-49
Nonforested Wetland	0	42	42
Bottomland Hardwoods	20	27	7
Total	69	69	0

TABLE 4

COMPARISON OF ALIGNMENT 1 WITH WATER CONTROL AND THE NO ACTION ALTERNATIVE

Target Species	Average Annual Habitat Units (AAHUs)		
	Alignment 1 With Water Control	No Action	Net Impact
Mallard	40.00	37.62	2.38
Canada Goose	29.76	23.92	5.84
Green-Backed Heron	13.15	11.20	1.95
Wood Duck	14.45	12.20	2.25
American Coot	4.14	0.00	4.14
Prothonotary Warbler	10.78	5.20	5.58
Great Blue Heron	45.27	0.00	45.27
AAHUs for Target Species			67.42

TABLE 5

COMPARISON OF ALIGNMENT 1 WITHOUT WATER CONTROL AND THE NO ACTION ALTERNATIVE

Target Species	Average Annual Habitat Units (AAHUs)		
	Alignment 1 Without Water Control	No Action	Net Impact
Mallard	13.36	37.62	-24.26
Canada Goose	4.39	23.92	-19.53
Green-Backed Heron	35.64	11.20	24.44
Wood Duck	14.45	12.20	2.25
American Coot	20.31	0.00	20.31
Prothonotary Warbler	10.78	5.20	5.58
Great Blue Heron	45.27	0.00	45.27
AAHUs for Target Species			54.06

TABLE 6

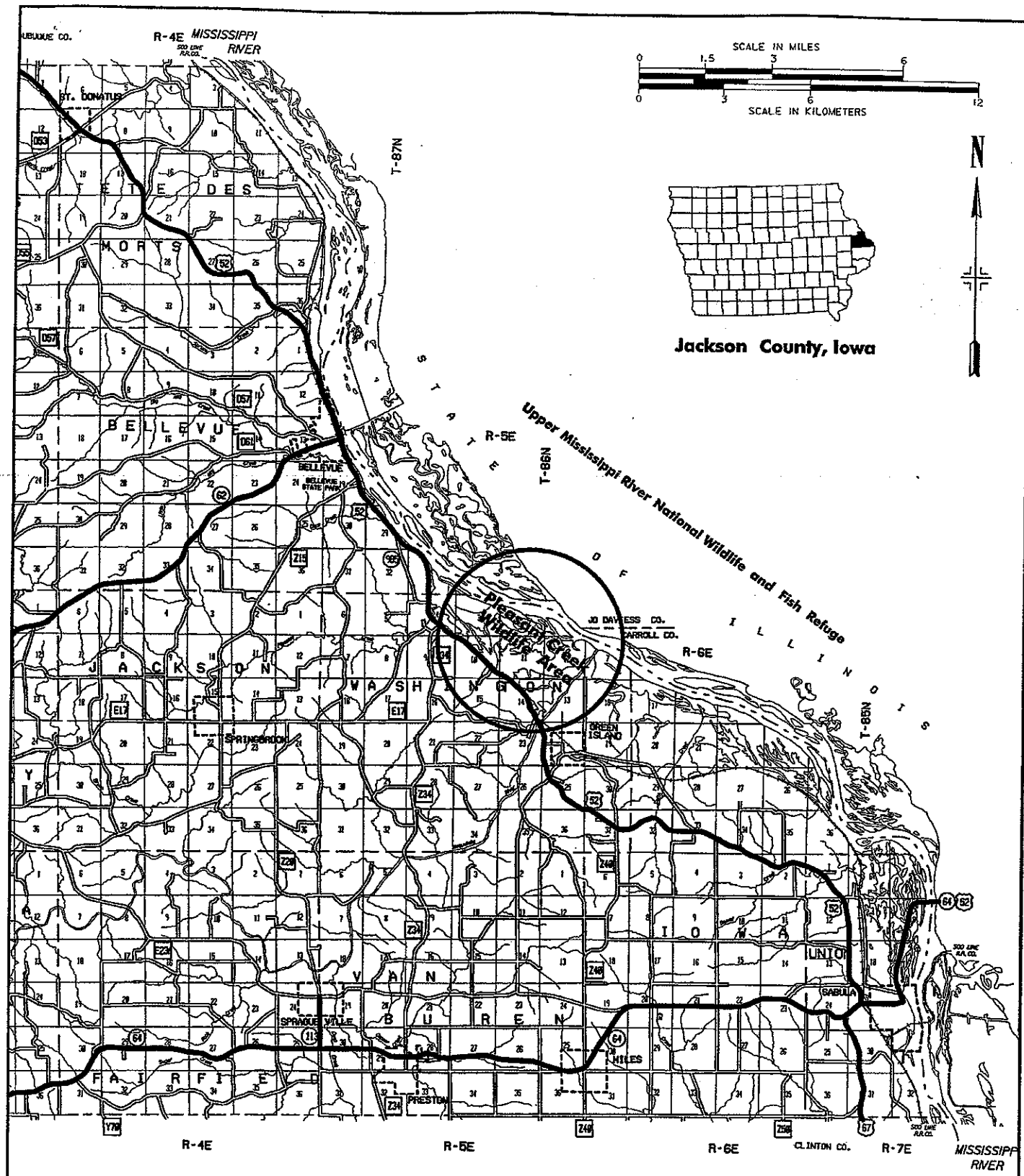
COMPARISON OF ALIGNMENT 2 WITH WATER CONTROL AND THE NO ACTION ALTERNATIVE

Target Species	Average Annual Habitat Units (AAHUs)		
	Alignment 2 With Water Control	No Action	Net Impact
Mallard	42.22	37.62	4.60
Canada Goose	29.76	23.92	5.84
Green-backed Heron	7.02	11.20	-4.18
Wood Duck	14.32	12.20	2.12
American Coot	4.14	0.00	4.14
Prothonotary Warbler	10.37	5.20	5.17
Great Blue Heron	45.27	0.00	45.27
AAHUs for Target Species			62.96

TABLE 7

COMPARISON OF ALIGNMENT 2 WITHOUT WATER CONTROL AND THE NO ACTION ALTERNATIVE

Target Species	Average Annual Habitat Units (AAHUs)		
	Alignment 2 Without Water Control	No Action	Net Impact
Mallard	7.21	37.62	-30.41
Canada Goose	4.39	23.92	-19.53
Green-backed Heron	29.51	11.20	18.31
Wood Duck	13.49	12.20	1.29
American Coot	20.31	0.00	20.31
Prothonotary Warbler	10.37	5.20	5.17
Great Blue Heron	45.27	0.00	45.27
AAHUs for Target Species			40.40



US Army Corps of Engineers Rock Island District	Designed By:	Date: July 1999
	Drawn By: SWM	Scale: AS SHOWN
	Checked By: TJV	Drawing Code:
	Reviewed By:	Solicitation Number:

Upper Mississippi River Environmental Management Program
Pool 13, RM 548.7 Thru 552.8
Pleasant Creek Habitat Rehabilitation and Enhancement

Study Location

Figure 1

$$$prfss
$$$dgn$$

Figure 2

Upper Mississippi River
Environmental Management Program
Pool 13, RM 548.7 thru 552.6
Pleasant Creek Habitat
Rehabilitation and Enhancement

Existing Conditions

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

Designed By:	Date: July 1999
Drawn By: SWM	Scale: AS SHOWN
Checked By: TJV	Drawing Code:
Reviewed By:	Solicitation Number:

Revisions

Symbol	Description	Date	Approved

US Army Corps of Engineers
Rock Island District

Figure 3	Upper Mississippi River Environmental Management Program Pool 13, RM 548.7 thru 552.8 Pleasant Creek Habitat Rehabilitation and Enhancement **With Project Future Conditions**	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS	Designed By: Drawn By: SWM Checked By: TJV Reviewed By:	Date: July 1999 Scale: AS SHOWN Drawing Code: Solicitation Number:

Symbol	Description	Date	Approved

Revisions

US Army Corps of Engineers Rock Island District