WALNUT CREEK National Wildlife Refuge and Prairie Learning Center

Master Plan

December 1992

WALNUT CREEK National Wildlife Refuge and Prairie Learning Center

Master Plan

The U. S. Fish and Wildlife Service proposes this Master Plan to' reconstruct one of the rarest of North America's major ecosystems, tallgrass prairie and oak savanna, at the Walnut Creek National Wildlife Refuge near Prairie City, Iowa. The Plan describes the reconstruction of over 7,000 acres as native habitats and the establishment of a major Prairie Learning Center, small research facility, and system of roads, trails, and interpretive sites for public use, enjoyment, and environmental education. As the largest prairie reconstruction project in the United States, establishment of the refuge provides the Service with a unique opportunity to expand its ongoing efforts to protect and enhance environmental quality and habitat diversity.

Sam Marler
Regional Director
Region 3
U. S. Fish and Wildlife Service

Susan D. Haseltine
Assistant Regional Director
Refuges and Wildlife
U. S. Fish and Wildlife Service

Matthias A. Kerschbaum
Wildlife Associate Manager
Division 2-Refuges
U. S. Fish and Wildlife Service

Richard M. Birger
Refuge Manager
Walnut Creek National
Wildlife Refuge
U. S. Fish and Wildlife Service

David M. Shaffer
Master Plan Coordinator
U. S. Fish and Wildlife Service

TITLE PAGE i

TABLE OF **CONTENTS** ii

ILLUSTRATION CREDITS ..... **viii**

LIST OF PREPARERS ..... **ix**

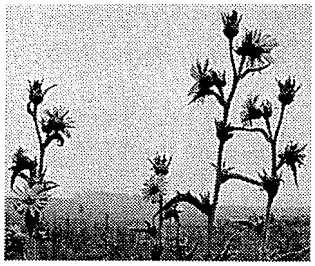
1. **INTRODUCTION** 1-1

Overview .....
Planning Process .....
Goals and Objectives .....

3. RESOURCE INVENTORY AND ANALYSIS **2-1**

Introduction .....
Geology .....
Soils .....
Physiography .....
Climate .....
Water Resources .....
Vegetation .....
Wildlife .....
Land Use and Zoning .....
Ownership .....
Social/Economic Conditions .....
Transportation .....
Visual Resources .....
Public Use .....
Cultural Resources .....
Utilities .....

3. PLAN OBJECTIVES AND COMPONENTS 3-1



Introduction .....
Natural Communities .....
Prairie .....
Oak **Savanna/Woodland** .....
Riparian /Wetland .....
Wildlife .....
Facilities, Activities, and Visitor Programs .....

4. MASTER PLAN 4-1

Introduction .....
Master Plan Description .....

6. MASTER PLAN IMPLEMENTATION 5-1

Introduction .....
Phase I: Pre-Development Site Preparation .....
Phase II: Major **Development** .....
Phase III: **Future Development** .....
Required Permits .....
Implementation Responsibility .....
Costs .....
Conclusion .....

LIST OF MAPS

Map 1 Refuge Location and Regional Context 1-2
Map 2 Refuge Ownership 1 4
Map 3 Current Erosion Status of **Soils** 2-3
Map 4 Native Vegetation Based on Soils 2-5
Map 5 Walnut Creek Watershed 2-7
Map 6 Remnant Native Vegetation 2-12
Map 7 Visual Resources 2-19
Map 8 Master Plan Concept ..... following **4-4**
Map 9 Central Canopus Conceptual Site Plan ..... following 4-5

APPENDICES (bound separately)

Appendix A: Public Use Plan

U.S. Fish and Wildlife Service, *Walnut Creek National Wildlife Refuge and Prairie Learning Center Public Use Plan,* July 1992.

This document provides direction for programs and facilities related to the three major public use purposes of the Refuge: environmental education, interpretation, and wildlife and wildlands-oriented recreation.

Appendix B: Habitat Reconstruction Plan

Daryl D. Smith, *Prairie/Savanna Restoration and Reconstruction Plan & Restoration Recommendations for Native Plant Communities,* July *1992.*

This document contains guidelines for the reconstruction of prairie and savanna habitats and the restoration of existing native plant communities on the Refuge.

Appendix C: Research Strategy

Walnut Creek Research Planning Team, *Ecological Restoration at Walnut Creek National Wildlife Refuge: A Strategic Plan for the First Five Years of Long-Term Research, July* 1992.

This document provides a framework for the development of a research program that will accomplish the research goal established for the Refuge and integrate research with the other Refuge purposes.

Appendix D: Pre-Schematic Design Document

Eskew Filson Architects/Perkins Guidry Beazley Ostteen, *Program Elements/Cost Summary,* November *1992.*

Eskew Filson Architects and Wallace Roberts & Todd, *Pre-Schematic Design Criteria,* November *1992.*

Perkins Guidry Beazley Ostteen/Eskew Filson Architects, *Construction Project Worksheets,* November 1992.

Program Elements/Cost Summary outlines the facilities and habitats included in the Refuge program together with their costs. *Design Criteria* contains the criteria that will be used to govern the design of Refuge facilities. The *Construction Project* contain more detailed information regarding the individual development projects (habitats and facilities) that comprise the Refuge program.

Appendix E: Economic Impact

Harrison Price Company, *Market Demand and Economic Impact of the Walnut Creek National Wildlife Refuge,* December 1991.

This document analyzes the impacts of the Refuge on the local and regional economies as well as projected market support and attendance for Refuge public use programs.

Appendix F: Cultural Resources

Malcolm Pirnie, Inc., *Walnut Creek National Wildlife Refuge Cultural Resources Investigation,* December 1991.

This document presents the results of a study of existing archaeological, historic, and archaeological resources within the Refuge.

Appendix G: Wildlife

James J. Dinsmore, *Birds, Mammals, Reptiles and Amphibians of Walnut Creek National Wildlife Refuge,* 1991.

This document presents an analysis of existing birds, mammals, fish, reptiles, and amphibians likely to occur on the Refuge.

Appendix H: Vegetation

Pauline M. Drobney and Scott J. Bryant, Compass Plant Consultants, *Walnut Creek National Wildlife Refuge Native Plant Community Assessment,* October 1991.

John M. Pleasants, *Description of Vegetation Types,* September 1991.

Walnut Creek National Wildlife Refuge Native Plant Community Assessment provides detailed information concerning the location and condition of existing native plant communities on the Refuge, for use in formulating restoration and reconstruction strategies. *Description of Vegetation Types* presents general descriptions and species lists of the major native vegetation types existing on the Refuge.

Appendix I: GIS Component

Wallace Roberts & Todd, *GIS Component,* November 1992.

This document describes the computerized mapping and database system (Geographic Information System, or GIS) used in the development of the Master Plan.

Appendix J: Hydrology

Sellards and Grigg, Inc., *Walnut Creek Hydrologic Investigation,* May 1992.

U.S. Fish and Wildlife Service, *Preliminary Water Quality Sampling Data,* 1991.

Walnut Creek Hydrologic Investigation evaluates hydrologic conditions within the Walnut Creek watershed including the 100-year floodplain and the hydraulic adequacy of existing cross drainage structures. Also included is an evaluation of and design criteria for the proposed impoundments and moist soil units. *Preliminary Water Quality Sampling Data* presents the results of a water quality sampling study undertaken to determine baseline water quality conditions within the Refuge.

Appendix K: Topography

Topographic Maps of Walnut Creek National Wildlife Refuge (2-foot contour intervals), November 1992.

This appendix contains a topographic survey of the Refuge presented in digital format for GIS application.

Appendix L: Public Involvement Record

Eskew Filson Architects, *Public Involvement Record,* November 1992.

This document summarizes public participation in the development of the Walnut Creek National Wildlife Refuge Master Plan.

Appendix M: Bison and Elk

U.S. Fish and Wildlife Service, *Proceedings from the Master Planning Workshop for the Introduction of Bison and Elk into the Walnut Creek National Wildlife Refuge Program,* November 24, 1992.

This document contains preliminary recommendations concerning interpretation and management of bison and elk at the Walnut Creek National Wildlife Refuge based upon a workshop with national experts in bison and elk management. A more detailed management plan will be prepared by the Refuge staff before the first animals are introduced to the Refuge.

ILLUSTRATION CREDITS

Page 1-1	Kai Curry-Lindahl, *Wildlife of the Prairies and Plains.* New York: Harry N. Abrams, Inc., 1981. Illustration by Dolores R. Santoliquido, page 198.
Page 1-11	John Madson, *Where the Sky Began: Land of the Tallgrass Prairie.* San Francisco: Sierra Club Books, 1986. Illustration by Dycie Madson, page xiii.
Page 2-2	Janet Runions, Artist.
Page 2-9 (Yellow Coneflower)	Janet Runions, Artist.
Page 3-1	Janet Runions, Artist.
Page 3-3	Janet Runions, Artist.
Page 3-7 (Black-Eyed Susan)	Laura C. Martin, *The Wildflower Meadow Book: A Gardener's Guide.* Charlotte, N.C.: Fast & McMillan Publishers, Inc., 1986. Illustration
Page 3-7 (Little Bluestem)	Kai Curry-Lindahl, *Wildlife of the Prairies and Plains.* New York: Harry N. Abrams, Inc., 1981. Illustration by Dolores R. Santoliquido, page 198
Page 4-1	Janet Runions, Artist.
Page 5-1	Roger Tory Peterson and Margaret McKenney, *A Field Guide to Wildflowers of Northeastern and Northcentral North America.* Boston: Houghton Mifflin Company, 1968. Illustration by Roger Tory Peterson, page 81.

All photographs by the Fish and Wildlife Service. All other graphics and maps by Wallace Roberts & Todd.

LIST OF PREPARERS

United States Fish and Wildlife Service

David Aplin	Outdoor Recreation Planner
Richard Birger	Project Leader/Refuge Manager
Pauline Drobney	Wildlife Biologist
Carla Dykstra	Administrative Assistant Assistant
Michael Marxen	Master Plan Coordinator Master
David Shaffer	Plan Coordinator

Technical Advisors and Reviewers

Keith Beseke	Elizabeth Jones
Bill Clark	Matthias Kerschbaum
John Dobrovolny	Joe Kimbel
John Eadie Bob	Erv Klaas
Ellis John Ellis	Lynn MacLean
Wayne Fischer	James Mattsson
Lisa Friedlander	Mamie Parker
Sharon Gartner	Rick Rampi
Pat Geary Jon	Penny Saiki
Holbrook Bill	Dick Sorenson
Hutchinson Doug	Paul Vohs
Johnson	Tom Worthington

Wallace **Roberts** & **Todd**

William H. Roberts	Partner-in-Charge/Landscape Architect
Richard Collier, Jr.	Senior Associate/Planner
Diana Mendes	Associate/Planner
John Gless	GIS Specialist/Planner
David Rouse Eric	Planner/Landscape Architect
Tamulonis Rossanna	Landscape Architect
Vaccarino Stephanie	Graphic Artist/Landscape Architect
Cohn Eric Jacobson	Planner
Lisa Bachman	Planner
	Draftsperson

Eskew Filson/Perkins Guidry Beazley Ostteen

R. Allen Eskew	Architect
Charles Beazley	Architect

Sellards & Grigg

David Sellards	Principal
Thomas Roberts	Project Manager
Charles McKnight	Hydrologist

Other Consultants

Daryl D. Smith	Prairie Vegetation Specialist
Harrison Price Company	Economists
Malcolm Pirnie, Inc. Sellards & Grigg, Inc. James T. Dinsmore Compass Plant Consultants John M. Pleasants	Cultural Resource Specialists Hydrologists Wildlife Specialist Prairie Vegetation Specialists
Rod Schmidt	Botanist Bison and Elk Rancher

Other Agency Participants

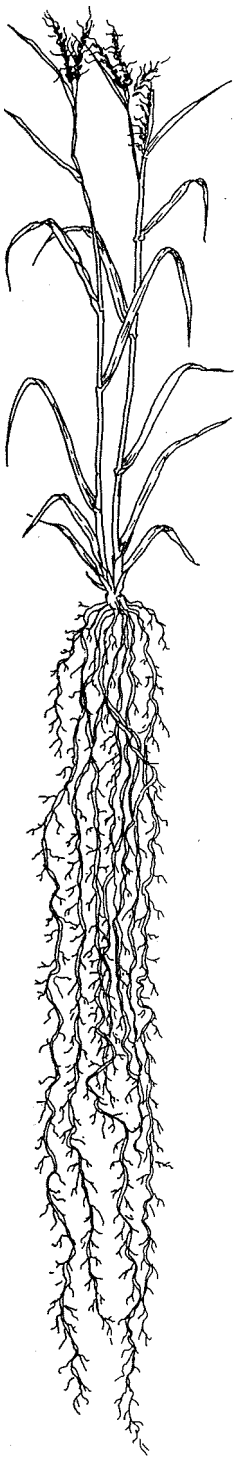
Dorie Bollman	U.S. Army Corps of Engineers
Larry Larson	Manager, Prairie State Park, Liberal, Missouri
Arnie Olson	Montana Department of Fish, Wildlife and Parks
Arnie Sohn	Iowa Department of Natural Resources

1. Introduction

"The successful conservation of biological diversity depends less on keeping humans out of fragile ecosystems than on making sure they do the right things when they are there".

- Edward C. Wolf

OVERVIEW



Big Bluestem

The Walnut Creek National Wildlife Refuge and Prairie Learning Center (Refuge) is among the most unique and valued initiatives in restorative landscape ecology in the United States. The Refuge is located in jasper County, Iowa, approximately 20 miles east of Des Moines (see Map 1). Prior to Euro-American settlement, the rolling landscape of this portion of Iowa was dominated by tallgrass prairie with islands of oak savanna. Establishment of the Refuge by the U.S. Fish and Wildlife Service (Service) was authorized by Congress on May 25, 1990 for the following purposes:

- *To restore native tallgrass prairie, wetland, and woodland habitats for breeding and migratory waterfowl and resident wildlife;*
- *To serve as a major environmental education center providing opportunities for study;*
- *To provide outdoor recreation benefits to the public; and*
- *To provide assistance to local landowners to improve their lands for wildlife habitat.*

The Refuge is part of the National Wildlife Refuge System administered by the U.S. Department of the Interior, Fish and Wildlife Service which includes 481 refuges located throughout the United States. The mission of the National Wildlife Refuge System is:

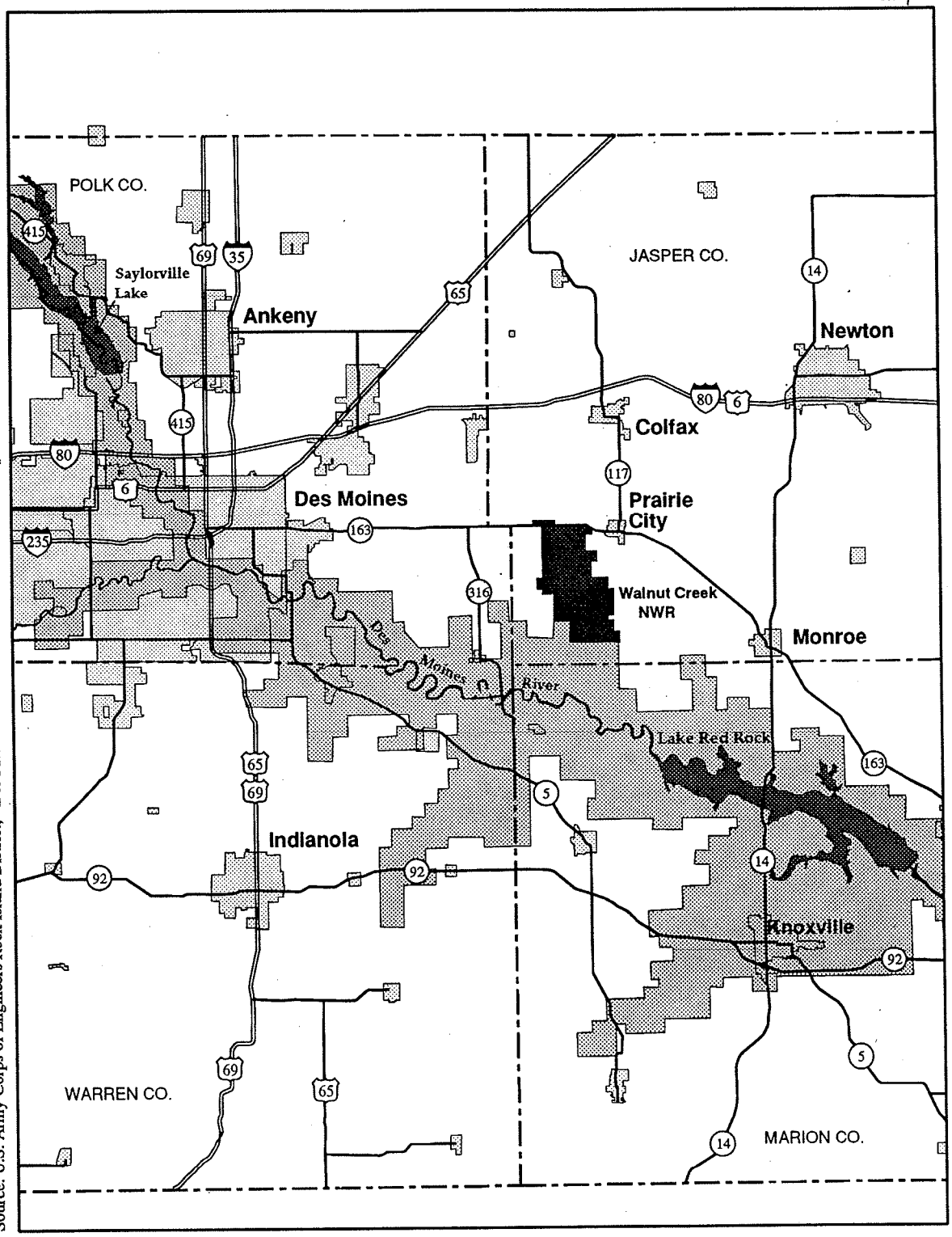
> *To preserve,* ***restore, and manage a national network of lands and waters sufficient in size, diversity, and location to meet society's needs for areas where the widest possible spectrum of benefits associated with wildlife and wildlands is enhanced and made available.***

The Walnut Creek National Wildlife Refuge is unlike any existing refuge in that it has been established by Congress to restore a major expanse of tallgrass prairie. The Refuge is the largest prairie reconstruction effort in the country and is symbolic of a growing national and international interest in healing the environment. The restorative and foresighted nature of this project is best summarized by Aldo Leopold:

> *The first law of intelligent tinkering is saving all the pieces.*

As authorized, the Refuge consists of 8,654 acres of cropland, pasture, and remnant native plant communities bisected by Walnut Creek, a tributary of the Des Moines River. The Refuge is an autonomous project within the Des Moines Recreational River and Greenbelt; a regional open space corridor. The U.S. Fish and Wildlife Service is currently in the process of acquiring land within the authorized Refuge boundary under a willing seller acquisition

Map 1.



Source: U.S. Army Corps of Engineers Rock Island District, "Des Moines Recreational River and Greenbelt", September 1991.

Refuge Location and Regional Context

Walnut Creek National Wildlife Refuge

Des Moines Recreational River and Greenbelt

NORTH

0 2 6 10 miles

program. As of August 1992, approximately 4,000 acres had been acquired (see Map 2).

Master Plan

The purpose of the Walnut Creek National Wildlife Refuge Master Plan is to guide the long-range development of the Refuge, by identifying and integrating appropriate habitats, management strategies, program elements, and facilities which support the goals and objectives for which the Refuge was established. The Master Plan is based on a 10-year time frame and should be evaluated for modification every five years. The plan is divided into the following chapters:

1. ***Introduction:*** This chapter contains an overview of the establishment of,the Walnut Creek National Wildlife Refuge and the Refuge Master Plan, a discussion of the master planning process, and the Refuge goals and objectives.

2. *Resource Inventory and Analysis:* This chapter summarizes information collected concerning the existing physical, biological, and cultural resources of the Refuge, and the implications of this information for the siting of Refuge habitats and facilities.

3. *Plan Objectives and Components:* This chapter describes the habitats, facilities, and activities which will comprise the Refuge program.

4. *Master Plan:* This chapter describes Walnut Creek National Wildlife Refuge as envisioned when the reconstructed habitats and supporting facilities are fully established and available for the enjoyment of Refuge visitors.

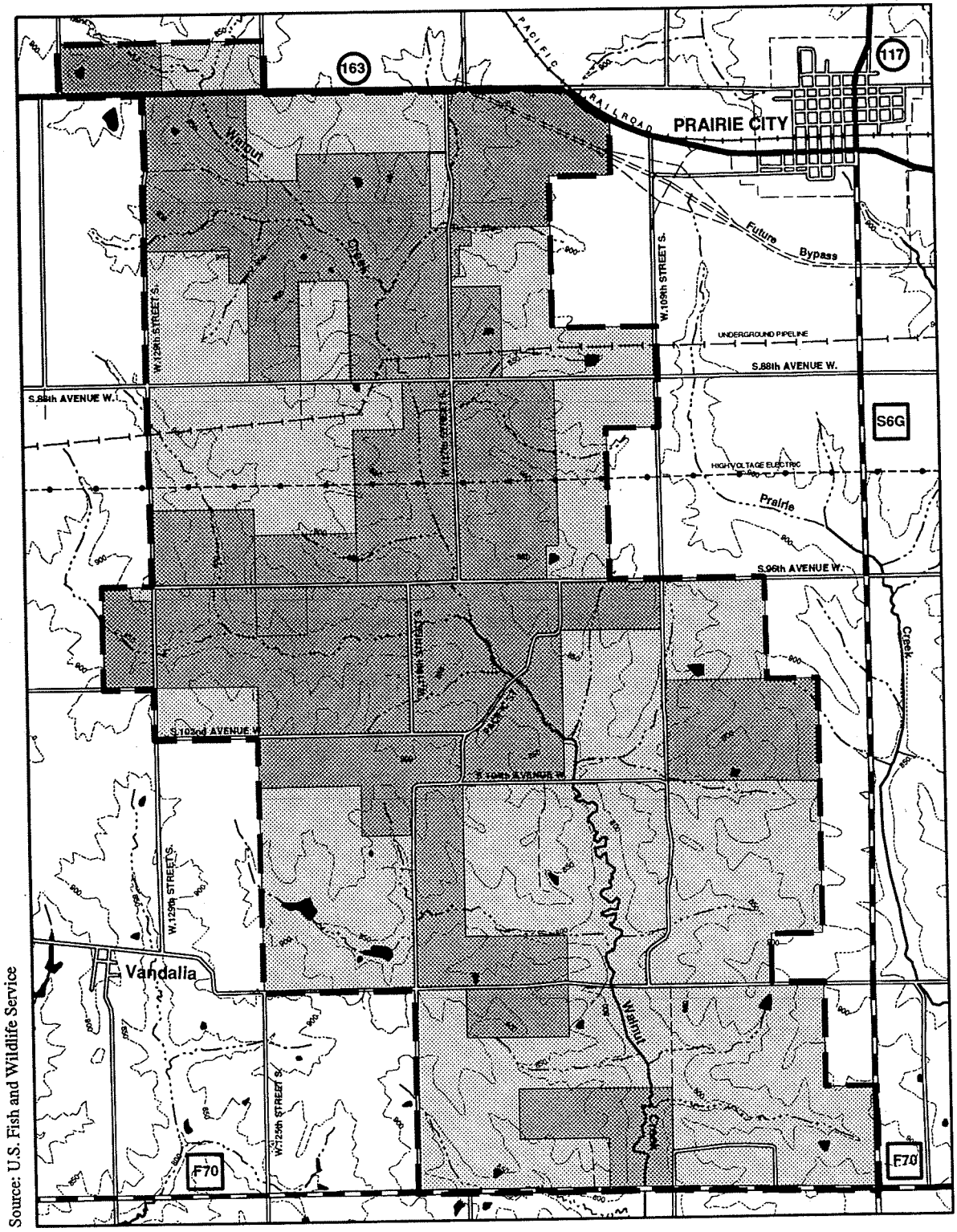
5. *Master Plan Implementation:* This chapter outlines the steps necessary to implement the Master Plan, including phased development of Refuge habitats and facilities, project costs, and permitting requirements.

Support Documents

The Master Plan is an umbrella document which summarizes the results of an intensive 18-month long planning process. More detailed information on the various aspects of the Plan are available in the following Technical Reports included as appendices:

- Public Use Plan
- Habitat Reconstruction Plan
- Research Strategy
- Pre-Schematic Design Document
- Bison/Elk Workshop Proceedings

Map 2.



Source: U.S. Fish and Wildlife Service

Refuge Ownership

U.S. Fish and Wildlife Service Property (As of August 1992)

Other Property to be Acquired Through Willing Seller Program

Refuge Boundary

100 acres
40
10

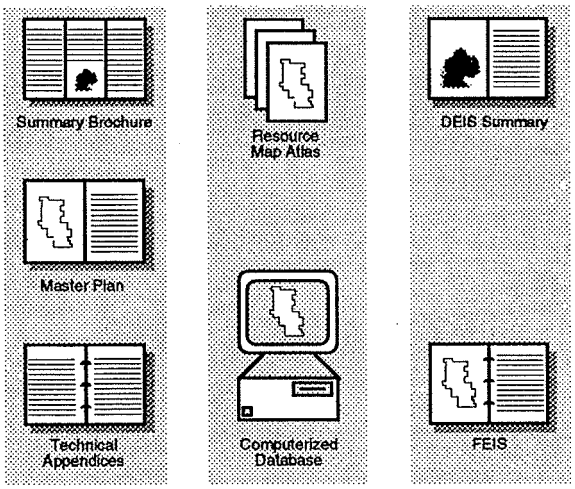
NORTH

0 1000 3000 5000 Ft.

The technical appendices also include resource inventory studies prepared during the data gathering phase of the Master Plan. The following studies are included:

- Economic Impact
- Cultural Resources
- Wildlife
- Vegetation
- GIS Component
- Hydrology
- Topography
- Public Involvement Record

Several other reports - a Resource Atlas, Environmental Impact Statement, and Summary Brochure - have been prepared in conjunction with the Master Plan. The Resource Atlas consists of computer generated resource maps used in the development of the Master Plan. The Environmental Impact Statement (EIS) was prepared to evaluate the effects of Master Plan alternatives on the environment. The Summary Brochure provides a summary of the Master Plan oriented towards the general public.

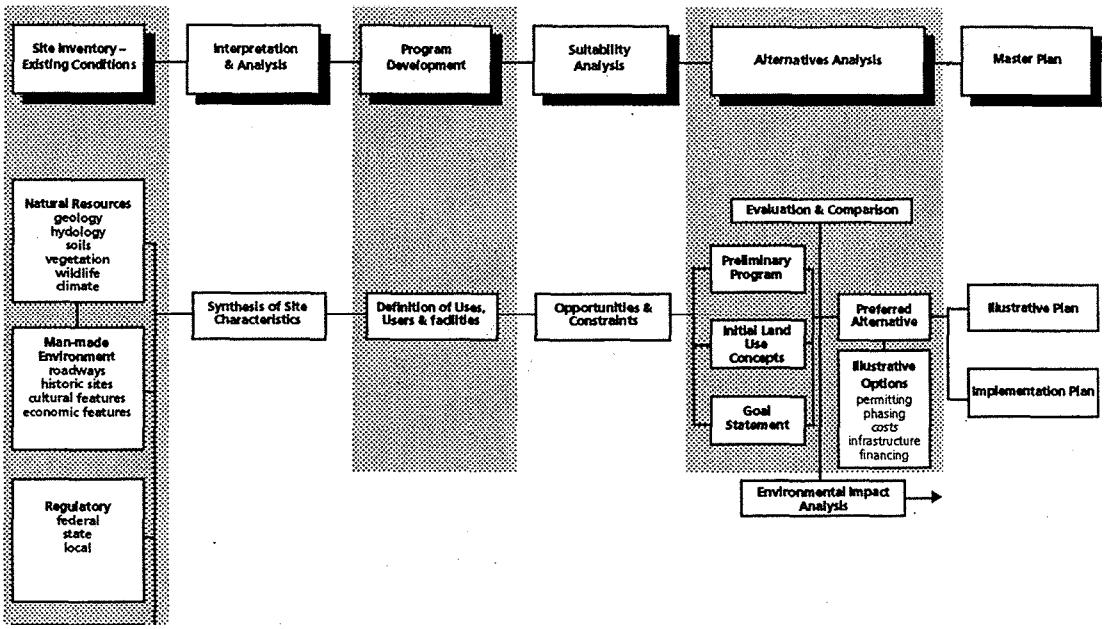


Master Plan/ EIS Documents

PLANNING PROCESS

Planning for the Walnut Creek National Wildlife Refuge commenced with the preparation of an Environmental Assessment (EA) as required by the National Environmental Policy Act (NEPA) for the establishment of the Refuge. The EA was approved in August 1990, and the Service began preparation of a Master Plan for the Refuge in December of the same year. In accordance with NEPA, an Environmental Impact Statement (EIS) was prepared concurrently with the Master Plan in order to evaluate the environmental effects of the Master Plan alternatives. Throughout the planning process, public opinion was requested using a variety of forums.

The master planning process is an iterative and creative one which consisted of six sequential phases, each of which built on the findings of previous steps (Figure 1.3). The purpose of this process was to produce an overall plan for development of the Refuge which is sensitive to the natural, social, and economic environments of the Refuge as well as to the needs of the American public.



Master Planning Process

Site Inventory

In the initial site inventory phase, extensive information was collected concerning the existing physical, biological, social, and economic environments of the Refuge. Other tasks conducted during this phase included the identification of important issues associated with development of the Refuge based upon input received during a series of focus group meetings and a public scoping meeting, and the preliminary formulation of project goals and objectives. The following focus groups were selected based upon key subjects pertaining to development of the Refuge:

- Greenbelt Advisory Committee
- School District Educators
- Environmental Educators
  Prairie City Citizens

- Government and Regulatory Agencies (U.S. Army Corps of Engineers, Iowa Department of Natural Resources, etc.) • Environmental Interest Groups
- Tourism and Economic Development
- Research Options and Interests
- Agricultural Interests
- U.S. Fish and Wildlife Service

Interpretation and Analysis

In the interpretation and analysis phase, the inventory of existing conditions was used to generate a series of maps for use in planning the location of Refuge habitats and facilities. These maps depicted a broad range of information such as physiography, watersheds, soil suitability for various land uses, existing and historic vegetation, utilities, and the visual characteristics of the Refuge landscape.

Program Development

In the third step, a preliminary Refuge program was developed consisting of proposed facilities, habitats, and activities. The program was developed based upon the preliminary goals and objectives established for the Refuge, and input received at the focus group and public scoping meetings.

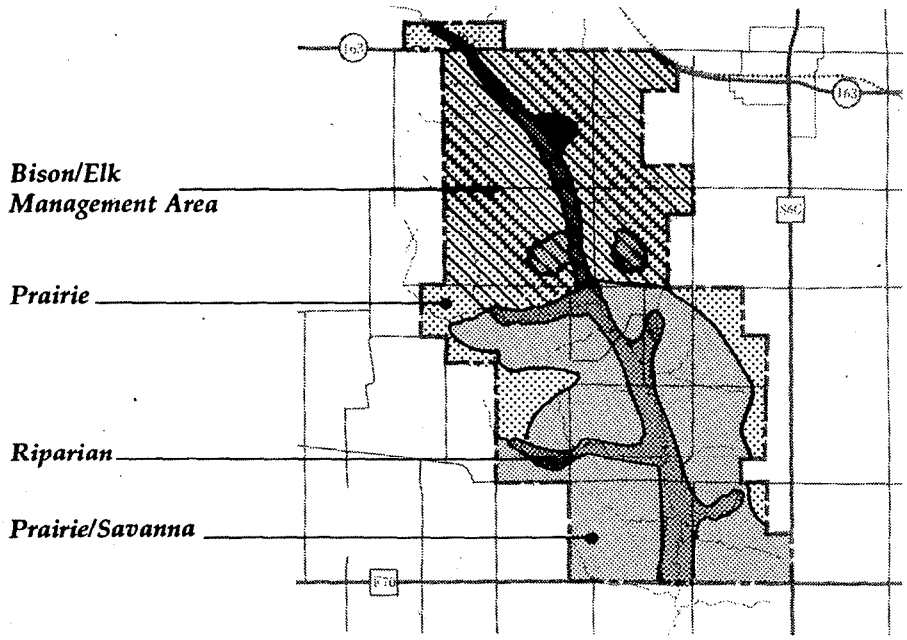
suitability Analysis

In step four, the suitability analysis phase, locational criteria were developed to characterize the natural and human-made resource conditions required to support the facilities and habitats identified by the preliminary Refuge program. Based upon these criteria, the site analysis maps were used to determine site opportunities and constraints. This assessment identifies the suitability of various portions of the Refuge to support the proposed facilities and habitats.

alternatives Analysis

In the alternatives analysis phase, a series of alternatives were developed for each of four elements comprising the Master Plan. The four elements of the Master Plan are:

- Habitat/Wildlife Emphasis (what types of habitats will be established and wildlife will be managed for at the Refuge);
- Refuge Management Concept (how the Refuge will be developed to accommodate both Service requirements and public use);
- Refuge Program (what facilities and activities will be provided at the Refuge); and
- Facilities Siting (where the facilities will be located and sited).



Preferred Habitat/Wildlife Emphasis Alternative

The Master Plan alternatives were evaluated and a Preferred Alternative selected for each element based upon the following considerations:

- Compliance with national policies, legislation, regulations and principles affecting resource management and the National Wildlife Refuge System;
- Compatibility with guidance provided by the enabling legislation for the establishment of the Walnut Creek National Wildlife Refuge;
- Consistency with the goals and objectives established for the Refuge;
- Responsiveness to public input received from citizens, interest groups, and federal, state and local agencies as expressed during focus group meetings, public meetings, and through correspondence; and
- Existing conditions, opportunities, and constraints within the Refuge and surrounding landscape as identified by previous phases of the master planning process.

vlaster Plan

This document is the result of the final phase of the master planning process, during which the Refuge goals and objectives and Preferred Master Plan Alternative were refined and strategies identified for implementing the Plan. The end result of the master planning process is a long-range plan which will guide the development and management of reconstructed habitats, facilities, and programs at the Walnut Creek National Wildlife Refuge.

Public Participation

The master planning process has relied heavily on the ideas and comments of private citizens, interest groups, and public agencies. To ensure that the opinions and concerns of the public and public agencies are addressed in the Master Plan and EIS, the Fish and Wildlife Service initiated a public participation process that has included the following components:

- coordination with local, state and federal agencies to identify issues of concern and regulatory requirements to be addressed in the Master Plan;
- meetings with focus groups concerning specific issues of relevance to the Master Plan;
- a series of public meetings held to discuss preparation of the Master Plan and EIS and to allow the public to comment on issues of concern; and
- issuance of factual materials to inform the public about the Master Plan and EIS. These materials included brochures and updates on the Plan distributed to citizens at key points in the planning process, as well as press releases to encourage public service announcements and press coverage of public meetings.

Focus Groups

Focus groups consist of individuals and organizations with an interest in a particular issue concerning development of the Refuge, such as environmental education, research, tourism and economic development, and agriculture. General areas of interest were identified during preparation of the Environmental Assessment in 1990, and individuals within the community familiar with these issues were contacted. These individuals recommended other people and organizations within the community as candidates to participate in the focus groups. A total of ten focus groups were established. During the site inventory phase of the master planning process, the Service and planning team met with these groups to identify issues of concern, opportunities, and potential impacts associated with development of the Refuge which should be addressed in the Master Plan and EIS. The Service continued to consult with selected focus groups during the remainder of the master planning process to exchange information and receive further input into the formulation of the Master Plan. Together

with the public meetings held on the Master Plan and EIS, these sessions were an invaluable part of the planning process, as they served to 1) highlight public concerns that were addressed in the Master Plan and EIS, and 2) provide the basis for balancing diverse public interests (economic development, research, recreation, etc.) in the development of the Master Plan.

May 1992 Public Meeting

Public Meetings

A series of five public meetings were held during preparation of the Master Plan and EIS. In March 1991, a scoping meeting was held to solicit public comment on issues of concern related to development of the Refuge. In June 1991, a second public meeting was held to discuss preliminary program and locational alternatives for the development of the Refuge. In January 1992, a community meeting was held to present the economic analysis and findings. A public open house in May 1992 and a public meeting in June 1992 were held to review the findings of the Draft Environmental Impact Statement (DEIS) prepared on the Master Plan. At the June 1992 meeting, formal comments related to the DEIS and its conclusions were accepted in writing and in verbal testimony.

GOALS AND **OBJECTIVES**

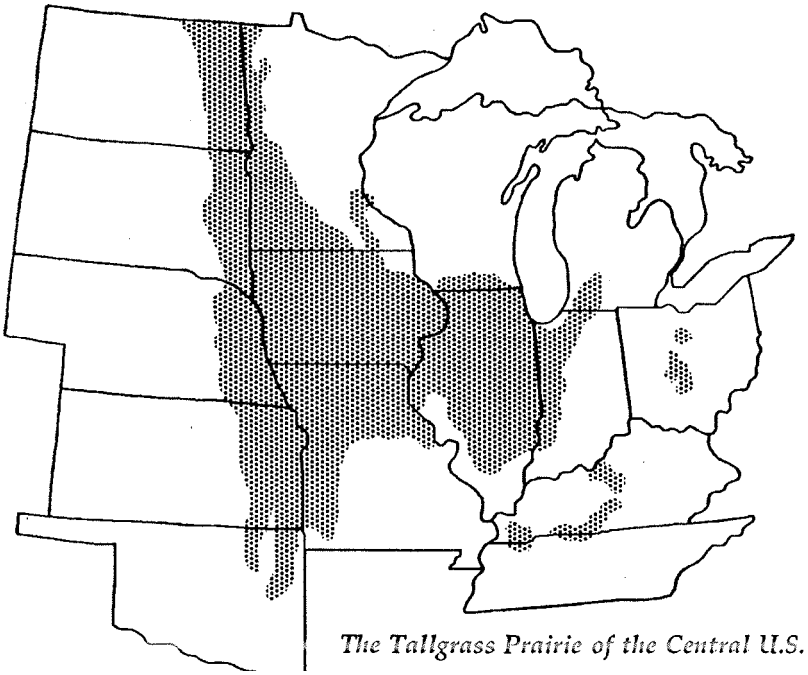
The establishment of goals and objectives for the Walnut Creek National Wildlife Refuge was a vital part of the master planning process. These goals and objectives were formulated based upon the purposes for which the Refuge was established and current National Wildlife Refuge System Management policies. Five goals and supporting objectives were established for the Refuge, addressing the following major Refuge purposes: biodiversity preservation, environmental protection, environmental education, research, and interpretation and recreation.

Biodiversity Preservation

As indicated in the list of Refuge Goals and Objectives on pages 1-12 and 1-13, the preservation of biodiversity is one of the primary goals of the Refuge. Biological diversity or biodiversity refers to the complex interaction of the many species of plants and animals which comprise and sustain natural communities. Biodiversity loss is an increasingly serious global environmental problem as the destruction of natural habitats by human activities results in the extinction of irreplaceable plant and animal species. The Walnut Creek National Wildlife Refuge offers a unique opportunity to understand the process needed to reverse this global trend at a local level by restoring a significant acreage of one of the rarest of North America's major ecosystems, tallgrass prairie and oak savanna.

Prior to Euro-American settlement, tallgrass prairie graced over 90 percent of Iowa's landscape. As the native tallgrass prairie and islands of oak savanna were cleared and plowed by settlers throughout the 1800s and early 1900s, many native species of vegetation and wildlife vanished from the Iowa landscape. Today, only a small fraction of the original prairie remains in small isolated tracts scattered throughout the state. In Iowa, as in other midwestern states where it once dominated the landscape, tallgrass prairie is essentially lost as a functioning ecosystem. The reconstruction of the historic tallgrass prairie and savanna habitats, and management of these habitats to sustain native plant and animal species, will achieve the biodiversity goal established for the Refuge:

Encourage biodiversity through sound land stewardship.



The Tallgrass Prairie of the Central U.S.

*BIODIVERSITY PRESERVATION

Goal ***Encourage biodiversity through sound land stewardship.***

Objectives: Re-establish and enhance the natural biodiversity of the Walnut Creek National Wildlife Refuge by reconstructing native tallgrass prairie, oak savanna, and riparian woodlands for the benefit of migratory and resident wildlife.

Preserve and enhance remnant native plant communities existing on the Refuge.

Reconstruct and maintain tallgrass prairie using native seed stock to ensure the continuance and viability of native Iowa prairie.

Augment existing riparian woodlands and establish wetlands to contribute to a *national* net gain of migratory bird habitat.

Reconstruct and maintain oak savanna to achieve a biologically rich transition between riparian woodlands and open prairie.

Enhance and maintain a diverse distribution of wildlife species and populations in balance with their habitats.

*ENVIRONMENTAL PROTECTION

Goal: ***Promote*** *sound land management practices to maintain wildlife and wildland resources while accommodating compatible human uses and activities.*

Objectives: Provide leadership in interjurisdictional responsibilities associated with major international, federal, state, regional, and local cooperative efforts and programs.

Provide technical assistance and other incentives to private landowners for wildlife habitat protection, restoration, improvement, and management.

Use existing statutory mandates, laws, regulations, and law enforcement capabilities to work with federal, state, and local governments and private interests to restore, enhance, and protect the Walnut Creek watershed to ensure maximum consideration of fish and wildlife resources.

Promote environmentally sound design and planning to avoid and/or minimize conflicts between endangered species needs and human activities.

Establish a working relationship between agricultural interests and Service programs to integrate ecological and economic considerations.

Retain and enhance the visual integrity of the Refuge.

Sustain the connection between people and the prairie through the protection of existing human historical and cultural resources.

*ENVIRONMENTAL EDUCATION

Goal: ***Foster the development of an informed citizenry engaged in the exploration and resolution of issues that affect the quality of life and the quantity of wildlife and wildland resources.***

Objectives: Provide innovative on-site and outreach programming for a variety of audiences with an emphasis on developing an awareness and appreciation of wildlife and wildland resources.

Provide visitors with varied program opportunities to acquire the ecological knowledge and practical skills necessary to participate in the protection and enhancement of wildlife and wildland resources.

Incorporate environmental education theories and methodologies throughout the public use programming including state of the art technology in visitor and learning facilities.

Coordinate environmental education opportunities at the Refuge with other programs throughout Iowa, the region, and beyond.

• RESEARCH

Goal: ***Document the tallgrass prairie and prairie/savanna reconstruction and restoration process in a scientific format and transfer that knowledge to active refuge management and other educational forums.***

Objectives: Encourage research which contributes to the science of prairie management, including the cost effective application of scientific information and technological innovation.

Provide research opportunities related to habitat reconstruction and restoration.

Provide opportunities for research related to agricultural techniques and wildlife responses during the reconstruction.

•INTERPRETATION AND RECREATION

Goal: *Provide opportunities for the public to understand, enjoy, and enhance wildlife and wildland resources.*

Objectives: Implement a customer-oriented approach to promote year-round, quality wildlife experiences for all segments of the population.

Provide an opportunity to develop wildlife and wildland oriented recreational skills.

Enhance partnerships with government, conservation organizations, volunteers, and the public to meet the needs for wildlife and wildland oriented recreational skills.

Where compatible, promote quality wildlife oriented recreational experiences by providing a variety of year-round opportunities.

Establish trails and observation points which support watchable wildlife opportunities.

Establish interpretive programs and displays that relate the story of the native prairie landscape, its values, and the role of human interaction with the land.

Coordinate Refuge activities with other regional agencies, programs, and facilities by providing visitor information about the National Wildlife Refuge System, local nature centers, and related regional facilities.

Environmental Protection The second goal established for the Walnut Creek National Wildlife Refuge involves balancing land development and management activities with the protection of natural resources:

> *Promote sound land management practices to sustain wildlife and wildland resources while accommodating compatible human uses and activities.*

To achieve this goal and supporting objectives, the Refuge will be developed and managed in a manner which addresses the ' protection of sensitive environmental resources such as wetlands, floodplains, and native habitats in planning and constructing facilities or implementing programs and activities. In addition, the Service will work with local landowners, public agencies, and private organizations to foster protection and enhancement of wildlife habitat and other resources within the Walnut Creek watershed.

Environmental Education A third goal of the Refuge is to provide a major environmental education center designed to assist citizens of the region to become environmentally knowledgeable and active:

> *Foster the development of an informed citizenry actively engaged in the exploration and resolution of issues that affect the quality of life and the quantity of wildlife and wildland resources.*

The landscape-scale reconstruction of historic tallgrass prairie and oak savanna offers an unparalleled opportunity to establish environmental education programs and facilities to impart to Refuge visitors an increased awareness and knowledge of the prairie landscape, the interaction between humans and natural systems, and the value of conserving, enhancing, and restoring wildlife and wildland resources. The introduction of bison and elk, two large animals which formerly roamed the tallgrass prairie landscape, will serve as a living symbol of the Prairie Learning Center to be established at the Refuge.

Research

Interest in the reconstruction of native ecosystems such as the tallgrass prairie is growing as an increasing number of practitioners of ecological restoration seek to reverse the global trend towards destruction of natural habitats. The unprecedented scale of the Walnut Creek National Wildlife Refuge tallgrass prairie reconstruction will provide opportunities for ecological research which will increase technical knowledge of the prairie reconstruction and management process for use in teaching and other restoration projects. Accordingly, the fourth goal established for the Refuge is to:

Document the tallgrass prairie and prairie/savanna ***reconstruction*** *and restoration process in a scientific format and transfer that knowledge to active refuge management and other educational formats.*

Learning About *Native Plant* ***Species***

Interpretation and Recreation

The final major goal of the Refuge is to provide wildlife and wildlands-oriented recreational benefits for the enjoyment of the public. In accordance with the mission of the National Wildlife Refuge System, recreational activities to be offered at the Refuge will be compatible with the purposes for which the Refuge was established and oriented towards interaction with and appreciation of wildlife and wildland resources. In conjunction with wildlife/wildlands-oriented recreation, interpretive programs will be implemented to assist visitors in understanding the natural and cultural history of the prairie and the compelling process of tallgrass prairie reconstruction:

Provide opportunities for the public to understand, enjoy, and enhance wildlife and wildland resources.

These programs are expected to enhance visitors' awareness and appreciation of the reconstructed Refuge landscape and the wildlife (e.g., reintroduced bison and elk) inhabiting it.

These varied yet complementary purposes - biodiversity preservation and enhancement *through habitat* reconstruction and management, environmental protection, environmental education,

research, and wildlife/wildlands-oriented interpretation and recreation - are the fundamental principles which will guide the development and management of the Walnut Creek National Wildlife Refuge and Prairie Learning Center. The environmental education, research, interpretive, and recreational facilities and programs to be established in support of these purposes will afford a broad spectrum of visitors - students, families, senior citizens, scouts, researchers, and many others - the opportunity to learn about the historic tallgrass prairie/savanna ecosystem.

Environmental Education Class

"It is relatively easy to build a National Park around a naturally striking site like Yellowstone or Mount Rainier. It is quite a feat to reweave the torn fabric of an abused ecosystem".

- P. J. Ryan

INTRODUCTION

Pale Purple Coneflower

In order to gain an understanding of the existing environment of the Walnut Creek National Wildlife Refuge, extensive information was collected concerning physical, biological, and cultural resources. This information was used to 1) determine the suitability of different portions of the Refuge for development of the habitats and facilities that comprise the Refuge program, and 2) evaluate the impacts of the Master Plan on the physical, biological, social and economic environment of the Refuge and the surrounding area. Information concerning the following types of resources was collected during the site inventory phase of the master planning process:

- Geology
- Soils
- Physiography
- Climate
- Water Resources
- Air Quality
- Vegetation
- Wildlife
- Rare, Threatened and Endangered Species
- Land Use, Ownership and Zoning
- Social and Economic Conditions
- Transportation
- Visual Resources
- Public Use
- Cultural Resources
- Utilities

As part of the master planning process, a computer database was developed from a variety of sources and used to produce a series of maps for resource categories of concern. This computerized Geographic Information System (GIS) was used to generate overlays of various resource types in order to assess the feasibility of different parts of the Refuge for proposed habitats and facilities and to determine the impacts of alternative facility sites on sensitive resources such as wetlands and floodplains.

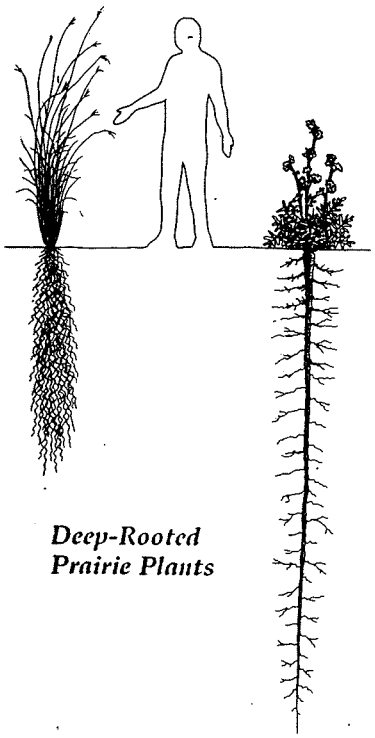
This chapter summarizes the results of the site inventory and analysis, focusing on resources of particular relevance to the Master Plan. More detailed information is available in the technical appendices and the Environmental Impact Statement (EIS) prepared on the Walnut Creek National Wildlife Refuge Master Plan.

;EOLOGY

The current Refuge landscape consists of materials deposited by wind (loess), and flowing water (alluvium) over glacial till and bedrock. Loess, a fine, ash-like, wind-deposited material, typically occurs on uplands, while alluvium, found on valley bottoms, consists of material eroded *by water* from upland areas. The loess deposits tend to be thinner on valley slopes where they have been

subject to erosion than on the ridgetops. Although the underlying bedrock is generally buried to a considerable depth by glacial till and loess, narrow outcrops of sandstone occur in a few locations.

SOILS



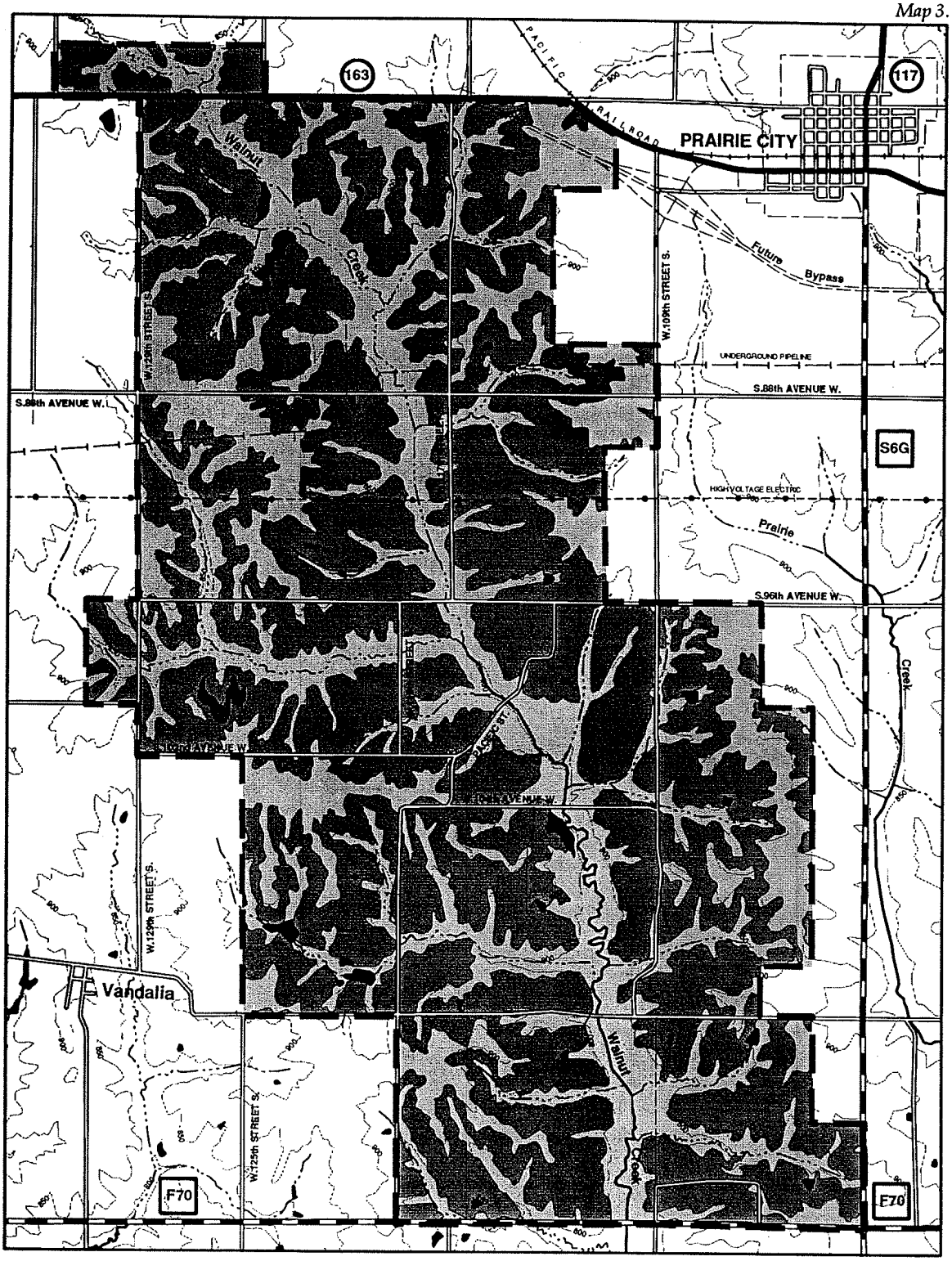
The soils of the Refuge formed as a result of the interaction of climate with the growth of tallgrass prairie and deciduous trees in loess, glacial till or alluvial deposits. The decomposition of the deeply penetrating, fibrous root systems of grasses and forbs (herbaceous plants that are not grasses) over many centuries produced the rich, black organic soils characteristic of tallgrass prairie. Soils formed under deciduous trees are generally lighter in color and more acidic than soils formed under tallgrass prairie. Over 60 soil series have been identified by the U.S. Department of Agriculture Soil Conservation Service (SCS) as occurring on the Refuge and the surrounding area (*Soil Survey of Jasper County, Iowa,* issued March 1979). The SCS has evaluated these soils in terms of their physical characteristics and suitability for agriculture and other land uses. This information was used in the master planning process to identify portions of the Refuge best suited to accommodate various types of habitats and facilities. Soil factors mapped based upon SCS information included hydric soils, agricultural land capability, several factors related to erosion, native vegetation types under which soils were formed, depth to seasonal high water table, potential wetland, shallow water and wildlife habitat, shrink/swell potential, average crop yields, and suitability for structures, septic tank absorption fields, and other facilities. Information collected regarding several of these factors is summarized below.

Erosion Potential

According to the SCS, approximately 60 percent of the soils on the Refuge are subject to moderate erosion (see Map 3). These soils are located on valley slopes, which are subject to water erosion, and on flatter ridgetops, which are more prone to wind erosion. Soils eroded from valley slopes are washed down into the valley bottoms of Walnut Creek and its tributaries, which have minor erosion potential. The exposure of bare ground to wind and water action under agriculture can accelerate the process of erosion. Agricultural development during the last 150 years may have resulted in the erosion of up to five to six feet of topsoil from some uplands to valley bottoms, thus accounting for the thin and weakly developed soil profiles currently encountered in upland areas.[1] Such accelerated erosion can be halted through vegetative stabilization of erosion-prone soils, as provided by interim cover or establishment of reconstructed habitats.

1 Malcolm Pirnie, inc., *Walnut Creek National Wildlife Refuge Cultural Resource Investigation,* December 1991, pp. 7-5 to 7-6

Map 3.



Source: U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Jasper County, Iowa, 1979.

Current Erosion Status of Soils

Minor Erosion

Moderate Erosion

Severe Erosion

Refuge Boundary

100 acres
40
10

NORTH

0 1000 3000 5000 Ft.

Native Vegetation Suitability

For master planning purposes, the presence of soil formed under a particular native vegetation type is a good indication that the soil is suitable for re-establishment of that vegetation type. SCS information provides a basis for estimating the historic extent of native habitat types on the Walnut Creek National Wildlife Refuge. Based upon interpretation of the SCS data, the majority of Refuge soils were formed under tallgrass prairie (approximately 62 percent) and oak savanna (approximately 36 percent). A much smaller portion of the Refuge (less than 2 percent) formed under deciduous woodlands. The general location of the native vegetation types under which Refuge soils were formed are illustrated in Map 4.

Development Suitability

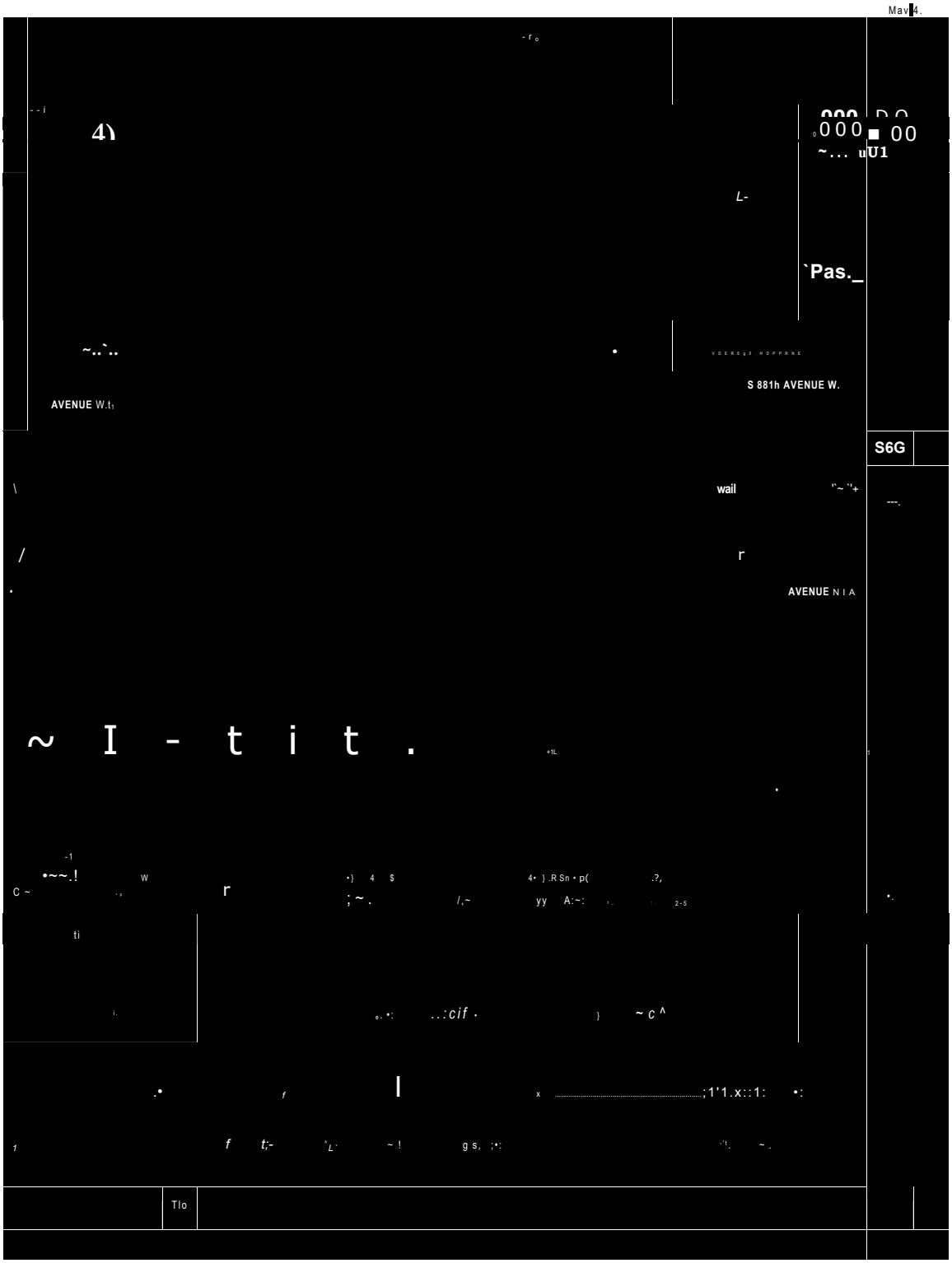
According to the SCS, most of the Refuge soils are characterized by moderate to severe limitations for septic drainfields, sewage lagoons, and local roads and streets. A composite measure of suitability for structures was developed using SCS soil rankings for septic tank absorption fields, shrink-swell potential,[2] and bearing strength based upon American Association of State Highway and Transportation Officials (AASHTO) criteria. Based upon this evaluation, areas suitable for development (i.e., without severe limitations for construction of buildings, roads, and other facilities) are distributed throughout the Refuge. A significant portion of the Refuge is characterized by severe limitations for the development of such facilities. Such constraints can frequently be overcome by proper engineering design; however, this can increase the costs of construction.

Septic **Suitability** Public sewer service is not available within the Refuge. Because of several factors including slow permeability, steep slopes, and/or a seasonal high water table, the majority of soils on the Refuge with the exception of the northwest portion are characterized by severe limitations for septic tank absorption fields. Therefore, opportunities for wastewater disposal from major facilities such as the Visitor Center and Environmental Education Building by means of an on-site septic system are limited. As an alternative to an on-site septic system, a package treatment plant discharging into Walnut Creek or one of its tributaries could be constructed in compliance with applicable state water quality standards.

PHYSIOGRAPHY

The Refuge landscape has been molded by the erosive activities of Walnut Creek and its tributaries, consisting of steeply rolling hills interspersed with generally level upland divides and valley bottoms. Elevations within the Refuge range from a low of approximately 785 feet above mean sea level along Walnut Creek near the southern boundary of the Refuge to a high of approximately 930 feet above mean sea level at several locations on the ridgetops that occur at the periphery of the Refuge.

2 "Shrink-swell" potential refers to the extent to which a soil shrinks as it dries out or swells when it gets wet. Soils with a high shrink-swell potential, which typically have a high clay content, may damage building foundations, roads, and other structures.



Source: U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey o*

Native Vegetation Based on Soils

Prairie

Savanna

Refuge Boundary

100 acres

40 10

NORTH

0 1000 3000 5000 Ft.

The slope of the land affects a number of resource factors, including soil formation, drainage, runoff, erosion, microclimate, and suitability for agriculture and other land uses. The majority of the Refuge consists of relatively level 0 to 5 percent slopes (approximately 43 percent) and gently sloping 5 to 9 percent slopes (approximately 41 percent). Approximately 15 percent of the Refuge consists of moderately to steeply sloping land (10 to 20 percent slopes). These slopes, which are associated with stream valleys, tend to face east or west along Walnut Creek and north or south along its tributaries. In general, development of buildings and other facilities should be directed away from steeply sloping areas to more suitable locations characterized by level to moderate slopes.

CLIMATE

The climate of central Iowa, classified as humid continental, is characterized by warm, humid summers and cold, relatively dry winters. Approximately 70 percent of the average annual rainfall (32 inches in Jasper County) falls between April and September. The amount of rainfall is the primary factor in the historic dominance of tallgrass prairie in the region: drier areas to the west - from Oklahoma and the Dakotas to the Rocky Mountains - support midgrass or shortgrass prairie depending upon the quantity of precipitation, while deciduous forest is the native vegetation typically occurring in moister regions to the east. In the post-settlement period, the relative abundance of rainfall during the growing season has provided favorable conditions for the production of corn and other agricultural crops.

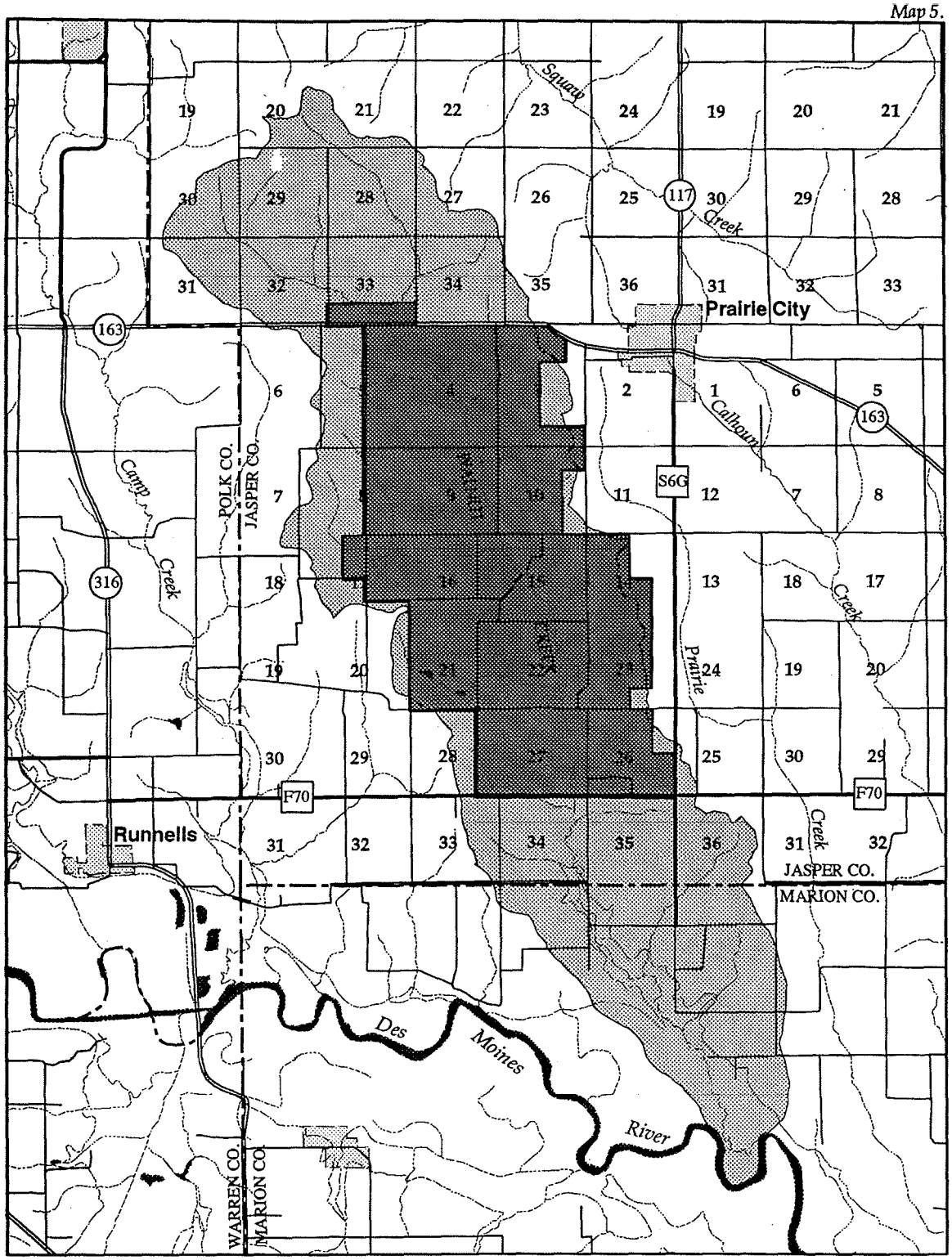
Prevailing winds in the region are from the northwest in the winter and from the southwest in the summer. For the purposes of the Master Plan, south-facing slopes which provide solar exposure and protection from winter winds are preferred sites for buildings such as the Visitor Center.

WATER RESOURCES

The Refuge is located almost entirely within the Walnut Creek watershed, which lies within the Des Moines River drainage basin (Map 5). From its headwaters located two to three miles north of Highway 163, Walnut Creek flows south approximately 10 miles to its confluence with the Des Moines River just northwest of the Red Rock Reservoir. The approximately 6.5-mile stretch of Walnut Creek within the Refuge boundary bisects the Refuge from north to south, and is fed by numerous tributary streams which generally flow in an east-west direction.

The Fish and Wildlife Service conducted studies of the existing hydrology and water quality of Walnut Creek in 1991. Stream flows within Walnut Creek increase substantially from north to south, with flows in the southern portion of the Refuge (adjacent to South 112th Avenue West) averaging about three times greater than flows in the northern portion of the Refuge adjacent to Highway

Map 5.



Source: Topography from U.S.G.S. 7.5 minute quadrangles.

Walnut Creek Watershed

Walnut Creek National Wildlife Refuge

Walnut Creek Watershed Jasper

18 County Section Numbers

0 .5 1.5 2.5 miles

163. In 1991, flows were greatest in the spring following heavy rains and decreased throughout the summer, a flow regime considered to be typical of conditions in the watershed. Water quality within Walnut Creek and its tributaries was found to be generally good, with conditions similar to those exhibited on other small central Iowa streams.

Walnut Creek and its tributaries are natural features of prime importance to the master planning process. These resources provide opportunities for the development of water-dependent habitats and facilities such as lowland tallgrass prairie, wetlands, and open water impoundments which will increase the biological diversity of the reconstructed Refuge landscape. At the same time, buildings, roads, and other facilities should be sited to avoid and minimize adverse impacts to streams and adjacent wetlands and floodplains.

Wetlands

Wetlands are transitional areas between upland and open water where the water table is at or near the ground surface or the land is periodically covered by shallow water supporting particular types of vegetation. Wetlands, which are protected by federal and state regulations, serve important environmental functions such as pollution prevention, attenuation of flooding, groundwater recharge, and provision of wildlife habitat. The Fish and Wildlife Service National Wetland Inventory (NWI) maps identify six types of wetlands totalling approximately 215 acres which occur on the Refuge. The majority of these wetlands, which are generally concentrated along Walnut Creek and its tributaries, consist of forest dominated by tree species such as red elm, silver maple, and black willow and marsh dominated by herbaceous species such as reed canary grass, prairie cord grass, sedges, and rushes.

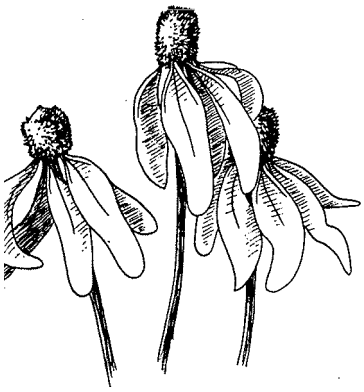
Federal regulations and Fish and Wildlife Service policy require the Service to take actions to avoid and minimize impacts to wetlands in the development of facilities such as buildings, roads, and open water impoundments. Unavoidable wetland impacts must be mitigated for through the creation of in-kind, on-site wetlands to replace wetlands lost with resources of equivalent biological value. Potential impacts to wetlands as defined by the NWI maps were taken into consideration in the development of the Preferred Master Plan Alternative. On-site delineation of wetlands in accordance with applicable federal and state wetland regulations will be undertaken prior to final design of the facilities in order to determine the extent of wetlands affected and mitigation required to compensate for unavoidable impacts.

Floodplains

Floodplains are located adjacent to streams and other water bodies, where they serve the essential purpose of holding and carrying excess water runoff resulting from heavy precipitation. The 100-year floodplain is defined as the area which has the statistical

probability of flooding once every 100 years. Federal policy requires the Fish and Wildlife Service to take action to avoid impacting the 100-year floodplain in the development of facilities unless that location is the only practicable alternative for the proposed action. The 100-year floodplain has been delineated for Walnut Creek and its major tributaries, and potential impacts to this resource taken into consideration in the development of the Master Plan.

VEGETATION



Yellow Coneflower

The vegetative communities occurring on the Refuge in the early 1800's were characteristic of the pre-settlement Iowa landscape, consisting of tallgrass prairie on the upland divides, a mixture of tallgrass prairie and oak savanna on the intermediate elevations between the upland divides and valley bottoms, and a mixture of tallgrass prairie, oak savanna, and riparian forest along the valley bottoms. This vegetative pattern was maintained by environmental factors such as climate, topography and hydrology combined with the effects of fire, either caused naturally by lightning or deliberately set by humans. Fire was an important factor in the ecology of tallgrass prairie, relieving it of litter build-up and suppressing the growth of woody vegetation.

The dominant grass of the tallgrass prairie, big bluestem, can reach heights of well over six feet. Other characteristic tall prairie grasses include Indian grass, switch grass, prairie cord grass on wetter sites, and little bluestem, sideoats grama, and tall dropseed on drier sites. A variety of forbs occur in the tallgrass prairie and provide a continuous display of flowers with rich variety in color and shape from early spring to late fall.

Historic Vegetation of Walnut Creek

The original vegetation of the Refuge has been largely replaced by agricultural cover types including cropland, which occupies approximately 69 percent of the Refuge landscape, and grazed

pasture, which occupies approximately 17 percent of the Refuge. In addition, some agricultural land (approximately 7.5 percent of the Refuge) has been converted to grassland dominated by brome under the federal Conservation Reserve Program (CRP). Other anthropogenic communities resulting from post-settlement disturbance such as plantings, escape from cultivation, or volunteer species in areas altered by humans, occupy portions of the Refuge.

Anthropogenic Communities[3]

Examples of non-agricultural anthropogenic communities on the Refuge include scrub woods, reed canary grass wetlands, and' ponds. Scrub woods, which are characterized by an open overstory of young trees and an understory of weedy herbaceous species and shrubs, are commonly found in areas modified by agricultural practices, such as abandoned fields and along fencerows and gullies formed in erodible soils. Reed canary grass wetlands are commonly found in floodplain depressions and along waterways. These wetlands are inhabited by populations of probable non-native origin, originally planted for pasture and erosion control, which occur in near monoculture conditions to the exclusion of native species. Therefore, they represent a liability for future reconstruction activities.

Existing ponds on the Refuge are water impoundments created as a water source for livestock or for soil erosion control purposes. These ponds are characterized by the presence of submergent or emergent aquatic plant species as well as herbaceous species along their edges. Although some ponds are silted in and abandoned, they continue to function as a source of water and cover for wildlife.

Native Communities

Remnant native communities, which are assemblages of native plant species resembling pre-settlement prairie, savanna, and forest communities, occur in portions of the Refuge, mostly on valley slopes and bottoms associated with Walnut Creek and its tributaries. In general, the native communities occurring on the Refuge are in a degraded condition as evidenced by a lack of native species diversity and/or the presence of non-native plants. Nevertheless, they are considered highly valuable because of their use as wildlife habitat and their great potential to serve as seed sources and focal points for native community reconstruction/ restoration. Based upon a study undertaken by the Fish and Wildlife Service in 1991, the following general categories of native communities occur on the Refuge: prairie (including remnant prairie and prairie populations in brome), savanna, forest, and wetland (see

a Anthropogenic communities are plant communities resulting from the influence of human beings on the natural environment. On the Refuge, these communities are considered to include agricultural cover types and non-agricultural cover types dominated by non-native species, native species of non-native ecotype, or by volunteer native species unrepresentative of a natural community.

Map 6). Native communities of particular significance to the reconstruction/restoration process include prairie, which occurs on several small sites in the central portion of the Refuge, and two types of savanna (oak savanna and shrub savanna).

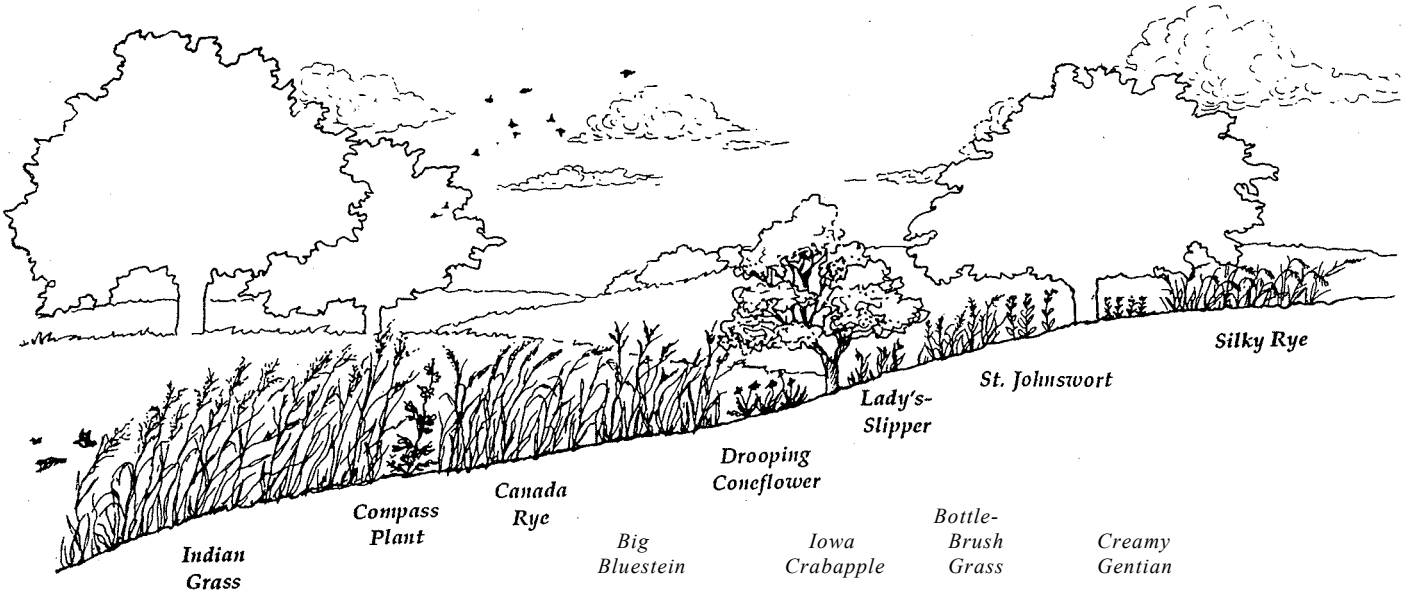
Existing Prairie

Existing prairie sites on the Refuge, which total approximately 24 acres in size, are in a highly disturbed condition and are not typical of the tallgrass prairie which once dominated the landscape. Major prairie grasses such as big bluestem, Indian grass, switch grass, and little bluestem are absent or occur infrequently on these sites. Two types of prairie are present. "Type A" prairies, which occur on sites with thin to absent topsoil and sandy, gravelly subsoil, possibly indicating mechanized disturbance, are characterized by a relatively low diversity but high density of prairie species. "Type B" prairies are characterized by a relatively high diversity of prairie species (especially forbs) occurring in a matrix of non-native grass (brome).

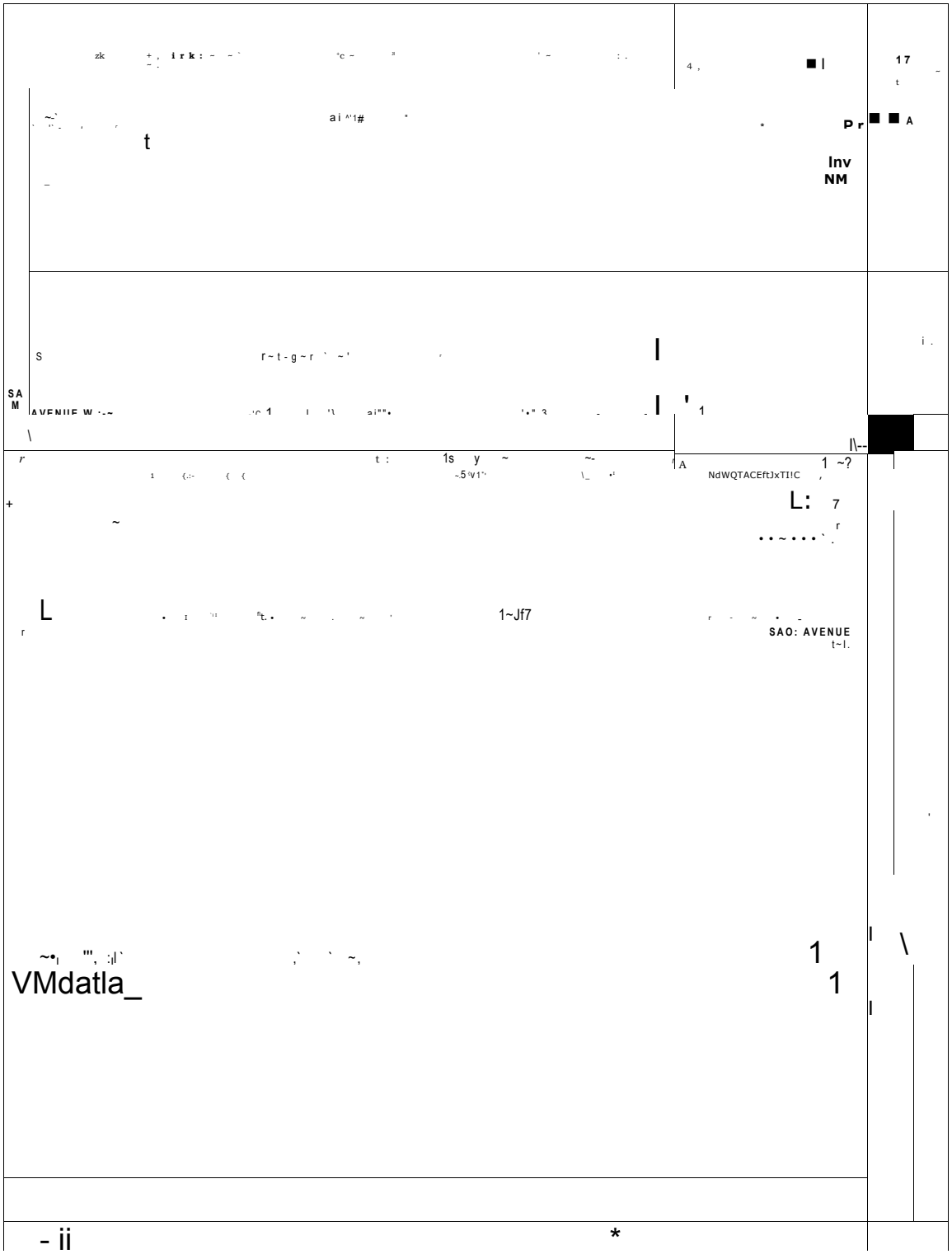
Prairie populations in brome are areas of CRP grassland dominated by brome with prairie plants present. These areas are more extensive than the remnant native prairie communities, occupying approximately 509 acres.

Existing Savanna

Existing savanna, which consists of scattered oaks or other trees growing with an open herbaceous understory, occurs on uplands or upland slopes, particularly in the southern portion of the Refuge. Three types of savanna (oak savanna, shrub savanna, and open woods) occur on the Refuge. Oak savanna is characterized by the presence of large bur oaks, often three to four feet in diameter,



Typical Oak Savanna



Source: Compass Plant Consultants, "Walnut Creek National Wildlife Refuge Native Community Assessment", October 1991.

Remnant Native Vegetation

Prairie /
Prairie Plants in Brome

Savanna

Wetland

Anthropogenic Communities
and Agriculture

Refuge Boundary

100 acres
40
10

0 1000 3000 5000 Ft.

which originally grew in open conditions unimpeded by neighboring trees. Approximately 145 acres of this community type occur on the Refuge. The impact of fire suppression on oak savanna is indicated by the presence of invasive trees and shrubs and the relatively low diversity of native prairie or savanna herbaceous species. Shrub savanna, which occurs on disturbed sites with thin to absent topsoil and sandy, gravelly clay subsoil, is characterized by a high diversity of native savanna shrubs and herbaceous prairie species. Bur oaks and other large trees are absent or occur infrequently in this community type, which ' occupies approximately 61 acres. Open woods are dominated by open-grown or somewhat open-grown bur oak and other tree species two feet or less in diameter. Heavily impacted by grazing, this community type occurs on approximately 169 acres.

Existing Forest

Two types of native forest communities (mesic wooded slope and floodplain woods) occur on the Refuge. Mesic wooded slope is found on slopes associated with ravines and streams in the southern portion of the Refuge, while floodplain woods occur on floodplains and flat areas adjacent to Walnut Creek and its major tributaries. These community types total approximately 87 acres and 114 acres, respectively.

Existing Wetland

Two general types of native vegetated wetland communities currently occur on the Refuge. Prairie wetlands, dominated by hydric grasses and herbaceous plants such as prairie cordgrass, rushes, and sedges, occur on approximately 66 acres located in riparian corridors and upland drainageways and seeps. Savanna wetlands are characterized by an open overstory of woody plants such as elderberry, cottonwood, and black willow growing over a ground layer comprised of herbaceous wetland plants. This community type is found on approximately 41 acres located at the confluences of Walnut Creek and its major tributaries.

WILDLIFE

An analysis of existing birds, mammals, fish, reptiles, and amphibians likely to occur on the Refuge was conducted by the Fish and Wildlife Service in 1991. Based upon this analysis, at least 174 species of breeding (both summer and permanent resident), migratory, and winter resident bird species are likely to occur on the Refuge. Permanent residents include red-tailed hawk, American kestrel, gray partridge, and ring-necked pheasant. White-tailed deer, eastern cottontail, red fox, coyote, and raccoon are among the most visible of the approximately 40 species of mammals likely to occur on the Refuge. In addition, it is estimated that some 43 species of fish, 19 species of reptiles, and 9 species of amphibians probably occur on the Refuge.

Habitats

The existing wildlife population of the Refuge reflects its current land use pattern dominated by cropland, grazed pasture, CRP grassland, and farmsteads interspersed with remnant native plant

communities. The Refuge's forested communities (savanna, mesic wooded slope, and floodplain woods) currently sustain the greatest number of wildlife species. Also supporting relatively diverse wildlife populations are open water (streams and farm ponds), which provide habitat for waterfowl and a number of fish, amphibian, and reptile species, and farmsteads, which are attractive to opportunistic and non-native species such as rock dove, European starling, and house sparrow. The Refuge's agricultural fields sustain a relatively low number of species and thus are considered to have a relatively low habitat value in terms of the diversity of wildlife species supported. Although some wildlife take advantage of the food supply provided by cropland, agricultural practices and the elimination of suitable habitat have resulted in a decline or elimination of native grassland species which formerly inhabited the Refuge landscape. Extirpated native species include two large mammals, the bison and American elk, which disappeared from the wild in Iowa in the nineteenth century.

Bison will be reintroduced to the Refuge.

Rare, Threatened, and Endangered Species

No occurrences of federally or state listed rare (species of special concern), threatened, or endangered species have been documented at the Walnut Creek National Wildlife Refuge. However, based on the 1991 wildlife survey conducted by the Fish and Wildlife Service, several federal and state listed species are likely to occur on the Refuge. Indiana bat, listed as both state and federally endangered, is known to use wooded riparian sites in adjacent counties and thus could potentially occur in riparian areas in the southern part of the Refuge. In addition, two bird species listed as state and federally endangered (peregrine falcon and bald eagle), three bird species listed by the state of Iowa as endangered (northern harrier, Cooper's hawk, and short-eared owl), and one bird species listed by the state as threatened (long-eared owl) have been identified as likely migrants or winter residents of the Refuge.

LAND USE AND ZONING

The existing land use on the Refuge and the adjacent area is predominantly agricultural, consisting of scattered farmsteads surrounded by cropland, grazed pasture, and CRP grassland. Almost 90 percent of the land within the Refuge boundary is devoted to these uses. Prairie City, a town with 1,360 inhabitants, is located on Highway 163 approximately one-half mile east of the northeast boundary of the Refuge. According to the Jasper County Zoning Map, most of the land within the Refuge boundary is zoned Agricultural District (A-1) with the exception of land along Walnut Creek and several of its tributaries, which is zoned Floodplain (F-1).

)WNERSHIP

As authorized by the Fish and Wildlife Service on September 5, 1990, the Walnut Creek National Wildlife Refuge is comprised of approximately 8,654 acres in 92 separate parcels. Twenty-eight of these parcels totalling approximately 4,000 acres had been acquired by the Fish and Wildlife Service through a willing seller program as of April 1992 (please refer to Map 2). The remaining 64 parcels, totalling approximately 4,654 acres, are in private ownership held by sixty landowners. The Service proposes to acquire this property through a willing seller program based upon priorities designed to facilitate the timely acquisition of those areas of most importance to Refuge objectives.

The current and future ownership of Refuge lands is of obvious significance to the implementation of the Refuge Master Plan. Although the Master Plan assumes Fish and Wildlife Service ownership of all land within the Refuge boundary, Refuge facilities and habitats will be developed in phases on land acquired through a willing seller program. Priorities for phasing of Master Plan facilities are discussed in Chapter 5.

)CIALIECONOMIC DNDITIONS

As part of an economic impact evaluation undertaken by the Fish and Wildlife Service, the resident market likely to be served by the Walnut Creek National Wildlife Refuge was estimated. This market consists of a primary (local) market extending up to about a 50-mile radius from Prairie City, and a secondary (regional) market extending between a 50-mile and 100-mile radius from Prairie City. Population within the defined local market is projected to increase slightly from approximately 666,000 persons in 1990 to approximately 680,000 persons in the year 2000, while population within the defined regional market is projected to decline from approximately 704,000 persons in 1990 to approximately 657,000 persons in the year 2000. In aggregate, the resident market is projected to decrease by approximately three percent between 1990 and the year 2000, from 1,370,000 to 1,337,000 persons.

Jasper County has a fairly diverse employment base. In 1980, approximately 25 percent of residents employed in manufacturing industries, 21 percent in retail and wholesale trade industries, and 13 percent in farming and agricultural services. The County's future employment is expected to reflect the continued national transition to a service economy. The service and finance, insurance, and real estate sectors are projected to increase in employment by approximately 49 percent and 77 percent, respectively, between 1980 and 2010, while the farming, mining, and construction industries are expected to decrease in employment by approximately 31 percent, 25 percent, and 22 percent, respectively, during the same period. Agriculture and livestock production are Jasper County's leading industries in terms of the value of goods produced.

Economic Impacts

The economic impacts of the Refuge on the local community are largely related to the removal of existing farmland from production, which will result in a reduction in agricultural output and employment. In addition, the conversion of privately-owned land to the public domain will result in a loss in property tax revenues. This loss will be partially offset by payments by the federal government to Jasper County under the Refuge Revenue Sharing Act. On the positive side, it is expected that operation of the Refuge will provide employment and generate spending on materials, supplies and services within the local community, and that . expenditures by Refuge visitors will contribute to the local and regional economies.

TRANSPORTATION

The existing roadway system within the Refuge and surrounding area reflects the pattern of roads found throughout rural Iowa, generally consisting of roadways laid out in a rectangular grid pattern following agricultural field boundaries. Primary roads carrying relatively heavy volumes of regional traffic include Highway 163, which runs east-west along the northern boundary of the Refuge, and Highway 117, which runs north-south to the north of Prairie City. Paved secondary roads in the project vicinity include Route S6G, which runs north-south to the east of the Refuge and south of Prairie City, and Highway F70, which runs east-west along the southern boundary of the Refuge. Other roadways within and adjacent to the Refuge boundary are gravel surfaced. Included are two roadways classified as farm-to-market roads: South 96th Avenue West, an east-west road which bisects the Refuge, and West 129th Street South, a north-south road located along the western boundary of the Refuge. The remaining local roads in the project vicinity serve abutting farmsteads and other residences.

The Iowa Department of Transportation (IDOT) is currently widening and realigning portions of Highway 163 in order to separate local and regional traffic and improve safety conditions. The improvements include widening the portion of the highway bordering the Refuge from two to four lanes, and constructing a bypass which will run to the south of Prairie City. A grade-separated interchange is planned at the intersection of the bypass with West 109th Street South, a north-south gravel road which runs along the eastern boundary of the Refuge.

For the purposes of the Master Plan, construction of the IDOT bypass and interchange on West 109th Street South provides an opportunity for relatively direct access to Prairie City, points east and west (including Des Moines) via Highway 163, and points north (including Interstate 80) via old Highway 163 and Highway 117. Therefore, access to the. Refuge is proposed via a new roadway constructed from the intersection of West 109th Street South with the new Highway 163 bypass. South 96th Avenue West and West 129th Street South will remain open for farm-related and other local

traffic. Local roads within the Refuge boundary which are no longer required for public access or Refuge purposes can be closed following approval by Jasper County. The Service will request that Jasper County close these roadways in order to provide contiguous habitat areas, facilitate the movement of wildlife, and minimize the occurrence of visually incompatible elements in the reconstructed Refuge landscape.

VISUAL RESOURCES

The existing visual character of the Walnut Creek National Wildlife Refuge is defined by its rolling topography consisting of alternating ridgetops and stream valleys and its predominantly open, agricultural cover (cropland, pasture, and CRP grassland). Significant natural visual features include Walnut Creek, which changes from an intermittent stream in the northern part of the Refuge to a more substantial watercourse towards F70, and trees which occur in copses or narrow bands along Walnut Creek and tributary streams, or as isolated specimens in old fields or on farmsteads. Human-made visual features include the gravel roads lined by utility poles which dissect the Refuge on a north-south, east-west grid, and the farmhouses, barns, silos, and other buildings associated with the farmsteads scattered throughout the Refuge.

Existing Refuge Landscape

The Refuge landscape can be divided into five distinct visual "landscape units" based upon topography and vegetative cover:

- *Flat, open plateau:* This landscape unit occurs at relatively high elevations (generally greater than 900 feet above mean

sea level) on the ridgetops between stream valleys at the periphery of the Refuge. The predominant vegetative cover is cropland.

- ***Rolling, open:*** This landscape unit consists of gently to steeply sloping land occurring at intermediate elevations (generally between 800 and 900 feet above mean sea level) on the sides of stream valleys throughout the Refuge. The predominant vegetative cover is cropland, grazed pasture, or CRP grassland.

- *Rolling, enclosed:* This landscape unit is similar to the rolling, open unit, except that the primary vegetative cover is wooded (e.g., savanna).

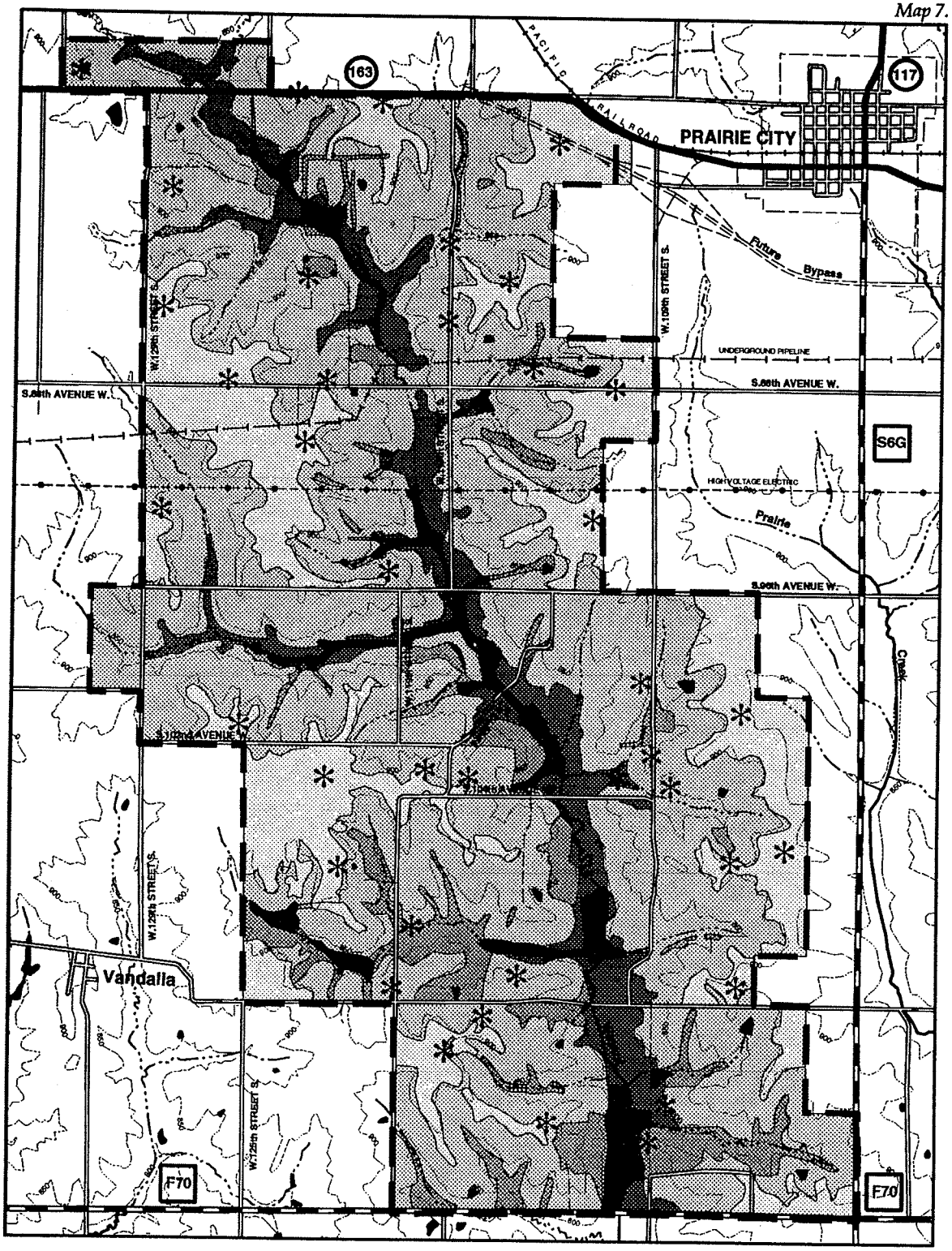
- ***Flat, open bottom:*** This landscape unit consists of flat land at relatively low elevations (generally between 800 and 900 feet above mean sea level) along Walnut Creek and several of its major tributaries. The predominant vegetative cover is cropland or other open vegetation.

- *Flat, enclosed bottom:* This landscape unit is similar to the flat, open bottom unit, except that the primary vegetative cover is wooded (floodplain woods, riparian woods, etc.).

The visual units which comprise the Refuge landscape, delineated in Map 7, represent a significant resource which can be used in planning the location of Refuge facilities such as the Visitor Center, tour route, and trail system. High points located on flat, open plateau are potential viewing points for visitors to enjoy panoramic views across the reconstructed Refuge landscape. The other landscape units ranging from undulating slopes to flat valley bottoms offer the potential for a variety of shorter range views partially or totally enclosed by topography and/or vegetation. The tour route and trails can thus be sited to afford the Refuge visitor a changing sequence of views of the reconstructed tallgrass prairie/savanna landscape. The "visual compartments" defined by ridgelines can be used in siting Refuge facilities so as not to be visually obtrusive when viewed from overlooks and trails, and to provide the visitor with a sense of being visually immersed within the reconstructed Refuge landscape.

Existing human-made visual elements such as the grid-like roads, agricultural fields, utility poles, and buildings are for the most part incompatible with the desired visual character of the reconstructed landscape and should be appropriately screened or removed to minimize their visual impact where no longer needed for Refuge purposes and subject to appropriate approvals.

Map 7.



Source: Wallace Roberts & Todd, 1991.

Visual Resources

- Flat, Open Plateau
- Rolling, Open
- Rolling, Enclosed
- Flat, Open Bottom
- Flat, Enclosed Bottom
- * Significant Viewpoints
- Refuge Boundary

100 acres
40
10

NORTH

0 1000 3000 5000 Ft.

PUBLIC USE

Public use programs planned for the Walnut Creek National Wildlife Refuge include environmental education, interpretation, and wildlife/wildlands-oriented recreation. The centerpiece of these programs will be the historic tallgrass prairie/savanna landscape as represented by over 7,000 acres of reconstructed native habitats, making the Refuge unique among public use facilities in Iowa.

The Refuge is located within the boundary of the Des Moines Recreational River and Greenbelt, an open space corridor along the Des Moines River. Authorized in August 1985, the purpose of the Greenbelt is "to coordinate existing and future Federal, State, and local recreational and environmental enhancement projects by linking them collectively to maximize the attraction of recreation use and economic development.[i4]

Environmental **Education**

Environmental education (EE) programs currently offered in Iowa range from federally-provided programs at National Monuments and Wildlife Refuges, to local programs run by school districts, County Conservation Boards, and private conservation organizations. EE facilities offering overnight accommodations include the Springbrook Conservation Education Center, located an hour's drive west of Des Moines, and 37 camps run by a variety of organizations which provide some overnight educational programs for schools. The Jasper and Polk County Conservation Boards provide programs for students including both classroom and field **activities.**

The focus of the Walnut Creek National Wildlife Refuge EE program on the reconstruction of native tallgrass prairie and savanna will serve to complement existing programs and enhance EE opportunities available in the region. The master planning process concluded that overnight accommodations will not be provided in conjunction with the EE program. Based upon a study undertaken by the Iowa Department of Natural Resources analyzing existing facilities and user groups, construction of an overnight EE facility in eastern Iowa is not justified .[5]

Recreation

Existing public parks near the Refuge include the Prairie City Park, a small recreational facility located in Prairie City, and the Vandalia Forest and Wildlife Management Area, an undeveloped natural area located near the southwestern portion of the Refuge. Lake Red Rock, a multiple use flood control and recreational facility managed by the USCOE, is located approximately eight miles southeast of the

[4] U.S. Army Corps of Engineers, *General Design Memorandum: Des Moines Recreational River and Greenbelt, Des Moines River, Iowa,* September 1987, executive summary

[5] Iowa Department of Natural Resources, *Feasibility Assessment for a Residential Environmental Education Center in Eastern Iowa,* November 1991

Refuge. Robert's Creek County Park, Elk Rock State Park, and various other recreational facilities are located in the vicinity of Lake Red Rock. A variety of wildlife and non-wildlife oriented recreational opportunities are available at Lake Red Rock and adjacent facilities, including horseback trail riding, boating, swimming, hunting, fishing, hiking, camping, and picnicking.

The wildlife and wildlands-oriented recreational opportunities provided under the preferred Refuge program will complement the activities available at existing recreational facilities in the region. The Refuge will contribute to implementing the Des Moines Recreational River and Greenbelt, and provides an opportunity for a trail linkage southward along Walnut Creek to Lake Red Rock.

:ULTURAL ZESOURCES

The Walnut Creek watershed has a long history of use by humans, with evidence indicating that Native Americans may have used the area for hunting and gathering for ten millennia or more. The area was first settled by Euro-Americans in the 1840's. Over the ensuing decades, the landscape was converted from tallgrass prairie, savanna and forest to cropland and pasture.

In 1991, the Fish and Wildlife Service sponsored a study of archaeological, historic, and architectural resources within the Refuge in order to determine the presence of sites listed or potentially eligible for listing on the National Register of Historic Places. The results of this study have been coordinated with the State Historic Preservation Officer. Cultural resources identified included seven archaeological sites as well as two Native American burial locations and one Native American camping area noted in the historic literature as being present on the Refuge. In addition, two soil groups were identified that are of interest because of their potential for harboring archaeological resources.

None of the cultural resources identified were determined to be listed or potentially eligible for listing on the National Register of Historic Places. However, the presence of archaeological sites or archaeologically significant soils was taken into consideration in the development of the Master Plan.

TTILITIES

Residences within the Refuge boundary are currently provided with rural water, electric, and telephone service. A system of below-ground water mains operated by the Central Iowa Water Association (formerly the Jasper County Water Association) serves the Refuge and the surrounding area, while above-ground electric and above and below-ground telephone wires run along public roads in the area. Public sewer service is provided only within the limits of Prairie City; residences within the Refuge are served by on-site septic systems.

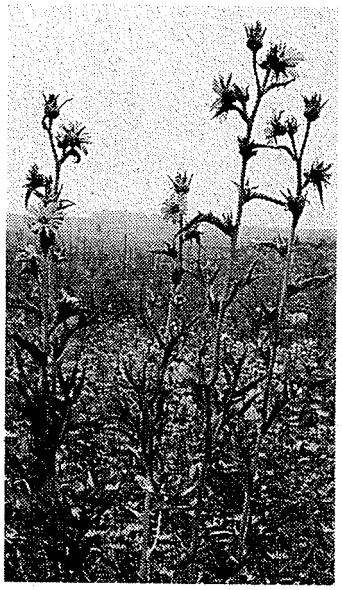
Extension of existing water, electric, and telephone lines can be provided to Refuge facilities without exceeding available capacity or disrupting service to existing customers. As previously noted, wastewater disposal will have to be provided by on-site sewage septic systems or a package treatment plant because public sewer service is not available.

Two utility easements run east-west across the northern part of the Refuge. Iowa Power owns a 100-foot easement for an above-ground electric line, while the Enron Liquids Pipeline Company owns a 50-foot easement for an underground liquid gas pipeline. The locations of these easements were taken into account in the planning of Refuge facilities. A third utility easement, an AT&T fiber optic easement, is associated with the Iowa power easement. The above-ground electric line is visually incompatible with the reconstructed Refuge landscape. Therefore, Refuge visitor facilities should not be located in close proximity to or afforded visual access to this easement.

3. Plan Objectives and Components

"What a thousand acres of Silphiums looked like when they tickled the bellies of the buffalo is a question never again to be answered, and perhaps not even asked."

- Aldo Leopold -



INTRODUCTION

Stiff ***Goldenrod***

The Walnut Creek National Wildlife Refuge and Prairie Learning Center is unique among wildlife refuges in its emphasis on the large-scale restoration/reconstruction of the "sea of waving grass" referred to in the journals of early European travellers. The reconstruction of the historic tallgrass prairie/oak savanna landscape is one of the fundamental purposes of the Refuge and was a guiding factor in developing a program of facilities and activities.

Because of the unique nature of the Walnut Creek National Wildlife Refuge project, an innovative approach was used to develop the Refuge program. Existing native habitats, which now occupy a scant 16 percent of the Refuge landscape, consist primarily of remnant forest communities in a degraded condition along Walnut Creek and its tributaries or scattered prairie plants in a matrix of non-native grasses. The vast majority of the Refuge now consists of cropland, pasture, and other non-native habitats which are the result of over a century and a half of agricultural usage. The program for the Walnut Creek National Wildlife Refuge addresses an opportunity and challenge unprecedented in the National Wildlife Refuge System and other public and private land conservation initiatives. This challenge is to reconstruct thousands of acres of land as a complex community of native plants, animals, and soils resembling the fertile landscape which sustained Native Americans for centuries before the arrival of the first Euro-American settlers.

The central focus of the Refuge program is the reconstruction and restoration of over 8,000 acres of tallgrass prairie and related native habitats. Accordingly, program development began with the definition of the major native habitat "components" to be reconstructed on the Refuge. These are:

- Prairie
- Oak Savanna/Woodland
- Riparian/Wetland

Objectives were set for each component, expressed in terms of acres to be reconstructed and natural communities to be monitored as a measure of the success of habitat reestablishment.

Major Habitat Component)	Existing on Refuge	Proposed Objective	Proposed Restoration	Proposed Reconstruction
Prairie	**725** acres	7,000 acres	725 acres	6,275 acres
Oak Savanna/ Woodland	450 acres	750 acres	450 acres	300 acres
Riparian/ Wetland	220 acres	750 acres	220 acres	530 acres

Summary of Objectives for Major Habitat Components

Following definition of the Major Habitat Components/natural communities, groups likely to be attracted to the Refuge were identified and the interests, needs, and expectations of such target audiences as tourists, recreationists (hikers, hunters, birders, photographers, etc.), and school groups were analyzed. Appropriate environmental education, research, and interpretive facilities and activities were selected based upon the desired user groups, compatibility with the reconstructed habitats, and the extent to which they will contribute to achieving the goals established for the Walnut Creek National Wildlife Refuge and Prairie Learning Center. The Refuge has projected an annual visitation goal of 200,000 people, of which 150,000 are expected to participate in one of the many educational, interpretive, and recreational programs.

This chapter of the Master Plan is divided into two sections that address the composition of the Refuge. These sections describe the primary plan objectives - the Major Habitat Components and the related Facilities and Activities to be provided by the Refuge program. For each proposed facility, the anticipated size based upon projected usage is noted. The proposed locations of the habitat components and facilities within the Refuge were determined based upon an analysis of site conditions and locational criteria developed during the suitability analysis phase of the planning process. These locations are described in Chapter 4.

NATURAL COMMUNITIES

The three Major Habitat Components, which correspond to the natural communities to be reestablished on the Refuge, are intended as a framework to guide reestablishment of the historic tallgrass prairie/oak savanna landscape. Two approaches, reconstruction and restoration, will be used to reestablish each of the natural communities. Reconstruction is required where native vegetation has been completely eliminated and must be replanted. Restoration techniques such as prescribed burning and selective removal and/or

Major Habitat Components are the natural communities to be reestablished on the Refuge.

planting of certain species can be used on remnant native plant communities to enhance and recreate the pre-settlement plant community.

PRAIRIE

Consistent with its preeminence in the pre-settlement landscape, prairie is the largest of the three natural communities to be established at the Refuge. An objective of 7,000 acres has been established for this community. This total includes approximately 6,275 acres to be reconstructed, primarily on agricultural land, and approximately 725 acres of remnant native communities to be restored.

Resource Description/ Typical Species

The native prairie of Iowa was an ecosystem dominated by grasses, in which trees and shrubs played a minor role, and flowering non-grasses referred to as forbs bloomed in vivid succession from spring to fall. To reconstruct this ecosystem, three types of prairie will be established at the Refuge in locations determined by topography, moisture regime, and soil type. These types include mesic prairie, formerly typical of deep, rich, and moist but well-drained soils; xeric or dry prairie, characteristic of drier sites with thin, often sandy or stony soils; and hydric or wet prairie, found in wetter areas with a high groundwater table.

Mesic Prairie

Bobolink** on Big **Bhucsteui

The mesic tallgrass prairie thrived in the rich soils of Iowa prior to Euro-American settlement and is expected to be the dominant type of prairie in the reconstructed Refuge landscape. Vigorously growing grasses such as big bluestem and Indian grass, which can reach head height by late summer, are typical species of this community. Because these warm season plants are still relatively inconspicuous in April and May, carpets of small flowering forbs such as shooting star, prairie phlox, and blue-eyed grass visually dominate the prairie landscape in the spring. During the summer, flowering forbs such as coneflowers, blazing star, black-eyed Susan, and compass plant mix with the emerging grasses to create a luxuriant mosaic of greens accented by bright colors. The late summer and early autumn landscape is marked by the towering seed stalks of big bluestem and other tall grasses, among which are nestled late-flowering forbs such as asters and goldenrods. The rich fall colors of the grasses and distinctive dried stalks and leaves of many of the forbs enliven the mesic prairie during the fall, with many of the plants lingering in the landscape to provide visual interest during the winter.

Xeric Prairie

Because of a characteristically drier environment, the xeric prairie is less luxuriant than the mesic prairie. Typical species of the xeric prairie include mid-grasses such as little bluestem, sideoats grama, and prairie dropseed which typically reach knee height when mature. Like the mesic prairie, the xeric prairie is highly colorful throughout the season. The drier growing conditions which promote early warming of the soil allow the xeric prairie to bloom

earlier in the spring than the other prairie types. Xeric prairie will be established on upland sites with thin or absent topsoil and on other dry sites within the Refuge.

Wet Prairie

The third prairie type, hydric or wet prairie, grows in areas where the water table is high but where soils are not saturated or inundated during the summer. Tall grasses adapted to hydric soil conditions such as cordgrass, switchgrass, and bluejoint grass are typical species of the wet prairie. Because its soils are slow to warm up in the spring, the wet prairie comes into bloom later in the season than the other prairie types. In the summer and fall, the moist soil conditions promote the growth of a diversity of flowering forbs that are different than those that typically occur in the other prairie types.

Within the Walnut Creek National Wildlife Refuge, areas suitable for establishment of wet prairie are mostly confined to riparian corridors, one of the other natural communities. However, some areas suitable for wet prairie occur on upland drainageways and areas of high water table outside of riparian corridors.

Management Prescriptions Methods used to establish and manage prairie communities will vary according to existing vegetation and site conditions. The majority of prairie will be reconstructed "from scratch" by planting seed of local ecotype on former cropland and pasture. Restoration techniques will be used on existing remnant native communities which harbor viable populations of prairie plants, including small prairie tracts and larger areas in which prairie plants occur in a matrix of brome, in order to promote the growth of prairie species and eliminate non-native plants.

Prairie Reconstruction

The prairie reconstruction process will be implemented in stages due to initial limitations in the availability of seed. Staging will allow seed harvested from plots established early in the process to be harvested for use on plots planted in later phases. *These early seed plots must be successful and easily harvested to assure a readily available seed supply.* It is estimated that during the first years of reconstruction, the number of acres to be planted will range between 10 and 50 acres per year because of the limited availability of local ecotype seed. Assuming that a prairie planting will produce seed suitable for use on other plots in four years, the amount of prairie established will begin to increase significantly in the fourth year.

In order to accelerate the reconstruction process, interim grassland consisting of prairie grasses will be planted in the early stages of reconstruction. Based upon the following assumptions, it is estimated that 6,000 acres of prairie can be planted by the thirteenth year of the reconstruction process and that all prairie should be well established by the seventeenth year:

- between 10 and 50 acres of seed from local ecotype sources will be planted each year during the first four years;
- a planting will produce seed in four years;
- one acre of seed will plant four acres of prairie; and
- between 75 and 300 acres of interim grassland will be planted each year during the first six years.

If more seed can be collected for prairie planting in the early stages of development, this schedule could be accelerated assuming that sufficient land, labor, and equipment are available.

Site Preparation: If possible, prairie reconstruction sites should be maintained in agriculture prior to initiating the reconstruction process to help control non-native plant species. Interim grassland to be converted to prairie may be plowed under and cropped for one to several years prior to planting with prairie seed. Other techniques such as a mosaic of interseeded areas may also be used. Site preparation prior to planting of prairie or interim grassland will include removal of fences, certain drainage tile lines, and terraces to restore the natural contour of the land. In addition, most woody plants with the exception of oaks, hickories, and other selected species native to the tallgrass prairie/oak savanna ecosystem should be removed. Elimination of invasive trees and shrubs will simplify the planting process and permit the prairie landscape to become more completely established.

Seed Sources: In order to maintain the genetic integrity of Iowa prairie plants, seed to be used for prairie reconstruction will be obtained from local ecotypes, which are plants found in local remnants of the original pre-settlement prairie? Suitable remnants will be located and arrangements made for seed collection. Care will be taken to confirm that the remnants are derived from the original pre-settlement prairie and are not naturalized plants of non-local ecotypes.

Because large quantities of local ecotype seed will be needed during the early phases of the prairie reconstruction process, a variety of methods of obtaining seed will be implemented. Seed can be hand collected from small prairie remnants confirmed to be of local ecotypes. Students, volunteer groups, and others could be recruited

The following Iowa counties will be considered as a source of seed: Adair, Adams, Appanose, Audubon, an, Boone, Carroll, Cass, Clarke, Dallas, Davis, Decatur, Greene, Guthrie, Henry, Iowa, Jasper, Jefferson, Johnson, :uk, Linn, Lucas, Madison, Mahaska, Marion, Marshall, Monroe, Polk, Poweshiek, Ringgold, Story, Tama, Union, Buren, Wapello, Warren, Washington, and Wayne.

to participate in the hand collection of seed, thus helping to implement the Refuge's environmental education mission.

Evaluating Seed Sources

Because of the large scale of the Walnut Creek National Wildlife Refuge prairie reconstruction project, mechanical harvesting from larger prairie remnants will be necessary. Where feasible and permission granted, collection of seeds will be made from sites in the region including county conservation lands, DNR wildlife areas, and private lands. Although currently limited in number, seed producers are another potential source of seed if demand by the Refuge stimulates more individuals to market local ecotype seed. Such seed producers will be required to certify that their seed has been obtained from remnants of the original pre-settlement prairie.

As reconstructed prairie plots derived from local ecotype seed become established, seed will be harvested from them and used for subsequent reconstruction. As more and more prairie is harvested from the growing number of reconstructed sites, the seed supply will increase exponentially until reconstructed prairie within the Refuge will become the major seed source. It is anticipated that local genotype seed will continue to be collected from prairie remnants throughout the reconstruction project to supplement seed harvested on the Refuge and to enhance genetic diversity.

Seed Mixtures: The seed mixtures used to reconstruct prairie within the Walnut Creek National Wildlife Refuge will vary according to topography, soil type, and moisture conditions. Several different seed mixtures generally corresponding to the major prairie types and adapted to local site conditions will be used. In terms of composition, the communities are commonly described as xeric, mesic and wet but are transitional in nature rather than distinct communities. There is overlap in species composition with some components common to the three types. The table on the following page shows representative species along the continuum that ranges from dry to wet prairie.

The interim grassland seed mixture will consist of two to three grass species from the expanded ecotypic region and a few forbs of local ecotype. Major factors to be considered in selecting species for the interim grassland seed mixture will be ease of establishment and rate of increase in order to establish native cover as quickly as possible without sacrificing the commitment to local ecotypes. The use of interim grassland cover will be related to the difficulty in

Black-Eyed Susan

• MESIC

Grasses:

Big bluestem

Canada wild rye

Indian grass

Forbs:

Compass plant
Wild strawberry
Rosin weed
Prairie phlox
Purple prairie clover
Culver's root Black-eyed Susan
Tick trefoil

Virginia ground cherry
White wild indigo
Heath aster Stiff goldenrod
Flowering spurge
Prairie rose Blue-eyed grass
Round-headed bush clover
Smooth goldenrod

Clammy ground cherry

Little Bluestem

•. XERIC

Grasses:

Little bluestem

June grass
Porcupine grass

Side-oats grama

Forbs:

Lead plant
Wind flower
White prairie clover Pale purple coneflower

Prairie larkspur
Smooth aster
Sky-blue aster
Tickseed

•WET

Grasses:

Cord grass

Switchgrass

Forbs:

Prairie gayfeather
Canada anemone
Cup plant

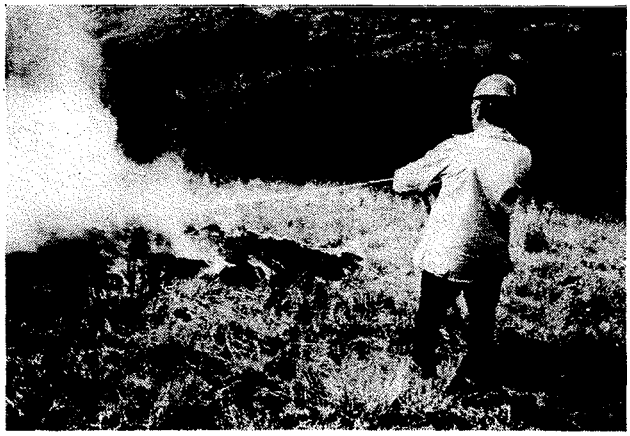
Licorice
Marsh milkweed
Pale spiked lobelia

Note: Composition of prairie communities represents a continuum with some species of grasses and forbs common to the mesic, xeric, and wet communities.

gathering sufficient quantities of local ecotype seed in affordable quantities and reasonable time frames.[3]

Planting Seed: For best results, reconstructed prairie at the Walnut Creek National Wildlife Refuge will be planted in spring. Seeding methods will be selected based on the ability to successfully sow seed in random patterns of species typically found on prairies. These methods could include broadcast seeders, blowers, hydromulchers, drills, and other techniques.

Tallgrass prairie typically grows as a patchwork mosaic rather than as a uniform stand comprised of evenly distributed species. To replicate this growth pattern, different seed mixtures will be planted in different locations determined by soil type and topography. This variation will include use of the major seed mixtures (xeric, mesic, wet) as well as planting of different combinations of seeds in specific locations. This planting method will result in a healthy diversity which is expected to foster development of a stable reconstructed prairie ecosystem.



Prescribed Burning

Management: Management of the reconstructed prairie will include an aggressive noxious weed control program using all techniques available to the Fish and Wildlife Service. The primary long-term management tool will be prescribed burning. Fire in reconstructed prairie may be similar to the role of fire in the historic tallgrass prairie/oak savannah ecosystem, helping to control woody and non-native species which are not fire adapted. Fire will accelerate establishment of species diversity and dramatically improve stand vigor. Secondary techniques will include occasional mowing, chemical treatment, or mechanical removal that may be required to control problem species.

Like fire, migratory grazing by large mammals such as bison was a factor in the tallgrass prairie/oak savanna ecosystem. The inclusion of bison and elk in the Refuge program provides a major opportunity to observe, document and study the effects of grazing

[3] Local ecotypes collected from a larger area than that designated for the prairie seed mixtures will be used for interim grassland. The following counties in Iowa and Missouri will be considered as a source of seed for interim grassland: Monona, Crawford, Carroll, Greene, Boone, Story, Marshall, Tama, Benton, Linn, Jones, Cedar, Muscatine, Johnson, Iowa, Poweshiek, Jasper, Polk, Dallas, Guthrie, Audubon, Shelby, Cass, Adair, Madison, Warren, Marion, Mahaska, Keokuk, Washington, Henry, Jefferson, Wapello, Monroe, Lucas, Clarke, Union, Adams, Montgomery, Page, Taylor, Ringgold, Decatur, Wayne, Appanose, Davis, and Van Buren in Iowa, and Worth, Mercer, Putnam, Schuyler, Scotland, Grundy, and Sullivan in Missouri.

t

in a reconstructed prairie landscape. The length of time spent and intensity of bison and elk on specific reconstruction sites will be controlled in order to simulate the effects of migratory grazing.

Prairie Restoration

Because of the relatively few remnants of native prairie, most of the prairie at the Walnut Creek National Wildlife Refuge will be reconstructed. Restored remnants are critical in the development of a healthy prairie ecosystem because they contain important components difficult to introduce to the system (e.g., soil micro-organisms). In addition, these remnants will serve as centers from which the existing diversity of plants and animals they contain can expand. Remnant prairie communities on the Refuge have been heavily impacted by the suppression of fire and agricultural practices. Restoration of these communities will primarily involve providing favorable conditions for native species and eliminating or retarding the expansion of undesirable species such as brome, sweet clover, red elm, gray dogwood, sumac, reed canary grass, and honey locust. Prescribed burning will be the primary management tool used to eliminate non-native plants and stimulate the growth of native prairie species. Girdling or cutting and stump treatment with non-residual herbicide will be used as a mechanism to reduce woody species. Inventories of animal and plant populations will be undertaken and permanent monitoring plots or transects established prior to initiation of active management to facilitate assessment of the restoration process.

n

:ed
lis

and

ing.
ar

Approximately 725 acres of remnant native prairie communities exclusive of prairie wetland (addressed below in the section on the riparian/wetland natural community) exist on the Refuge today (please refer to Map 6 in Chapter 2). These communities include:

to
iich

- Prairie (24 acres)
- Relict prairie in brome (50 acres)
- Colonizing prairie in brome (459 acres)
- Old field (191 acres)

anal
cal

Prairie: Remnant prairie is represented by five small sites located in the northern two-thirds of the Refuge. These sites will be managed to encourage the expansion and seed production of native prairie species and to reduce undesirable or exotic species. Prescribed burning and selective removal of woody plants by girdling or treatment with non-residual herbicide will be the primary management tools for these sites.

as a
ision

.ng

Relict Prairie Populations in Brome: This remnant community is present at 13 erosion-prone sites scattered throughout the Refuge. Prairie species on these sites are often persistent, deep-rooted species which survived conversion of the original tallgrass prairie to agriculture. The recommended management procedure for these sites is prescribed annual burning to. eliminate or reduce brome and

;ed for
nterim
catine,
larion, •,
Page,
huyle[r];

increase the relict prairie species, followed by seeding with a prairie seed mixture. Herbicide treatment may be necessary to eliminate brome if burning is not sufficient.

Colonizing Prairie Populations in Brome: This community is represented by numerous erosion-prone upland sites located throughout the Refuge. The prairie plants present on these sites are early colonizers of relatively low restoration value. Prescribed annual burning followed by seeding with a prairie seed mixture is the recommended management procedure.

Old Field: Old field is found at six sites located primarily in the southern part of the Refuge. The restoration value of these sites is relatively low because they are dominated by early successional native perennial species mixed with annuals and a few alien species. However, they could be used for applied research to compare restoration practices such as burn regimes, over-seeding techniques, and effectiveness of burning and mowing.

OAK SAVANNA/ WOODLAND

In contrast to prairie, the oak savanna/woodland community is distinguished by the presence of trees and savanna grasses and forbs. This category includes oak savanna, which was common in the pre-settlement landscape of the Refuge on slopes between ridgetops and valley bottoms, and a smaller amount of upland woods growing on slopes above valley bottoms.

Management of oak savanna/woodland will be focused primarily on the restoration and expansion of existing remnant communities. An objective of 750 acres has been established for this natural community. This total includes approximately 450 acres of remnant native communities to be restored and approximately 300 acres to be actively reconstructed on the margins of the restored communities (oak savanna) or on north or east facing slopes above riparian corridors (upland woods). Over time, it is expected that the southern portion of the Refuge will evolve into a mixture of tallgrass prairie and oak savanna.

Resource Description/ **Typical Species**

Oak Savanna: Formerly a prominent part of the central Iowa landscape, oak savanna is a distinctive community characterized by the presence of scattered trees growing with an understory of prairie and woodland species in addition to unique savanna species. This community, like prairie, was maintained by the frequent fires that swept the pre-settlement landscape. Bur oak, an important species of the oak savanna, possesses thick, corky bark which provides resistance to fire which would kill less well-adapted woody species.

The historic oak savanna was visually dominated by the wide-branching, open-grown crowns of gnarled oaks. These oaks often grew as scattered groves or in orchard-like patterns. The density of

the tree layer varied according to the moisture content of the soil and relative protection from fire. The density of the tree canopy in turn affected the ground layer, which in open conditions typically consisted of sun-loving grasses and forbs such as prairie clover and goldenrod. Under the light shade produced by more closed canopy conditions, the ground layer included a mix of prairie plants and oak woodland species such as gray dogwood, hazelnuts, and Solomon's seal.

Woodland: Woodland communities in the historic tallgrass prairie/ oak savanna landscape were mainly confined to the moist riparian corridors along rivers and streams. Upland woods, which occurred along protected slopes above lowland woodland found along the valley bottoms, was dominated by such species as basswood and red oak.

!s.

Management Prescriptions Because of the distinctive characteristics of the oak savanna and upland woods habitats as well as dissimilarities in their historic and current distribution on the Refuge, different management strategies will be used for these two communities. Management of oak savanna will be primarily focused on the restoration and expansion of existing remnant sites. Analyses of nineteenth century land surveys and soil survey information indicate that upland woods in the pre-settlement landscape were confined to relatively small areas on the east and north facing slopes of Walnut Creek and its tributaries. Remnant upland woods, which may be similar to current mesic wooded slope communities, are found not in these locations but rather on sites historically occupied by prairie or oak savanna which have been heavily impacted by agricultural practices. Accordingly, management strategies for upland woods will emphasize the restoration of existing remnant communities on a case by case basis, as well as reconstruction of forested communities on selected sites indicated by soil characteristics and historic vegetation information.

s.

ant

ve

Oak Savanna

Approximately 375 acres of upland savanna in the following remnant community types remain on the Refuge:

by

- Oak savanna/prairie
- Shrub savanna/prairie
- Open woods

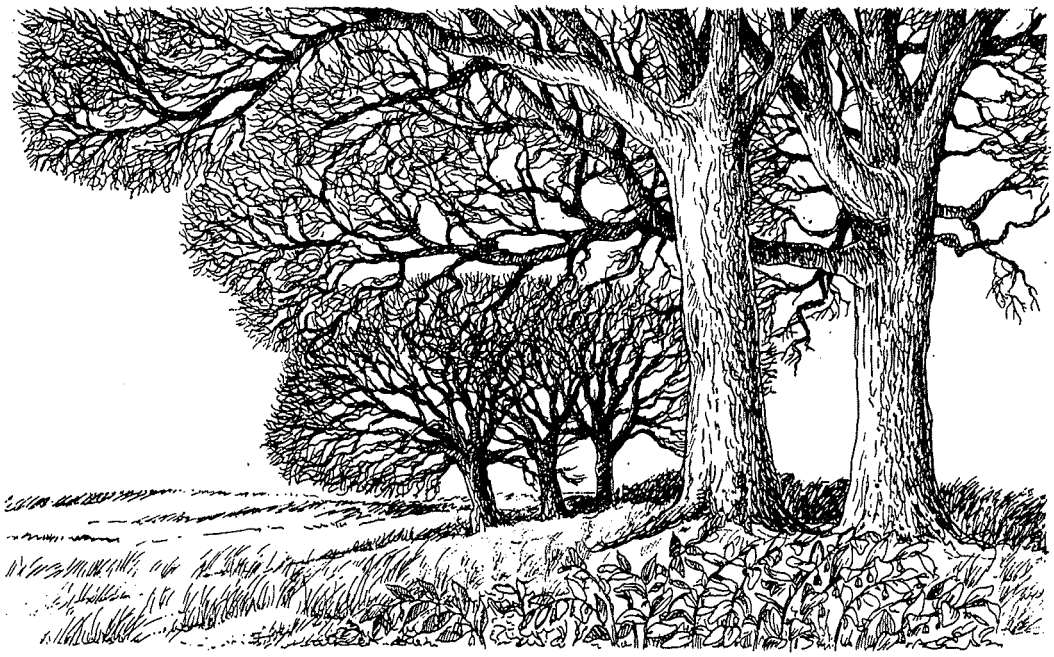
ties.
.es

These communities have been heavily impacted by logging, pesticide use, grazing and fire suppression, which have resulted in invasion by undesirable woody plants and a decrease in the diversity and density of the prairie ground layer which was an important component of the historic oak savanna ecosystem. Therefore, restoration of existing savanna communities will involve the use of fire and chemical or mechanical removal of invasive woody species such as multiflora rose. Reconstruction efforts will

:en
ty of

focus on the expansion of existing communities into adjacent cropland or other suitable areas.

Oak Savanna/Prairie: This community, present at 14 sites in the southern portion of the Refuge, is dominated by large, wide-branching trees, usually bur oaks. The largest of these sites, approximately 45 acres dominated by bur oaks three to four feet in diameter and approximately 100 to 150 years in age, is located on the west side of Walnut Creek between Pacific Street and South 102nd West. The effects of logging, grazing, and fire suppression on the remnant oak savanna/prairie sites are evident in the decline or decrease in diversity of savanna grasses and forbs, the presence of invasive, fire-intolerant woody species, and a general successional trend towards a closed canopy wooded community. Management strategies for these sites will include prescribed burning on sites with sufficient graminoid cover to support combustion, selective removal of trees, and use of mechanical, chemical, or biological controls to remove problem species such as multiflora rose. As oak savanna areas are restored, they will be expanded by collecting and planting seeds at the margins of the sites and by encouraging natural succession.



Bur Oaks

Shrub Savanna/Prairie: This remnant native community is present at nine scattered sites located in the northwest, central, and southern portion of the Refuge. Oaks are generally absent from these sites, which are dominated by native savanna shrubs such as Iowa crabapple, hawthorn, hazelnut, and nannyberry intermingled with openings of prairie grasses and forbs. Because of the highly

disturbed nature of the sites, it is difficult to determine whether they should be managed as shrub savanna or prairie. Management strategies will include prescribed burning and mechanical or chemical treatment to eliminate non-native woody species. The response to frequent fire will be used to determine whether subsequent management efforts on individual sites should be directed towards establishment of prairie and/or savanna; seeds of prairie or savanna species could be planted to hasten this process. Like the remnant oak savanna communities, the shrub savanna/prairie sites will be expanded onto cropland or other suitable land by planting seed collected within the sites on adjacent areas and by annual burning for a period of time during establishment.

Open Woods: Open woods occur at eight sites located in the southern portion of the Refuge. Heavily impacted by grazing, these sites are dominated by open-grown to somewhat open-grown trees usually two feet or less in diameter. Characteristic tree species include bur oak, shagbark and bitternut hickory, and other species which occur in the oak savanna/prairie and mesic wooded slope communities. Recommended management strategies for open woods include immediate elimination of grazing to encourage growth of grasses and herbaceous plants, mechanical and chemical removal of undesirable woody plants such as multiflora rose, and annual prescribed burning **once sufficient fuel** has **accumulated.**

***Mesic Wooded** Slope*

Mesic wooded slope occurs on 11 sites in the southern part of the Refuge totalling approximately 87 acres. Associated with slopes of tributaries to Walnut Creek, these sites are characterized by a variety of tree species including basswood, red oak, shagbark hickory, and bitternut hickory. As previously noted, mesic wooded slope on the Refuge does not generally occur in areas which historically supported upland woods vegetation. Post-settlement land use practices such as grazing and agriculture have greatly influenced the development of the Refuge's mesic wooded slope communities, which are not necessarily representative of the native vegetation that formerly occurred on these sites. Each individual site will be carefully studied to determine if the appropriate management strategy involves restoration of upland woods or selective thinning to create a more open savanna community. Eroded slopes will be stabilized by seeding or transplanting appropriate herbaceous species.

RIPARIAN/WETLAND

The riparian/wetland habitat natural community consists of the flat, linear corridors that occur along Walnut Creek and its major tributaries. Included are three distinctive plant communities (prairie wetland, floodplain woods, and savanna wetland) as well as the open water habitat of Walnut Creek and its tributaries. The plant communities share a common tolerance of periodic flooding and high groundwater conditions.

An objective of 750 acres has been established for the riparian/wetland natural community. This total includes approximately 480 acres of prairie wetlands to be reconstructed, approximately 50 acres to be established as impoundments and moist soil units, and approximately 220 acres of remnant native communities to be restored.

Resource Description/ **Typical Species**

Prairie Wetland: Wetlands dominated by hydric prairie grasses and forbs or other herbaceous vegetation were a prominent part of the historic tallgrass prairie landscape. Depending upon moisture conditions, herbaceous wetland communities ranged from the wet prairie to wet meadow, shallow water marsh, or deep water marsh in areas saturated or covered with water during a significant part of the growing season. In the Refuge landscape, herbaceous wetland communities including wet prairie and wet meadow were found in upland drainageways and seeps and lowland areas along streams. The wet prairie community has been previously described in the section on the prairie natural community. Typical species of the wet meadow, which occurs where the soil is normally saturated but is covered with standing water only during the spring, include a mixture of hydric prairie grasses and other herbaceous plants adapted to wet conditions such as cordgrass, bluejoint grass, **sedges, and** rushes.

Floodplain Woods: **In** the tallgrass prairie landscape, floodplain woods typically occurred in lowland areas adjacent to rivers and more substantial streams, which afforded some protection from the stress of drought and prairie fires. These floodprone areas supported tree species tolerant of periodic inundation. Typical species of the floodplain forest include cottonwood, silver maple, green ash, elm, and boxelder. A variety of shade and moisture tolerant vines, shrubs, and herbaceous plants thrive beneath the closed canopy of this community.

Savanna Wetland: Savanna wetland has a vertical structure similar to upland savanna, consisting of an open tree canopy over herbaceous groundcover. In the Walnut Creek National Wildlife Refuge, this community occurs on the broad, flat floodplain areas at the confluences of Walnut Creek and its major tributaries. Because of saturated soil conditions and periodic flooding, many of the same species that occur in prairie wetland and floodplain woods are found in *savanna* wetland. Typical species include trees such as cottonwood, willow, and red elm and herbaceous wetland plants such as hydric prairie grasses, sedges, and rushes.

Management Prescriptions A combination of reconstruction and restoration strategies will be used to establish and manage the riparian/wetland habitat natural community. These strategies will include establishment of wet prairie along minor tributary streams which traverse agricultural land; restoration and expansion of remnant prairie wetland,

floodplain woods, and savanna wetland that occur in wetter situations along Walnut Creek and its major tributaries; and establishment of six moist soil units and impoundments managed with small structures and water control facilities. Breakage and removal of agricultural tile drainage fields may be necessary in some locations to restore hydrologic conditions suitable for supporting wetland vegetation. In addition, the landscape will be managed to encourage the restoration of stream meanders to those areas of Walnut Creek that have been channelized in order to approximate pre-settlement stream morphology.

Prairie Wetland

Approximately 66 acres of remnant prairie wetlands occur at 20 sites distributed throughout the Refuge within both riparian corridors and upland drainageways and seeps. These sites are dominated by hydric grasses and herbaceous plants such as prairie cordgrass, rushes, and sedges. Prescribed annual burning in the spring will be considered as a management strategy for remnant prairie wetland communities. Additional prairie wetlands may be reconstructed in suitable lowland locations by reestablishing appropriate hydrologic conditions and planting with herbaceous wetland vegetation.

Floodplain Woods

Floodplain woods are represented on the Refuge by seven sites totalling approximately 114 acres in size. These sites occur in a linear corridor along the Walnut Creek floodplain in the northwestern and central portions of the Refuge. Characteristic tree species include red elm, silver maple, and boxelder. Floodplain woods on the Refuge have been heavily impacted by erosion and siltation caused by agricultural runoff and by associated catastrophic flooding of waterways. Reed canary grass, which aggressively increases in native communities in the absence of fire, has colonized large portions of this community. Recommended management strategies include removal of non-native woody species, prescribed burning, mechanical, and chemical control to reduce or eliminate reed canary grass, and encouraging the growth of appropriate species. Monitoring of successional trends will be important to help determine the proper direction of future management.

Savanna Wetland

Savanna wetland is present at 11 sites totalling approximately 41 acres. For the most part, these sites are located in the central and southern portions of the. Refuge at the confluences of Walnut Creek and its major tributaries. Several of the Refuge's savanna wetland sites have been invaded by reed canary grass, which exists almost . as a monoculture in certain locations. Prescribed annual burning may be used to help control this plant and to enhance the diversity of the herbaceous ground layer. The wet spring conditions typical of savanna wetland make the timing of prescribed burning problematic, providing a good opportunity for applied research to ascertain the proper burn time to control reed canary grass.

Impoundments/
Moist Soil Units

In addition to native wetland communities to be reconstructed or restored, six impoundments and moist soil units each less than ten acres in size will be created within riparian corridors. The purpose of. these wetland habitats will be to increase the value of the Refuge for wildlife, provide educators with the opportunity to teach the public about wetlands and wildlife, and enhance the visual and biological diversity of the Refuge. The impoundments will require construction of dikes and water control structures combined with limited excavation of riparian habitat to create an aquatic environment of sufficient depth to support a combination of open water and marsh. The moist soil units will consist of shallow, seasonally wet marshes which are intensively managed to support herbaceous wetland vegetation with high food value for wildlife.

Impoundment under Construction

WILDLIFE

The goal of wildlife management at the Walnut Creek National Wildlife Refuge will be to restore a facsimile of the diversity of wildlife that flourished in the tallgrass prairie/oak savanna ecosystem before Euro-American settlement. Prior to settlement, the tallgrass prairie occupied a belt running north-south along the edge of the Eastern deciduous forest. The tallgrass prairie is thus a continuum of communities, a region of dynamic tension between woodlands to the east and more arid grasslands to the west. Wildlife adapted to this region include species that evolved primarily in grasslands, primarily in woodlands, or in a mixture of both.

The tallgrass prairie/oak savanna ecosystem is a mosaic of plant communities formed by topographic and hydrologic features resulting in a diversity of grassland, savanna, wetland, and riparian habitats. In this ecosystem, biological richness (the total number of plant and animal species) increases markedly from grassland to woodland, as the more complex vertical and horizontal structure of the oak savanna/woodland community supports a greater variety of wildlife species than tallgrass prairie. Nonetheless, the biological diversity of the tallgrass prairie/oak savanna ecosystem to be restored at the Refuge includes the sum total of the species richness values for each of the natural communities to be reconstructed/ restored: prairie, oak savanna/woodland, and riparian.

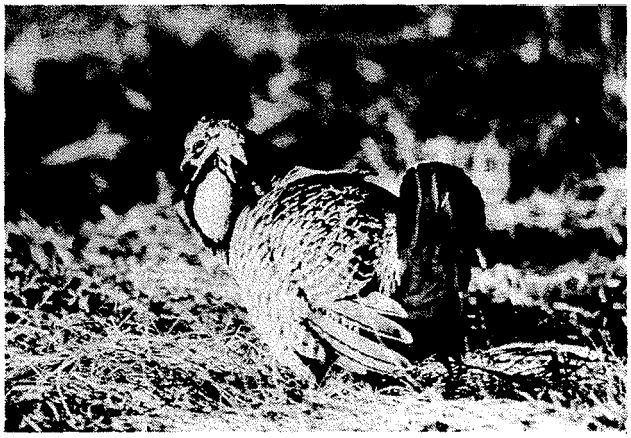
It is expected that reconstruction of the natural communities comprising the tallgrass prairie/oak savanna ecosystem will attract a variety of native wildlife species. Other species that have declined dramatically or have been locally extirpated may be possible candidates for reintroduction. Because the knowledge of bird populations is generally greater than for other animal classes, the following discussion focuses on birds to illustrate the variation in species composition that is typical of the natural communities to be reconstructed/restored. However, inferences may be drawn to mammals, reptiles, amphibians, and invertebrates as well.

Nesting bird species typically associated with tallgrass prairie habitat include dickcissel, bobolink, American bittern, sedge wren, eastern meadowlark, northern harrier, gadwall, and prairie chicken. Henslow's sparrow, northern bobwhite, and common yellowthroat are likely to occur in areas of tallgrass prairie where shrubs are present in moderate quantities.

Sites dominated by midgrasses such as little bluestem and sideoats grama are preferred by upland sandpiper, grasshopper sparrow, savanna sparrow, western meadowlark, and (where wetlands are present) Wilson's phalarope and pintail. Species which respond to a shrub component in midgrass habitat include clay-colored sparrow, field sparrow, and loggerhead shrike. Species preferring dry sites dominated by short, sparse grasses include horned lark and killdeer.

Typical bird species of savanna habitat include lark sparrow, vesper sparrow, western and eastern kingbirds, northern flicker, and American kestrel. Species likely to be present in more wooded areas with well-established trees and shrubs include eastern bluebird, willow flycatcher, blue-winged warbler, American goldfinch, Bell's vireo, and mourning dove.

In addition to the nesting species, it is expected that a large number of bird species will use the reconstructed/restored prairie, savanna, and riparian habitats of the Refuge for purposes other than reproduction (e.g., feeding and resting during migration and wintering periods), thereby contributing to the avian diversity of the wildlife community.



Greater Prairie Chicken

Once common grassland birds that have declined dramatically or are now extirpated as breeders in Iowa include greater prairie chicken, upland sandpiper, burrowing owl, Henslow's, vesper, and grasshopper sparrows, sedge wren, short-eared owl, and northern harrier. Although the status in the Refuge of less conspicuous small vertebrates such as western harvest mouse, plains pocket mouse, and western grass lizard is poorly known, populations of these species are certain to be low because of the current scarcity of grassland habitat on the Refuge.

Periodic manipulation of reconstructed and restored natural communities will be necessary to maintain the diversity of wildlife in the tallgrass prairie/oak savanna landscape. In general, the most effective techniques will be those which mimic natural processes. As previously discussed, a variety of management techniques including prescribed burning, mowing, grazing by bison and elk, and selective use of herbicides will be used to maintain the reconstructed landscape. Prior to implementation of habitat reconstruction/restoration, more detailed wildlife management plans will be prepared to identify the specific wildlife species to be encouraged and/or reintroduced to the Refuge landscape as well as management strategies appropriate for these species. Management plans will also address control of the white-tailed deer and other species which have prospered in the post-settlement landscape due to human-induced changes such as the abundant food supply provided by agricultural fields.

Rare, Threatened, and Endangered Species

Certain species of animals or plants listed as threatened or endangered may currently exist on or are candidates for reintroduction to the Walnut Creek National Wildlife Refuge. Wildlife management plans will take into consideration the

per

fiber
Ana,

f the

tted
pie
wl,

and
ithe
rates

is
des
rent
ige.

and

uding
lective

ged

ment
her
e due

preservation and enhancement of likely habitat for rare, threatened, and endangered species. For example, disturbance to forested riparian habitat in the southern portion of the Refuge will be minimized to prevent adverse impacts to potential habitat for Indiana bat, listed as state and federally endangered. (The Service is conducting an on-going survey of potential Indiana bat habitat on the Refuge.) It is expected that development of Refuge facilities will not adversely affect other listed species identified as potentially occurring on the Refuge, as they are unlikely to nest on the Refuge under current conditions. Recovery plans will be developed and implemented for the Indiana bat and any additional federally protected species found on the Refuge. The reconstruction of the native ecosystem will afford a unique opportunity to study habitat restoration for such species.

Extirpated Species

It is expected that reconstruction of the historic tallgrass prairie/savanna landscape may attract grassland species which formerly occurred on the Refuge but have been locally extirpated as a result of the replacement of native habitats by agricultural cover types. Several bird species, including two species listed as endangered in Iowa (northern harrier and short-eared owl) and a third which is unlisted but uncommon (upland sandpiper), currently occur as migrants on the Refuge or nest in nearby areas and thus could recolonize the Refuge if suitable habitat were available. Other species including barn owl, Henslow's sparrow, and greater prairie chicken are possible candidates for reintroduction. Several species of mammals listed as threatened in Iowa (least shrew, spotted skunk, and river otter) and two reptile species listed as endangered in Iowa (western slender glass lizard and speckled kingsnake) may also recolonize the Refuge if suitable native habitat were available or are possible candidates for reintroduction.

Bison/Elk

The bison and American elk, two large mammals extirpated in Iowa following the arrival of Euro-American settlers, are representative of the natural forces which formed the historic tallgrass prairie/oak savanna landscape. The relatively large-scale nature of the Walnut Creek National Wildlife Refuge reconstruction project affords an opportunity to reintroduce herds of these animals into the Iowa landscape.

The intent of incorporating bison and elk into units of the National Wildlife Refuge System is to perpetuate the species through habitat management. The unique aspect of Walnut Creek National Wildlife Refuge is that careful management of the herds will contribute to the perpetuation of the habitat by recreating the role of large grazers in the historic tallgrass prairie/oak savanna ecosystem.

A limited number of bison and elk will demonstrate the role of large grazers in the prairie ecosystem. Intensively managed as a

learning tool, these animals will serve as a living symbol of the environmental education message:

Protecting the future by restoring the past.

The opportunity to study the interaction between the large grazers and the reconstruction/restoration process will also serve as a focus of research at the Refuge. While some information exists concerning the relationship between grazing and existing prairie, little is known about the role of grazing and movement patterns of large native animals in reestablished prairie.

The effort to restore, reconstruct, and understand the historic prairie habitat will be diminished without the interest and enthusiasm of the visiting public. The chance to view and learn about bison and elk will be integral to the enjoyment and educational value of the Refuge. If the visitor is first attracted by the opportunity to see these large animals and leaves with a better understanding of the complex issues related to wildlife and wildland resources, then the Refuge will have succeeded in its mission.

Following the establishment of suitable tallgrass prairie habitat, bison and elk will be introduced into a management area which will ultimately total approximately 2,000 acres in size. A maximum of 100 bison and 150 elk will be maintained at the Refuge after all lands have been acquired and the restored/reconstructed landscape is fully established. The bison and elk will be occasionally visible from the Refuge entry road and tour route, providing Refuge visitors with a glimpse of the diversity of wildlife that once abounded in the Iowa landscape. The management area will be enclosed by high tensile strength, electric perimeter fencing to confine the naturally free-ranging animals. A smaller bison/elk display area approximately 150 to 200 acres in size will allow visitors a better opportunity to view the animals. This display area will be visible from the campus and trails. leading from the Visitor Center.

A bison and elk handling facility to be used for routine health inspections and other management practices will be established in conjunction with the bison/elk management and display areas. This facility will consist of a corral, chutes, pens, and scale to facilitate handling of large animals.

FACILITIES, **ACTIVITIES,** AND VISITOR PROGRAMS

The Refuge program includes an assortment of environmental education, research, and interpretive facilities and related activities which were carefully selected to support and complement the natural communities to be established on the Refuge. Each element of the program is wildlife and wildlands-oriented consistent with Fish and Wildlife Service policies for refuges. The facilities and activities will afford Refuge visitors the opportunity to learn about and directly interact with the reconstructed prairie environment in a variety of outdoor and indoor settings, instilling in them a new awareness of the value, diversity, and beauty of plant and animal resources which have largely disappeared from the American landscape.

It is expected that the skills and knowledge acquired concerning the environment will instill an understanding and appreciation for this native ecosystem and other natural resources. Visitors will learn about both the impacts of humans on native habitats and the beneficial efforts to restore damaged systems. These lessons are intended to be applied to the everyday lives of Refuge visitors, motivating a more informed citizenry.

Prior to the construction of the facilities described below, an interim office/visitor contact station will be used to initiate environmental education and other public use programs.

Celebration of First Seed Planting, May 1992

Access to the Refuge from the regional road network will be provided by means of a paved entry road 22 feet in width with two-foot shoulders. Information and viewing points will be provided along the road to orient visitors to the reconstructed landscape. Approximately 4.5 miles in length, the entry road will guide visitors to the Visitor Center and other Refuge facilities located in a campus.

Entry Road

The Refuge's primary buildings and associated outdoor spaces and displays will be organized in a campus setting of approximately 35 acres. The buildings will include a Visitor Center, Environmental Education Building, and Research Facility. The campus will also include several support facilities (a 200-car parking lot, administrative offices, and maintenance facilities). The purpose of consolidating these facilities in one location is to foster a stimulating interaction and exchange of ideas between environmental education, research, and interpretive facilities and programs, to facilitate more efficient management of the Refuge, to concentrate infrastructure and support facilities, and to allow the remainder of the Refuge to be devoted to native habitat reconstruction.

Visitor Center

The Visitor Center will orient the public to the Refuge and serve as the focus of Refuge interpretative programs. The building will include approximately 14,600 square feet of space including interpretive exhibits, an auditorium for meetings and multi-media presentations, conference rooms, an exhibit hall, an information/ media center, and a wildlife/prairie bookstore. Defined outdoor spaces associated with programs at the Visitor Center will be provided. Visitor conveniences will include a small food vending area and restrooms.

Restoring the past by protecting the future: As part of the Visitor Center interpretive facilities, a variety of contemporary media systems will tell the story of human interaction with the tallgrass prairie/oak savanna. Major subjects may include:

- how the "prairie sea" evolved over many centuries while Native Americans lived with natural forces;
- how the prairie survives and regenerates as a subtle and striking natural system dependent on fire and grazing;
- how in recent history the oak savanna was cleared and the tall grasses plowed under to feed a growing nation; and
- how the reconstruction of over 8,000 acres of native habitats at the Refuge represents an unprecedented challenge to understand ecological processes

The experiences and learning opportunities available at the Visitor Center through indoor and outdoor exhibits and audiovisual media will include a powerful and insightful display of the varied forms of plant and animal life, climactic extremes, and other natural forces such as fire that characterized life on the prairie. An important concept in the design of the exhibitry is the ability to adapt the presentations and exhibits to the changing Refuge landscape.

Maintenance Facility

A Maintenance Facility will be provided at the edge of the campus to provide a base for staff to maintain the physical plant and equipment of the Refuge and manage the Refuge landscape. The Maintenance Facility will consist of a shop building, covered vehicle storage, storage space, staff support areas, and a multi-bay garage. The size of the enclosed spaces will be approximately 18,000 square feet accompanied by a secured storage and maintenance yard approximately one acre in size. *A* sewage treatment plant will be provided to serve the wastewater disposal needs of the campus facilities.

Environmental Education Facilities and Habitats

Consistent with the goals and objectives established for the **Refuge,** public use programs and activities are divided into two major categories: environmental education and interpretation/recreation. Although there is, by necessity, some overlap between these categories, environmental education is focused on teaching program participants about environmental issues in an organized setting, while interpretation is oriented towards providing more informal recreational opportunities for the general public to learn about and enjoy wildlife and wildland resources. *A* variety of environmental education facilities and habitat management areas will be established and managed throughout the Refuge. These facilities and habitats will provide environmental education (EE) program participants with numerous opportunities to study existing and reconstructed native communities.

Prairie Learning Center

Some individuals and groups will arrive at the Refuge for. the specific purpose of participating in the varied and innovative EE programs offered by the "Prairie Learning Center." Encompassing the entire Refuge, the Center will be a special assemblage of habitats, indoor and outdoor displays, exhibits, and instruction designed to teach visitors about the tallgrass prairie/savanna ecosystem. The educational experience begins along the Refuge entry road and is formalized at the campus, where an Environmental Education Building approximately 9,000 square feet in size will be established as one of the campus facilities. This building will contain a multi-purpose/assembly room, classrooms, conference rooms, teacher/staff offices, restrooms, and maintenance and storage areas.

Outdoor Classroom Sites

Environmental education programs and activities offered by the Prairie Learning Center will be designed to reach a variety of audiences including students, adults, families, and special populations. These programs will make use of the entire Refuge as an outdoor laboratory and classroom to impart an awareness and appreciation of the value of wildlife and wildlands resources. The Center will transcend the traditional indoor classroom educational experience by bringing EE program participants into direct contact with a variety of reconstructed habitats at three "living classrooms" located throughout the Refuge. At these outdoor classroom sites, visitors will gain an in-depth understanding of a specific resource or resources. Outdoor classrooms to be developed include:

1. Composite (featuring a range of existing and reconstructing native habitats representative of the entire Refuge landscape)

2. Woodland/Savanna

3. Wetland

Outdoor Classroom Site

The Composite outdoor classroom will be a full-service facility for groups of up to 45 persons and will include an outdoor teaching area, weather protection, restrooms with running water, and storage. The Woodland/Savanna and Wetland outdoor classrooms will be smaller facilities for groups of up to 20 persons and will be equipped with portable sanitary facilities rather than restrooms.

Demonstration Areas

Demonstration areas will be established at several locations within the Refuge. Each of these areas will focus on a specific theme related to the reconstruction and management of native habitats and wildlife/wildland resources. Demonstration areas to be developed include:

- Native Plant Preserve
- Prairie Nursery
- Prairie Demonstration Area

Environmental Education
Camping

Some individuals and groups participating in environmental education programs or special events will stay overnight by special permit at a semi-primitive campground located in a secluded part of the Refuge. Facilities provided at the campground will include 20 to 30 campsites, handicapped accessible toilets, and potable water.

Research Facilities

The scale of the Walnut Creek National Wildlife Refuge tallgrass prairie reconstruction will attract scientists interested in conducting research related to native habitat reconstruction, restoration, and management. Such research will afford opportunities to test the process and feasibility of prairie reconstruction for application in other contexts.

Information about approaches to reconstruction of a natural landscape in an area that has been almost completely converted to agricultural use is scant and primarily limited to small parcels of land. Research is needed to document the effects of different approaches to reconstruction of the tallgrass prairie/oak savanna landscape and to evaluate the progress towards or regress from ecological goals and objectives. Walnut Creek National Wildlife Refuge, as one of the largest prairie/savanna reconstructions as yet attempted, can support research on several aspects of ecological restoration simultaneously.

The Project Leader and staff will provide the lead for coordinating the research activities. These activities will take place within designated areas of the Refuge including plant propagation and study areas such as the prairie nursery and greenhouses. Research functions will share administrative and reference facilities with the Refuge staff. Research facilities will include a bunkhouse with

minimal dining and informal meeting facilities in a location situated to promote privacy from other Refuge activities.

Interpretive Facilities **and Habitats**

The goal of the interpretive programs to be offered at the Walnut Creek National Wildlife Refuge is to provide opportunities for the public to understand and enjoy wildlife and wildland resources. This goal will be achieved through a variety of Refuge programs allowing visitors to explore and directly interact with native plant communities and the wildlife inhabiting them through a recreational learning experience. Together with the exhibits and programs offered at the Visitor Center, these interpretive facilities and habitats will teach visitors about the natural and cultural history of the prairie and the process of native habitat reconstruction.

Outdoor *Campus Facilities*

The Visitor Center and Environmental Education Building will be surrounded by outdoor demonstration and interpretive display areas approximately 20 acres in size which will complement the indoor exhibits and activities. A trail system comprised of a shorter and longer loop will provide access to the demonstration and display areas and other landscape features located in the vicinity of the campus, reinforcing and expanding upon the knowledge gained from the indoor exhibitry and programming. A hard-surfaced, handicapped accessible loop trail will be designed for use by individuals and groups. This trail will connect to a longer trail which will provide the opportunity for more extensive investigation of the different habitats comprising the Refuge landscape. Other outdoor facilities to be provided near the campus include an outdoor assembly area for groups of 50 or more persons and a picnic area with approximately 12 tables.

Tour Route

Most visitors to the Refuge will arrive by automobile or bus. It is anticipated that the tour route will be a popular interpretive feature of the Refuge providing many visitors with their primary experience of the reconstructed tallgrass prairie/savanna landscape. This hard surfaced roadway, approximately eight miles in length, will allow visitors to enjoy a self-guided overview of the Refuge landscape, wildlife resources, and important natural or cultural features. In addition, it will link the central campus with some outdoor classroom sites and demonstration areas located along the route. Except where it will serve as the two-way entry road to the central campus, the route will be one-way, consisting of one travel lane twelve feet in width with two foot shoulders. Small wayside parking areas will be provided at scenic overlooks with interpretive materials.

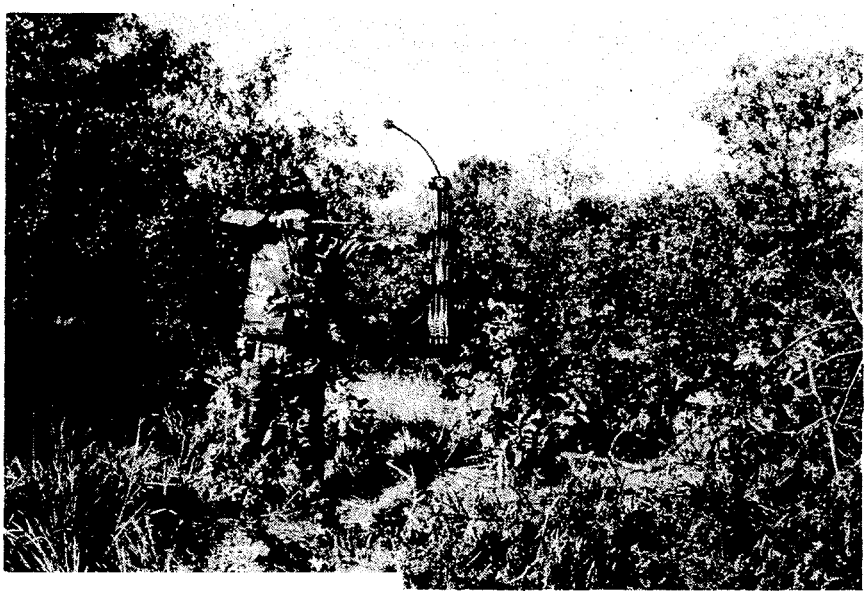
Hiking/Biking Trail

Many visitors will be motivated to expand their experience of the reconstructed landscape beyond the tour route and trails associated with the campus. For hikers, bikers and other visitors desiring a non-motorized outdoor experience, a multi-purpose hiking/biking trail system approximately 4.5 miles in length will be available.

Gravel-surfaced and approximately eight feet in width with two foot shoulders, this trail system will provide access to some of the outdoor facilities of the Refuge.

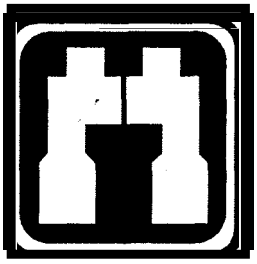
Recreational Activities

Refuge visitors will be able to *enjoy a* number of wildlife-oriented recreational activities not specifically related to environmental education and interpretive programs and facilities. These activities include nature and wildlife observation, photography, hunting, fishing, and collecting edible plants (berries and mushrooms).



Bow Hunting will be one of many wildlife-oriented recreational activities on the Refuge.

Watchable *Wildlife* Wildlife observation is a popular activity in the National Wildlife Refuge System. The Walnut Creek National Wildlife Refuge will provide numerous opportunities for this activity including trails, viewing sites, a tour route, and information kiosks as well as printed materials and signs directing visitors to good viewing spots. The reconstructed prairie ecosystem with bison, elk, and other uncommon native species will provide excellent wildlife viewing opportunities in central Iowa.



Standardized Sign

The Refuge will participate in the national program known as "Watchable Wildlife," a partnership among eight federal land managing agencies, four private conservation groups, and the International Association of Fish and Wildlife Agencies. This program promotes wildlife viewing on and the conservation of private and public lands across the country. The program is developing a broad range of educational material, including stateby-state viewing guides encouraging the public to visit sites such as

"Maybe I haven't been able to define prairie, because it is an intangible - a feeling, an emotion a sensitivity to a special kind of quiet mood to be mostly enjoyed, in solitude. My finite mind cannot comprehend the infinite prairie.

It is simple; it is complex.
It is harsh; it is tender.
It is barren; it is lush.
It is a love affair between
a few special people and
a special kind of land."

— Elsie Rose

Walnut Creek. The Refuge will post a standardized brown and white road sign featuring a pair of binoculars indicating participation in the Watchable Wildlife program.

Hunting is an integral part of a comprehensive wildlife management program that is used to maintain wildlife populations at levels which will not significantly damage Refuge habitats. Hunting of white-tailed deer and resident upland game will be allowed in accordance with a Refuge Hunting Plan and will be designed to minimize potential conflicts with other uses.

Hunting

Based upon coordination with the Service Fishery Assistance Office and the Iowa DNR, it has been concluded that the small wetlands and streams created and maintained at Walnut Creek will not support a resource suitable for a Refuge fishing program. Refuge staff will work with the Army Corps of Engineers and the Iowa DNR to co-sponsor fishing opportunities for youth. These programs will take place primarily at Red Rock and Saylorville Reservoirs. If compatible and appropriate, a Refuge pond could be stocked with fish for a "put-and-take" special event.

INTRODUCTION

Swallowtail on Purple Coneflower

The Walnut Creek National Wildlife Refuge and Prairie Learning Center will tell the story of one of America's most endangered ecosystems, the tallgrass prairie. The Refuge will address a diverse audience, including rural and urban dwellers, school children, adults and senior citizens, individuals, families, and organized groups, who will be drawn by a common interest in wildlife and wildland resources. Euro-American travellers in the early nineteenth century described the tallgrass prairie landscape as a boundless, rolling sea punctuated by occasional trees, carpeted with lush grasses and delicate flowers and illuminated by bright sunshine. Others wrote of the gloom and loneliness of the prairie landscape, particularly in the winter under overcast skies. The challenge of the Walnut Creek National Wildlife Refuge facilities and programs is to convey a sense of the expansiveness, subtlety and changing qualities of the tallgrass prairie/oak savanna landscape. This will be accomplished by reconstructing historic habitats in a modern setting, and by skillfully siting facilities to allow visitors to enjoy and interact with the reconstructed landscape without compromising natural habitat values or detracting from the research mission of the Refuge. If the challenge is successfully met, visitors will leave the Refuge with an increased awareness and understanding of the prairie landscape, the effects of humans on the environment, and the value of America's natural heritage. Other lessons to be imparted include a sense of pride and ownership of a unique natural resource restored and preserved for future generations, and new skills and a commitment to conserve, enhance, and restore wildlife and wildland resources.

At the outset of the planning process, a visitation goal was set by the Fish and Wildlife Service of 200,000 people per year. It is projected that 150,000 of the visitors will take advantage of the campus facilities and 50,000 will visit for the sole purpose of enjoying the 8,600 acre tallgrass prairie/oak savanna landscape. Within the total visitation, 20,000 visitors are expected to participate in an environmental education program. The Refuge audience is projected to include rural and urban dwellers; tourists; hunters; elementary, secondary, and college students; educators; scientists; land managers; naturalists; photographers; organized groups; families; senior citizens; and others. The proposed habitats, buildings, programs, and activities will be assembled to serve the interests of each group.

The goal of the master planning process was to formulate a plan for development of the Refuge that best achieves the purposes for which the Refuge was established while respecting the natural, social, and economic environments as well as the needs of the American public. In order to achieve this goal, alternatives were developed, reviewed by the public, and modified based upon public input received. A Preferred Alternative was then selected for each of four elements comprising the Master Plan:

- Habitat/Wildlife Emphasis
- Refuge Management Concept
- Refuge Program
- Facilities Siting.

Habitat/Wildlife Emphasis

Alternatives evaluated for Habitat/Wildlife Emphasis explored the various habitat types and associated wildlife which could be provided at the Refuge. The majority of National Wildlife Refuges are managed to emphasize production of migratory birds and waterfowl such as ducks, geese, and swans. The Walnut Creek National Wildlife Refuge, however, is unique in its congressionally mandated purpose to restore tallgrass prairie. Under the selected Habitat/Wildlife Emphasis Alternative, the Fish and Wildlife Service will seek to reestablish the historic tallgrass prairie/oak savanna ecosystem and reintroduce native wildlife species into the landscape.

Refuge Management Concept

The Refuge Management Concept Alternatives examined how the the Refuge would be developed and managed to achieve the selected Habitat/Wildlife Emphasis and to accommodate various levels of public use. Under the Preferred Alternative for this element, the Refuge will be actively managed to reconstruct tallgrass prairie/oak savanna habitat and to emphasize environmental education programs with a balance of interpretive, recreational, and research uses.

Refuge Program

A variety of program alternatives were evaluated based upon their consistency with the selected Habitat/Wildlife Emphasis and Refuge Management Concept. These alternatives ranged from the provision of no facilities and habitats to maximum development of facilities and habitats. The Preferred Refuge Program includes reconstructed habitats (tallgrass prairie, oak savannah/upland woods, and riparian/wetland) with bison and elk and a variety of public use facilities which provide for environmental education, research, interpretation, and wildlife/wildlands-oriented recreation. The habitat components, facilities, and activities comprising the Preferred Refuge Program are described in Chapter 3.

Facilities Siting

During the concept development phase of the master planning process, a number of alternative site locations and configurations were developed for the facilities to be provided under the selected Refuge program. These alternatives were tested against locational criteria which define the land resource conditions necessary to support proposed facilities and habitats. Under the Preferred Facilities Siting Alternative, environmental education, interpretive, research, and maintenance facilities will be grouped together in a campus centrally located within the Refuge. The tour route and trail system will be limited in their extent, thus minimizing impacts on sensitive environmental resources and *maintaining portions of*

the reconstructed Refuge landscape relatively free of human encroachment following habitat reconstruction.

The Preferred Alternatives selected for each of the four elements summarized above together comprise the Master Plan for the Walnut Creek National Wildlife Refuge. The Master Plan is, however, much more than the sum of its elements. The special quality which is the goal of the Master Plan will be achieved by people - the Fish and Wildlife Service, students, researchers, and volunteers - who will work together not just to reconstruct the physical and biological components of the historic tallgrass prairie/oak savanna ecosystem, but to recreate a semblance of the expansive landscape of rolling grasses and scattered trees that greeted the first European travellers. This effort will create a positive, dynamic experience for the broad spectrum of visitors who will come to the Refuge.

This chapter of the Master Plan depicts the proposed locations of habitats and facilities within the Refuge. The vision of the future Refuge described in this chapter assumes that all the land within the Refuge boundary has been acquired through a willing seller program and the proposed habitats and facilities are fully developed. For the following reasons, it is expected that full establishment of the Refuge will take a number of years:

- The Fish and Wildlife Service does not currently own all the land within the Refuge boundary. Non-Service owned land will be acquired over time through a willing seller program.

- The Master Plan shows the abandonment of certain local roads within the Refuge boundary which will no longer be required for public access or Refuge purposes. County roads can be closed only with the approval of Jasper County.

- Because of the scale and complexity of the reconstruction project, it is anticipated that the establishment of reconstructed habitats will be undertaken in several phases.

Additional information regarding the phasing of Refuge habitats and facilities is presented in Chapter 5.

MASTER PLAN DESCRIPTION

Map 8 depicts the future physical form of the Refuge. The locations of the proposed habitats and facilities were determined based upon:

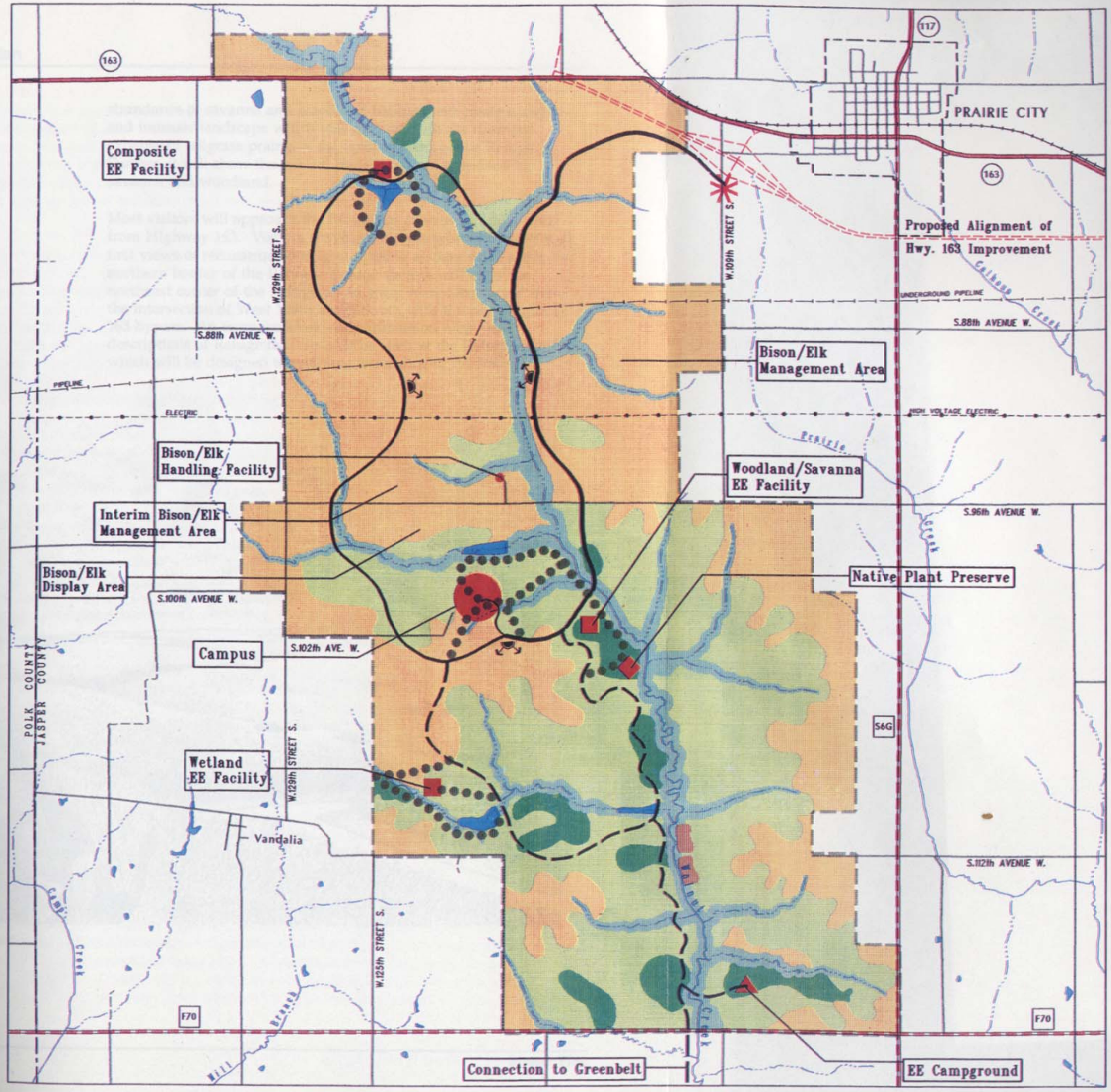
- locational criteria developed during the land suitability analysis phase of the planning process;
- establishing the best possible spatial relationships among habitats and facilities to maximize the visitor's experience of the Refuge; and
- creating a "sense of place" that evokes the historic tallgrass prairie/oak savanna landscape.

The locational criteria were developed for each of the major habitat components and facilities such as the campus, tour route, and walking trails. These criteria define the natural and human-made resource conditions (e.g., slope, soils, and views) which are necessary or desirable to support a particular habitat or facility. The criteria also address the optimal relationships between different habitats and public use facilities such as the campus and tour route, with the objective of providing visitors with a coherent and engaging experience of the Refuge.

Natural Communities

The foundation of the Master Plan is provided by the reconstructed natural communities which will define the special and unique character of the Walnut Creek National Wildlife Refuge. The northern portion of the Refuge above South 96th Avenue West will be visually dominated by tallgrass prairie on ridgetops and on slopes bordering the upper reaches of Walnut Creek and the small tributary streams which occur in this area. Fingers of riparian habitat will extend through the tallgrass prairie along Walnut Creek and its tributaries. These riparian corridors will consist primarily of wet prairie and prairie wetlands which will be visually consistent with the surrounding "sea of grass." Floodplain woods along Walnut Creek and occasional groves of oak savanna on valley slopes will add interest and a visual contrast to the expanse of tallgrass prairie.

South of South 96th Avenue West, tallgrass prairie will dominate the ridgetops between stream valleys that occur at the periphery of the Refuge. The rolling terrain characteristic of most of the southern portion of the Refuge will support a mosaic of tallgrass prairie and savanna communities. The well-defined riparian corridors along the lower reaches of Walnut Creek and its major tributaries will support a mixture of floodplain woods, savanna wetland, and prairie wetland communities. The vegetative pattern to be established in the southern portion of the Refuge reflects the historic and current distribution of native savanna and woodland communities within the Refuge. Combined with the rolling topography characteristic of this portion of the Refuge, the relative



CONCEPTUAL REFUGE PLAN

- Prairie
- Prairie/Savanna
- Riparian
- Forest
- Moist Soil Unit
- Impoundment
- Central Campus
  - Administrative Offices
  - Environmental Education
  - Visitor Center
  - Research Quarters
  - Maintenance Facility
  - Nursery
  - Sewage Treatment Facility
- Environmental Education Outdoor Classroom Facility
- Environmental Education Campground
- Native Plant Preserve
- Main Refuge Access
- Entry Road (two way)
- Tour Route (one way)
- Hiking/Biking Trail
- Vista Point / Information
- Trail

0 1000 3000 5000 Ft.

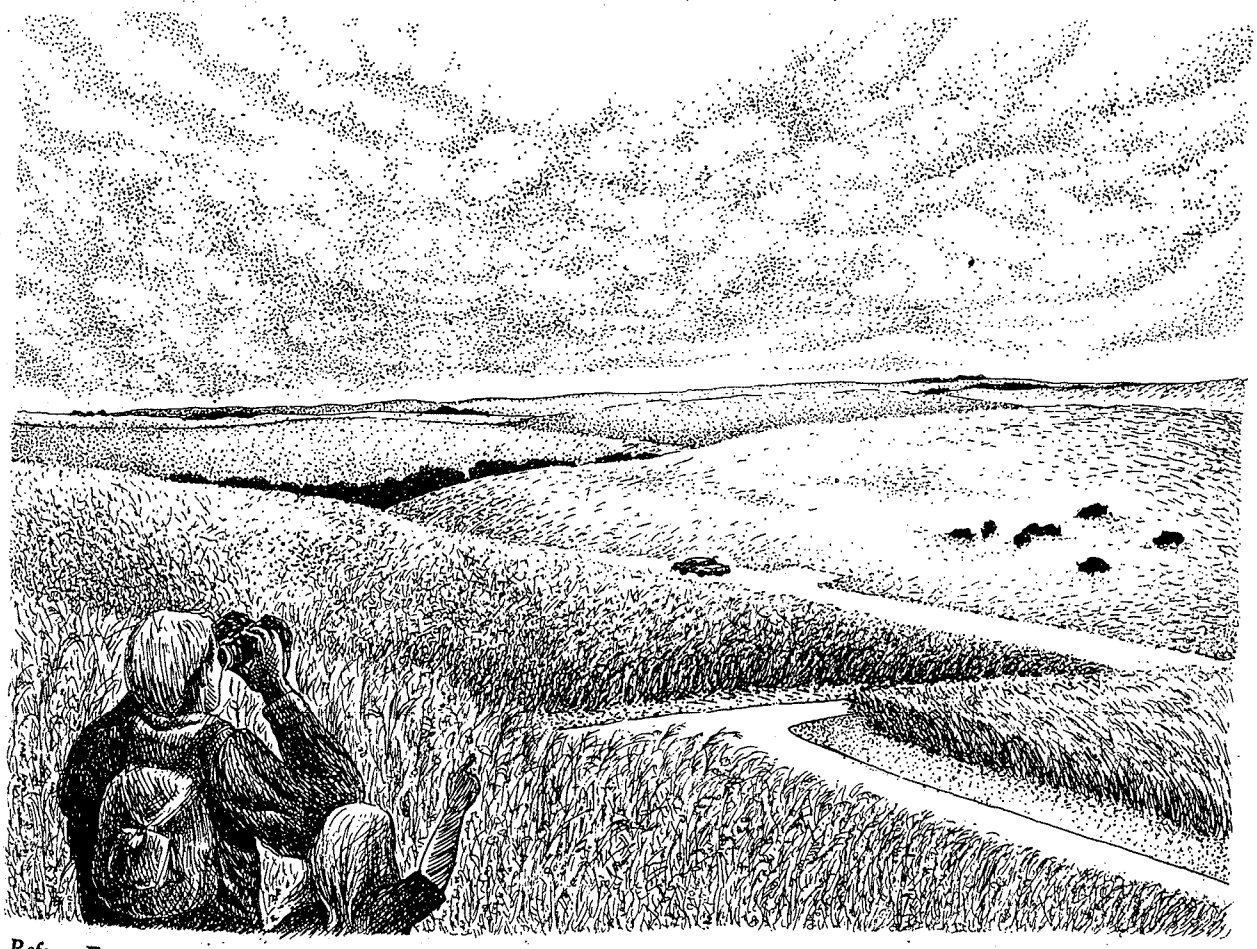
100 Acres
40 ac.
10

NORTH

abundance of savanna and woodland habitats will create a varied and intimate landscape which will contrast with the dramatic expanse of tallgrass prairie in the northern part of the Refuge. Further, it will show the natural transition from grassland to savanna and woodland.

Facilities

Most visitors will approach the Refuge by private vehicle or bus from Highway 163. Visitors arriving from the west will enjoy their first views of reconstructed tallgrass prairie as they drive along the northern border of the Refuge. Refuge visitors will enter the northeast corner of the Refuge on an entry road constructed from the intersection of West 109th Street South with the new Highway 163 bypass. An entrance kiosk with orientation maps and descriptions of Refuge facilities will be sited at the Refuge entrance, which will be designed to welcome the visitor to the Refuge.



Refuge Entry Road

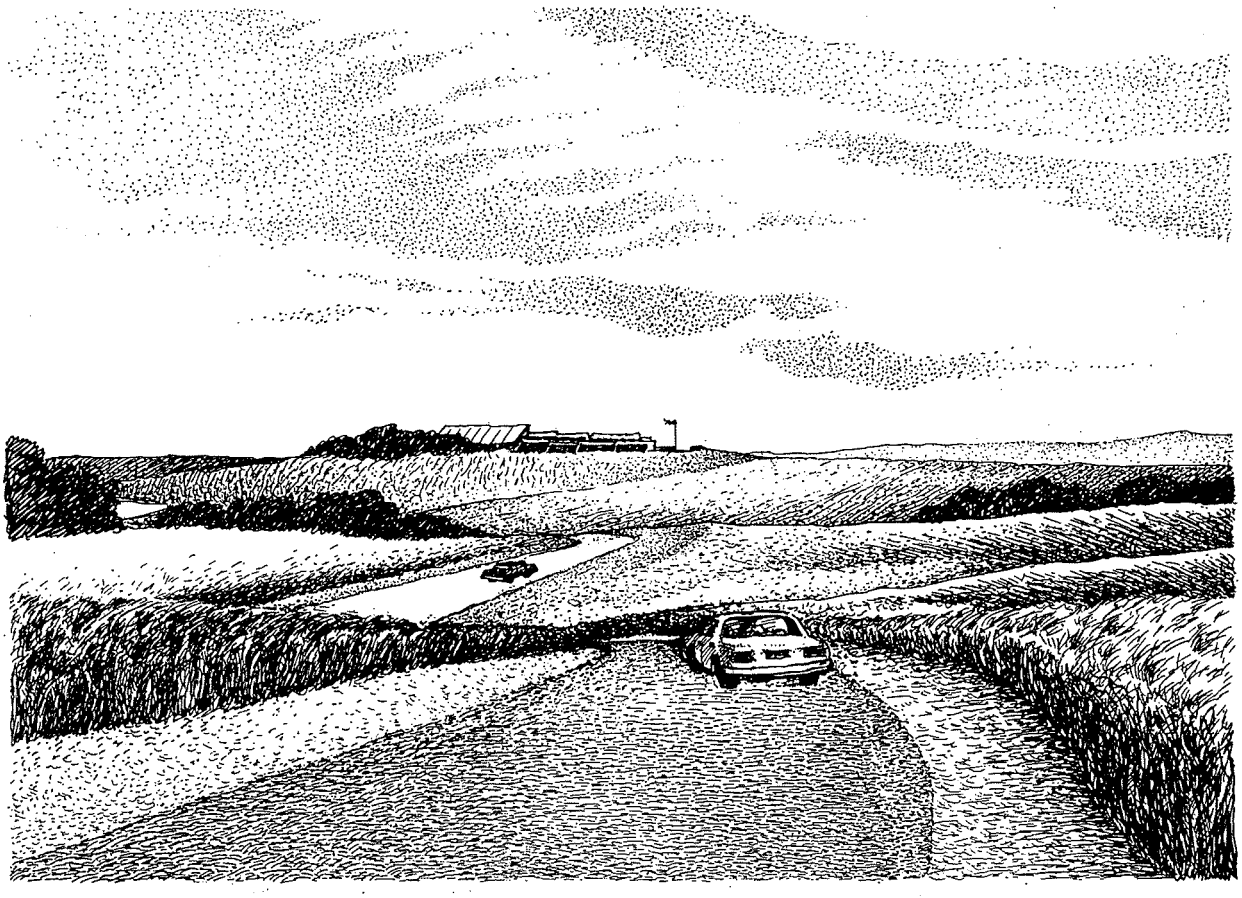
Entry Road

Approximately 4.5 miles long, the Refuge entry road will provide a transition from public roadways, visually introducing visitors to the reconstructed tallgrass prairie/oak savanna landscape. From the Refuge entrance, the entry road will wind through tallgrass prairie established on the northeastern portion of the Refuge, providing a dramatic contrast to the agricultural landscape seen from the rural road grid which serves the region.

Merging with the tour route, the meandering entry road will convey the visitor into the heart of the Refuge. Driving around and through the rolling topography, the visitor will enjoy a controlled sequence of views designed to provide a sense of immersion in the reconstructed landscape. Views of the agricultural landscape outside of the Refuge will be minimized in order to accentuate the prairie experience. As the visitor drives south, parallelling the course of Walnut Creek, the expanse of tallgrass prairie in the northeastern portion of the Refuge will be replaced by a more diverse environment of tallgrass prairie, savanna, and riparian habitats. Glimpses of such unique resources as a herd of bison or elk roaming across the landscape or a hillside adrift with colorful wildflowers will heighten the visitor's sense of anticipation as he or she approaches the campus. After crossing South 96th Avenue West, an east-west local road, the visitor will follow the *entry* road as it curves southwest across Walnut Creek and then turn north onto the campus entrance drive. Approaching the campus from the south, the visitor will first see the campus buildings beyond the native vegetation of a stream valley. The entry road will cross the stream valley and curve to the west past a dropoff area in front of the buildings, conveying the visitor to the campus parking lot. Capable of holding 200 cars and five buses, the parking lot will be terraced into the hillside and landscaped with native plants. Arrival in the parking lot will provide visitors with their first contact with the plants characteristic of the reconstructed habitats seen along the entry road.

Campus

The main visitor facilities will be arranged in a campus with a cluster of buildings, outdoor spaces, and displays connected by pedestrian paths and corridors. The component pieces relate functionally to each other and will be linked to permit movement under all weather conditions. The proposed campus site was selected because of ownership patterns and its central location between two tributaries of Walnut Creek, providing good views across the undulating topography of the southern portion of the Refuge and proximity to a diversity of native habitats. This site will provide a rich setting for visitors to learn about and enjoy the reconstructed native Iowa landscape. The visitor will experience a sense of immersion although the distant landscape will remain a visual reminder of the adjacent human uses.



Approach to the Campus

Campus Building Cluster

A series of walkways surrounded by native plants will direct visitors from the parking lot and dropoff area to an orientation space designed to welcome and orient visitors to the campus facilities. Environmental Education and Administration functions will be sited on the south-facing slope of a ridge. A walkway leading north from the orientation space will provide access to the Visitor Center and a viewing area located at the top of the ridge. From the viewing area, visitors will enjoy panoramic views across the reconstructed Refuge landscape to the north.

The Visitor Center will define the northern edge of the campus cluster. Portions of the building are planned to be built into the hillside with the roof covered by earth and tallgrass prairie. This earth sheltered concept would minimize the visual intrusion of the Visitor Center *in* the reconstructed landscape, illustrate energy efficient design principles by maximizing southern exposure and

providing protection from winter winds, and evoke an image appropriate to the prairie setting at Walnut Creek.

An outdoor gathering area accessible to both the Environmental Education Building and Visitor Center will be provided adjacent to the buildings.

Maintenance Facilities

The campus cluster is comprised of buildings and facilities whose primary functions are related to the public use and environmental education missions of the Refuge. A physical and visual separation will be provided between the primary cluster and two other buildings whose functions are related to maintenance. The Maintenance Facility and sewage treatment plant buildings will be located approximately 1,000 feet west and on the opposite side of the ridge from the main campus cluster and parking lot. Access to these buildings will be provided by a service road which intersects the campus entrance drive between the dropoff area and parking lot.

Although primarily devoted to support uses, the Maintenance Facility will provide opportunities for instructing participants in the Refuge environmental education programs on topics such as Refuge operations and prairie reconstruction methods. Located a short walk from the main campus cluster, a prairie nursery demonstration area to be established near the Maintenance Facility will demonstrate processes and techniques involved in the reconstruction of native prairie and prairie/savanna habitat including reconstruction/restoration methods, equipment use, seed processing, and nursery operations.

Research Facility

Design for research facilities will reflect the importance of field investigation and will include space that provides for interaction of research activities with Refuge management, environmental education programs, and maintenance operations. Space will be reserved for long-term research and monitoring activities performed by Refuge staff as well as for shorter term research performed on-site by a limited number of visiting researchers. To accommodate these researchers, a bunkhouse with minimal dining and informal meeting facilities for visiting researchers will be sited approximately 700 feet west of the campus cluster near the Maintenance Facility. The location of this facility separated from the primary cluster will promote privacy for research activities.

Outdoor Campus *Facilities*

The campus site and surrounding area are currently characterized by a diversity of vegetative cover types (prairie, prairie plants in brome, scrub savanna, non-native grassland, wooded gullies, and cropland) and topographic and hydrologic conditions varying from ridgetop to stream valley. These diverse natural resource conditions provide abundant opportunity *for* the reconstruction of new and restoration of existing native plant communities. From the campus

CENTRAL CAMPUS CONCEPTUAL SITE PLAN

- **a** Arrival Plaza / Drop-off Zone
- **b** Prairie Campus Complex
  - Visitor Center
  - Environmental Education Center
  - Administrative Offices
  - Outdoor Displays / Exhibits
  - Demonstration Areas
- **c** Viewing Area
- **d** Prairie Demonstration and Display Area
- **e** Campus Loop Trails
- **f** Entry Drive
- **g** Visitor Parking
- **h** Research Quarters
- **i** Sewage Treatment Facility
- **j** Maintenance Facility and Nursery

0 100 200 300 Ft.

0.5 Acres

NORTH

buildings, visitors will be directed to trails which will allow them to experience first hand the beauty and diversity of the tallgrass prairie landscape presented in the Visitor Center. Those preferring a short walk will enjoy a "condensed" prairie experience offered by a short campus loop providing access to 20 acres of demonstration and display areas located to the west of the campus buildings. Interpretive signage will identify the characteristic plants of the tallgrass prairie: brilliantly colored spring and summer flowering forbs, and big bluestem and other prairie grasses growing to impressive heights by late summer and turning gold, yellow, and deep bronze in the fall. Other displays will be established to supplement the themes of the indoor exhibitry. As an example, "idea gardens" will be established which illustrate how the homeowner can recreate a "piece of the prairie" in his or her backyard. From carefully placed scenic overlooks, the visitor will enjoy middle and long-range views to the north and west across the reconstructed prairie, savanna, and riparian habitats found within the Refuge.

Campus Loop Trail

The short campus loop trail will provide access to two facilities located near the campus buildings. A picnic area will be provided for school children participating in Refuge Environmental Education programs. An outdoor assembly area will accommodate educational and interpretive programs and activities for groups of 50 or more persons in an open-air setting surrounded by the reconstructed landscape.

Visitors will also have the opportunity to explore a loop trail which branches from the campus loop into the surrounding landscape. Walkers following this trail will encounter a range of habitats: tallgrass prairie on the ridgetop surrounding the campus site, tallgrass prairie and savanna on the sides of the valleys of Walnut Creek and its tributary streams, and riparian habitats on the valley bottoms. The trail will offer a variety of visual experiences including panoramic vistas of the Refuge landscape from the ridgetop, partially enclosed views defined by valley slopes, and more intimate views from beneath the canopies of oak savanna and woodlands along the valley bottoms. Expanding upon the indoor and outdoor exhibitry contained in the campus buildings and adjacent demonstration and display areas, interpretive signage will be placed at scenic overlooks and other points of interest along the trail. These points of interest will include an impoundment created on the tributary stream north of the campus and a bison display area located between the impoundment and South 96th Avenue West. Walking along the curving edge of the long, narrow impoundment, visitors will observe the flora and fauna typical of central Iowa's native aquatic ecosystems. The trail will also provide access to the prairie demonstration area located to the north and east of the campus facilities.

Tour Route

Some visitors may choose to leave the Refuge after visiting the campus, satisfied with the enjoyment and knowledge gained from experiencing the indoor and outdoor exhibits, demonstration areas, and trails. Other visitors wishing to explore the larger Refuge landscape by automobile will follow the campus entrance drive back to the tour route. Interpretive media available at the Refuge entrance and Visitor Center will provide these visitors with information regarding important natural or cultural features keyed to roadside interpretive signs. Turning onto the one-way tour route from the entrance drive, visitors may choose to stop at a scenic overlook offering sweeping views across the diverse habitats and rolling landscape of the southern portion of the Refuge. Visitors will follow the route as it curves first southwest and then northwest across the broad valley of a tributary of Walnut Creek. After passing through the tallgrass prairie, oak savanna and riparian habitats typical of the southern portion of the Refuge, the tour route will cross South 96th Avenue West, with views of the more open tallgrass prairie environment characteristic of the northern portion

of the Refuge. Bison and elk may be visible as they graze within the prairie-ranges established in this part of the Refuge.

The tour route will curve through the northern portion of the Refuge, for the most part running along the sides of stream valleys above riparian habitats and below ridge lines, thus immersing visitors in the tallgrass prairie environment while avoiding excessive grading or impacts on sensitive natural resources. A scenic overlook will be provided on the edge of a plateau in the western part of the Refuge, providing the visitor with views east across the Walnut Creek valley. Other wayside stops will be provided at outdoor classrooms and other points of interest along the route. In the northwestern corner of the Refuge, the visitor will follow the tour route as it curves east across the upper part of the Walnut Creek valley. After crossing Walnut Creek, the tour route will run southeast along the stream valley until it merges with the two-way entrance road in the northeastern corner of the Refuge. At this intersection, the visitor can either turn left to exit the Refuge or turn right to complete the tour and return to the campus.

Two outdoor classroom sites will be situated along the tour route. A Composite outdoor classroom site will be located at the confluence of Walnut Creek and a tributary stream in the northwestern portion of the Refuge. This facility will demonstrate a range of habitats which represent a microcosm of the larger Refuge landscape. These habitats will include wooded and herbaceous riparian habitats along Walnut Creek and its tributary, woodland, and oak savanna, all surrounded by the tallgrass prairie of the northern part of the Refuge. An impoundment will be established in the low-lying area between Walnut Creek and the tributary stream.

A Woodland/Savanna outdoor classroom site will be located on the combined tour route/Refuge entry road southeast of the central campus. In contrast to the tallgrass prairie dominant in the northern part of the Refuge, this site will allow visitors to experience a mature oak savanna and other woodland communities along Walnut Creek, restored and augmented with additional tree plantings. A walking trail will meander beneath the canopy of the restored oak savanna.

Bison/Elk Management Area

A bison/elk management area will be established on approximately *2,000* acres in the northern part of the Refuge north of South 96th Avenue West. This part of the Refuge is most suitable for reconstruction of the tallgrass prairie environment favored by bison and elk, contains both wooded areas and sources of water located along riparian corridors, and provides viewing opportunities from the tour route, Refuge entry road, and South 96th Avenue West. Visitors will view bison and elk in their natural habitat, the tallgrass prairie ecosystem, from their vehicles and from pullovers located

along the tour route and entry road. Long-range views of the herds roaming the reconstructed landscape will be available from the Visitor Center viewing area. Fencing required to contain the bison and elk herds will be hidden from public view to the maximum extent possible.

Prior to establishment of the entire bison/elk management area, an interim management area of approximately 150 to 200 acres will be located across South 96th Avenue West from the bison display area. Bison and elk will be confined to this area before all of the land north of South 96th Avenue West is acquired and the reconstructed/restored landscape is fully established. A bison/handling facility will be located within the interim management area.

***Hiking/Biking** Trail*

Major public use facilities provided on the Refuge such as the Visitor Center, Environmental Education Building, and tour route will be concentrated in the northern and central parts of the Refuge. By contrast, public access to the area south of the Visitor Center and tour route will be more limited so that the landscape can be managed to emphasize reconstructed habitats, wildlife, and research. The hiking/biking loop trail will provide walkers, bicyclists, and environmental education program participants partial access to the varied terrain and vegetation found in this portion of the Refuge. This crushed limestone trail will intersect the tour route at two points located east and west of the campus entrance drive. Trail connections from the longer campus loop trail to these points will allow pedestrians and bicyclists easy access to the hiking/biking trail from the campus facilities. The hiking/biking trail will be sited to follow the existing topography, and will reward users with a more intimate experience of the tallgrass prairie/savanna landscape than will be possible by vehicle.

Visitors hiking or biking along the trail connection from the campus to the western section of the hiking/biking trail will initially traverse a flat, open plateau of tallgrass prairie which recalls the prairie expanses found in the northern part of the Refuge. Crossing the tour route onto the hiking/biking trail, visitors will continue along the edge of the tallgrass prairie plateau, from which views east across the rolling terrain and diverse habitats of the Walnut Creek valley will be available. From the plateau, the trail will curve southeast, descending into the valley of one of the major tributaries of Walnut Creek. Visitors will enjoy a variety of reconstructed or restored tallgrass prairie, savanna, forest, and riparian habitats and a changing sequence of views framed by topography and/or vegetation as they move along the trail towards the Walnut Creek valley. Two impoundments established on this tributary will enhance the visual diversity of the landscape and provide opportunities for viewing aquatic wildlife.

Near the confluence of the tributary stream and Walnut Creek, the main hiking/biking trail will turn north and run parallel to Walnut Creek. A spur of the main trail will extend south along the Walnut Creek valley to the southern boundary of the Refuge at Highway F70, providing a potential future connection to the Des Moines Recreational River and Greenbelt trail system. Two moist soil units will be located along Walnut Creek a short walk down the spur trail from the main hiking/biking trail, providing opportunities for viewing wildlife in an intensively managed wetland environment.

Walking in the Oak Savanna

Visitors moving north along the main trail will pass through open groves of bur oak and other savanna trees, the closed canopies of upland woods on slopes overlooking Walnut Creek, and open carpets of prairie grasses and forbs as they make their way north towards the tour route and campus. The flowing water and riparian habitats of Walnut Creek will be a constant presence in the landscape. Approaching the eastern intersection with the tour route, the hiking/biking trail will turn west and then north to skirt the edge of a restored oak savanna community containing the oldest bur oaks in the Refuge. Bicyclists wishing to return to the campus will continue along the trail to the tour route, where they will turn left and then right on the campus entry drive. Hikers have the option of turning onto a trail associated with the Woodland/ Savanna outdoor classroom site. This trail will wind through bur oaks with gnarled, three to four foot diameter trunks. From the Woodland/Savanna walking trail, hikers will be directed to a second trail running north along Walnut Creek, which will cross the tour route and bring them back to the campus facilities.

Although intended primarily for use by hikers and bicyclists, the **hiking/biking** trail will also be used by authorized vehicles *transporting* participants in the Refuge environmental education programs. The hiking/biking trail will provide access to the Wetland outdoor classroom site as well as the Refuge Native Plant Preserve. Environmental education program participants and other visitors will reach the Wetland outdoor classroom site, located on the western tributary stream, after a short walk along a loop trail from the hiking/biking trail. Continuing along the loop trail, visitors will encounter a variety of riparian habitats including an open water impoundment.

The Refuge Native Plant Preserve will be located on the eastern leg of the hiking/biking trail along Walnut Creek. Located near the edge of the restored oak savanna community, the preserve will be accessible from the hiking/biking trail and the loop trail associated with the Woodland/Savanna outdoor classroom site. Approximately 25 to 40 acres in size, this area will be devoted to a naturalistic display of grasses, wildflowers, and woody plants which comprise the native plant communities represented on the Refuge.

Environmental Education Campground

The environmental education campground will be **an** important adjunct to the Refuge **EE** programs. The campground will be located at a remote and secluded site in the southeastern corner of the Refuge, east of Walnut Creek and north of the Refuge boundary at Highway F70. The campground will be the only major public use facility located in the portion of the Refuge east of Walnut Creek and south of South 96th Avenue West. Controlled access to the campground from F70 will be provided by a trail extending east from the north/south hiking/biking trail spur. Campers utilizing this facility will participate in environmental education and interpretive programs as part of an expanded environmental education program.

Walnut Creek

The students at North Cedar School in Cedar Falls, Iowa, planted a prairie in back of their school in 1983.

"I like it because I like to work outdoors and I like seeing different plants. I like to come down here on my bike and watch the wind blow onit..."

- Student at North Cedar School in Cedar Falls, Iowa

INTRODUCTION

Round-Headed Bush Clover

The physical development of a Refuge is a carefully orchestrated process blending the gradual reconstruction and restoration of the natural environment with the concentrated construction of built facilities. The Walnut Creek National Wildlife Refuge Master Plan has been developed to optimize this blending and to ensure that the implementation and construction phasing can be executed with design excellence and fiscal responsibility.

Construction activity throughout the Refuge has been organized into seven (7) separate development components. Each component has been programmed with specific functional requirements and budgetary parameters. Construction Project Worksheets (CPWs) have been developed for specific projects under each component. The CPWs provide an initial program outline for design and construction and are also part of a regional system to track and budget refuge projects. The components consist of the following:

1.0 Basic Refuge Development: This component generally includes the development of the Refuge's natural habitats and physical property. Pre-existing structures and fencing deemed unsuitable will be demolished, water wells capped, obsolete bridges and roads removed, and inappropriate landscape areas grubbed and cleared. Open water impoundments will be constructed. Property boundary fencing will be erected where necessary to accommodate adjacent property owners. Directional, regulatory, operational and perimeter boundary signage is installed to assist the public in properly accessing the property.

During initial phases, the Basic Refuge Development will be managed on-site from an interim Refuge office. This temporary facility will provide office space for the Refuge staff and serve as the first contact station for public participation.

With native prairie as the dominant focus of the Refuge, a major prairie reconstruction and grassland management program will be initiated. Complementing the prairie reconstruction will be selected areas of oak savanna/woodland reconstruction. Planting and cultivation equipment needed to implement this habitat reconstruction activity will be purchased.

CPWs developed for this component include:

- WNT 92101 (Prairie Reconstruction 1993)
- WNT 92102 (Prairie Reconstruction 1994)
- WNT 92103 (Prairie Reconstruction 1995)
- WNT 92104 (Prairie Reconstruction 1996)
- WNT 92105 (Prairie Reconstruction 1997)
- WNT 92111 (Prairie Campus Impoundment D)

- WNT 92112 (Composite Outdoor Classroom Site Impoundment E)
- WNT 92113 (Future Wetlands Impoundment A)
- WNT 92114 (Future South Central Impoundment B)
- WNT 92115 (Future Moist Soil Units Cl and C2)
- WNT 92131 (Fencing)
- WNT 92132 (Future Fencing)
- WNT 92151 (Refuge Signage)
- WNT 92152 (Future Refuge Signage)
- WNT 92161 (Demolition, Site Clearing, & Well Capping)
- WNT 92162 (Future Demolition & Site Clearing)
- WNT 92163 (Demolition of Roads & Bridges)
- WNT 92164 (Future Demolition of Roads)
- WNT 92165 (Demolition of Interim Office)

2.0 Maintenance Facilities: Operation of a Refuge requires on-site facilities for equipment maintenance, repair, and seasonal storage. Seed storage and drying equipment will facilitate the prairie reconstruction program. A maintenance shop will provide space for both vehicle service and general carpentry. An attached storage garage will provide seasonal protection for service vehicles. Selected species of plants will be developed in a propagation house prior to replanting in the habitat reconstruction areas. Maintenance equipment, shop tools and adequate storage structures will ensure efficient on-site servicing and minimize equipment down time. Equipment for fire fighting and prescribed burning operations will be provided for prairie reconstruction and management.

CPWs developed for this component include:

- WNT 92201 (Maintenance Facility)
- WNT 92202 (Heavy Equipment & Shop Equipment)
- WNT 92203 (Prescribed Burn Equipment)

3.0 ***Environmental Education*** *Center:* Classroom and meeting facilities will be constructed in this component to provide the educational staff with appropriate spaces. Educational staff offices will be located near a centralized resource area. A multi-purpose room/auditorium will provide space for large group activities and foul weather programming. Staff activities will be complemented with research workrooms, equipment storage lockers, and administrative support areas. Fixed and movable equipment needed to develop and deliver the educational program will be provided.

Environmental Education materials and brochures will be designed and printed for use and distribution on the Refuge. Travelers Information Stations will broadcast informational messages along the Entrance Road to inform the visitor of

Refuge programs. A traveling classroom - The Prairie Schooner - will be provided for carrying the message of the Refuge to nearby schools.

CPWs developed for this component include:

- WNT 92301 (Environmental Education (EE) Center)
- WNT 92302 (EE Program Materials)
- WNT 92303 (Print Brochures Graphic Design)
- WNT 92304 (Travelers Information System)
- WNT 92305 (Prairie Schooner)

4.0 Visitor Center: *This* building will contain a diverse collection of interpretive exhibits and educational opportunities. An auditorium for multi-media presentations will complement the exhibit galleries. A small gift shop/bookstore will have for sale environmental education material, and high-quality vending equipment will provide the visitor with a select choice of pre-packaged snacks and beverages.

CPWs developed for this component include:

- WNT 92401 (Visitor Center)

5.0 Refuge Administrative Offices: Permanent on-site offices will be constructed to house the Refuge administrative staff. Support facilities such as meeting rooms, storage areas, staff lockers, and administrative workrooms will be included.

CPWs developed for this component include:

- WNT 92501 (Administrative Offices)

6.0 Research Facilities: Laboratory and research facilities will be provided for Refuge research teams in the Prairie Learning Center. On-site lodging facilities also will be constructed to accommodate overnight stays by research teams. These modest facilities will include sleeping quarters, lockers, kitchen space, and equipment storage.

CPWs developed for this component include:

- WNT 92601 (Research Facilities)
- WNT 92602 (Research Quarters)

7.0 Site Amenities: For visitors experiencing the Refuge landscape, a number of facilities will be constructed and developed to enhance the educational and recreational opportunities. An easily accessible section of reconstructed prairie habitat will be developed within **walking distance of the**

Visitor Center with interpretive exhibits and signage. Wetland habitats will be established. Herds of bison and elk will be visible in management and display areas. A variety of walking, hiking and biking trails will allow the visitors to explore selected areas of the Refuge and provide a potential future linkage to a regional trail network.

Within this component, the primary entry road will be constructed and landscaped. A vehicular tour route will connect to the main entry road, providing access to a large portion of the Refuge. Interpretive and observation points including two outdoor classrooms will be located along the tour route. Service roads will be constructed that link the Maintenance Facility and bison/elk handling facility with the Refuge road system.

Hard surface parking will be built adjacent to the Visitor Center. This visitor parking area will be carefully constructed to minimize visual intrusion in the reconstructed landscape.

Site utilities will be provided where required to serve Refuge facilities. A sewage treatment facility serving the campus buildings will be located near the Maintenance Facility.

CPWs developed for this component include:

- WNT 92711 (Prairie Demonstration Area)
- WNT 92721 (Bison/Elk Display Area)
- WNT 92722 (Bison/Elk Interim Management Area)
- WNT 92723 (Future Bison/Elk Management Area)
- WNT 92724 (Bison/Elk Handling Facility)
- WNT 92731 (Campus Loop Trail)
- WNT 92732 (Two Mile Campus Loop Trail)
- WNT 92733 (Future Hiking/Biking Trail)
- WNT 92734 (Woodland/Savanna Trail)
- WNT 92735 (Future Wetlands Trail)
- WNT 92736 (Composite Trail)
- WNT 92741 (Entry Road)
- WNT 92742 (Tour Route)
- WNT 92743 (Future Tour Route)
- WNT 92744 (Interior Service Roads)
- WNT 92751 (Composite Outdoor Classroom)
- WNT 92752 (Woodland/Savanna Outdoor Classroom)
- WNT 92753 (Future Wetlands Outdoor Classroom)
- WNT 92754 (Prairie Nursery)
- WNT 92755 (Native Plant Preserve)
- WNT 92756 (Outdoor Assembly Area)
- WNT 92757 (Arrival Plaza/Drop-Off Zone)
- WNT 92758 (Picnic Area)
- WNT 92759 (Future EE Campground)

- WNT 92761 (Visitor Parking)
- WNT 92781 (Sewage Treatment Facilities)
- WNT 92782 (Utility Distribution)
- WNT 92783 (Future Utility Distribution)

These seven components of physical development will be implemented in three phases as follows:

Phase I:	Pre-Development Site Preparation	(1993- 1994)
Phase II:	Major Development	(1995- 1996)
Phase III:	Future Term Development	(1997+)

Implementation phasing will be executed by Refuge staff and private sector contractors working on various sub-components.

PHASE I: **PRE-DEVELOPMENT** SITE **PREPARATION**

During this phase which is scheduled for 1993 to 1994, work on a variety of site amenities and habitats will be initiated. The first two of the four open water impoundments will be constructed near the Visitor Center and Composite outdoor classroom sites. The required demolition of obsolescent structures, roads and bridges will begin and perimeter regulatory signage will be posted. The interim Refuge office will be completely operational.

The first phases of prairie reconstruction and restoration will begin. This will include the restoration of over 90 acres of prairie, savanna and riparian communities as well as the reconstruction of over 90 acres of these habitats. To facilitate cultivation, most of the prairie reconstruction equipment will be purchased.

The Bison/Elk Handling Facility will be built along with the Interim Management Area. Approximately 200 acres of pasture will be planted in interim cover.

Approximately 70 percent of the work on the entry road and that portion of the tour route on Refuge property will be completed in this phase.

Most of the sewage treatment facility will be constructed, and most of the site utility distribution system will be installed.

PHASE II: MAJOR **DEVELOPMENT**

In Phase II which is scheduled for 1995 to 1997, the major portion of the Refuge buildings will be constructed along with all of the site work that is located on U.S. Fish and Wildlife property.

A major portion of the prairie restoration and reconstruction will be accomplished during this phase. Over 240 acres of prairie, savanna and riparian communities will be restored, and approximately 300 acres of prairie habitat will be reconstructed. These operations will include purchasing and establishing seed sources that the Refuge will use to complete the reconstruction.

Most of the remaining site signage will be posted, and the demolition of selected obsolete buildings, bridges, and roads will continue. Upon occupancy of the Campus Complex, the interim office will be removed.

The Maintenance Facility will be constructed during this phase.

The Environmental Education Center will be constructed, fixed and movable equipment purchased, and program materials developed.

The Visitor Center will be constructed and 90 percent of the exhibit material installed. The feature film will be produced, and most of the fixed and movable equipment purchased and installed.

The Refuge Administrative Offices will be constructed along with the staff parking areas. Most fixed and movable equipment will be purchased.

The Research Facilities will be constructed and equipped.

Work on the entry road and the portion of the tour route on Refuge property will be finished. Visitor parking areas and the arrival plaza will be constructed.

The Site Amenities will be substantially completed. The remaining portions of the prairie demonstration area and outdoor exhibits and displays will be finished.

The prairie animal displays associated with the bison and elk programs will be largely completed.

The pedestrian trail system around the Central Campus and prairie demonstration area will be completed and trails connecting outdoor classrooms will be constructed. The prairie plant nursery will be installed.

Two outdoor classrooms (Composite and Savanna/Woodland) will be established along with the interpretive exhibits around these sites.

The outdoor environmental education assembly area will be constructed, and the picnic area installed at the campus.

The final phase of the sewage treatment facilities will be completed. The site utility distribution will also be finished.

PHASE III: **FUTURE DEVELOPMENT**

During Phase III, the final development and build-out of the Refuge will take place. This work will begin in 1998 and continue throughout the life of the Refuge. Since most of the Phase III projects are located on property that is not currently owned *by U.S.*

Fish and Wildlife Service, implementation will depend upon the acquisition of privately-owned property.

Two of the impoundments will be constructed, and both moist soil units will be established.

Installation of signage will continue as property is purchased.

All remaining demolition of obsolete buildings, bridges, and roads and removal of site debris will take place as land is acquired.

The bison and elk management area will be completed.

The remaining trails and outdoor classrooms will be completed along with the final leg of the tour route.

The largest portion of the prairie and savanna reconstruction will be completed as part of the Refuge Operation and Management budget using seed sources developed on the Refuge.

REQUIRED PERMITS

Federal and state permits which may be required prior to construction of certain Refuge facilities include wastewater disposal permits, Section 404 wetland permits, National Pollutant Discharge Elimination (NPDES) permits, Section 401 water quality certification, floodplain permits, and dam permits. In addition, building permits will be obtained from Jasper County for the construction of structures such as the Visitor Center, Environmental Education Center, administrative offices, and maintenance facilities. Jasper County approval also will be necessary for the closing of public roads within the Refuge. Coordination with the Iowa Office of Historic Preservation (OHP) and other appropriate agencies will be undertaken prior to undertaking construction projects which could affect known archaeological sites or soils of potential archaeological significance.

Wastewater Disposal Permits

Under Chapters 60-65 and 69 of the Iowa Code, the Iowa Department of Natural Resources (DNR) is responsible for regulating direct or indirect discharges of wastewater to waters of the state. The construction and operation of wastewater disposal systems including the sewage treatment facility serving the campus will require permits from the DNR.

Section 404 Wetland Permits

Permits will be required from the U.S. Army Corps of Engineers (USCOE) for any construction activities requiring stream crossings, conversion of existing wetlands, or filling of existing wetlands. ' Under Section 404 of Public Law 92-500, 'The Federal Water Pollution Control Act Amendments of 1972," it is necessary to obtain a permit from the USCOE to locate a structure, excavate, or discharge dredged or fill material in waters of the United States, including adjacent wetland areas. A joint permit application must

be submitted to the USCOE and the Iowa DNR for any such activities. Refuge development projects potentially requiring Section 404 permits include stream crossings required for the entry road, tour route, and hiking/biking trail, and the excavation and construction of moist soil units and impoundments. Prior to undertaking projects potentially affecting wetland resources, on-site delineation of wetlands must be undertaken and a jurisdictional determination obtained from the USCOE.

NPDES Permits

NPDES permits will be required from the U.S. Environmental Protection Agency (EPA) for construction activities disturbing five acres or more of land area. In order to obtain a permit, the applicant must submit a stormwater pollution prevention plan. The plan must include project impact descriptions, including estimates of the total area of the site that is expected to undergo excavation or grading, an estimate of the runoff coefficient of the site and the increase in impervious area after the construction is completed, descriptions of the nature of the fill material and the quality of discharge from the site, and other pertinent information. Measures addressing erosion and sediment control, control of solid and sanitary waste disposal, minimization of off-site vehicle tracking of sediments, stormwater management, and maintenance must be included in the plan. Refuge development projects potentially requiring NPDES permits include construction of the campus building projects, roadways and impoundments.

Section **401** Water **Quality** Certification

State Section 401 water quality certification is mandatory for all projects requiring a Department of the Army Section 404 permit. This certification is Iowa DNR's concurrence that a project is consistent with the State's water quality standards.

floodplain Permits

Projects which encroach on the 100-year floodplain of Walnut Creek or one of its tributaries may require a floodplain permit from the Iowa DNR. Chapter 71 of the Iowa Code establishes administrative thresholds which determine when approval from the DNR must be obtained for any development including construction, maintenance, and use of a structure, dam, obstruction, deposit, excavation, or "flood control work" on a floodplain or floodway. Refuge development projects potentially requiring floodplain permits include stream crossings, impoundments, moist soil units, and associated embankments.

Dam Permits

The dams forming the impoundments and moist soil units may require permits from the Iowa DNR in accordance with the criteria established in Chapter 71 of the Iowa Code. These dams will most likely be classified as moderate hazard dams according to the Iowa DNR Design Criteria and Guidelines for Dams. Moderate hazard structures are required to pass one-half of the probable maximum flood as the freeboard design flood. In addition, impoundments which store over 18 acre-feet of water require storage permits.

Permits are also required for withdrawals in excess of 25,000 gallons per day. Evaporative losses could invoke release requirements downstream.

Cultural Resources

Section 106 of the National Historic Preservation Act of 1966, as amended and Executive Order 11593, "Protection and Enhancement of the Cultural Environment," require federal agencies including the Fish and Wildlife Service to determine the effects that their actions, and any project receiving federal assistance or approval, may have .on historic properties included in, eligible for, or potentially eligible for inclusion in the National Register of Historic Places. The cultural resources survey of the Refuge conducted by the Service concluded that none of the cultural resources present on the Refuge are eligible for the National Register of Historic Places (see Chapter 2). However, prior to undertaking construction activities that could impact known archaeological sites or soils of potential archaeological significance, the Service will consult with the Iowa Office of Historic Preservation and other appropriate agencies. If deemed necessary, a survey will be undertaken to identify archaeological resources within the direct construction impact zone. This action would most likely include field surveys and subsurface testing, and would be concentrated in areas where some basis exists for predicting the occurrence of significant archaeological resources.

The contract specifications for Refuge construction projects will require that the State Historic Preservation Officer be notified if any evidence of archaeological remains is uncovered. Necessary actions would then be undertaken to complete appropriate investigation of such resources. This requirement will ensure that as yet undiscovered archaeological resources (if any) will not be adversely impacted as a result of Refuge construction.

IMPLEMENTATION **RESPONSIBILITY**

Implementation of the Walnut Creek National Wildlife Refuge Master Plan will begin immediately after the Master Plan is signed and the thirty-day waiting period following issuance of the Record of Decision on the Final Environmental Impact Statement (FEIS) has ended. Design, engineering, and construction of the proposed facilities will be directed by the U.S. Fish and Wildlife Service, Region 3 (the Region) and the U.S. Fish and Wildlife Service Engineering Center (SEC) in Denver, Colorado.

The Region will have overall responsibility for Master Plan development and will establish direction and specific program needs for facilities and habitat areas. This effort will include establishment of the development budget and the allocation of funds. The SEC will be responsible for design and construction of most of the major facilities. In cooperation with the Region, the SEC will prepare scopes of service, develop contract documents, and negotiate contracts.

Typical projects for the Region will include boundary posting, construction of impoundments and moist soil units, reconstruction and restoration of prairie and other small habitat improvements, and environmental education curriculum. The SEC projects will include the visitor and environmental education centers, administrative offices, entry road and parking areas, and maintenance and research facilities.

COSTS

The estimated construction costs of Refuge development are as follows (1995 dollars):

Phase I: Pre-Development Site Preparation

Total cost: $6,927,667

Phase IL: Major Development

Total cost: $22,663,275

Phase III: Future Development

Total cost: $2,646,174

The Gross Total Development Budget (Total Construction Budget plus Contingency plus Overhead) is *$32,239,117.*

Of this total, the Construction Budget plus a 10 percent Construction Contingency is $24,690,395. The Fish and Wildlife Service Overhead is budgeted at $7,548,722.

CONCLUSION

The budget allocated for Refuge development is indicative of a major commitment of funds commensurate with the importance of the Walnut Creek National Wildlife Refuge and Prairie Learning Center as one of the largest initiatives in prairie reconstruction in the United States. The project is consistent with the Fish and Wildlife Service goals to preserve and manage habitat in such a way that a diversity of wildlife and natural communities is achieved. The actions summarized in this chapter have been designed to provide for the orderly development of Refuge habitats and facilities of the highest possible quality. Furthermore, it is intended that the Refuge as an entity provide a rich learning experience for the public. By facilitating implementation of these actions, it is expected that the financial commitment made to planning, design, programming, and construction will help ensure the success of the Refuge in fulfilling its major purposes: biodiversity preservation, environmental protection, environmental education, research, and interpretation and recreation.