U. S. AIR FORCE

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

Wright-Patterson Air Force Base

(See INRMP signature pages for plan approval date)

ABOUT THIS PLAN

This installation-specific Environmental Management Plan (EMP) is based on the United States Air Force's (USAF) standardized Integrated Natural Resources Management Plan (INRMP) template. This INRMP has been developed in cooperation with applicable stakeholders, which includes Sikes Act cooperating agencies and/or local equivalents, to document how natural resources will be managed. Where applicable, external resources, including Air Force Instructions (AFIs); Department of Defense Instructions (DoDIs); USAF Playbooks; federal, state, and local requirements; Biological Opinions; and permits are referenced.

Certain sections of this INRMP begin with standardized, USAF-wide "common text" language that address USAF and Department of Defense (DoD) policy and federal requirements. This common text language is restricted from editing to ensure that it remains standard throughout all plans. Immediately following the USAF-wide common text sections are installation sections. The installation sections contain installation-specific content to address local and/or installation-specific requirements. Installation sections are unrestricted and are maintained and updated by the approved plan owner.

NOTE: The terms "Natural Resources Manager," "NRM," and "NRM/POC" are used throughout this document to refer to the installation person responsible for the natural resources program, regardless of whether this person meets the qualifications within the definition of a natural resources management professional in DoDI 4715.03, Natural Resources Conservation Program.

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DOCUMENT CONTROL

Standardized INRMP Template

In accordance with (IAW) the Air Force Civil Engineer Center (AFCEC) Environmental Directorate (CZ) Business Rule (BR) 08, *EMP Review, Update, and Maintenance*, the standard content in this INRMP template is reviewed periodically, updated as appropriate, and approved by the Natural Resources Subject Matter Expert (SME).

This version of the template is current as of 06/26/2020 and supersedes the 2018 version.

NOTE: Installations are not required to update their INRMPs every time this template is updated. When it is time for installations to update their INRMPs, they should refer to the eDASH EMP Repository to ensure they have the most current version.

Installation INRMP

Record of Review—The INRMP is updated no less than annually, or as changes to natural resource management and conservation practices occur, including those driven by changes in applicable regulations. IAW the Sikes Act and AFMAN 32-7003, *Environmental Conservation*, the INRMP is required to be reviewed for operation and effect no less than every five years. An INRMP is considered compliant with the Sikes Act if it has been approved in writing by the appropriate representative from each cooperating agency within the past five years. Approval of a new or revised INRMP is documented by signature on a signature page signed by the Installation Commander (or designee), and a designated representative of the United States Fish and Wildlife Service (USFWS), state fish and wildlife agency, and National Oceanic and Atmospheric Administration (NOAA) Fisheries when applicable (AFMAN 32-7003).

Annual reviews and updates are accomplished by the installation Natural Resources Manager (NRM), and/or a Section Natural Resources Media Manager. The installation shall establish and maintain regular communications with the appropriate federal and state agencies. At a minimum, the installation NRM (with assistance as appropriate from the Section Natural Resources Media Manager) conducts an annual review of the INRMP in coordination with internal stakeholders and local representatives of USFWS, state fish and wildlife agency, and NOAA Fisheries, where applicable, and accomplishes pertinent updates. Installations will document the findings of the annual review in an Annual INRMP Review Summary. By signing the Annual INRMP Review Summary, the collaborating agency representative asserts concurrence with the findings. Any agreed updates are then made to the document, at a minimum updating the work plans.

INRMP APPROVAL/SIGNATURE PAGES

This Integrated Natural Resources Management Plan (INRMP) fulfills the requirements for the INRMP in accordance with the Sikes Act (16 United States Code [USC] §670a *et seq*.), as amended; Department of Defense Instruction 4715.03—*Department of Defense Natural Resources Conservation Program*; and AFMAN 32-7003—*Environmental Conservation*. This document was prepared and reviewed in coordination with the Department of Interior, acting through the Director of the United States Fish and Wildlife Service; and the Director, Ohio Department of Natural Resources, in accordance with the 2013 Memorandum of Understanding for a Cooperative Integrated Natural Resources Management Program on Military Installations. By their signatures below, or an enclosed letter of concurrence, all parties grant their concurrence with and acceptance of the following document.

We approve implementation of the activities in this five-year Review and Update of the INRMP for Wright-Patterson Air Force Base as supporting the military mission while sustaining natural resources for future generations. This plan has been prepared pursuant to the Sikes Act Improvement Act of 1998 (16 USC § 670a *et seq*., as amended through 2014).

WARNER.DARRYN.M.1386410808 Digitally signed by WARNER.DARRYN.M.1386410808 Date: 2022.08.25 06:43:56 -04'00'

Signature	*Date*	
		Base Natural Resources Manager

VINCENT.STEVEN.S.1219691692 Digitally signed by VINCENT.STEVEN.S.1219691692 Date: 2022.09.01 10:40:01 -04'00'

Signature	*Date*	
		Director, 88th Civil Engineer Group
See enclosed concurrence letter from USFWS.	24 Aug 2022	Ohio Field Office Supervisor, U.S. Fish and Wildlife Service
Signature	*Date*	
See enclosed concurrence letter from ODNR.	23 Aug 2022	Director of the Ohio Department of Natural Resources
Signature	*Date*	

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
4625 Morse Road, Suite 104
Columbus, Ohio
(614) 416-8993 / FAX (614) 416-8994

August 24, 2022

Project Code: 2022-0077046

Mr. Darryn Warner
88 CEG/CEIEA
1450 Littrell Road, Building 22
Wright-Patterson AFB, OH 45433-5209

Dear Mr. Warner:

This is in response to your July 21, 2022 email requesting U.S. Fish and Wildlife Service concurrence with the 5-year update and the 2021 annual review to the Wright-Patterson Air Force Base Integrated Natural Resources Management Plan. We have reviewed the updated information and have no objection and no further comments on the revisions.

We appreciate the opportunity to work with you on these conservation efforts. If you have questions, or if we may be of further assistance in this matter, please contact Jenny Finfera at extension 113 in this office.

Sincerely,

KAREN HALLBERG-ROZDEBA
Digitally signed by KAREN HALLBERG-ROZDEBA
Date: 2022.08.24 16:02:57 -04'00'

acting for
Patrice Ashfield Ohio
Field Supervisor

Office of Real Estate
John Kessler, Chief
2045 Morse Road – Bldg. E-2
Columbus, OH 43229
Phone: (614) 265-6621
Fax: (614) 267-4764

August 23, 2022

Darryn M. Warner
88 CEG/CEIEA
1450 Littrell Road, Bldg. 22
Wright-Patterson AFB OH 45433-5209

Re: 22-0745; 2022-2026 Integrated Natural Resources Management Plan

Project: The proposed project involves review of the WPAFB INRMP which is a tool to guide the management of natural resources on WPAFB between the years 2022 and 2026, and to provide a foundation from which to build the program beyond the year 2026.

Location: The proposed project is located in Bath Township, Montgomery County, Ohio.

The Ohio Department of Natural Resources (ODNR) has completed a review of the above referenced project. These comments were generated by an inter-disciplinary review within the Department. These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the National Environmental Policy Act, the Coastal Zone Management Act, Ohio Revised Code and other applicable laws and regulations. These comments are also based on ODNR's experience as the state natural resource management agency and do not supersede or replace the regulatory authority of any local, state or federal agency nor relieve the applicant of the obligation to comply with any local, state or federal laws or regulations.

Natural Heritage Database: The Natural Heritage Database has the following data at or within one mile of the project area:

Ear-leaved-foxglove (*Agalinis auriculata*), E
Northern Adder's-tongue (*Ophioglossum pusillum*), T
Great Plains Ladies'-tresses (*Spiranthes magnicamporum*), P
Blanchard's Cricket Frog (*Acris blanchardi*), SC
Upland Sandpiper (*Bartramia longicauda*), E
Sedge Wren (*Cistothorus platensis*), SC
Tonguetied Minnow (*Exoglossum laurae*), E
Indiana Myotis (*Myotis sodalis*), E, FE
Smooth Greensnake (*Opheodrys vernalis*), E
Eastern Massasauga (*Sistrurus catenatus*), E, FT
Badger (*Taxidea taxus*), SC
Paiute Dancer (*Argia alberta*), T
Beer's Noctuid (*Papaipema beeriana*), E

Conservation status abbreviations are as follows: E = state endangered; T = state threatened; P = state potentially threatened; SC = state species of concern; SI = state special interest; U = state

status under review; X = presumed extirpated in Ohio; FE = federally endangered, and FT = federally threatened.

The review was performed on the specified project area as well as an additional one-mile radius. Records searched date from 1980.

Please note that Ohio has not been completely surveyed and we rely on receiving information from many sources. Therefore, a lack of records for an area is not a statement that rare species or unique features are absent from that area.

Water Resources: The Division of Water Resources has the following comment.

The local floodplain administrator should be contacted concerning the possible need for any floodplain permits or approvals for this project.

Since the plan does not identify any specific proposed impacts, the Division of Natural Areas and Preserves and the Division of Wildlife have no additional comment. The routine surveys cover the items that would be of concern.

ODNR appreciates the opportunity to provide these comments. Please contact Mike Pettegrew at mike.pettegrew@dnr.ohio.gov if you have questions about these comments or need additional information.

Mike Pettegrew
Environmental Services Administrator

EXECUTIVE SUMMARY

The Integrated Natural Resources Management Plan (INRMP) is the principal tool by which the natural resources of Wright-Patterson Air Force Base (WPAFB) are managed. WPAFB contains significant natural resources that make preparation of the INRMP appropriate. The purpose of this INRMP is to guide management of natural resources on WPAFB between the years 2022 and 2026, and to provide a foundation from which to build the program beyond the year 2026.

This Plan is based on an interdisciplinary ecosystem management approach that integrates natural resource management with the installation's mission. This INRMP has been prepared in accordance with the Sikes Act, Department of Defense (DoD) Directive 4700.4, DoD Instruction 4715.03, Air Force Policy Directive 32-70, and Air Force Manual 32-7003 This Plan was prepared cooperatively with the United States Fish and Wildlife Service (USFWS) and the Ohio Department of Natural Resources (ODNR).

The INRMP describes the existing condition and management of natural resources on WPAFB, including soils, surface and groundwater, wetlands, terrestrial and aquatic habitat, fish and wildlife including federally and state listed species, and outdoor recreation. The Plan addresses management of natural resources to avoid constraints to the military mission, and measures for avoiding impacts to natural resources.

Goals for natural resources management on WPAFB between 2022 and 2026 remain largely the same as in recent years, though have been consolidated into over-arching programmatic goals. Natural resources are managed to support the military mission, comply with applicable federal, state, and Air Force regulations, and provide for multiple-use of installation lands when consistent with the mission. However, management goals and objectives in this INRMP are more pro-active than in previous years, and projects are designed as specifically as possible to allow measurement of progress toward goals. As in recent years, primary focuses of natural resources management continue to include conservation of threatened and endangered species, restoration, expansion and management of existing native prairie habitat, and protection of natural habitats and water quality. A focus on controlling invasive and noxious plants will be continued for the years 2022 through 2026. This INRMP integrates the activities described in the Integrated Pest Management Plan (IPMP; Tab 4), Bird/Wildlife Aircraft Strike Hazard (BASH; Tab 2), Wetland and Stream Management Plan (WMP; Tab 5), Emerald Ash Borer Management Plan (Tab 7), and Huffman Prairie Management Plan (Tab 6) with natural resources goals and objectives.

The INRMP establishes the following five goals for managing natural resources on WPAFB.

1. Manage natural resources on WPAFB in accordance with applicable federal and state laws and Air Force guidance in a manner that supports the WPAFB mission and conserves natural habitats and native species on the base.
2. Protect Federal and State-listed and candidate species and their habitat on WPAFB.
3. As consistent with the mission, protect and improve water resources and wetland habitats on WPAFB.
4. Fully support the WPAFB BASH Program.
5. Promote outdoor recreational opportunities on WPAFB.

Objectives and specific projects designed to meet management goals are described in Section 8.0 Management Goals and Objectives. Annual checklists of projects, including the schedule, funding source, and priority level, are provided in Section 10.0 Annual Work Plans, to guide annual budgeting and project

scheduling during the 5-year period. Annual checklists identify the funding priority for each project based upon guidance in Air Force Manual 32-7003, *Environmental Conservation*.

The INRMP is a working document in which adaptive management principles are used to ensure goals, objectives, and projects are realistic and effective. INRMP goals, objectives, and projects may be adjusted based upon changes to the military mission, monitoring or survey results, new data, or regulatory changes. Based upon the annual review of INRMP projects, the Base Natural Resources Manager may recommend modifications to the INRMP. The INRMP will be updated on an annual basis.

Note: As of 2011, WPAFB is divided into two sections, Areas A and B. Area A consists of what was historically referred to as the separate Area A and Area C. This consolidation did not affect the building structure, and/or wetland numbers that were located in Area C.

1.0 OVERVIEW AND SCOPE

This INRMP was developed to provide for effective management and protection of natural resources. It summarizes the natural resources present on the installation and outlines strategies to adequately manage those resources. Natural resources are valuable assets of the USAF. They provide the natural infrastructure needed for testing weapons and technology, as well as for training military personnel for deployment. Sound management of natural resources increases the effectiveness of USAF adaptability in all environments. The USAF has stewardship responsibility for the physical lands on which installations are located to ensure all natural resources are properly conserved, protected, and used in sustainable ways. The primary objective of the USAF natural resources program is to sustain, restore, and modernize natural infrastructure to ensure operational capability and no net loss in the capability of USAF lands to support the military mission of the installation. The plan outlines and assigns responsibilities for the management of natural resources, discusses related concerns, and provides program management elements that will help to maintain or improve the natural resources within the context of the installation's mission. The INRMP is intended for use by all installation personnel. The Sikes Act is the legal driver for the INRMP.

1.1 Purpose and Scope

The Integrated Natural Resources Management Plan (INRMP) is the principal tool by which the natural resources of WPAFB are managed. WPAFB contains significant natural resources that make preparation of the INRMP appropriate. The purpose of this INRMP update is to guide management of natural resources on WPAFB during fiscal year (FY) 2022 through 2026 (inclusive), and to provide a foundation from which to build the program beyond the year 2026.

This Plan is based on an interdisciplinary ecosystem management approach. The Plan implements the AF principles for ecosystem management, including the principles of maintenance/restoration of native ecosystems and ecological processes, conservation of biodiversity, control of exotic and invasive species, and support for natural heritage programs.

The INRMP integrates natural resource management with the installation's mission. The INRMP is part of the overall planning process and ensures no net loss in capability of the installation lands to support the military mission. Information herein regarding the existing condition of, and management strategies for, natural resources on the base provides a link between natural resources management and WPAFB's comprehensive planning process. This document provides essential support for the Environmental Impact Analysis Process (EIAP), which is the mechanism for compliance with the National Environmental Policy Act (NEPA). For each proposed construction project, a Base Civil Engineer Work Request (Air Force Form 332) is filed through TRIRIGA with the 88 ABW Civil Engineering Directorate. Base Civil Engineer Work Requests (Air Force Form 332) are reviewed monthly to identify the need for NEPA analysis. Through the EIAP, potential impacts to natural resources are evaluated. Analysis of potential effects of proposed projects to wetlands, federally listed species, natural habitats, and other natural resources are an important component of the project planning process and compliance with federal, state, and WPAFB regulations.

1.2 Management Philosophy

An interdisciplinary approach was used to develop the ecosystem management philosophy of this plan. The management philosophy of the Natural Resources Program at WPAFB promotes environmental stewardship under the principles of multiple use and sustained yield.

Maintenance of long-term ecosystem function requires management practices oriented toward understanding ecosystem processes. With this perspective, management objectives and practices can respond to the dynamic nature of ecosystems and how they respond to human activity. Ecosystem

management focuses on the interrelationships of processes such as the influence of climate or soils on species' habitat requirements, as well as multispecies relationships.

Natural resources management on DoD facilities must compliment the military mission. The mission of WPAFB is compatible with the goals of ecosystem management. The management philosophy of this plan considers how the AF mission influences natural resources and how, in turn, sound natural resources management practices can enhance the AF mission by providing realistic training environments and recreational and aesthetic value.

The USAF commitment to conservation of natural and cultural resources (AFPD 32-70) will be implemented by integrating this plan with the base comprehensive planning process.

Consequently, the INRMP is as dynamic as the resources it serves to maintain and improve. Management strategies require monitoring to determine their effectiveness. As the ecosystem component under management changes, the management strategy may also require modification. New research and technology may also provide new direction in resource management. As the plan is frequently reviewed, appropriate adjustments in management strategies will be made.

1.3 Authority

The Sikes Act, 16 United States Code (USC) § 670a, requires an INRMP be written and implemented for all DoD installations with significant natural resources. This plan has been developed cooperatively between the installation, the USFWS, and ODNR. The USAF natural resources program ensures continued access to land, air, and water resources to conduct realistic military training and testing, as well as to sustain the long-term ecological integrity of the resource base.

This INRMP is developed under, and proposes actions IAW, applicable DoD and USAF policies, directives, and instructions. AFMAN 32-7003 provides the necessary direction and instructions for preparing an INRMP. Issues are addressed in this plan using guidance provided under legislation, Executive Orders (EOs), Directives, and Instructions including DoDI 4715.03; Air Force Policy Directive (AFPD) 32-70, *Environmental Quality*; and AFMAN 32-7003. DoDI 4715.03 provides direction for DoD installations to establish procedures for an integrated program for multiple-use management of natural resources. AFPD 32-70 discusses general environmental quality issues, including proper cleanup of polluted sites, compliance with applicable regulations, conservation of natural resources, and pollution prevention. AFMAN 32-7003 provides guidance on the preservation of cultural resources at USAF installations. The ‘Annotated Summary of Key Legislation Related to Design and Implementation of the INRMP’ Table, included as an appendix to this plan, summarizes key legislation and guidance used to create and implement this INRMP. Refer to the complete listing of AFIs, AFMANs, the Federal Register, and the USC to ensure that all applicable guidance documents, laws, and regulations are reviewed. Installation-specific policies, including state and local laws and regulations are summarized in the table below.

Installation-Specific Policies (including State and/or Local Laws and Regulations)	
WPAFBI32-7064	Hunting, fishing and boating on Wright Patterson AFB

1.4 Integration with Other Plans

In addition to integration with the military mission, this INRMP is integrated with other land management activities on the base. This INRMP incorporates information from the following plans.

- Storm Water Pollution Prevention Plan (WPAFB 2021)
- Storm Water Management Plan (WPAFB 2021)
- ICUZ Study (WPAFB 2022)
- Bird/Wildlife Air Strike Hazard Plan 91-212 (2021)
- Integrated Pest Management Plan: WPAFB (WPAFB 2021)
- Integrated Cultural Resources Management Plan for WPAFB (WPAFB 2021)
- WPAFB Wetland and Stream Management Plan (BHE Environmental, Inc. [BHE] 2014)
- Integrated Lake Management Plan for Gravel and Lower Twin Lakes (Shaw 2005a)
- Huffman Prairie Management Plan and Addendum (The Nature Conservancy [TNC] 2001a; HGS Engineering 2011; Nolin 2016)
- 88 SFS Operating Instruction 32-7064 (2020) Security Forces Fish and Wildlife Protection Program
- WPAFB Civil Engineering Performance Work Statement for Grounds Maintenance
- Emerald Ash Borer Management Plan (WPAFB 2010)
- Wildland Fire Management Plan (WPAFB 2022)

2.0 INSTALLATION PROFILE

Office of Primary Responsibility (OPR)	88 CEG/CEIEA
Natural Resources Manager/Point of Contact (POC)	Name: Darryn Warner Phone: 937-257-4857 Email: darryn.warner@us.af.mil
State and/or local regulatory POCs (include agency name for Sikes Act cooperating agencies)	Ohio Department of Natural Resources
Total acreage managed by installation	8,145
Total acreage of wetlands	20.1
Total acreage of forested land	815
Does installation have any Biological Opinions? (If yes, list title and date, and identify where they are maintained)	No
Natural Resources Program Applicability (place a checkmark next to each program that must be implemented at the installation. Document applicability and current management practices in Section 7.0)	☒ Fish and Wildlife Management ☒ Outdoor Recreation and Access to Natural Resources ☒ Conservation Law Enforcement ☒ Management of Threatened, Endangered, and Host Nation-Protected Species ☒ Water Resource Protection ☒ Wetland Protection ☒ Grounds Maintenance ☒ Forest Management ☒ Wildland Fire Management ☒ Agricultural Outleasing ☒ Integrated Pest Management Program ☒ Bird/Wildlife Aircraft Strike Hazard (BASH) ☐ Coastal Zone and Marine Resources Management ☒ Cultural Resources Protection ☒ Public Outreach ☒ Geographic Information Systems (GIS)

2.1 Installation Overview

2.1.1 Location and Area

Wright-Patterson Air Force Base is located east of Dayton, Ohio, in Montgomery and Greene Counties (Figure 2-1). WPAFB covers 8,145 acres of diverse natural, suburban, and urban habitats. The Mad River flows along the northwest boundary of the installation. To the south, the base is bordered by Wright State

University, and a mixture of commercial and residential property. There are no satellite/geographically separated units associated with WPAFB.

The base is partitioned into Areas A and B. Area A primarily houses administrative offices, maintenance facilities and the active airfield. Area B houses the research and development branch with educational functions. The airfield is located upstream of Huffman Dam, a flood control dam for the City of Dayton (Woolpert Consultants 1988).

Installation/GSU Location and Area Descriptions

Installation/ Geographically Separated Unit (GSU)	Main Use/ Mission	Acreage	Addressed in INRMP?	Describe Natural Resource Implications
There are no GSUs associated with Wright-Patterson Air Force base				

2.1.2 Installation History

WPAFB has a prominent role in American aviation history. Following their historic flight at Kittyhawk, North Carolina, the Wright brothers conducted aircraft experiments and gave flying lessons in a pasture owned by a family friend. The pasture became known as Huffman Prairie Flying Field and was used by the Wright brothers from 1904 until 1916 when Orville Wright closed the flying school.

In 1917, the U.S. Army leased 2,075 acres from the Miami Conservancy District (MCD) to create Wilbur Wright Field, an aviation school for World War I pilots, armorers, and mechanics. In 1918, warehousing and supplying began by the Fairfield Aviation Depot on a 40-acre tract of land adjacent to Wilbur Wright Airfield. In 1924 the City of Dayton donated over 4,500 acres of land for the construction of an aerodrome and new research facilities.

These lands included the leased lands of Wilbur Wright Field and lands that became a state-of-the-art aviation research complex known as Wright Field. In 1927, Wright Field opened with primary functions of research and development and air operations. In 1931, Wright Field was divided into Wright and Patterson Fields. The two fields were then joined again in 1948 to form WPAFB. It is named in honor of Wilbur and Orville Wright and Lt. Frank Stuart Patterson, a native Daytonian killed in a crash at the base while flight testing a machine gun synchronizer during World War I. Additional land has been acquired to expand the base, but the land use has remained basically unchanged since 1927. Today the base is the site for the conception, testing, modification, and retesting of weapons systems for the AF (Woolpert Consultants 1988, KZF et al. 1994, Woolpert LLP 2001).

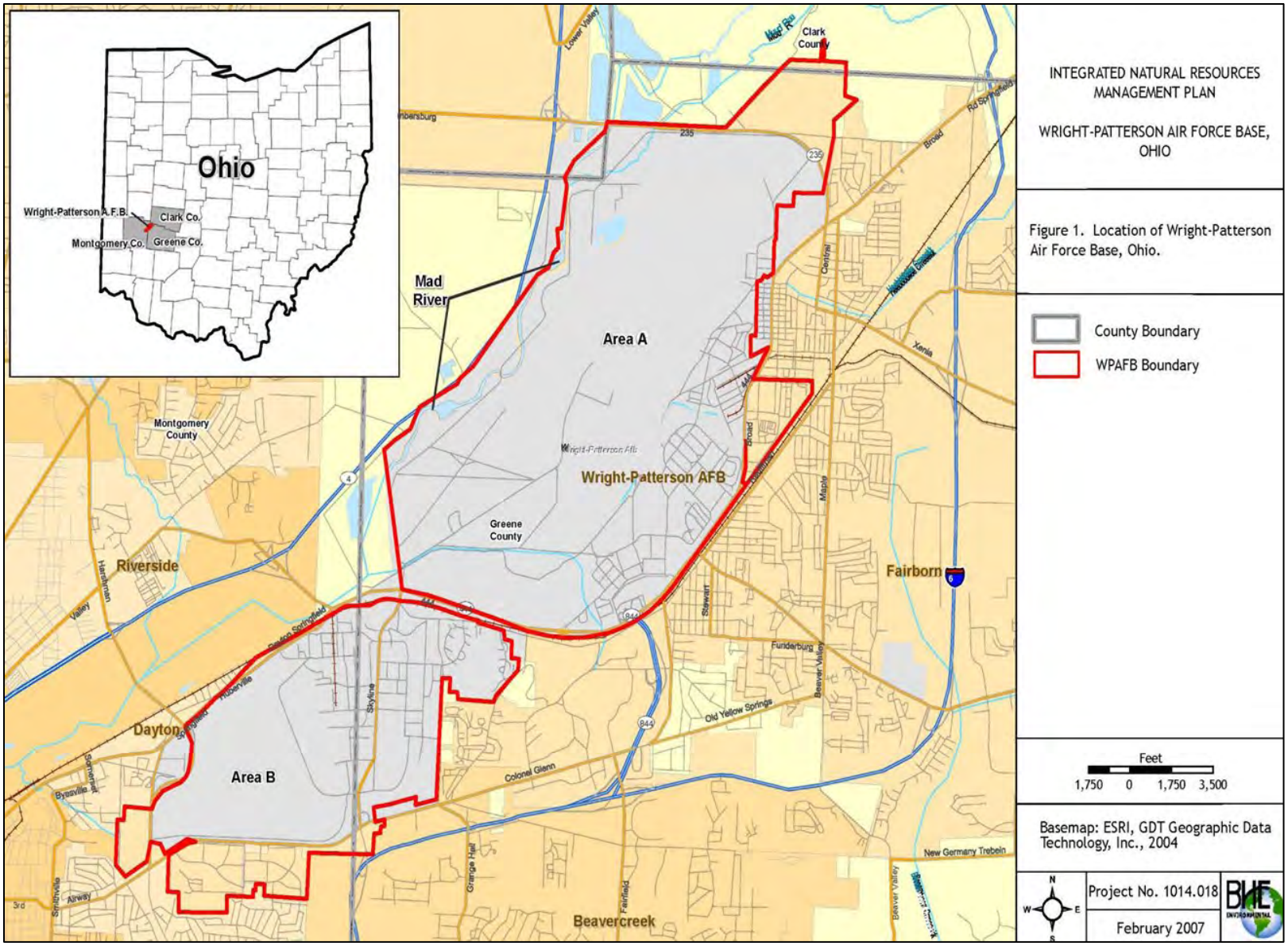

Figure 2-1. Location of Wright Patterson Air Force Base, Ohio.

2.1.3 Military Missions

The Air Force Life Cycle Management Center (AFLCMC), the largest of three product centers in AF Materiel Command, is charged with delivering weapons systems. AFLCMC develops, acquires, sustains and modernizes advanced aerospace capabilities. Programs managed here are the F-22 Advanced Tactical Fighter, B-2 strategic stealth bomber, the next generation C- 17 transport, the Advanced Cruise Missile, and training and propulsion systems for aircraft and missiles.

Wright-Patterson Medical Center provides reasonably priced, state-of-the-art medical service to its clients. Education and training are important in the medical mission evidenced by its close alliance to training and education with area universities. The clinical investigations program has over 100 research protocols including treatments for cancer and rare eye disorders.

The 88th Air Base Wing manages the entire base as its mission. It is responsible for payroll and personnel services, human resources development, base security, transportation, maintenance and engineering for all buildings, utilities, pavements and grounds, airfield management for runways, taxiways, and aprons, base housing and billeting, base communications systems, morale, welfare, recreation, services, warehousing and supply, fire protection, and environmental management.

Wright-Patterson has several major tenants. They include the Headquarters Air Force Materiel Command (HQ AFMC), the National Museum of the United States Air Force, the Air Force Institute of Technology, the National Air and Space Intelligence Center (NASIC), the Air Force Research Laboratory (AFRL), and the 445th Air Lift Wing.

The HQ AFMC delivers war-winning technology, acquisition, test, sustainment, and expeditionary capabilities to the warfighter. It advances and uses technology to acquire and maintain weapons systems with its customers.

The National Museum of the United States Air Force preserves the history of the pioneers of aviation. It also serves as a technological resource for engineers in the Air Force.

The Air Force Institute of Technology keeps the Air Force current on aerospace technology and management through specialized education, basic research, and consultation. It has four resident schools and an extensive non-resident program affiliated with hundreds of civilian schools and organizations. Approximately 23,600 people receive education from the four schools annually.

The NASIC is the sole national center for integrated intelligence on aerospace systems, forces and threats. It assesses foreign research and development trends. NASIC members brief national decision makers and help the United Nations on sanction enforcement.

AFRL leads the discovery, development and integration of affordable warfighting technologies for our air and space force. AFRL is comprised of 10 Directorates employing more than 9,600 government people – Air Vehicles, Directed Energy, Human Effectiveness, Information, Materials & Manufacturing, Munitions, Propulsion, Sensors, Space Vehicles, and the Air Force office of Scientific Research. Five of these directorates are headquartered at WPAFB. The others are located at Kirtland AFB, Rome Research Site in Rome, New York, Eglin AFB and in Arlington, Virginia. While research and development of aerospace technology is the primary mission of AFRL, most of this technology is available for immediate commercial application and industrial problem solving. This exchange of information helps America maintain leadership and competitiveness in the global market.

Listing of Tenants and Natural Resources Responsibility

Tenant Organization	Natural Resources Responsibility
Headquarters Air Force Materiel Command (HQ AFMC)	*88 CEG/CEIEA*
National Museum of the United States Air Force	*AFMC NMUSAF/MUR*
Air Force Institute of Technology	*AETC AFIT/ENR*
National Air and Space Intelligence Center (NASIC)	*NASIC/GXFO*
Air Force Research Laboratory (AFRL)	*AFMC AFRL/RXOE, RQOE, and RYOI*
445th Air Lift Wing	*445 MXG/MGQ*

2.1.4 Natural Resources Needed to Support the Military Mission

Groundwater and surface water resources on and near WPAFB are critical to sustaining the military mission, as well as the natural flora and fauna on the base. WPAFB obtains potable water for nearly all residences and facilities from on-base wells. The base owns and operates three water collection, treatment, storage, and distribution systems (Woolpert LLP 2001). Non-potable wells provide water for irrigation of the golf courses and other limited uses (Woolpert LLP 2001). Additionally, aquifers below WPAFB are a portion of the sole source of drinking water for the City of Dayton. To ensure continued use of groundwater resources, the resources, and the watersheds that feed them, must be protected from contamination.

Outdoor recreation opportunities on WPAFB support the base mission by improving the quality of life for military and civilian personnel and their families. Recreational facilities such as campgrounds, fitness paths, and hunting and fishing areas improve morale and the health and welfare of the WPAFB community.

2.1.5 Surrounding Communities

The base is located in Greene and Montgomery counties (Figure 2-2) approximately eight miles northeast of downtown Dayton. Besides Dayton, the base is surrounded by 11 cities with populations between 20,000 and 100,000. They represent significant regional markets and population centers. They are Springfield, Fairborn, Huber Heights, Kettering, Beavercreek, Middletown, Hamilton, Fairfield, Norwood, Xenia, and Piqua. Interstate 70 connecting Richmond, Indiana to Columbus, Ohio is located near the base, as well as Interstate 75, connecting Cincinnati to Toledo, and Interstate 675, which provides access from the southern Dayton suburbs and western Greene County communities. The base is within 50 miles of 17 municipal and county airports. The closest is Dayton International Airport, located approximately 10 miles to the northwest.

Land uses around WPAFB vary from rural agricultural to urban. Montgomery, Greene, Clark, and Miami counties have implemented land use restrictions near WPAFB that are sensitive to the aviation training mission of the installation.

The City of Fairborn is adjacent to the east and south boundaries of WPAFB. It is a residential community with limited commercial uses. Wright State University is located in the southwest portion of Fairborn, between the WPAFB boundary and Colonel Glenn Highway.

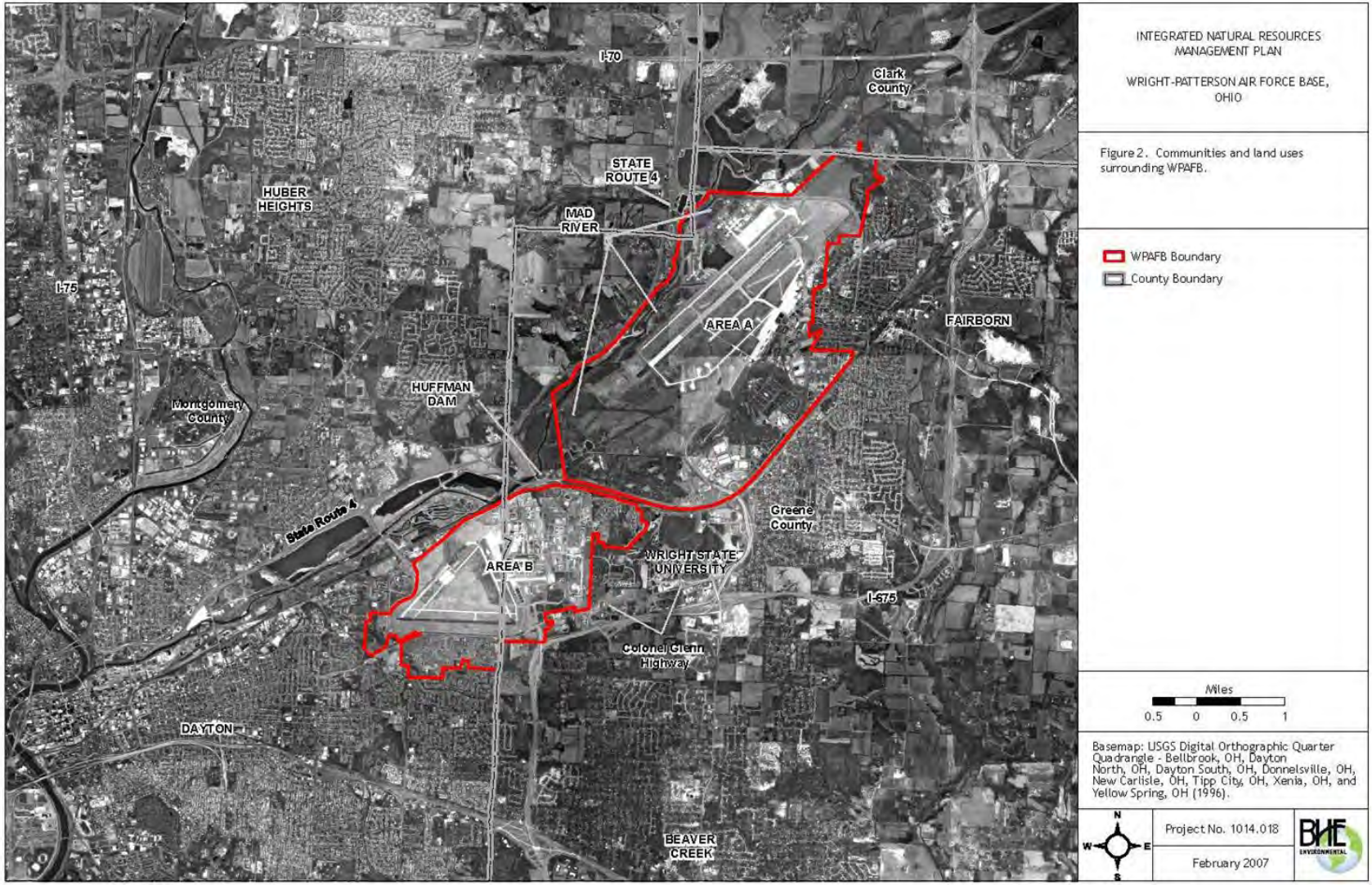

Figure 2-2. Communities and land uses surrounding Wright-Patterson Air Force Base.

The City of Beavercreek is located south of Fairborn and is adjacent to the southern boundary of WPAFB Area B. The principal land use in Beavercreek is residential, except for commercial uses along the I-675 corridor.

Southwest of WPAFB, toward the City of Dayton, land use becomes increasingly urban, with a mix of residential, commercial, industrial, and recreational land uses.

Northwest of WPAFB is primarily rural and agricultural, except for the incorporated Huber Heights, a high-density residential community.

To the north of WPAFB is primarily agricultural land. Much of the area lies within the floodplain of the Mad River, in which residential and commercial development is restricted.

2.1.6 Local and Regional Natural Areas

Natural areas on and near WPAFB include the Mad River, Huffman Prairie, and several parks. City of Dayton Five Rivers MetroParks manages six local parks in the Mad River corridor that are within approximately six miles of WPAFB, including Deeds Point and the Eastwood, Huffman, Taylorsville, and Carriage Hill Metroparks. Eastwood Metropark is just south and Huffman Metropark is adjacent to the northwest of WPAFB along the Mad River. The Metroparks contain natural areas similar to those on WPAFB.

Riparian woodlands exist in various locations along the Mad River. The higher quality woodlands exist primarily east of the Huffman Dam. A high-quality upland woodland exists north of State Road 4 near the Huffman Reserve on property owned by MetroParks. Upland prairies have been restored at various MetroParks around the Dayton area. These prairies are similar to WPAFB's Huffman Prairie.

Chief waterbodies within about 3 miles of WPAFB include the Mad River; Huffman Lake; and Eastwood Lake, lagoons, and the Blue Lake in Eastwood Metropark.

2.2 Physical Environment

2.2.1 Climate

The climate of southwestern Ohio is humid and temperate with a mean annual temperature of 11 °C (52 °F). Summers (June–August) are warm with a monthly mean maximum temperature of 28 °C (83 °F) and minimum mean temperature of 17 °C (63 °F). Winters (December–February) are moderate with a monthly mean maximum temperature of 3 °C (37°F) and minimum mean temperature of -6 °C (22 °F).

Prevailing winds are from the southwest and south-southwest with wind speeds between 2 to 5 m/s (meters per second; 5–12 miles/hour). Calm wind periods (less than 0.5 meters/second) comprise 5.6 percent of annual wind speed data.

Annual precipitation recorded at Dayton International Airport averages 87.4 cm (34.4 inches) and is evenly distributed throughout the year. The highest monthly mean precipitation is 9.9 cm (3.9 inches) occurring in June. October has the lowest monthly mean precipitation at 4.9 cm (1.9 inches).

2.2.2 Landforms

WPAFB is located in the Glacial Till Plain Section of the Central Lowland physiographic province. The Till Plain is a fertile region characterized by gently rolling hills. The base covers three major resource zones: the Mad River and its relatively broad floodplain; the alluvial terraces that overlook the floodplain; and the surrounding uplands. Establishment of these resource zones were influenced by preceding glacial episodes

and the underlying geology of the region. During the Pleistocene epoch, the Illinoisan and Wisconsin ice sheets extended into the central and southwestern parts of the state. The development and retreat of glaciers resulted in the extant drainage pattern, including the channel of the Mad River. In the immediate post-glacial period, conditions in northwestern Greene County favored wind and water erosion (Garner et al. 1978). This geographic history provides the base with a variety of aquatic and terrestrial habitats.

Historically, 95 percent of the Till Plains region was forested. The region lies within the Beech-Maple Forest Region (Braun 1950, Kuchler 1964). While beech-maple forest was dominant in mesic areas, wetter sites were likely dominated exclusively by beech (Anderson 1988). Regional vegetation also included swamp forests dominated by elm, maple, oak, and ash; oak or oak-hickory forests on drier sites; and tall grass prairies and/or oak savannas on some level and poorly drained sites (Anderson 1988). Agriculture is a predominant land use in the area today. Forest communities, while maintaining similar composition as historic forest, generally occur as small and scattered fragments of the historic coverage. Additional description of historic and current vegetative cover at WPAFB is provided in Section 2.3.2 Vegetation.

The majority of WPAFB is located on the broad alluvial plain of the Mad River Valley, which grades downward southwest at 10–20 feet per mile. This area is within the Central Lowland physiographic province, which is characterized by low rolling hills, level plains, and flat alluvial valleys. Total relief at WPAFB is approximately 220 feet, ranging from 760 feet above mean sea level (MSL) along the easternmost boundary of Area B to 980 feet above MSL along National Road (US 40) near the intersection of Colonel Glenn Highway.

The Mad River Valley narrows from approximately 2 miles wide near the center of Area A to approximately 0.5 mile wide at Huffman Dam, which separates Area B from Area A. The ridge at Huffman Dam is the most prominent of several northwest-trending ridges that flank the southeastern edge of the Mad River Valley. A second ridge exists along the extreme northeastern boundary of WPAFB.

Some of the natural relief is a result of the Wisconsin glaciation, which deposited approximately 80 to 100 feet of glacial outwash and till along the northeastern flank of the bedrock ridges in Area B and as much as 250 feet of sediment in the buried bedrock valley in Area A. Minor relief found on the valley floor is primarily the result of gravel quarrying operations.

2.2.3 Geology and Soils

2.2.3.1 Surface Soil

Surface soil at WPAFB formed on unconsolidated deposits, primarily alluvium, glacial outwash, glacial till, and loess. Small areas of residual soils over limestone and shale bedrock exist on steep slopes in the northeastern portion of Area A and in the eastern portion of Area B.

Development and substantial earthmoving activities have altered the natural soil characteristics at WPAFB, making precise classifications difficult. The Soil Conservation Service (SCS, now known as the Natural Resources Conservation Service/NRCS) mapped most of WPAFB as urban land complexes (SCS 1978a, b). Major soil complexes represented at WPAFB include Warsaw-Fill land complex, Sloan-Fill land complex, Miamian-Urban land complex, Fox-Urban land complex, Linwood Muck, Westland-Urban land complex, and Warsaw-Urban land complex.

Forty soil mapping units occur on WPAFB (Table 2-1, Figure 2-3). Warsaw-Fill land complex is the most common soil unit on base and occurs on 1,326 acres. This soil is found in the northeast portions of the installation. The second most common soil occurring on the base is Sloan-Fill land complex. This soil is found in the northern portions of the base and covers 1,232 acres.

Table 2-1. Land coverage and characteristics of soils found on Wright-Patterson Air Force Base.

Soil Type	ID	Total Acres	Percent cover on WPAFB	Slope	Characteristics	Prime Farmland
Brookston-Urban land complex	Bu	237	3	N/A	Hydric	No
Casco-Eldean loams	CcD2	10	<1	12–18 %	Moderately erodible	Yes
Eldean silt loam	EmA	10	<1	0–2 %	Little or non-erodible	Yes
Eldean silt loam	EmB	23	<1	2–6 %	Little or non-erodible	Yes
Eldean silt loam	EmB2	18	<1	2–6 %	Moderately erodible	Yes
Eldean-Urban land complex	EpC	31	<1	Rolling	Highly erodible	No
Fox-Urban land complex	FuB	786	11	Gently sloping	Moderately erodible	Yes
Linwood muck	Ln	548	7	N/A	Hydric	No
Made land	Mb	8	<1	N/A	N/A	No
Miamian silt loam	MhB	26	<1	2–6 %	Hydric inclusions, Moderately erodible	Yes
Miamian silt loam	MhB2	<1	<1	2–6 %	Hydric inclusions, Moderately erodible	No
Miamian silt loam	MhC2	34	<1	6–12 %	Hydric inclusions, Moderately erodible	No
Miamian silt loam	MhD2	4	<1	12–18 %	Moderately erodible	No
Miamian silt loam	MlB	37	<1	2–6 %	Moderately erodible	Yes
Miamian silt loam	MlB2	6	<1	2–6 %	Moderately erodible	Yes
Miamian-Urban land complex	MoB	78	1	Undulating	Moderately erodible	No
Miamian-Eldean silt loams	MoC2	11	<1	6–12 %	Hydric inclusions, Moderately erodible	No
Miamian and Hennepin soils	MpF	7	<1	25–50 %	Highly erodible	No
Miamian-Urban land complex	MrB	956	13	Undulating	Hydric inclusion, Highly erodible	No
Miamian-Urban land complex	MrC	541	7	Rolling	Highly erodible	No
Ockley silt loam	OcA	6	<1	0–2 %	Slightly erodible	Yes
Ockley silt loam	OcB	6	<1	2–6 %	Moderately erodible	Yes
Ockley-Urban land complex	OdB	165	2	Undulating	Highly erodible	No

Table 2-1. Land coverage and characteristics of soils found on Wright-Patterson Air Force Base.

Soil Type	ID	Total Acres	Percent cover on WPAFB	Slope	Characteristics	Prime Farmland
Pits, gravel	Pg	51	<1	N/A	N/A	No
Pits, quarry	Pu	3	<1	N/A	N/A	No
Ragsdale silty clay loam	Ra	26	<1	N/A	Little or non-erodible	Yes
Raub silt loam	RdB	172	2	2–6 %	Hydric inclusions, Moderately erodible	Yes
Ritchey silt loam	RhD	25	<1	12–18 %	Highly erodible	No
Ritchey silt loam	RhE2	23	<1	18–25 %	Moderately erodible	No
Sloan silty clay loam	So	79	1	N/A	Hydric	Yes
Sloan silt loam	So	28	<1	N/A	Hydric	Yes
Sloan-Fill land complex	Sp	1232	17	N/A	Hydric	No
Sloan-Urban land complex	Sr	12	<1	N/A	Hydric	No
Udorthents	Ud	140	2	N/A	N/A	No
Water	W	139	2	N/A	N/A	No
Warsaw loam	WaA	83	1	0–2 %	Little or non-erodible	Yes
Warsaw-Fill land complex	WbA	1326	18	Nearly level	N/A	No
Warsaw-Urban land complex	WcA	390	5	Nearly level	N/A	No
Westland silty clay loam	Ws	22	<1	N/A	Hydric	Yes
Westland-Urban land complex	Wt	359	5	N/A	Hydric	No

Sources: Soil Survey Geographic (SURRGO) database (http://www.ncgc.nrcs.usda/gov/), SCS 1978a, SCS 1978b.

Approximately one-half of the soils on the base have a moderate to high potential for erosion (Table 2-1). The potential for erosion varies with topographic conditions and includes both disturbed urban land complex soils and natural loams. Bare soil leads to erosion, creation of gullies and rills, and increased sediment load in streams. Erosion can render land unsuitable for training and impassable by vehicles. Sediment in streams may affect water flow and the survival of some aquatic organisms.

Mapping units designated as hydric or having hydric inclusions are also indicated in Table 2-1. Hydric soils are saturated, flooded, or ponded for sufficient periods during the growing season to develop anaerobic (oxygen-deficient) conditions in their upper layers. Anaerobic conditions in hydric soils are conducive to establishment of vegetation adapted for growth under wet oxygen-deficient conditions (hydrophytic vegetation). Areas on WPAFB where hydric soils or soils with hydric inclusions have been mapped are typically associated with the location of wetland soils such as the Linwood muck (Ln) but are also found in fill and urban land complexes such as the Sloan (Sp and Sr; Figure 2-3).

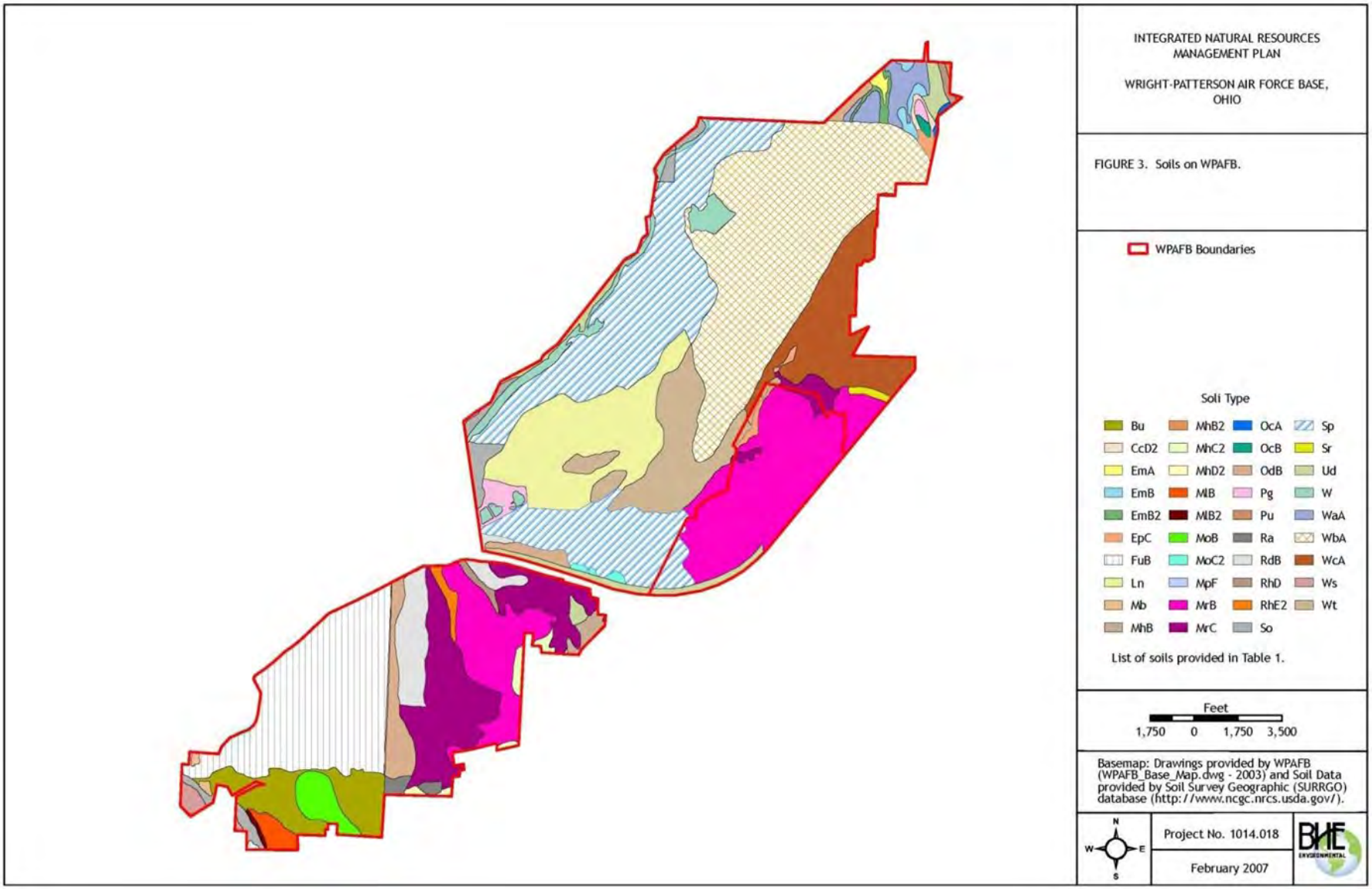

Figure 2-3. Soils on Wright-Patterson Air Force Base.

Sixteen of the mapping units on WPAFB are designated as prime farmland soils (Table 2-1). Most of these soils are loams located in the northeastern (Sandhill area) and southwestern portions of the base, and in areas near State Route 444.

More detailed information can be found in the soil surveys published by SCS for Montgomery and Greene counties (SCS 1978a, 1978b).

2.2.3.2 Subsurface Soil

Surficial deposits were created during the Quarternary Glacial Period which modified pre-existing drainage patterns and bedrock topography. During the late Tertiary period (approximately 3 million years ago), the main river draining the area was the Teays. This drainage system cut a number of valleys in the bedrock. Early Pleistocene (2.5 million years ago) glaciation dammed the rivers, so that lacustrine silts filled many parts of the Teays River system. During the Kansan-Illinoisan interglacial period (approximately 700,000 years ago), a different drainage system, the Deep Stage, prevailed in southwest Ohio (Norris and Spieker 1966). Bedrock valleys were deeply entrenched at this time. Glacial processes of Illinoisan (500,000 years ago) and Wisconsinan (100,000 years ago) age filled the deep stage valleys with till and outwash. Glacial till was deposited directly from the glacial ice without significant sorting by running water. Outwash deposits were laid down by melt water that flowed in the glacial melt water streams and are usually well-sorted sand or gravel or mixtures of both. Interbedded silts and clays (tills) occur in glacial deposits and may have developed in the former Deep Stage river valleys, or local re-advances of the Wisconsin ice sheet (Roy F. Weston, Inc. 1989). Sediment characteristics are quite heterogeneous.

Over 250 feet of sand and gravel filled the Mad River Buried Bedrock Valley underlying the airfield in Area A (Roy F. Weston, Inc. 1989). Interbedded within the relatively permeable sand and gravel are zones and lenses of low-permeability silty clay (till). These finer-grained materials occupy two principal horizons in the valley sediment column. The deepest fine- grained unit is reportedly a till zone that is 60 or more feet below the valley floor and up to 40 feet thick. Thinner, less-continuous clayey silts, possibly representing glacio-lacustrine deposits, occur in the valley sediments at depths of 10 to 30 feet below ground surface (International Consultants Incorporated [ICI] and Science Applications International Corporation [SAIC] 1995).

Glacial outwash deposits within the Mad River Buried Valley Aquifer are very permeable and exhibit high transmissivity and hydraulic conductivity, while the till deposits can act as aquitards with relatively low hydraulic conductivity. Bulk porosity of the aquifer materials has an estimated average of 34 percent, and effective porosity is about 25 percent (Roy F. Weston, Inc. 1989).

Glacial till deposits prevail under the eastern portion of Area B. During the advance of a glacial lobe, thin layers of drift (up to 20 feet in thickness) were deposited in the high ridges and thick layers were deposited in the valleys between prominent bedrock ridges (Roy F. Weston, Inc. 1989). The western side of the Mad River Valley, including the Area A airfield, is directly underlain by alluvium that consists of variable mixtures of sands, silts, and clays.

Alluvium deposits left by floodwater are the youngest, accumulating wherever fresh sediment was added by the stream overflow (SCS 1978b). The sediment was derived from the surface layer of the higher lying soils in the county and from exposures of glacial till.

2.2.4 Hydrology

Southwestern Ohio possesses prolific resources of both surface and groundwater resources. Accordingly, the existing hydrology of the WPAFB contains very active surface and groundwater resources and hydrology.

2.2.4.1 Surface Water Hydrology

WPAFB lies within the Great Miami River Basin with most of the base located within the floodplain of the Mad River (Figure 2-4, Figure 2-5). The Mad River originates approximately 40 miles north of Springfield, Ohio and flows south and southwest past WPAFB to its confluence with the Great Miami River in Dayton. The drainage basin of the Mad River at Harshman Road, immediately west of the WPAFB, has a total drainage area of 642 square miles (Cross 1967). The average discharge of the Mad River is 734 cubic feet per second based on 86 years of hydrologic data taken at the gauging station immediately upstream of Huffman Dam (U.S. Geological Survey [USGS] 2005). The Mad River has the highest dry weather index (a measure of the sustained flow between flood periods) in the state of Ohio at 0.19 million gallons per day per square mile (CH2M Hill 1986). Sustained flow in the Mad River originates from the discharge of groundwater in glacial deposits upstream of Huffman Dam, a flood control dam managed by the Miami Conservancy District (MCD). The Mad River adjacent to WPAFB has been designated a warm water habitat, agricultural and industrial water supply, and suitable for primary contact recreation by the Ohio Environmental Protection Agency (OEPA) (Ohio Administrative Code Chapter 3745-1-21).

The Mad River approaches WPAFB from the north and flows along the western boundary of Area A. Mud Creek joins the Mad River just north of WPAFB. The Mad River Valley is approximately 2 miles wide near the center of Area A and narrows to approximately 0.5 mile wide at Huffman Dam. At Huffman Dam the Mad River cuts through a northwest trending ridge that flanks the western and southeastern edge of the valley. A second ridge lies along the extreme northeastern boundary of the base. These ridges, which represent the highest elevation points in the area, bound the low-lying Mad River floodplain to the east and west of Area A forming a surface water drainage basin. Surface water drains from these ridges toward Hebble and Trout Creeks, Mud Run, and several unnamed tributaries in Area A. The Mad River exits the drainage basin at the narrow bedrock valley neck at Huffman Dam (Roy F. Weston, Inc. 1989).

Most of Area A lies behind Huffman Dam and is subject to flooding. The 10-year floodplain elevation of the Mad River at WPAFB is 804.7 feet above MSL, while the 100-year floodplain, based on recent modeling studies conducted by the U.S. Army Corps of Engineers (USACE) in 1994, is at an elevation of 814.3 feet above MSL. The Huffman Dam spillway is at an elevation of 835 feet above MSL, higher than most of Area A and portions of the city of Fairborn (ICI and SAIC 1995). The Mad River passes to the north and northwest of Area B. Area B is drained by an unnamed tributary and storm water drains that empty into the Mad River.

Although the Mad River is the dominant waterway within the area, two additional tributaries to the Mad River are located within the vicinity of WPAFB. Mud Run joins the Mad River at the extreme northern boundary of the base just east of the Montgomery County line. Mud Run is a perennial tributary whose watershed comprises approximately 27.4 square miles northeast of the base. A second perennial tributary, Hebble Creek, flows westward through the city of Fairborn into WPAFB where it becomes channelized and is eventually directed into the Mad River.

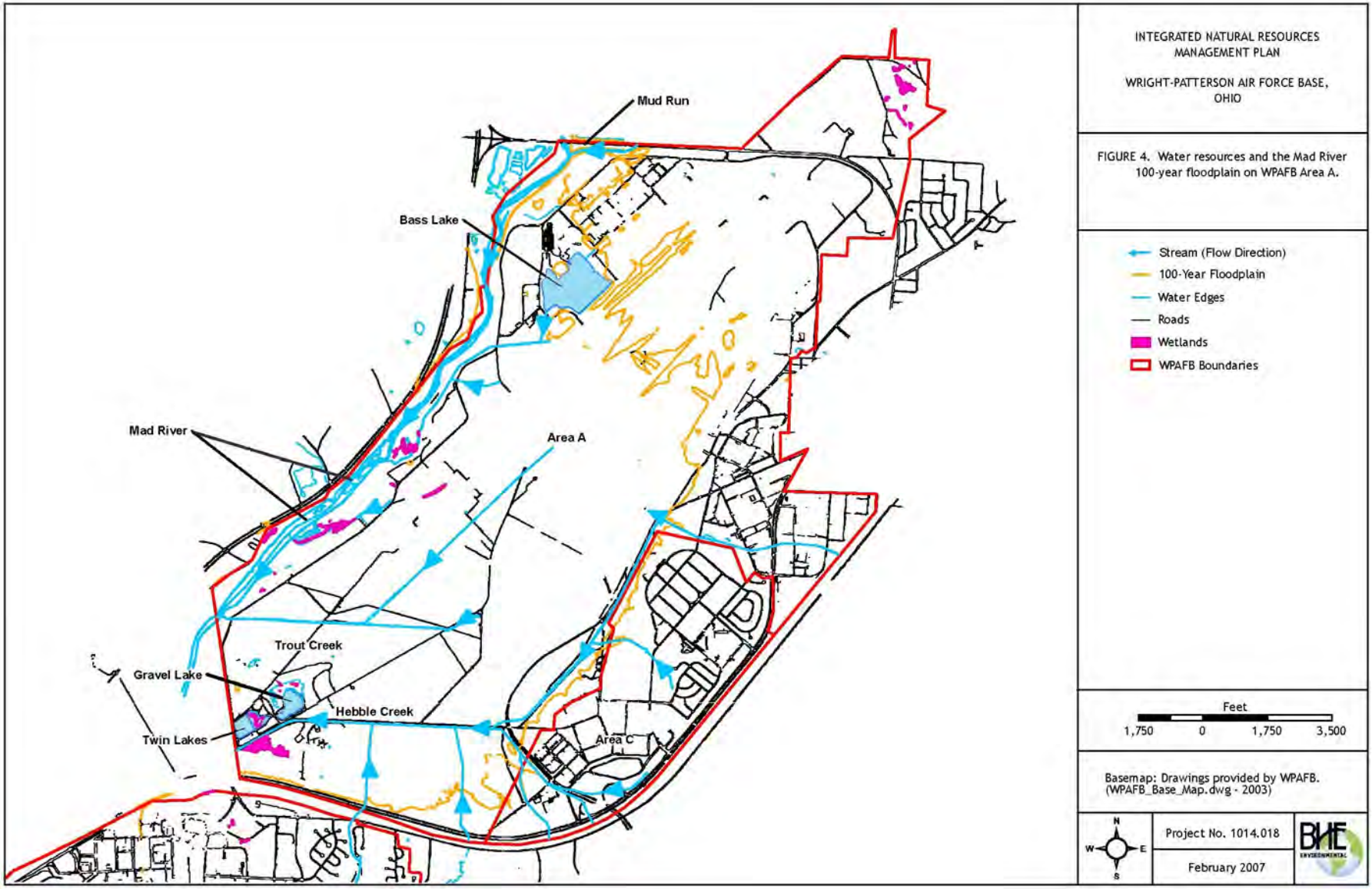

Figure 2-4. Water resources and the Mad River 100-yer floodplain on Wright-Patterson Air Force Base, Area A.

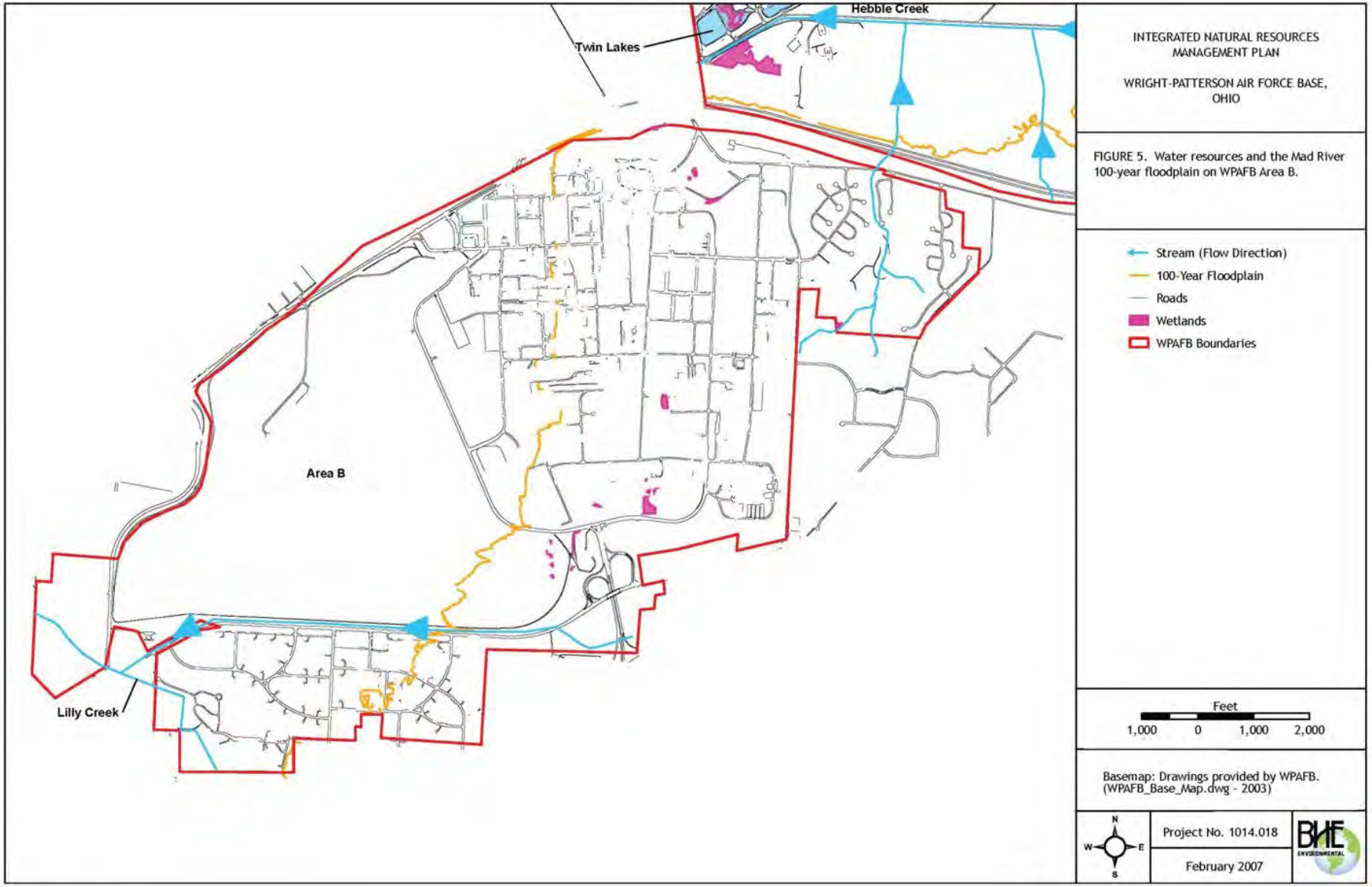

Figure 2-5. Water resources and the Mad River 100-year floodplain on Wright-Patterson Air Force Base, Area B.

Forty-four wetlands covering approximately 20.5 acres were identified within the limits of WPAFB in 2004 (BHE 2005a). Ten wetlands were identified in Area B, and 27 were found in Area A. All of the Area B wetlands were located in the developed portions of WPAFB, while most of the wetlands identified in Area A were located in undeveloped areas. A majority of the wetlands identified on the base were dominated by emergent vegetation. Jurisdictional determination of the wetlands has not been completed at this time.

The updated WPAFB Wetland and Stream Management Plan by BHE dated July 2010 identified 40 wetlands covering approximately 19.8 acres within the limits of WPAFB. Seventeen wetlands were identified in Area B, and 23 were found in Area A. The difference in the acreage from the 2004 delineation within the floodplain wetlands along and adjacent to the Mad River was likely caused by high water events changing the terrain and drainage patterns. Changes elsewhere on the base are likely resultant from groundwater pumping and the reduction of normal precipitation amounts in Ohio in recent years.

The BHE update report of July 2010 also recorded data on the streams on WPAFB property. Twenty-six streams were identified on the base in this report. Streams were scored by OEPA Primary Head Water Habitat (PHWH) methods using the Headwater Habitat Evaluation Index (HHEI) and Qualitative Habitat Evaluation Index (QHEI) field evaluation forms. Total stream length reported was 61,358 linear feet of jurisdictional stream on the base.

The base contains approximately 130 acres of open water, including four lakes: Upper Twin Lake (4.7 acres), Lower Twin Lake (3.2 acres), Gravel Lake (6.7 acres), and Bass Lake (42 acres). The latter three lakes support fish and provide recreational fishing; Bass Lake is also available for other recreation such as boating. Upper Twin Lake often is without significant amounts of surface water, especially in the late summer and fall. A culvert between Gravel Lake and Upper Twin Lake supplies water to Upper Twin Lake when water levels in Gravel Lake are high. At high water levels Upper and Lower Twin lakes have a hydrologic connection through a culvert between the two lakes. Lower Twin Lake has no natural surface water inlets, and the overall size of its drainage area is small. Lower Twin Lake receives a large portion of its water from precipitation and groundwater. Additionally, a substantial amount of water enters the lake from the EW-1 extraction well north of Lower Twin Lake that processes contaminated groundwater from Landfill 5. Water quality sampling was conducted in Gravel and Lower Twin lakes on three occasions in 2004 (BHE 2005b). Parameters measured included temperature, dissolved oxygen (DO), turbidity, specific conductivity, and pH. Compared to Gravel Lake, Lower Twin Lake consistently had high levels of turbidity, DO, and pH; and lower levels of specific conductivity. No data about the chemical and biological conditions of Bass Lake are available.

WPAFB is drained by 23 National Pollution Discharge Elimination System (NPDES) outfalls located around the base. Water discharged from the outfalls eventually flows into the Mad River. WPAFB monitors water quality with either monthly or bimonthly sampling at the 23 NPDES outfalls.

2.2.4.2 Groundwater Hydrology

Groundwater resources in southwestern Ohio are among the best and most productive in the state. The water table aquifer in the area of WPAFB is part of the Great Miami/Little Miami Buried Valley Aquifer System. In 1987, the U.S. Environmental Protection Agency (USEPA) designated this aquifer as a sole source aquifer under the provisions of the Safe Drinking Water Act (40 CFR 143 et seq.). The aquifer in the area of WPAFB is located approximately 20–30 feet beneath the ground surface and is very prolific, yielding between 1,500 and 2,000 gallons per minute (gpm). Bedrock groundwater at WPAFB generally occurs at a lower hydraulic head (elevation) than the water table aquifer. The shale bedrock in the region is of very low hydraulic conductivity (permeability) and does not constitute an aquifer (Dumouchelle et al. 1993).

The upland areas in the region serve in part as recharge areas for the Mad River Buried Valley Aquifer. These upland areas, including a groundwater mound in Fairborn, form groundwater divides which control groundwater flow in and around Area A of WPAFB, much like the surface water drainage basin (ICI and SAIC 1995).

2.3 Ecosystems and the Biotic Environment

2.3.1 Ecosystem Classification

WPAFB is located within the Eastern Broadleaf Forest (Continental) Province of the Hot Continental Division of the Humid Temperate Domain (Bailey 1995). The Humid Temperate Domain is in the middle latitudes (30–60 °North) and is governed by both polar and tropical air masses. Strongly pronounced seasons are found in this domain, with annual cycles of temperature and precipitation. The Humid Temperate Domain contains forests of broadleaf deciduous trees and needleleaf evergreen trees (Bailey 1995).

The Hot Continental Division is an area with hot summers and cool winters. The warmer portions of this climate division have a growing season that lasts 5 to 6 months, while that in colder portions lasts from 3 to 5 months. Vegetation in this climate division is deciduous forest, dominated by tall broadleaf trees that provide a dense canopy in summer, but shed their leaves completely in winter. Lower layers of shrubs and small trees are minimally present. Ground cover is typically rich with herbs in spring but reduced in summer after trees reach full foliage and the ground is heavily shaded. Rainfall in this division decreases as distance from the ocean increases (Bailey 1995).

The Eastern Broadleaf Forest (Continental) Province has average annual temperatures ranging from 4 °C (40 °F) in the north to 18 °C (65 °F) in the south. Summers are hot and most precipitation falls during the growing season. Annual precipitation averages 40 inches in Ohio (Bailey 1995). Although many parts of this province are dominated by oak-hickory forest associations, the glaciated areas of Ohio and Indiana contain a beech-maple forest characterized by American beech and sugar maple (Bailey 1995).

The USEPA (1997) and Omernik (1987) also described the ecoregions of the continental United States. According to their descriptions and associated maps, WPAFB is located within the Mad River Interlobate Area (Level IV) ecoregion within the broader Eastern Corn Belt Plains (Level III) ecoregion.

The Eastern Corn Belt ecoregion consists primarily of a rolling till plain with local end moraines. It has lighter soils than the prairie soils found in more westward portions of the Midwest, loamier and better drained soils than the glaciated soils of northwest Ohio, and richer soils than those found in glaciated northeast Ohio. Glacial deposits of the Wisconsinian age are extensive in this ecoregion. Originally, tree cover was extensive, with beech forests and elm-ash swamp forests dominating the landscape.

The Mad River Interlobate Area ecoregion received concentrated outwash deposits that filled glacial valleys. Groundwater is abundant in this ecoregion, feeding cold water streams.

Originally, the landscape was covered by beech forests, mixed-oak forests, and extensive freshwater fens and wet prairies. Today, the landscape is dominated by corn and soybean farms and livestock pastures, although forests still can be found on steep sites and along riparian corridors. Fens, wet meadows, and tallgrass prairies also occur locally and are scattered within this ecoregion (Omernik 1987, USEPA 1997).

2.3.2 Vegetation

2.3.2.1 Historical Vegetation Cover

The ODNR identifies the following three forest vegetation types historically found near WPAFB: oak-sugar maple forests, elm-ash swamp forests, and mixed-oak forests (Gordon 1969). In addition to the dominant forest vegetation, wet meadows and small prairie grasslands were scattered throughout the region.

Oak-Sugar Maple Forest

Oak-sugar maple forests contain a variety of tree species characteristic of well-drained, but moist soils (Gordon 1969). Dominant species include white oak (*Quercus alba*), northern red oak (*Q. rubra*), and sugar maple (*Acer saccharum*). Common associate species include silver maple (*A. saccharinum*), cottonwood (*Populus deltoides*), slippery elm (*Ulmus rubra*), American elm (*U. americana*), white ash (*Fraxinus americana*), black locust (*Robinia pseudoacacia*), honey locust (*Gleditsia triacanthos*), pignut hickory (*Carya glabra*), Ohio buckeye (*Aesculus glabra*), sycamore (*Platanus occidentalis*), and yellow poplar (*Liriodendrontulipifera*).

Understory tree and shrub species associated with this forest community include boxelder (*A.negundo*), wild black cherry (*Prunus serotina*), southern flowering dogwood (*Cornus florida),* and eastern redbud (*Cercis canadensis*).

Elm-Ash Swamp Forest

Elm-ash swamp forests are common in riparian areas, wetlands, and bottomland floodplains. These forests were particularly extensive in northwestern Ohio, and to a lesser extent, occurred over the till plains of Ohio and Indiana (Gordon 1969). Deciduous elm-ash swamp forests can be differentiated from southern swamp forest, as they do not contain southern species like bald cypress (*Taxodium distichum*) and various gums (*Tupelo* spp.). Dominant species include green ash (*F. pennsylvanica*), American elm, and silver maple. Common associate species include red maple (*A. rubrum*), cottonwood, honey locust, sycamore, and willows (*Salix* spp.).

Understory tree and shrub species associated with this forest community include box elder, southern flowering dogwood, eastern redbud, and greenbrier (*Smilax rotundifolia*).

Mixed Oak Forest

Mixed-oak forests are characteristic of well-drained, upland sites (Gordon 1969). These forests included a wide variety of primary forest types. Dominant species include white oak, northern red oak, shagbark hickory (*C. ovata*), and mockernut hickory (*C. tomentosa*).

Common associate species include pin oak (*Q. palustris*), chestnut oak (*Q. prinus*), scarlet oak (*Q. coccinea*), shagbark hickory, American elm, cottonwood, black cherry, and yellow poplar.

Understory tree and shrub species associated with this forest community include hop hornbeam (*Ostrya virginiana*), southern flowering dogwood, eastern redbud, and greenbrier.

Prairie Grasslands/Wet Prairie

Prairie grasslands and wet prairies were scattered throughout the landscape of what is now Madison, Clark, and western Greene County (Gordon 1969). Originally these grasslands and wet prairies were dominated by grass species such as giant reed grass (*Phragmites communis*), blue-joint (*Calamagrostis canadensis*), and more mesic species such as little bluestem (*Andropogon scoparius*), switchgrass (*Panicum virgatum*)

and Indian grass (*Sorghastrum nutans*). However, as a result of overgrazing during pioneer days, less palatable plants began to replace much of the original grassland vegetation. Chief among the replacements were members of the sedge family, primarily of the genus *Carex*, but also including *Cyperus*, *Eleocharis*, and *Scirpus*. The sedges, particularly in wet areas, would form distinctive mounds or hummocks within the pasture. These distinctive hummocks were present within Huffman Prairie and were described by Wilbur Wright (McFarland 1972).

Interspersed with the grasses were grassland forbs including milkweeds (*Asclepias*), asters (*Aster*), bushclover (*Lespedeza*), sunflowers (*Helianthus*), blazing star (*Liatris*), and goldenrods (*Solidago*).

2.3.2.2 Current Vegetation Cover

Floral surveys were conducted along the Mad River corridor during summer, fall, and spring of 1997 and 1998 (3D/International, Inc. [3D/I] 1998). In 1998 and 1999, surveys were conducted in Areas A and B of WPAFB, exclusive of the Mad River corridor (BHE 1999b). Comprehensive lists of botanical species on WPAFB can be found in reports of those surveys. No federally listed plants have been recorded on WPAFB. Plants listed by ODNR that occur on the base are discussed in Section 2.3.4 Threatened and Endangered Species and Species of Concern.

Natural vegetative communities on WPAFB can be divided into four general categories: forest (740 acres), wetlands (20.5 acres), prairie (109 acres), and old fields (306 acres).

Forest

The deciduous forest on WPAFB demonstrates seasonal variation. During winter, the leafless forest is open, and plants are dormant. In spring new leaves form, and most plants flower. During summer "leaf-out," little light penetrates the canopy to the forest floor. In autumn, the leaves turn color and drop (Vankat 1979). Figure 2-6 and Figure 2-7 show the location of wooded areas on the installation. Most wooded acres on WPAFB are riverine forest (362 acres) within the floodplain of the Mad River.

The deciduous forest can be divided into several distinct associations: the Mixed Mesophytic, Beech-Maple, Maple-Basswood, Hemlock-White Pine-Northern Hardwoods, Oak-Chestnut, Oak- Hickory, and Southern Mixed Hardwood Forests (Vankat 1979). WPAFB contains only the Beech-Maple and Mixed Mesophytic associations.

Beech-Maple Forest

The beech-maple forest association is found only on glaciated land, which includes most of Ohio, northern Indiana, and part of southern Michigan. This association is best developed on mesic, fairly well-drained sites. Throughout the beech-maple forest range, the two dominant tree species are American beech (*Fagus grandifolia)* and sugar maple. In areas with high soil moisture, like much of WPAFB, associated species like green ash and white ash are among the dominant tree species.

Mixed-Mesophytic Forest

The mixed-mesophytic forest association is the most diverse of deciduous forest types. This vegetative association occurs on moist, well-drained sites. The mixed mesophytic range includes a portion of eastern Tennessee, eastern Kentucky, much of West Virginia, and southern Ohio. Widespread dominants include American beech, yellow poplar, basswoods (*Tilia* spp.), sugar maple, red oaks, white oaks, and eastern hemlock (*Tsuga canadensis*).

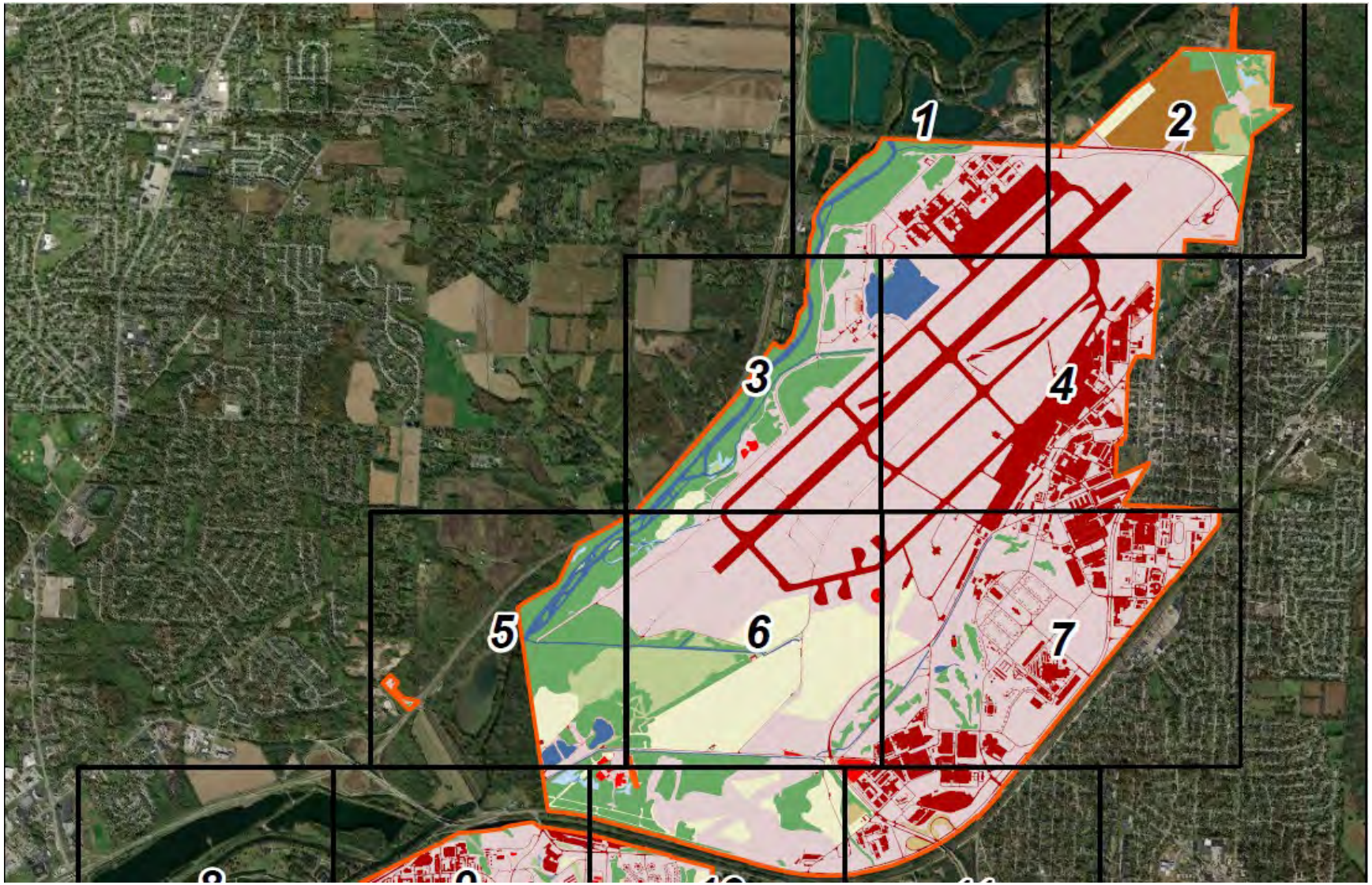

Figure 2-6. Vegetation cover on Wright-Patterson Air Force Base, Area A. (Legend in Figure 2-7)

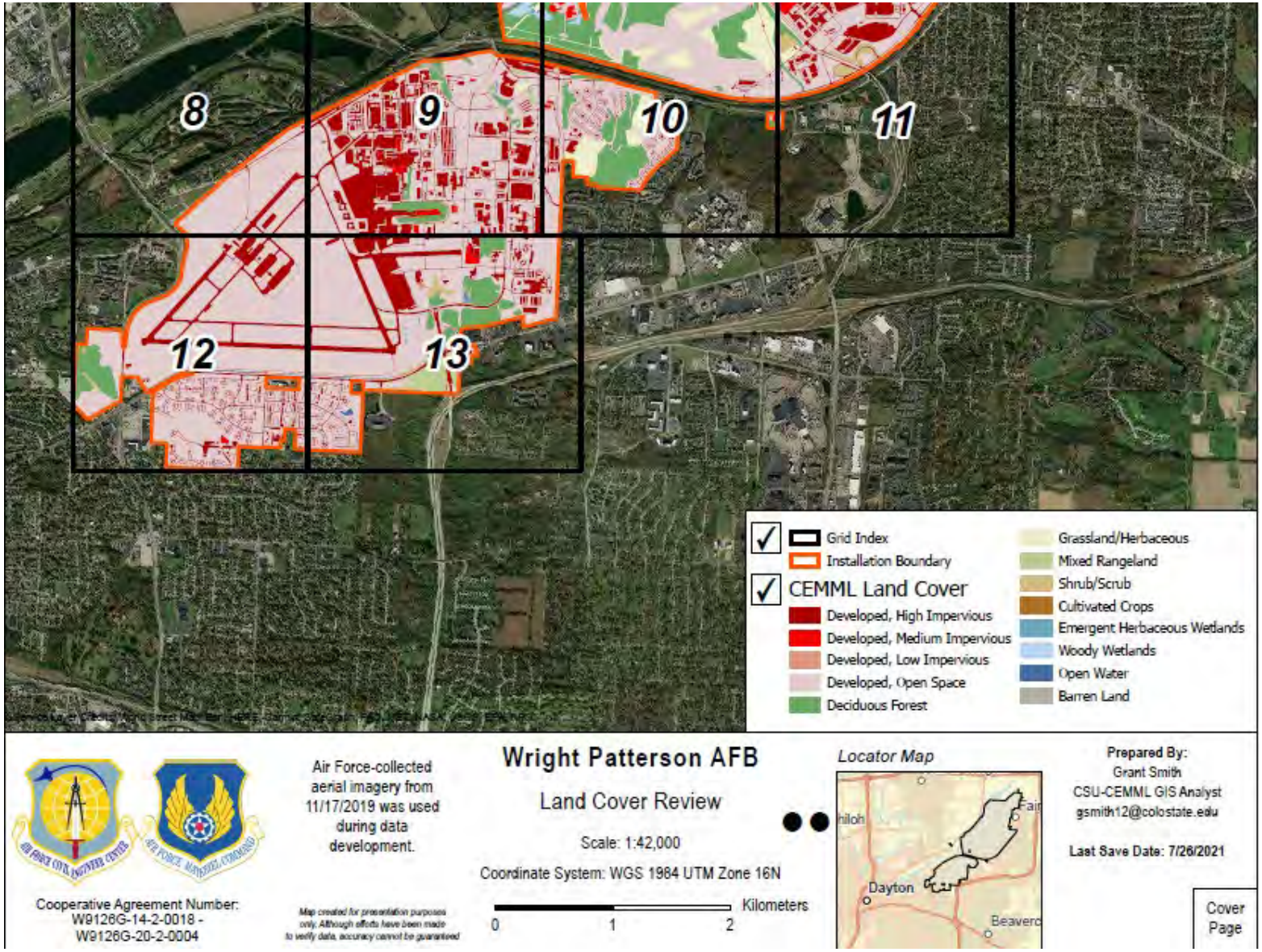

Figure 2-7. Vegetation cover on Wright-Patterson Air Force Base, Area B.

Prairie

The prairie at WPAFB is a relatively treeless community typically dominated by characteristic grasses. Huffman Prairie, designated at 109 acres in Area A, is one of the largest remnants of native prairie in Ohio (Figure 2-6). Dominant native grasses on this prairie include Indian grass (*Sorghastrum nutans*), big bluestem (*Andropogon gerardii*), and little bluestem. At least 23 species of prairie indicator plants are found in or near Huffman Prairie. Grasslands such as Huffman Prairie usually contain two herbaceous layers and a surface layer of mosses and lichens.

In the 1800s, the prairie was drained and farmed. Later it was used for pasture or was seasonally mowed. When mowing and farming ceased in 1984, the presence of native prairie grasses was recognized. The Ohio Natural Areas Council declared Huffman Prairie a State Natural Landmark in 1986. While native prairie vegetation is present, introduced forage grasses and non-native forbs also are established in Huffman Prairie. While past uses such as farming, grazing, and mowing had degraded the prairie plant community, significant management actions have taken place since 1990 to restore it. Management efforts include periodic mowing and/or prescribed burning of the prairie during the dormant season to control forage grasses, non-native forbs, and woody vegetation. Efforts to monitor and restore Huffman Prairie continue today.

Old Field

Old fields are relatively treeless communities dominated by grasses, forbs, and shrubs. They lack the plants and structure characteristic of native prairie. Some perimeter portions of the land area currently designated as Huffman Prairie would be classified as “old field”.

Dominant plants found in old field communities include grasses such as brome grass (*Bromus* spp.), goldenrod (*Solidago* spp.), ironweed (*Vernonia* spp.), thistle (*Cirsium* spp.) and some woody species. Associated old field vegetation includes forb stands, mixed shrubs, and early successional hardwood species. Dandelion (*Taraxicum officinale*), English plantain (*Plantago lanceolata*), and common plantain (*Plantago major*) are common in mowed areas (ICI and SAIC 1995).

2.3.2.3 Future Vegetation Cover

Content for this section will be added during the next annual review.

2.3.2.4 Turf and Landscaped Areas

Grounds are generally classified into three categories based on the intensity of maintaining them: improved, semi-improved and unimproved (Figure 2-8). At WPAFB there is an additional subcategory called enhanced improved grounds. Within WPAFB, approximately 263 acres have been designated enhanced improved grounds, 949 acres are improved grounds, 952 acres are semi-improved grounds, and 1,772 acres are unimproved grounds.

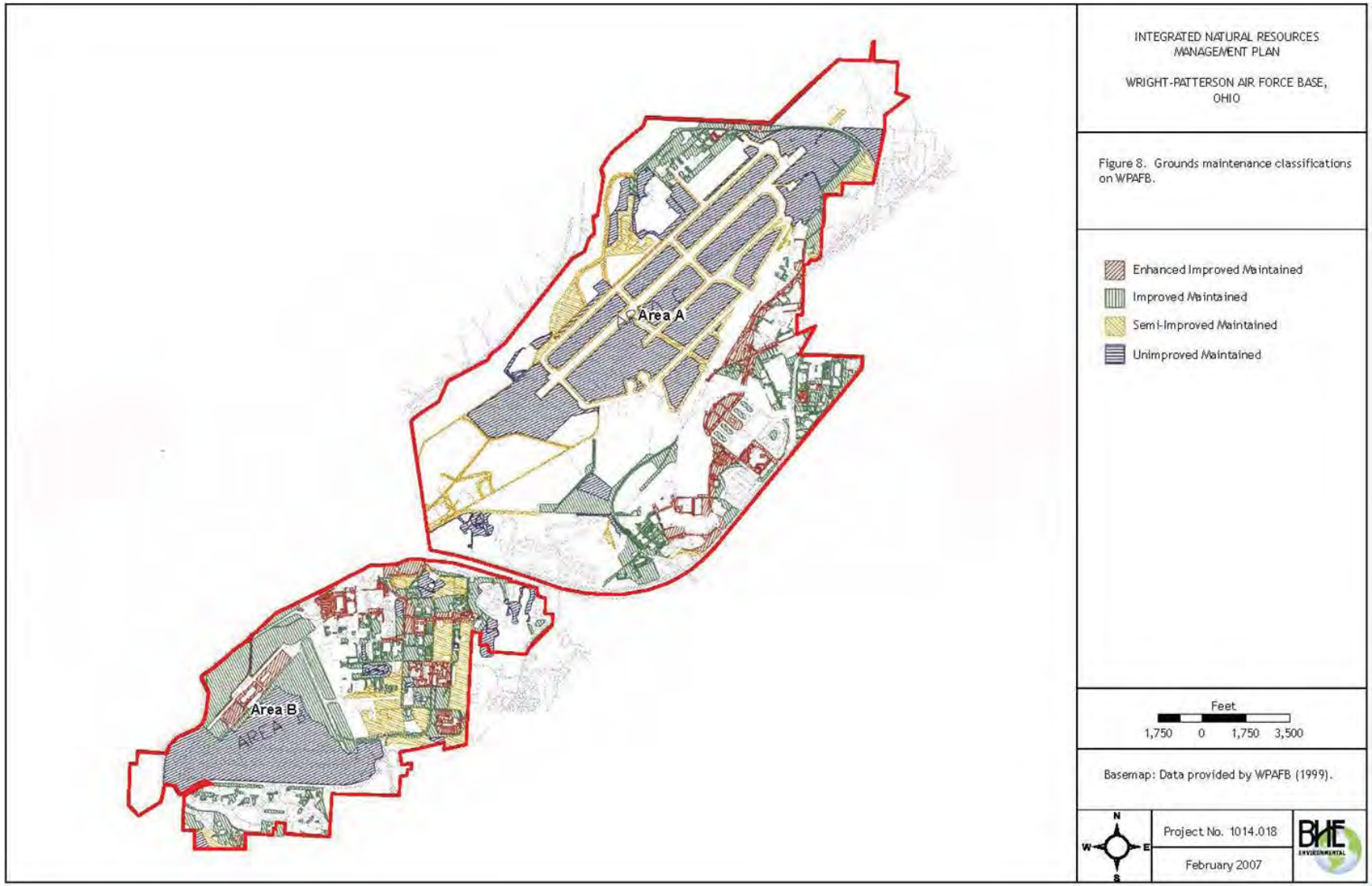

Figure 2-8. Grounds maintenance classification on Wright-Patterson Air Force Base**.**

Enhanced Improved Grounds

Enhanced improved grounds include portions of improved grounds but are designated to receive additional attention and more intensive maintenance. On WPAFB, enhanced improved grounds are located near headquarters buildings and major administrative buildings, certain thoroughfares, permanent officers' quarters, and other high visibility areas.

Establishment of turf on enhanced improved grounds is normally accomplished by seeding or sodding. Existing turf areas are comprised of various cultivars of primarily Kentucky bluegrass (*Poa pratensis*), perennial ryegrass (*Lolium perenne*), tall fescue (*L. arundinaceum*), and red fescue (*Festuca rubra*). Grass height in enhanced improved grounds is maintained at 2.5 to 3.5 inches. Turf is mowed from April through October. Application of pre-emergent herbicide and fertilizer are applied to all improved turf areas in the spring. Post-emergent herbicide and fertilizer is applied in the summer. Trees and shrubs used on enhanced improved grounds at WPAFB are usually planted between early March and late April or late September to mid-November.

Improved Grounds

Improved grounds consist of turfgrass areas and plant material that requires intensive maintenance but not as much attention as enhanced improved areas. Improved grounds include areas within the developed section of the base containing lawns, landscaped areas, parade grounds, road shoulders along main thoroughfares, most Military Family Housing (MFH) common areas, and unoccupied MFH units.

Establishment of turf on improved grounds is typically accomplished by seeding or sodding. Existing turf areas are comprised of various cultivars of primarily Kentucky bluegrass, perennial ryegrass, red fescue, and tall fescue. Improved turf areas are maintained at heights between 2.5 and 4.0 inches. These areas are mowed between April and October. Application of pre-emergent herbicide and fertilizer are applied to all improved turf areas in the spring, and post-emergent herbicide and fertilizer is applied in the summer. Trees and shrubs planted on improved grounds are usually set between early March and late April or late September to mid-November.

Semi-Improved Grounds

On semi-improved grounds, landscape maintenance is performed for functional, operational, or aesthetic reasons. These grounds cover on WPAFB include the airfield, rifle range, picnic areas, antennae facilities, ammunition storage areas, secondary road shoulders, and drainage ditch banks.

Semi-improved turf areas generally consist of tall fescue and Kentucky bluegrass that are maintained at between 4 and 7 inches high. Generally, trees and shrubs are not planted in semi-improved grounds, with the exception of picnic or other recreational areas. Trees and shrubs are continually removed from airfield clear zones.

Unimproved Grounds

Unimproved grounds include all other grounds on the base that require little to no maintenance. Unimproved grounds on WPAFB are primarily composed of undeveloped areas with natural landscapes and include, but are not limited to, the walnut tree plantation, rough areas around golf courses, Huffman Prairie Flying Field, and the licensed shooting preserve.

Unimproved grounds are mowed only as needed for bird control, habitat modification, or to eliminate fire hazards. Grass and weeds in these areas are maintained between 7 and 14 inches high and mowed from

once a year to once every 3 years. Generally, trees and shrubs are not planted in unimproved grounds, nor are they pruned unless needed.

2.3.3 Fish and Wildlife

Wright-Patterson Air Force Base is home to a diverse assemblage of animals. Many animals are only present at WPAFB for a short period while migrating between winter and summer habitats, while others are year-round residents. Fauna observed during surveys conducted from 1998–2020 are identified in Appendix C. Observed animal species to date include 38 mammals, 140 birds, 12 reptiles (7 snakes, 1 skink, and 4 turtles), 9 amphibians (5 frogs, a toad, and 3 salamanders), 39 fishes, 14 mussels, 160 butterflies and moths, 42 bees, 18 odonates, 7 carrion beetles, and 3 crayfish (3D/I 1998, BHE 1999a, 2005b, Davis 2015, Nolin 2016, Spring 2017, USFWS 2021).

Common mammals on base include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), beaver (*Castor canadensis*), groundhog (*Marmota monax*), eastern fox squirrel (*Sciurus niger*), eastern gray squirrel (*Sciurus carolinensis*), eastern chipmunk (*Tamias striatus*), and deer mouse (*Peromyscus maniculata*). A porcupine (*Erethizon dorsatum*) was observed in the stream mitigation area in April of 2018 (Applegate 2018, personal communication). Porcupines are not common in Ohio and it is suspected that this individual either escaped human captivity or was unknowingly transported here. Searches over the next few days did not locate the individual. This individual was most likely an accidental visitor and should not be considered a common species. In 2021 photographic evidence was received that indicates that a bobcat (*Lynx rufus*) has also utilized the base (Warner, personal communication 2021).

Common birds on base include European starling (*Sturnus vulgarus*), eastern meadowlark (*Sturnella magna*), barn swallow (*Hirundo rustica*), savannah sparrow (*Passerculus sandwichensis*), red-winged blackbird (*Angelaius phoeniceus*), Canada goose (*Branta canadensis*), red-tailed hawk (*Buteo jamaicensis*), horned lark (*Eremophila alpestris*), American robin (*Turdus migratorius*), turkey vulture (*Cathartes aura*), mourning dove (*Zenaida macroura*), killdeer (*Charadrius vociferus*), American crow (*Corvus brachyrhynchos*), and mallard (*Anas platyrhynchos*).

Bat mist net surveys have been conducted in 2000, 2007, 2012, and 2017 (USFWS 2018a, Bat Conservation and Management, Inc. 2012, AMEC 2007, BHE 2001a). During these surveys the following species were detected: Indiana bat (*Myotis sodalis*), big brown bat (*Eptesicus fuscus*), red bat (*Lasiurus borealis*), tri-colored bat (*Perimyotis subflavus*), little brown bat (*Myotis lucifugus*), hoary bat (*Lasiurus cinereus*), northern long-eared bat (*Mytois septentrionalis*), evening bat (*Nycticeius humeralis*), and silver-haired bat (*Lasionycteris noctivagans*) (USFWS 2018a, Bat Conservation and Management, Inc. 2012, AMEC 2007, BHE 2001a). A bat acoustic survey was completed during the summer of 2016 (Center for Integrated Research on the Environment [CIRE] 2017). Bat calls detected included the above 9 species, as well as the eastern small-footed Myotis (*Myotis leibii*) (CIRE 2017).

Between 2010–2014 a multi-year, systematic base-wide herpetological survey was conducted by herpetologist Jeff Davis in cooperation with ODNR and USFWS. The survey involved placement of coverboards in spring, and monitoring cover boards between April and October (Davis 2015). During this survey the following species were detected: Dekay's brown snakes (*Storeria dekayi*), eastern garter snakes (*Thamnophis sirtalis*), smooth green snakes (*Opheodrys vernalis*, state endangered), eastern milksnakes (*Lampropeltus triangulum*), northern watersnake (*Nerodia sipedon*), Blanchard's cricket frogs (*Acris blanchardi*), American bullfrogs (*Lithobates catesbeiana*), green frogs (*Lithobates clamitans*), five-lined skink (*Plestiodon fasciatus*), eastern box turtle (*Terrapene carolina carolina*, state species of concern), midland painted turtles (*Chrysemys picta marginata*) and eastern spiny softshells (*Apalone spinifera*).

WPAFB funded USFWS to do a herpetological survey in 2019 (Seymour 2020). The Service documented Dekay's brown snake, eastern garter snake, and smooth green snakes. Small-mouthed salamander (*Ambystoma texanum*), northern leopard frog (*Lithobates pipiens*), and eastern red-backed salamander (*Plethodon cinereus*) were documented new records for the base. Additionally, the following amphibians were detected: Blanchard's cricket frog, treefrog (*Hyla* spp.), green frog, and American toad (*Anaxyrus americanus*) (Seymour 2020).

Fish are present in Bass, Gravel, and Lower Twin lakes. In 2004, electrofishing surveys were conducted in Gravel and Lower Twin lakes (BHE 2005b). Three species of fish were observed in Gravel Lake: gizzard shad (*Dorosoma cepedianum*), bluegill (*Lepomis macrochirus*), and largemouth bass (*Micropterus salmoides*). Although none were collected during the survey, WPAFB annually stocks rainbow trout (*Oncorhynchus mykiss*) in Gravel Lake to support a put and take fishery. Other species potentially are present in Gravel Lake. In Lower Twin Lake, species collected during the survey included: largemouth bass; bluegill; green sunfish (*Lepomis cyanellus*); white crappie (*Pomoxis annularis*); carp (*Cyprinus carpio*); and white sucker (*Catostomus commersonii*). In addition, WPAFB routinely stocks channel catfish (*Ictalurus punctatus*) in Lower Twin Lake. Fisheries in Bass Lake have not been surveyed since 1988. Rainbow trout and channel catfish are stocked in Bass Lake. During 2016 fish surveys were conducted in Hebble and Trout Creeks (USFWS 2016). Twelve species of fish were collected in Hebble Creek, including creek chub (*Semotilus atromaculatus*), northern hogsucker (*Hypentelium nigricans*), green sunfish, banded darter (*Etheostoma zonale*), blacknose dace (*Rhinichthys atratulus*), redside dace (*Clinostomus elongates*), bluegill, white sucker, mottled sculpin (*Cottus bairdii*), rainbow darter (*Etheostoma caeruleum*), and central stoneroller (*Campostoma anomalum*) (USFWS 2016). Two species of fish were collected in Trout Creek which were grass pickerel (*Esox americanus vermiculatus*) and central mudminnow (*Umbra limi*). Captures of central mudminnows is notable, as they have not been recorded from the Great Miami River system in over 60 years, and Trout Creek appears to provide high quality habitat for this species.

Lepidopteran surveys of Huffman Prairie have identified 55 species of butterflies and skippers, and over 100 moth species, 28 of which were recorded in Ohio for the first time (Metzler and Zebold 1995). One moth, a new species to science, was discovered and named *Glyphidocera wrightorum* in honor of the Wright Brothers (Adamski and Metzler 2000).

Seventeen species of butterfly were recorded during visual surveys within Huffman Prairie in 2015. A total of 55 lepidopterans were identified to species level during the 2020 Lepidoptera survey (USFWS 2021). In 2016, six different species of bees were observed by hand collection or bee vacuum (Spring 2017, personal communication). As of April 2019, the bees from the May 2015 surveys have been identified to species. Additional samples from the 2015 survey are still being identified. Thirty-three species of five families were identified. This indicates a good diversity of bee species is present at Huffman Prairies. Identification of the bees captured through lethal sampling in 2015 is ongoing.

The native fauna of WPAFB includes several federally listed and state-listed species, which are identified and discussed in the next section.

2.3.4 Threatened and Endangered Species and Species of Concern

Air Force regulations (AFPD 32-70 and AFMAN 32-7003) require all AF properties to protect species classified as endangered or threatened under the Endangered Species Act of 1973 (ESA). Air Force Manual 32-7003 states that AF installations sustaining federally listed species or their habitats must address conservation of federally listed species in the INRMP. The INRMP also should include species that are proposed or candidates for federal listing. Additionally, AFMAN 32-7003 states the INRMP will provide

for the protection and conservation of state listed species (e.g., State of Ohio Law 1531.25) when practicable and not in conflict with the military mission.

Original surveys for rare species of plants and wildlife were conducted on WPAFB between 1995 and 2000 (3D/I 1998; BHE 1999a, 1999b, BHE 2001a; Minney 1990, 1991, 1992, 1993, 1994; Metzler 1995; Metzler and Zebold 1992, 1993, 1994; TNC 2001a). Surveys for threatened and endangered species are ongoing at WPAFB and have been conducted periodically to update the current status of these species at WPAFB. Federally and state- listed species observed on WPAFB are listed in Table 2-2. Federally listed species present on WPAFB are the Indiana bat and northern long-eared bat. The clubshell mussel (*Pleurobema clava*) has not been detected on WPAFB since a 1999 survey when sub fossilized shells were found and is extirpated from the Mad River. The eastern massasauga rattlesnake (*Sistrurus catenatus*) was added as a federal threatened species in September 2016. This species was present at WPAFB in the 1990's but has not been documented during recent surveys.

The rusty patched bumble bee (*Bombus affinis*) was listed as a federal endangered species on 11 January 2017 (82 FR 3186). The rusty patched bumble bee occurs in grasslands and prairies and gathers pollen and nectar from a variety of flowering plants. It emerges in early spring and is one of the last bumble bee species to go into hibernation in the fall. Because it is active so long, it needs a constant supply of flowers blooming from April through September. The species was broadly distributed historically across the eastern United States, upper Midwest, and southern Quebec and Ontario, including Ohio, but the distribution has declined significantly since 2007. Rusty patched bumble bee has not been documented at WPAFB historically or during bee surveys conducted during 2015. WPAFB is not included in the areas designated as "high potential zones," indicating that presence of rusty patched bumble bee is unlikely. Huffman Prairie and other areas of WPAFB that support nectar plants may provide suitable habitat for rusty patched bumble bee and other pollinators. The active management of Huffman Prairie that has been ongoing for many years ensures that suitable habitat for rusty patched bumble bee and other pollinators will remain in perpetuity.

The USFWS determined that listing the monarch as threatened or endangered is warranted but precluded at this time by higher-priority listing actions (85 FR 81813). This species can be found in a variety of habitats that provide nectar sources or its host plant: milkweed. Monarchs are frequently observed in Huffman Prairie, especially in September as they head south on migration.

There are no federally listed plants on WPAFB (BHE 1999b); however, the geographic ranges of the running buffalo clover (*Trifolium stoloniferum*), a federally endangered species, and the eastern prairie fringed orchid (*Platanthera leucophaea*), a federally threatened species, include WPAFB. While these two species potentially occur at WPAFB, they were not documented during base-wide botanical surveys (3D/I 1998, BHE 1999b). Furthermore, USFWS and ODNR conducted eastern prairie fringed orchid surveys in the Sandhill Area of the base at the end of June 2010. No orchids were observed. If suitable habitat exists elsewhere on base, USFWS recommends coordination with the Ohio Office to continue this survey effort in the future.

This update to the INRMP addresses all state-listed endangered and threatened species known to occur at WPAFB, and several state-listed special concern and special interest species known to breed within Huffman Prairie.

This section summarizes the status and natural history of Federal and State-listed endangered and threatened species addressed in this plan. Management strategies for these species are discussed in Section 7.4 Management of Threatened and Endangered Species, Species of Concern, and Habitats.

Table 2-2. Federally listed and state-listed species of animals, insects, and plants recorded at Wright-Patterson Air Force Base.

Common Name	Scientific Name	Federal Status[1]	State of Ohio Status[1]	Global Ranking[2]
MAMMALS				
Indiana bat	*Myotis sodalis*	E	E	G2
Northern long-eared bat	*Myotis septentrionalis*	T	T	G1, G2
Big brown bat	*Eptesicus fuscus*	—	SC	G5
Little brown bat	*Myotis lucifugus*	SSA	SC	G3
Tri-colored bat	*Perimyotis subflavus*	SSA	SC	G3
Red bat	*Lasiurus borealis*	—	SC	G4
Hoary bat	*Lasiurus cinereus*	—	SC	G4
Eastern small-footed myotis	*Myotis leibii*	—	SC	G4
Silver-haired bat	*Lasionycteris noctivagans*	—	SC	G3
Evening bat	*Nycticeius humeralis*	—	SI	G5
BIRDS				
Blackburnian warbler	*Setophaga fusca*	—	SI	G5
Bobolink	*Dolichonyx oryzivorus*	—	SC	G5
Brown creeper	*Certhia americana*	—	SI	G5
Canada warbler	*Cardellina canadensis*	BCC	SI	G5
Cerulean warbler	*Setophaga cerulea*	BCC	SC	G4
King rail	*Rallus elegans*	—	E	G4
Magnolia warbler	*Setophaga magnolia*	—	SI	G5
Prothonotary warbler	*Protonotaria citrea*	—	SC	G5
Black-throated blue warbler	*Setophaga caerulescens*	—	SI	G5
Mourning warbler	*Geothlypis philadelphia*	—	SI	G5
Purple finch	*Haemorhous purpureus*	—	SI	G5
Common tern	*Sterna hirundo*	BCC	E	G5
Red-breasted nuthatch	*Sitta canadensis*	—	SI	G5
Bald eagle	*Haliaeetus leucocephalus*	SC, BCC	—	G5
Sharp-shinned hawk	*Accipiter striatus*	—	SC	G5
Upland sandpiper	*Bartramia longicauda*	BCC	E	G5
Sedge wren	*Cistothorus platensis*	—	SC	G5
Henslow's sparrow	*Ammodramus henslowii*	BCC	SC	G4
Least flycatcher	*Empidonax minimus*	—	SI	G5
Golden-crowned kinglet	*Regulus satrapa*	—	SI	G5
Yellow-bellied sapsucker	*Sphyrapicus varius*	—	SI	G5
Northern bobwhite	*Colinus virginianus*	—	SC	G5
REPTILES				
Eastern massasauga rattlesnake	*Sistrurus catenatus*	T	E	G3, G4
Woodland box turtle	*Terrapene carolina carolina*	—	SC	G5
Smooth green snake	*Opheodrys vernalis*	—	E	G5
MUSSELS				
Clubshell (subfossil)	*Pleurobema clava*	E	E	G1, G2
ARTHROPODS				

Table 2-2. Federally listed and state-listed species of animals, insects, and plants recorded at Wright-Patterson Air Force Base.

Common Name	Scientific Name	Federal Status[1]	State of Ohio Status[1]	Global Ranking[2]
Monarch	*Danaus plexippus*	C	—	G4
Blazing star stem borer (Beer's noctuid; moth)	*Papaipema beeriana*	—	E	G2, G3
Moth	*Tarachidia binocula*	—	SC	N/A
PLANTS				
Fringe-tree*	*Chionanthus virginicus*	—	PT	G5
Ear-leaf foxglove	*Agalinis auriculata*	—	E	G3
Tall larkspur*	*Delphinium exaltatum*	—	PT	G3
Tamarack*	*Larix laricina*	—	PT	G5
Whorled water-milfoil	*Myriophyllum verticillatum*	—	EXTRP	G5
Royal catchfly*	*Silene regia*	—	T	G3
Great Plains ladies' tresses	*Spiranthes magnicamporum*	—	PT	G4
Northern white cedar*	*Thuja occidentalis*	—	PT	G5
Northern adder's tongue	*Ophioglossum pusillim*	—	E	G2

Sources: AMEC 2007, BHE 1999a, 1999b; ODNR 2017, and correspondence in Appendix B; NatureServe 2015; USFWS 2008, Nolin 2016, and correspondence in Appendix B.

* = Planted.

[1] E = endangered, T = threatened, T(p)= proposed threatened, SC = species of concern, SI = specialinterest, C = candidate, PT = potentially threatened, EXTRP = extirpated, BCC = Birds of ConservationConcern, SSA = species status assessment in development to determine if listing is warranted.

[2] Global Rankings (NatureServe natural heritage program) G1 = critically imperiled, G2 = imperiled, G3 = vulnerable to extirpation or extinction, G4 = apparently secure, G5 = demonstrably widespread, abundant, secure.

Indiana Bat (*Myotis sodalis*)

The Indiana bat was listed as endangered on March 11, 1967, by the USFWS (CFR 32 [48]). The State of Ohio lists it as endangered as well (ODNR 2017). The Indiana bat population (as recorded from counts at hibernacula) has declined dramatically since the late 1950's throughout its range. However, surveys of hibernacula conducted through 2007 suggest winter populations in most states, including Ohio were stable or increasing (USFWS 2015a).

Since 2006, white-nose syndrome (WNS), a fungal disease of hibernating bats, has killed millions of bats in eastern North America, including several *Myotis* spp., tri-colored bat, and big brown bat. As of April 2019, WNS has been confirmed in 33 states and 7 Canadian provinces (White-nose Syndrome.org 2019). In March 2011, the first case of WNS was confirmed in Ohio, in an abandoned mine in Lawrence County. Currently 18 counties in Ohio have been confirmed as WNS positive. Surveys of two Indiana bat hibernacula in Ohio, the Lewisburg Limestone Mine and the Ironton Mine, have documented 69% and 100% declines respectively, in Indiana bat populations compared to peak pre-WNS population estimates in 2012 (ESI 2016; K. Shultes, Wayne National Forest, pers. comm. 2016). As WNS spreads and infects Ohio's bat population, it may affect the population of Indiana bats on/around the base.

At present, Indiana bats are only known to occur on WPAFB during the summer season (approximately 1 April through 30 September). The base does not contain suitable Indiana bat winter habitat (i.e., hibernacula) and no critical habitat, as defined in the ESA, has been designated on the base. Specific dates when the bats arrive at WPAFB in the spring and depart in the fall are not known. Similarly, it is not known where Indiana bats that occur on base in the summer, hibernate. However, in 2019 two bats captured at WPAFB and banded in 2017 were found hibernating in a cave in Kentucky over 100 miles away (Lott 2019, personal communication). The nearest hibernaculum to WPAFB is the Lewisburg Limestone Mine in Preble County, Ohio approximately 20 miles west of the base.

At WPAFB, an Indiana bat was first captured at a mist net site on Trout Creek in Area A during a July 1993 survey (Whitaker 1993). The bat was an adult female, indicating that a maternity colony (i.e., a group of reproductive females and their offspring) probably was located on or near Area A. In July 2000, BHE captured two Indiana bats during a base-wide mist net survey of WPAFB (BHE 2001a). These two bats, a juvenile female, and an adult post-lactating female, were also captured at mist net sites along Trout Creek in Area A (Figure 2-9). Radio tracking of the two bats confirmed the presence of a maternity colony in a dead slippery elm within a woodlot on the campus of Wright State University (Figure 2-10). Data collected during BHE's radio telemetry study were plotted on aerial photos to delineate areas on WPAFB being used by these two Indiana bats (Figure 2-9, Figure 2-10).

Another mist net survey was conducted in the summer of 2007 by Eco-Tech Consultants. Four individual Indiana bats were captured, and one was re-captured at a different net site. All four Indiana bats captured were lactating females. No radiotelemetry was used during this survey.

During 2012, three adult female lactating Indiana bats were tracked via radio telemetry in order to document their day roosting locations. Two day roosts were recorded, one in Clark County north of the WPAFB, and a second in Greene County southeast of WPAFB. Both day roosts were snags on the bank of the Mad River. All three of the Indiana bats tracked were detected using the Mad River to move between their day roosts and foraging grounds.

Indiana bat acoustic calls were detected during surveys in 2016 at all five sites monitored (including Areas A and B) (CIRE 2017). Bat mist net surveys and radio telemetry of Indiana and northern long-eared bats occurred during 2017. Five adult female Indiana bats, and one adult male northern long-eared bat were captured. Two of the Indiana bats were tracked and found to be using a roost tree on base property along the Mad River.

The base provides summer roosting and foraging habitat for Indiana bats. Indiana bats captured within WPAFB boundaries likely were foraging or traveling between roost sites and foraging areas. Two bats tracked in 2017 used roost trees on WPAFB property along the Mad River. Therefore, all of the forested areas and woodlots on the base are potentially suitable roosting and foraging habitat for Indiana bats (Figure 2-9, Figure 2-10). The species typically forages near tree canopies in riparian and upland forest, along forest edges, and over fields or pastures.

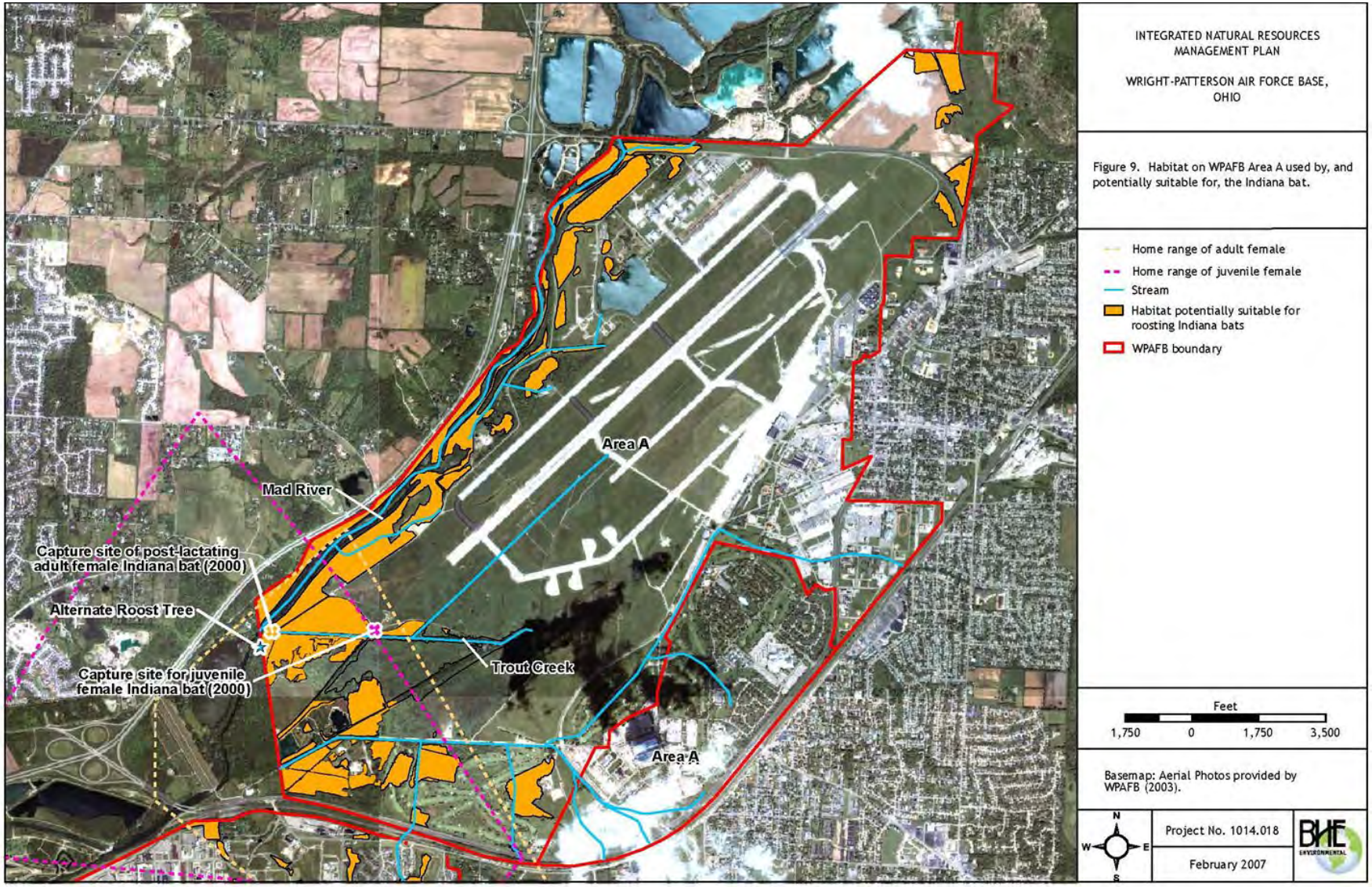

Figure 2-9. Habitat on Wright-Patterson Air Force Base used by, and potentially suitable for, the Indiana bat.

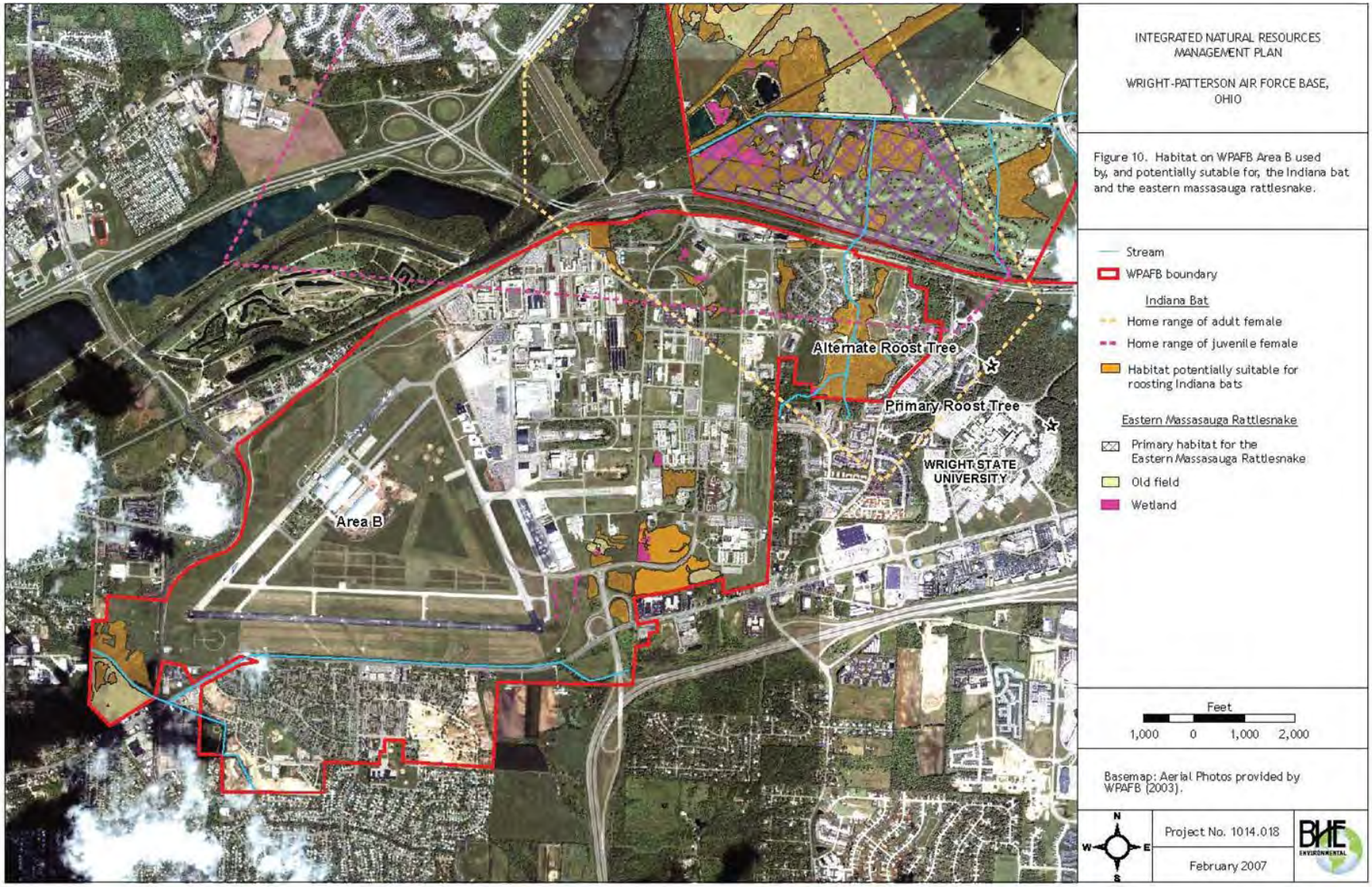

Figure 2-10. Habitat on Wright-Patterson Air Force Base, Area B, used by, and potentially suitable for, the Indiana bat and the eastern massasauga .

Northern Long-eared Bat (*Myotis septentrionalis*)

The U.S. Fish and Wildlife Service listed the northern long-eared bat as threatened under the Endangered Species Act (ESA) (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), effective May 4, 2015 (80 FR 17974). It is also listed as threatened in the State of Ohio (ODNR 2016a). No critical habitat has been established at this time. Recently WNS has caused serious declines in the northern long-eared bat population in the northeastern U.S. Surveys of two northern long-eared bat hibernacula in Ohio, the Lewisburg Limestone Mine and the Ironton Mine, have documented 96% and 100% declines respectively, in northern long-eared bat populations compared to peak pre-WNS population estimates in 2009 (ESI 2016; K. Shultes, Wayne National Forest, pers. comm. 2016).

During winter, northern long-eared bats hibernate in caves and abandoned mines. Summer habitat requirements for the species are not well defined but the following are considered important:

(1) Roosting habitat in dead or live trees and snags with cavities, peeling or exfoliating bark, split tree trunk and/or branches, which may be used as maternity roost areas

(2) Foraging habitat in upland and lowland woodlots and tree lined corridors

(3) Occasionally they may roost in structures like barns and sheds

Northern long-eared bats were not detected by mist net surveys that occurred regularly at WPAFB over the past 20 years including the summer of 2017. Bat acoustic surveys conducted during summer 2016 documented calls of northern long-eared bats. And as mentioned previously, one northern long-eared bat, a non-reproductive male, was captured during the 2017 surveys. Habitat on base that is suitable for Indiana bats (Figure 2-9) is also suitable for northern long-eared bats.

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle was listed in 1978 by USFWS as endangered throughout most of its range. It was classified as threatened in Minnesota, Michigan, Wisconsin, Washington, and Oregon. In 1980, only 1,250 nesting pairs were known in the lower 48 states. In recent years, bald eagle populations have increased and are progressing toward species recovery. The USFWS changed the status of the bald eagle from endangered to threatened in all of the lower 48 states, effective 01 August 1995 (CFR 60 [50]), and removed it from the federal threatened list on 28 June 2007. The bald eagle was also removed from the State of Ohio list of endangered, threatened, special concern and special interest species.

The bald eagle is currently protected under the Federal Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act (16 U.S.C. 668), which protects the species from take, and prohibits the possession, sale, transport, or trade of bald eagles, or their parts (e.g., feathers, eggs, body parts) without a permit.

Bald eagles only occur on WPAFB as rare winter visitors with most previous sightings having been along the Mad River (Blincoe 1984). During the winter of 2004/2005, one bald eagle was recorded in Greene County, and two in Montgomery County. In winter 2005/2006, one bald eagle was observed in Greene County, and none were seen in Montgomery County. During the winter of 2006/2007 no eagles were observed in Greene or Montgomery counties. In February 2009 a pair of bald eagles began nesting in the Eastwood Metro Park area. The pair was unsuccessful in producing eaglets both in 2009 and 2010, but in 2011 two eaglets were hatched. The nest has been active through 2014. This pair appears to roost and forage near the quarry. This nest is currently located approximately 0.35 miles north of Area B. In spring of 2020, ODNR and citizen scientists across the state of Ohio recorded 707 bald eagle nests including 4 nests in

Greene County and 3 nests in Montgomery County. One nest is located approximately 0.75 mile north of Area A along the Mad River.

WPAFB routinely performs bird surveys as part of the BASH Program in and around the flight line. All bald eagle sightings reported at WPAFB are documented for flight safety purposes.

Conservation measures for WPAFB address winter and summer habitat requirements of bald eagles. Should bald eagles nest or winter on WPAFB in the future, management strategies will be revised. Potential habitat for nesting bald eagles on WPAFB is forest within 0.5 mile of the Mad River, around Bass Lake, Gravel Lake, and Twin Lakes (Figure 2-11). Wintering bald eagles most likely will be found foraging or perching near those water bodies but could potentially establish roosts in any suitable large tree on the base. Foraging bald eagles potentially could be observed anywhere on WPAFB.

Clubshell (*Pleurobema clava*)

The clubshell was listed as endangered by USFWS in 1993 (58 FR 5638) and is listed as endangered by the State of Ohio (ODNR 2016a). Once widespread and apparently common throughout most of the Ohio River and Maumee River drainages, the species now exists in 10 to 12 isolated populations, most of which are small and peripheral to the species' historic range.

Clubshells were documented on WPAFB in the Mad River during two separate surveys (3D/I 1998, BHE 1999a). Both specimens were subfossil remains (i.e., the shells were greatly weathered, but not yet fossilized, indicating the mussels had been dead for a long period of time); one from a muskrat midden at the confluence of Trout Creek and the Mad River, and the other near the confluence of Mud Run and the Mad River (Figure 2-12).

A freshwater mussel survey was conducted during the summer of 2014 at WPAFB (USFWS 2014). The following species were observed: kidneyshell (*Ptychobranchus fasciolaris*), spike (*Elliptio delatata*), rainbow (*Villosa iris*), fluted shell (*Lasmigona costata*), cylindrical papershell (*Anodontoides ferussacianus*), fat mucket (*Lampsilis siliquoidea*), and Asian clam (*Corbicula fluminea*). No additional clubshell mussels were found.

Potential habitat for the clubshell exists throughout the Mad River on WPAFB (Figure 2-12). Although the species has been extirpated from the Mad River, WPAFB implements a management strategy to provide potential mussel habitat, to maintain or increase current population levels of freshwater mussels, and to protect them from adverse impacts resulting from the base mission. The U.S. Fish and Wildlife Service considers the closest stream with suitable habitat for this species to be the Little Miami River in Greene County. Since this species has been extirpated from the Mad River, surveys for this species are no longer necessary and funds will be used for other natural resource projects.

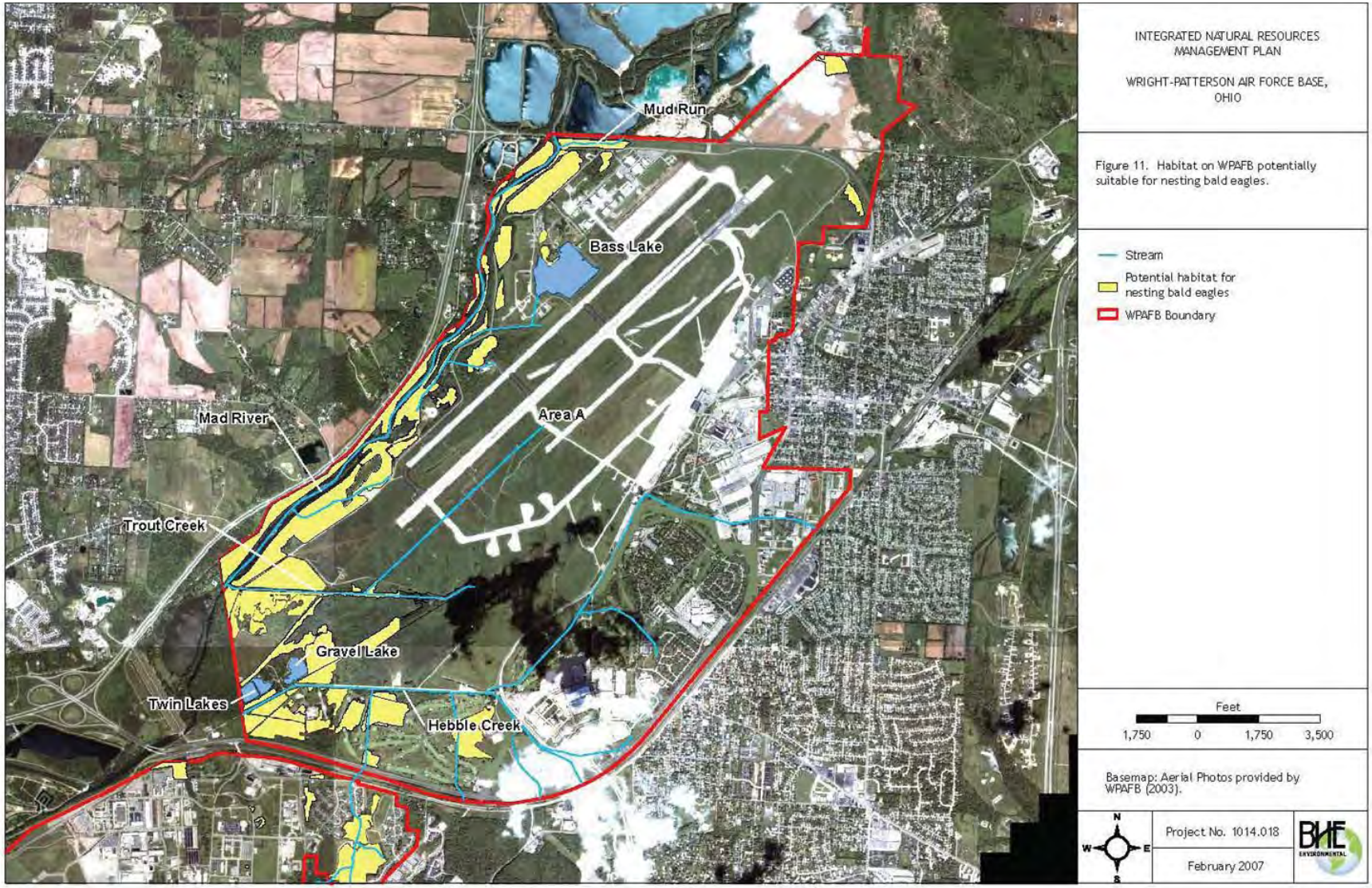

Figure 2-11. Habitat on Wright-Patterson Air Force Base potentially suitable for nesting bald eagles.

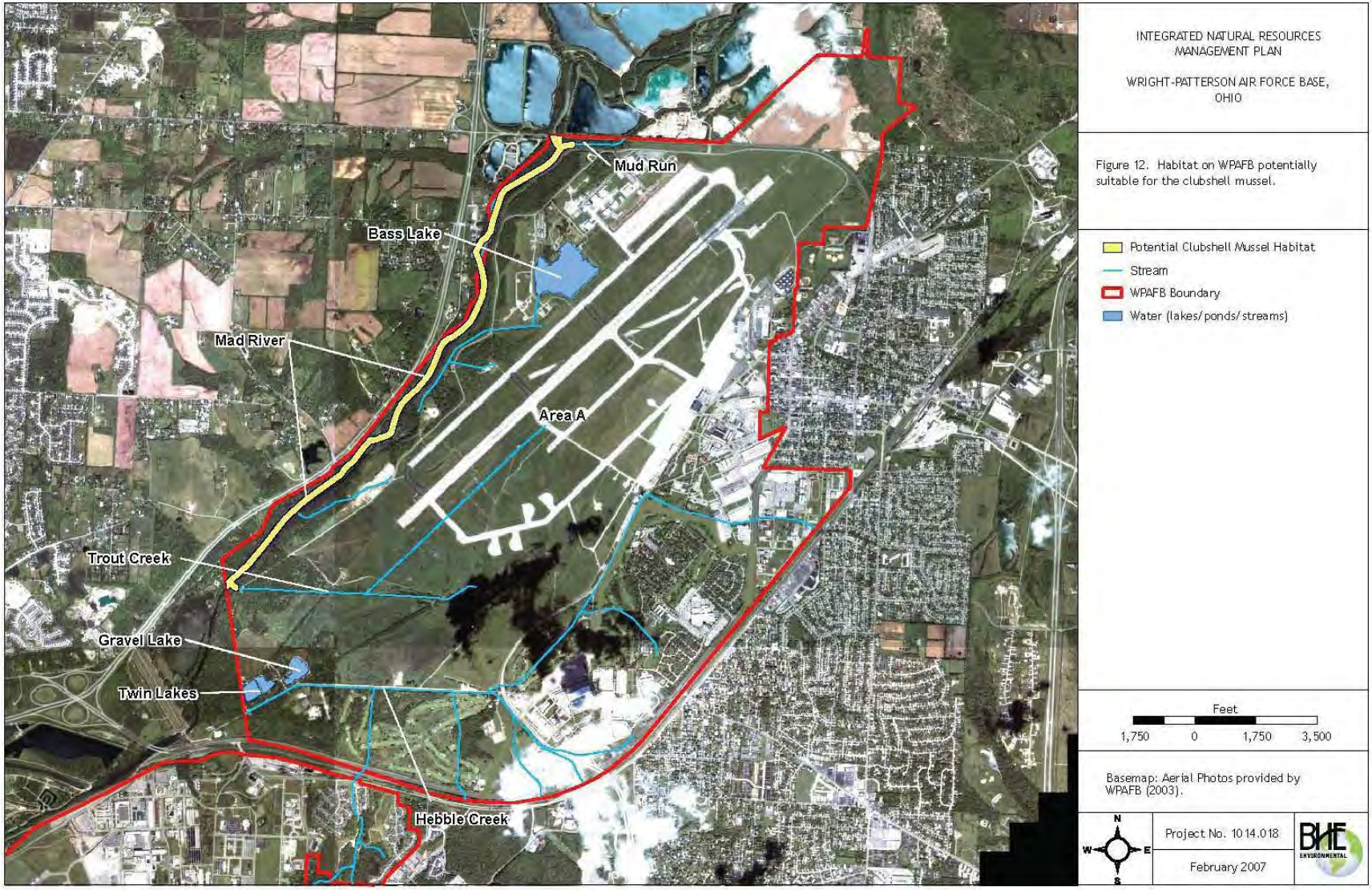

Figure 2-12. Habitat on Wright-Patterson Air Force Base potentially suitable for the clubshell mussel.

Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*)

In October 1999, the USFWS added the eastern massasauga to the federal candidate species list. In September 2016, the USFWS listed the massasauga as a threatened species under the ESA (81 FR 67193). The eastern massasauga is listed as endangered by the State of Ohio.

Neither the historic nor the current population size and status of massasaugas at WPAFB have been determined. The species apparently was common on WPAFB when the base was first built (26 August 1960 issue of The SkyWrighter). Subsequently, large-scale extermination was practiced. Occasional sightings persisted as recently as the 1990s, usually near the Warfighter Training Center (WTC) and Twin Base Golf Course (TBGC) in Area A (BHE 2001b; Figure 2-13).

Four massasaugas (two males and two pregnant/gravid females) were captured during a survey conducted within and around the WTC in 1993 (Colwell 1993). The males were released, but the 2 females were kept until they gave birth to a total of 18 young in August of that year. The females and young were released back in the WTC. Colwell was unable to make a population size estimate (Colwell 1993). Surveys were conducted in the same areas during 1999, but no massasaugas were observed. The latest surveys conducted from 2009–2015 and in 2019 did not find massasauga presence (Davis 2015, Seymour 2020).

Massasaugas are usually found in wet areas including wet prairies, marshes, and low areas along rivers and lakes. They avoid open water and heavily wooded areas, and seem to prefer the cover of broad-leafed plants, emergents, and sedges (ODNR 2005a). Suitable habitat for eastern massasaugas on WPAFB includes the WTC, small patches of land along the western border of TBGC, and, potentially, other wetland and old field areas on WPAFB (Figure 2-10, Figure 2-13). No crayfish burrows were observed at Prairie Road East or Huffman Prairie, and the lack of sufficient hydrology in these areas may preclude crayfish, and thus suitable overwintering habitat for Eastern Massasauga. Much of the base including portions of Huffman Prairie have been tiled and drained over the years which likely decreased suitable massasauga habitat.

Smooth Green Snake (*Opheodrys vernalis*)

Smooth green snakes are listed as endangered by the State of Ohio (ODNR 2016a). Smooth green snakes are found in moist, grassy areas, usually in prairies, pastures, meadows, marshes, and lake edges. They can also be found in open forested areas. They are most often found on the ground or climbing in low bushes. They also bask on and hide beneath rocks, logs, and other debris.

Between 2009–2014 a multi-year, systematic base-wide herpetological survey was conducted by herpetologist Jeff Davis in cooperation with ODNR and USFWS. The survey involved placement of coverboards in spring, and monitoring cover boards between April and October (Davis 2015). During the six years of survey, 123 records of smooth green snake were recorded (Davis 2015), with individuals detected each year. All the records were within Huffman Prairie, the nearby flight field, and a prairie remnant west of Huffman prairie.

The USFWS Ohio Field Office conducted additional survey work for this species during the 2019 field season. 270 cover boards were placed in 5 transects at TBGC, 4 transects in Huffman Prairie, and 7 transects in an old field area near Prairie Road. A total of five unique smooth green snakes were identified from Huffman Prairie and Prairie Road. Adult males and females were detected.

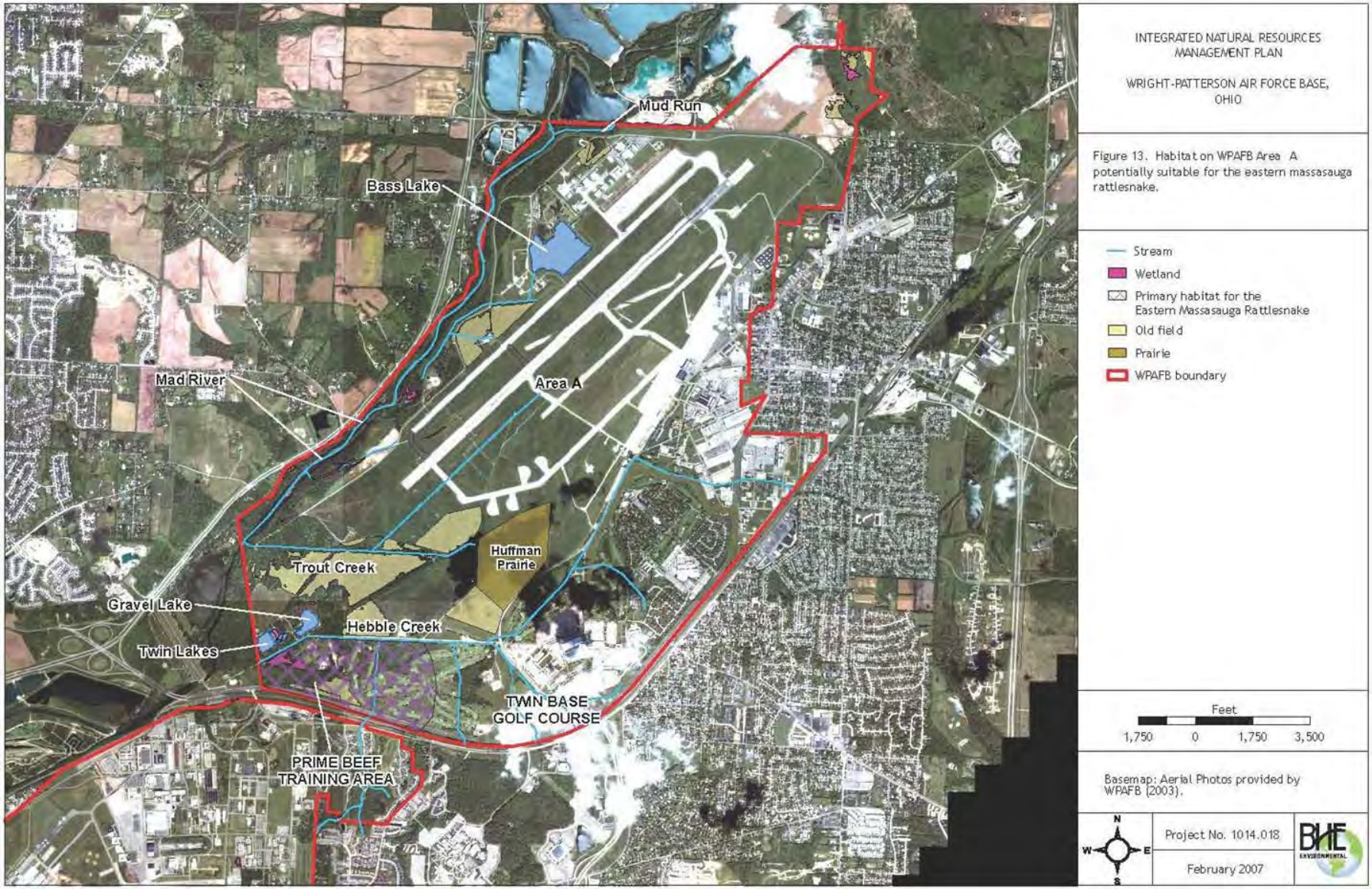

Figure 2-13. Habitat on Wright-Patterson Air Force Base, Area A, potentially suitable for the eastern massasauga rattlesnake.

Annual smooth green snake capture rates were calculated using the 2019 data and from data generated during previous surveys at WPAFB by Davis from 2009–2014. Capture rates of smooth green snakes during 2019 were similar to capture rates in 2012, 2013, and 2014, but were lower than capture rates in 2009, 2010 and 2011. Capture rates in 2011 were very high, approximately 12 times higher than 2019. Davis (2015) postulated that this may have been due to the very wet conditions that year being favorable for smooth green snakes.

The four smooth green snakes that were hand captured in 2019 were swabbed for snake fungal disease (SFD). Two individuals tested positive for SFD by Illinois Veterinary Diagnostic Laboratory. One was from Huffman Prairie and one from Prairie Road East. Both were captured on 23 May 2019. The SFD positive smooth green snake from Huffman Prairie had four black lesions; three were very small, covering approximately three scales or less, all on the dorsum, one near the head and two midway along the body. One lesion was larger and extended from the dorsum around to the ventral side. None of the lesions were open or necrotic and the snake appeared otherwise healthy. The SFD positive smooth green snake from Prairie Road East did not appear to have any significant lesions. Conversely, one smooth green snake that was negative for SFD had multiple lesions like the first snake in addition to a significant tail injury.

During the 2020 field season one deceased smooth green snake was found under a coverboard in Huffman Prairie. While most of the body had decayed the tail segment was still intact and was recovered. It is currently in cold storage at the USFWS Ohio Field Office.

Upland Sandpiper (*Bartramia longicauda*)

The upland sandpiper is listed as endangered by the State of Ohio (ODNR 2016a) and is on the USFWS Birds of Conservation Concern list (USFWS 2008). Nesting upland sandpipers utilize dry grasslands including native grasslands, seeded grasslands, grazed and ungrazed pasture, hayfields, and grasslands established through the Conservation Reserve Program (CRP). The upland sandpiper can be associated with, and at times, even prefer shorter grass/forb structures, and so areas that are grazed, hayed, or mowed are used by upland sandpipers. The species' nesting period is generally 15 April to 31 July.

Breeding bird censuses were completed within Huffman Prairie from 1991–1993, and after many years of intensive management again in 2014 (Minney 2014a, 1994, 1993, 1992, 1991). While upland sandpipers were not detected breeding within Huffman prairie, during 2014 multiple observations of individual birds, both adults and recently fledged juveniles, flying over Huffman Prairie were made throughout the breeding season (Minney 2014a). Minney (2014a) hypothesized that they may be breeding in the mowed grass areas adjacent to the airport runway. This species was also observed in 2018 (Nolin 2018).

King Rail (*Rallus elegans*)

The king rail is listed as endangered by the State of Ohio (ODNR 2016a). It typically occurs in marshes and forages for insects among aquatic vegetation. Nests for this species are deep bowls constructed out of grass and usually hidden very well in marsh vegetation within larger marshes and wetland complexes. The nesting period for this species is generally May 1 to August 1.

King rails were detected during summer of 1998–1999, and during spring, summer, and fall 2006–2007, indicating that they are probably breeding on the base (AMEC 2007). Playback surveys were conducted for this species 2019, though no individuals were observed.

Common Tern (*Sterna hirundo*)

The common tern is listed as endangered by the State of Ohio (ODNR 2016a). It is a colonial waterbird that typically nests near shores of lakes or oceans and forages for fish. This species was only detected during spring surveys; thus, it was likely a migrant passing through the area. WPAFB likely does not support breeding habitat for this species, and thus it will not be considered further in this INRMP.

Blazing Star Stem Borer (*Papaipema beeriana*)

The blazing star stem borer, also called Beer's noctuid, is listed as endangered by the State of Ohio (ODNR 2016a). The species is not federally listed.

Three *P. beeriana* were captured with blacklight traps during an inventory of lepidopterans at WPAFB's Huffman Prairie in August and October of 1992 (Metzler and Zebold 1992, Figure 2-14). Huffman Prairie is one of three locations where this species has been found in Ohio. The data set of Lepidoptera assembled from Huffman Prairie from 1992 through 1995 is the most complete of any prairie in North America (Metzler 1997). The only known food plants of *P. beeriana* are "blazing stars" belonging to the genus *Liatris*.

In 1998, three to four dozen spiked blazing star *L. spicata* plants were observed in Huffman Prairie and a few others were noted in nearby fields (BHE 1999a, Rich Reaves, pers. commun.). As only three of the plants were observed in Huffman Prairie in 1990 (Minney 1990), potential *P. beeriana* habitat at WPAFB appears to have increased in the past decade. Huffman Prairie is the primary suitable habitat for the blazing star stem borer on WPAFB (Figure 2-14). Because *L. spicata* plants were observed in other fields on WPAFB, old fields on the base may also provide suitable habitat for the moth (Figure 2-14, Figure 2-15).

Surveys for signs of *P. beeriana* were completed during 2016 at Huffman Prairie. The prairie was surveyed for dead or dying *Liatris* in July and August. Those plants were then inspected for exit holes from the larva at the base of the plant. Multiple holes were found in *Liatris*.

The *Liatris* is found sporadically in small patches throughout the prairie. Additional seed collection and dispersal of this species should occur.

Henslow's Sparrow (*Centronyx henslowii*), Bobolink (*Dolichonyx oryzivorus*), and Sedge wren (*Cistothorus stellaris*)

Henslow's sparrow, bobolink, and sedge wren are all listed as species of concern by the State of Ohio (ODNR 2016a). Henslow's sparrow is also on the USFWS Birds of Conservation Concern list (USFWS 2008). Henslow's sparrows typically occur in large, flat fields with no woody plants, and with tall, dense grass, a dense litter layer, and standing dead vegetation.

Likewise, bobolinks occur in tall grasslands, overgrown fields and meadows. Sedge wrens occur among dense tall sedges and grasses in meadows, hayfields, and marshes. All of these species have been documented breeding within Huffman Prairie.

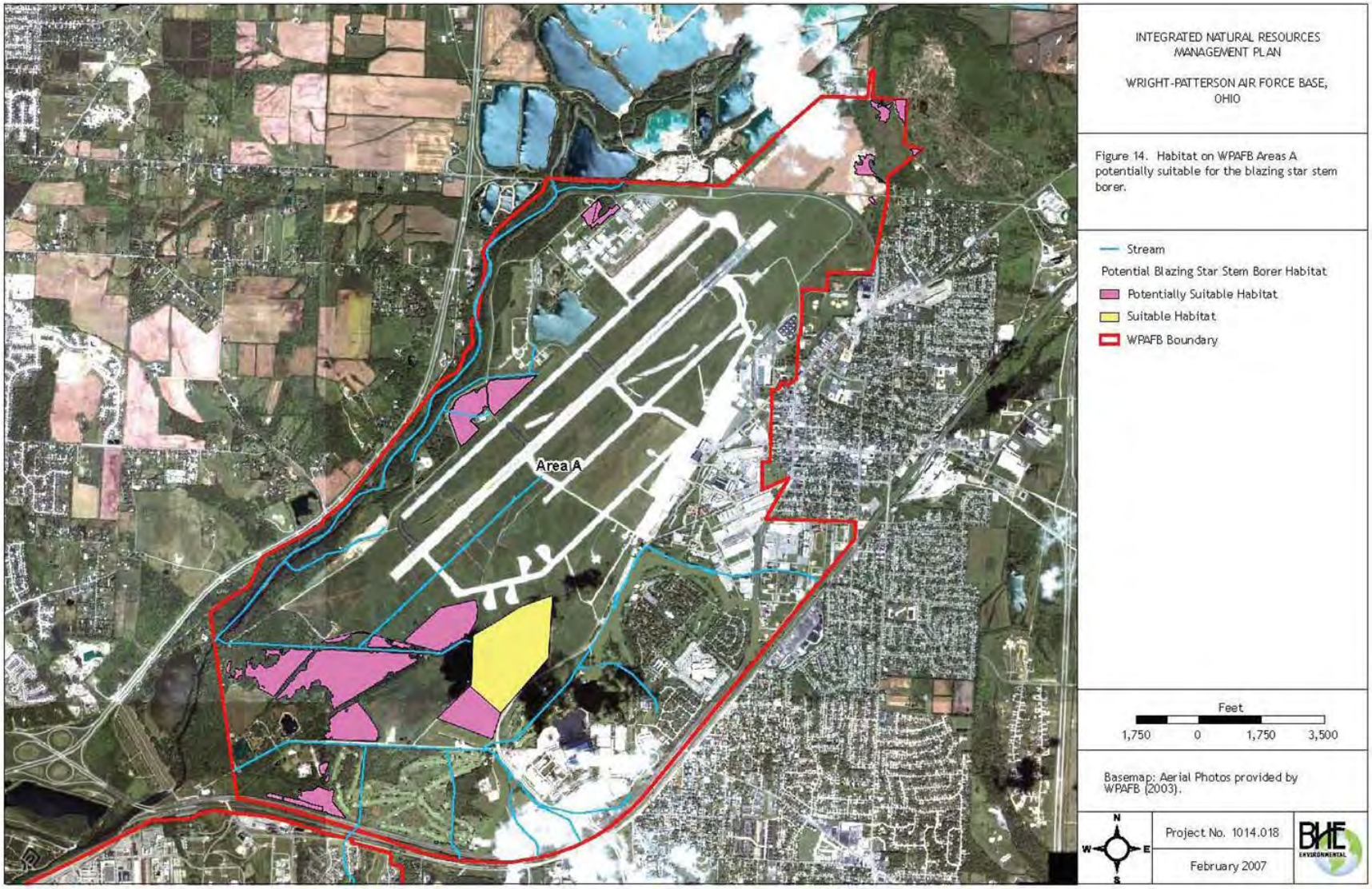

Figure 2-14. Habitat on Wright-Patterson Air Force Base, Area A, potentially suitable for the blazing star stem borer.

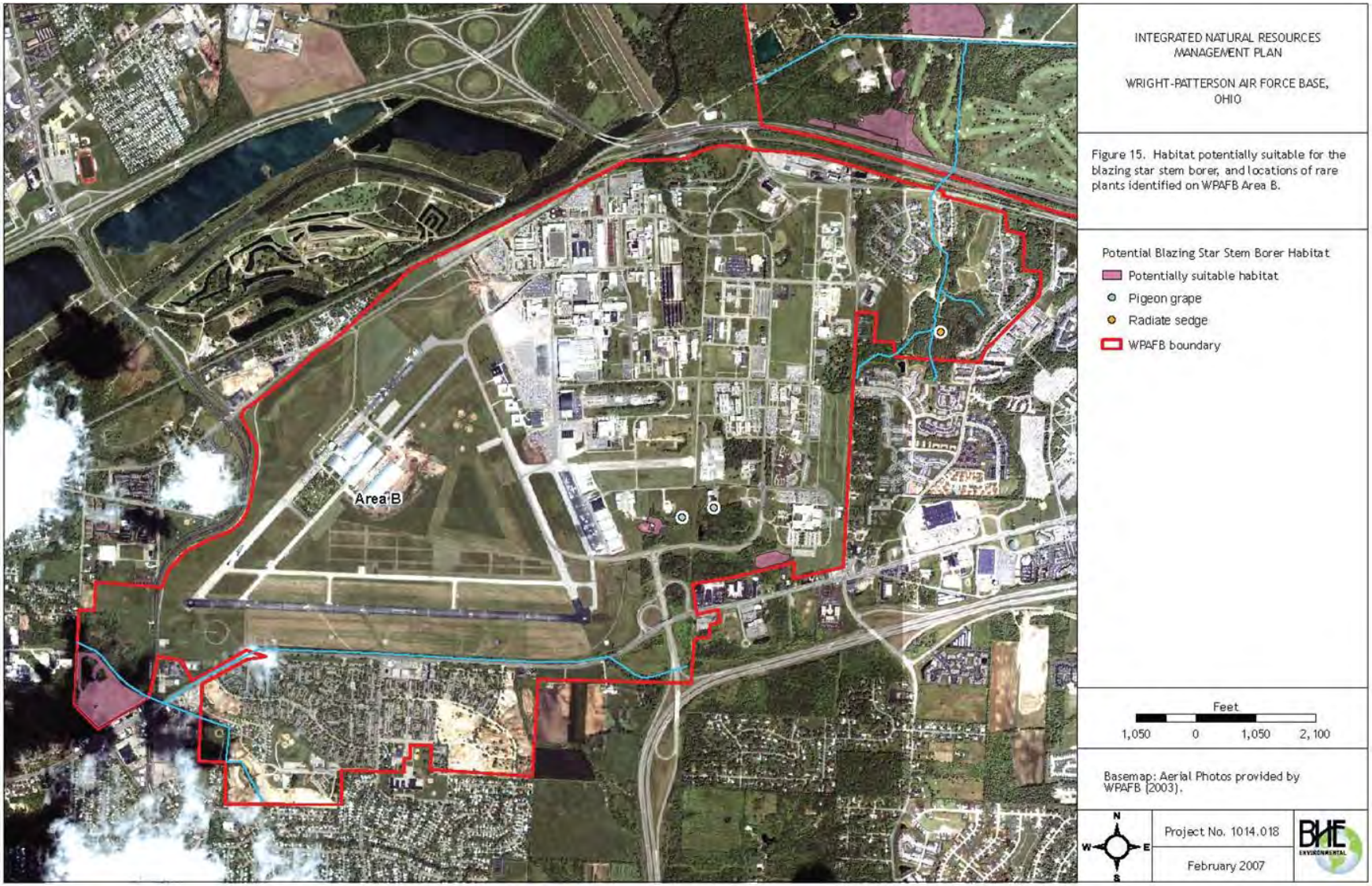

Figure 2-15. Habitat potentially suitable for the blazing star stem borer and locations of rare plants identified on Wright-Patterson Air Force Base, Area B.

Breeding bird censuses were completed within Huffman Prairie from 1991–1993, and after many years of intensive management again in 2014 (Minney 2014a, 1994, 1993, 1992, 1991). Bird inventories were also conducted by AMEC in 2006–2007. Breeding bird surveys were conducted by the USFWS Ohio Field Office in 2019. Two Henslow's sparrow breeding territories were detected in 1991 and 12 were detected in 1992, but no breeding territories were identified during 1990, 1993, or 2014 (Minney 2014a). Henslow's sparrows were detected in June/July 2006, indicating they were probably nesting during this year. A single Henslow's sparrow territory was mapped in 2019. Bobolink territories were detected during all years of survey, and ranged from 9–31 territories, but declined significantly between the 1990s and 2014 (Minney 2014b). 21 bobolinks were observed on 27 May 2019 at Huffman Prairie and the flying field (Nolin 2019). Three additional individuals were observed at the rod and gun field. Sedge wrens were documented nesting in 1992 and 2014, but are known to be transitory nesters, thus absence in various years is not uncommon (Minney 2014b). They did nest in the thick native grass at the north end of Huffman Prairie in 2018 (Nolin 2018).

Rare Plants

No federally listed plants are known to occur on WPAFB, and no critical habitat for any plant species exists on the base. Four species of plants listed as endangered, threatened, potentially threatened, or extirpated by the State of Ohio have been identified growing naturally on WPAFB during floral surveys (BHE 1999b, ODNR 2016b, Table 2-2, Figure 2-15, Figure 2-16). Whorled water milfoil (*Myriophyllum verticillatum*) is considered to be extirpated from the state according to 2016–2017 rare native Ohio Plants status. Two species currently listed by the State of Ohio as endangered has been identified on WPAFB: ear-leaf foxglove (*Agilinis auriculata*) and northern adder's tongue (*Ophioglossum pusillum*). The adder's tongue was found in Huffman Prairie in 2016 following treatment of invasive species (Nolin 2016, personal communication). One plant currently listed as potentially threatened by the State of Ohio occurs in apparent natural populations on WPAFB: Great Plains ladies' tresses (*Spiranthes magnicamporum*). Butternut (*Juglans cinerea*) and pigeon grape (*Vitis cinerea*) were previously a state listed species but are currently not listed.

The ODNR, Division of Wildlife indicates the midland sedge (*Carex mesochorea*), which is threatened in Ohio, has been identified just outside the boundary of WPAFB. While midland sedge potentially occurs on WPAFB, it has not been identified during floral surveys (3D/I 1998, BHE 1999b).

Five species listed by the State of Ohio as threatened or potentially threatened have been documented growing on WPAFB where they had been planted (Table 2-2). Royal catchfly (*Silene regia*) and tall larkspur (*Delphinium exaltatum*) were planted within the Huffman Prairie restoration area (TNC 2001a). Cultivars of northern white cedar (*Thuja occidentalis*), tamarack (*Larix laricina*), and fringe tree (*Chionanthus virginicus*) have been planted in landscaped areas. These planted species are outside their historical ranges in Ohio and planted specimens may be cultivars rather than the state-listed types (BHE 1999b). Similarly, natural populations of the silverbell (*Halesia carolina*) are presumed extirpated from Ohio, but specimens may be found in landscaped areas on WPAFB (BHE 1999b).

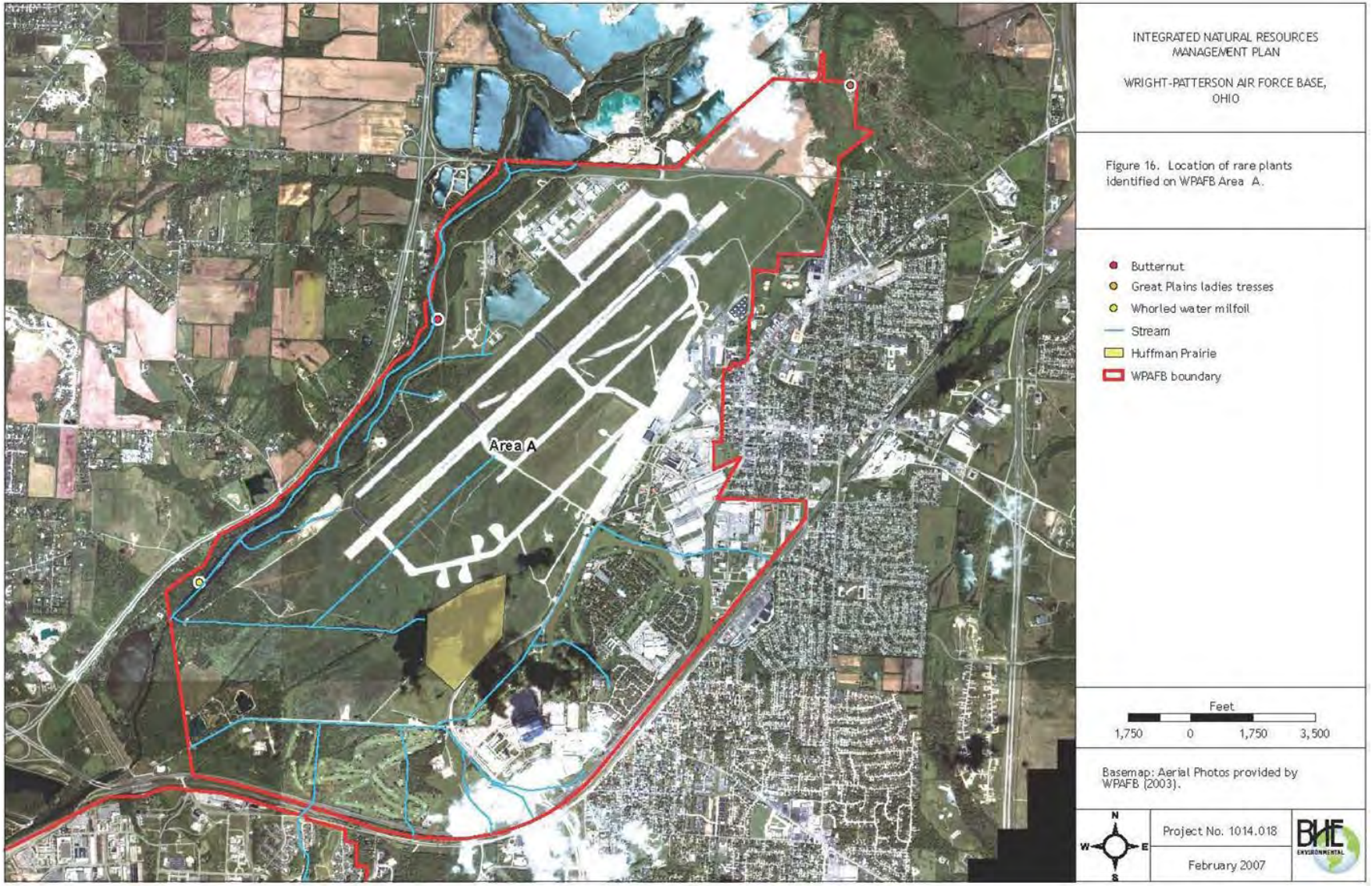

Figure 2-16. Location of rare plants on Wright-Patterson Air Force Base, Area A.

2.3.5 Wetlands and Floodplains

2.3.5.1 Wetland Functions and Values

The legal definition of a wetland in the Clean Water Act (CWA) is "…those areas that are inundated or saturated by surface water at a frequency to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Wetlands typically include swamps, marshes, bogs, and similar areas" (33 CFR 328.3(b)). Wetlands provide essential breeding, spawning, nesting, and wintering habitats for many fish and wildlife species. Wetlands also enhance the quality of surface waters by impeding erosive forces of moving water and trapping waterborne sediment and associated pollutants, maintaining baseflow to surface waters through the gradual release of stored floodwaters and groundwater, and providing a natural means of flood control and storm damage protection through the absorption and storage of water during periods of high runoff.

2.3.5.2 Relevant Regulations and Guidance

The Air Force Environmental Quality Program, as outlined in AFPD 32-70, establishes policies to meet all applicable environmental standards on AF installations. Executive Order (EO) 11990 (Protection of Wetlands) requires Federal agencies, including the DoD, to minimize any significant action that contributes to the loss or degradation of wetlands and that action be initiated to enhance their natural value. Waters of the United States, including jurisdictional wetlands, are protected by CWA Sections 404 and 401. The USACE and USEPA jointly administer Section 404 of the CWA, and the State of Ohio implements Section 401. The regulations established at 33 CFR Parts 320–330 prescribe the statutory authorities, and general and special policies and procedures applicable to the review of applications for USACE permits. U.S. Army Corps of Engineers permits are also required under Section 10 of the Rivers and Harbors Act prior to commencing any work in a navigable water of the United States.

In addition to the AFPD 32-70/AFI 32-7064, the Department of Defense (DoD) Instruction 9 4715.03 states in Section 4.2.10 "lands shall be managed for the goal of no net loss of wetlands. DoD operations and activities shall avoid the net loss of size, function, or value of wetlands. Additionally, the DoD will preserve the natural and beneficial values of wetlands in carrying out its activities" (DoD 1996). Section 4.2.12 goes on to state that "Consistent with ecosystem-based management, altered or degraded landscapes and associated habitats shall be restored and rehabilitated whenever practical."

All activities on WPAFB must conform to the following sections of the Ohio Administrative Code: Section 3745-1-50; Section 3745-1-51; Section 3745-1-52; Section 3745-1-53; Section 3745-1-54; Section 3745-32; Section 3745-33; and Section 3745-38. In addition, impacts to wetlands that are determined to be hydrologically isolated from other waters of the United States, and therefore not regulated under the CWA, are regulated under Section 6111.021 of the Ohio Revised Code. Impacts to isolated wetlands in Ohio are permitted through the General Isolated Wetland Permit administered by the OEPA.

2.3.5.3 Wetlands on WPAFB

A wetland delineation was completed base-wide on WPAFB in 1994 (3D/Environmental [3D/E] 1994). The delineation was updated via pedestrian reconnaissance in 1999, incorporating the results into the 2000 Wetland Management Plan (WMP) (BHE 2000a, 2000b). A base-wide wetland delineation was again conducted between June and July 2004 and 2009, and results were incorporated in the updated delineations (BHE 2010). Field work for identification and mapping of additional wetlands and streams occurred during 2015, and new information will be incorporated into subsequent revisions of the INRMP.

The WMP assists WPAFB in achieving its goals under the Air Force Environmental Quality Program. As part of the 2010 WMP (BHE 2010), the location and boundaries of wetlands were identified and documented via pedestrian reconnaissance in 2009 using the "Routine Onsite Determination Method" described in the USACEs' Wetlands Delineation Manual (USACE 1987). All identified wetlands were mapped using Global Positioning System (GPS) technology. Non-wetland waters that did not meet the wetland criteria (hydrophytic vegetation, hydric soils, and hydrology) defined in the 1987 Manual were not identified or mapped as part of this wetland delineation study. The Ohio Rapid Assessment Method (ORAM v. 5.0) (Mack 2000 and Mack 2001) was applied to assess the functional value of each wetland identified on the installation. The ORAM was developed to assess wetlands in Ohio, classifying wetlands into three categories (Category 1, 2, and 3) that are afforded different levels of regulatory protection.

Forty wetlands covering approximately 19.8 acres were identified within the limits of WPAFB in 2009 (BHE 2010). Twenty-three wetlands were identified in Area A (Table 2-3, Figure 2-17, Figure 2-18) and 17 wetlands were identified in Area B (Table 2-4, Figure 2-19). Some of the wetlands identified on WPAFB may be hydrologically isolated from navigable waters of the United States, i.e., are potentially isolated wetlands. In Ohio, isolated wetlands are protected through a permitting process described in Section 7.6 Wetland Protection. The ORAM category is also a factor in determining the type of permitting required to impact the wetland, and in determining the required ratio for compensatory mitigation. Of the wetlands identified on WPAFB in 2009,

- 8 were classified as Category 1 wetlands through ORAM evaluation,
- 6 were borderline between Category 1 and Category 2 wetlands,
- 11 were Modified Category 2 wetlands,
- 12 were classified as Category 2 wetlands,
- 2 were borderline between Category 2 and Category 3 wetlands, and
- 1 was classified as a Category 3 wetland.

Wetlands on base were categorized according to vegetation types consistent with Cowardin et al. (1979). In total, there were 5.37 acres of palustrine emergent, 8.56 acres of palustrine forested, 0.23 acres of palustrine shrub/scrub, and 5.64 acres of other/mixed wetlands (Table 2-5).

Although not included in the 2010 WMP, there is another wetland approximately 10 acres in size that occurs within the northwest portion of Huffman Prairie. This remnant wet prairie has been subject to hydrological alterations in the past, including tiling and draining the area around it. It is also impacted by the presence of non-native vegetation including wing-stem (*Actinomeris alternifolia*) field thistle (*Cirsium discolor*), and smooth bromegrass (*Bromus inermis*). Some native wet prairie vegetation persists, including prairie cordgrass (*Spartina pectinata*) and big bluestem (*Andropogon gerardi*).

Table 2-3. Wetlands identified within Area A of Wright-Patterson Air Force Base, Clark, Greene and Montgomery Counties, Ohio.

Wetland Designation	Area (acre)	Wetland Classification[1]	Hydrologic Connectivity	ORAM Score	ORAM Category[2]
C1	0.19	PSS	Isolated	40	Modified 2
C2	0.12	PEM	Isolated	31	Between 1 or 2[3]
C4a	0.01	PEM	Isolated	35	Modified 2
C5	0.03	PEM	Isolated	31	Between 1 or 2
C6	0.54	PEM	Isolated	38.5	Modified 2
C12	0.02	PFO	Connected	55	2
C13	0.06	PFO	Connected	56	2
C15	2.31	PFO/POW	Connected	63	Between 2 or 3
C16	0.05	PFO	Connected	54.5	2
C17	0.11	PFO	Connected	44.5	Modified 2
C18	6.02	PFO	Connected	50.5	2
C18A	0.90	PFO	Isolated	40	Modified 2
C19	0.76	PFO	Connected	62.5	Between 2 or 3
C20	0.20	PFO	Connected	50.5	2
C21	0.50	PEM/PAB	Connected	47.5	2
C22	1.84	PEM/PFO	Connected	65	3
C24	2.35	PEM	Isolated	50.5	2
C26	0.35	PEM	Isolated	42.5	Modified 2
C27	0.17	PEM	Connected	45	2
C28	0.06	PFO	Connected	53	2
C29	0.10	PFO	Connected	54	2
C29A	0.24	PFO	Connected	53	2
C32	0.13	PEM	Isolated	34	Between 1 or 2
Huffman Prairie[4]	~10	PEM	undetermined	undetermined	undetermined

Source: BHE 2010.

[1]Wetland classification based on Cowardin et al. 1979.

[2]ORAM wetland classification based on Mack 2000.

[3]OEPA makes the final determination as to ORAM Category for wetlands falling between two categories.

[4]Source: HGS Engineering 2011. Wetland was not officially delineated, thus acreage isapproximate.

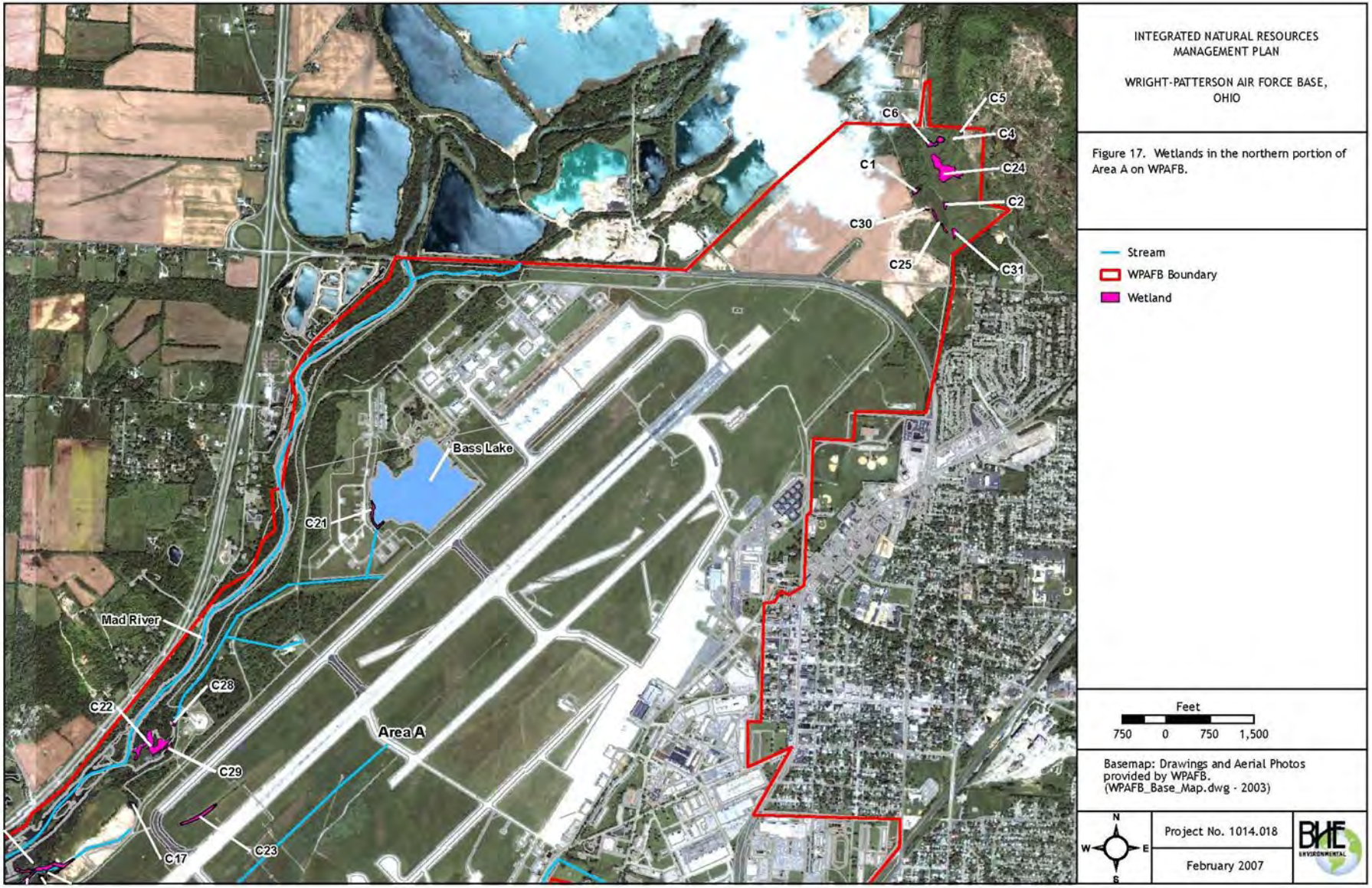

Figure 2-17. Wetlands in the northern portions of Area A on Wright-Patterson Air Force Base.

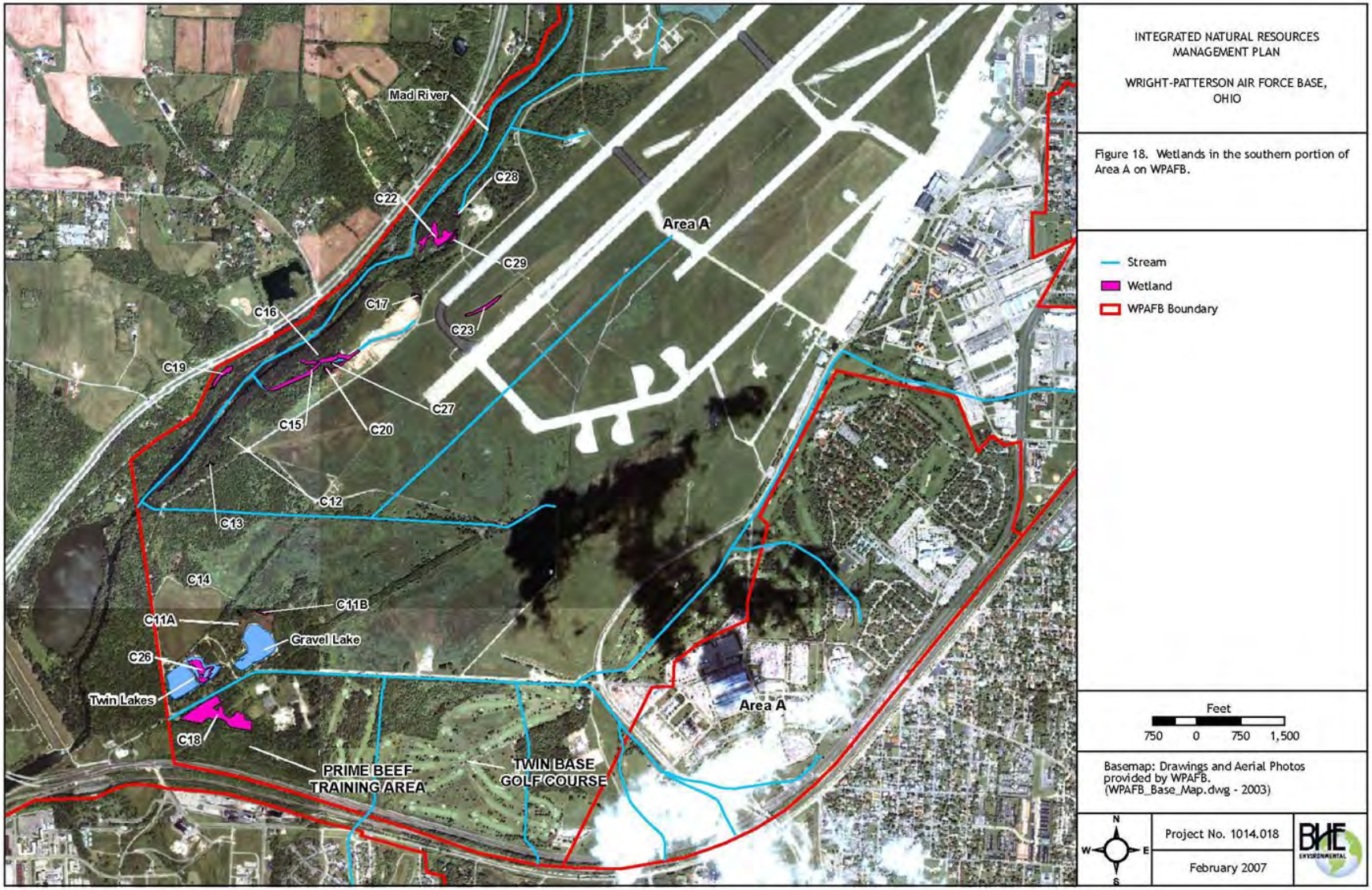

Figure 2-18. Wetlands in the southern portion of Area A on Wright-Patterson Air Force Base.

Table 2-4. Wetlands identified within Area B of Wright-Patterson Air Force Base, Greene and Montgomery Counties, Ohio.

Wetland Designation	Area (acre)	Wetland Classification[1]	Hydrologic Connectivity	ORAM Score	ORAM Category[2]
B1	0.99	PFO/POW	Isolated	53	2
B2	0.03	PFO	Isolated	42	Modified 2
B3	0.04	PSS	Isolated	42	Modified 2
B4	0.15	PEM	Connected	23	1
B5	0.50	PEM	Isolated	38	Modified 2
B6	0.05	PEM	Isolated	29	1
B7	0.21	PEM	Isolated	32	Between 1 or 23
B9	0.15	PEM	Isolated	41.5	Modified 2
B10	0.01	PFO	Isolated	35	Modifies 2
B11	0.03	PEM	Isolated	30.5	Between 1 or 2
B12	0.21	PEM	Connected	33.5	Between 1 or 2
B13	0.01	PEM	Connected	23	1
B14	0.06	PEM	Isolated	26.5	1
B15	0.05	PEM	Isolated	26.5	1
B16	0.04	PEM	Isolated	26.5	1
B17	0.08	PEM	Isolated	26.5	1
B18	0.13	PEM	Isolated	22.5	1

Source: BHE 2010.

[1] Wetland classification based on Cowardin et al. 1979.

[2] ORAM wetland classification based on Mack 2000.

[3] OEPA makes the final determination as to ORAM Category for wetlands falling between two categories

Table 2-5. Area of wetland types on Wright-Patterson Air Force Base.

WetlandType[1]	Area B(acres)	Area A(acres)	Total acres (percent of total)
PEM	1.67	3.70	5.37 (18)
PEM[2]		~10	~10 (33)
PFO	0.04	8.52	8.56 (29)
PSS	0.04	0.19	0.23 (1)
Other/Mix	0.99	4.65	5.64 (19)
Total	2.74	27.06	29.80

Source: BHE 2005a.

[1] Wetland classification based on Cowardin et al. 1979: PEM = palustrine emergent, PFO = palustrine forested, PSS = palustrine scrub-shrub.

[2] Source: HGS Engineering 2011. Huffman prairie wetland was not officially delineated, thus acreage is approximate.

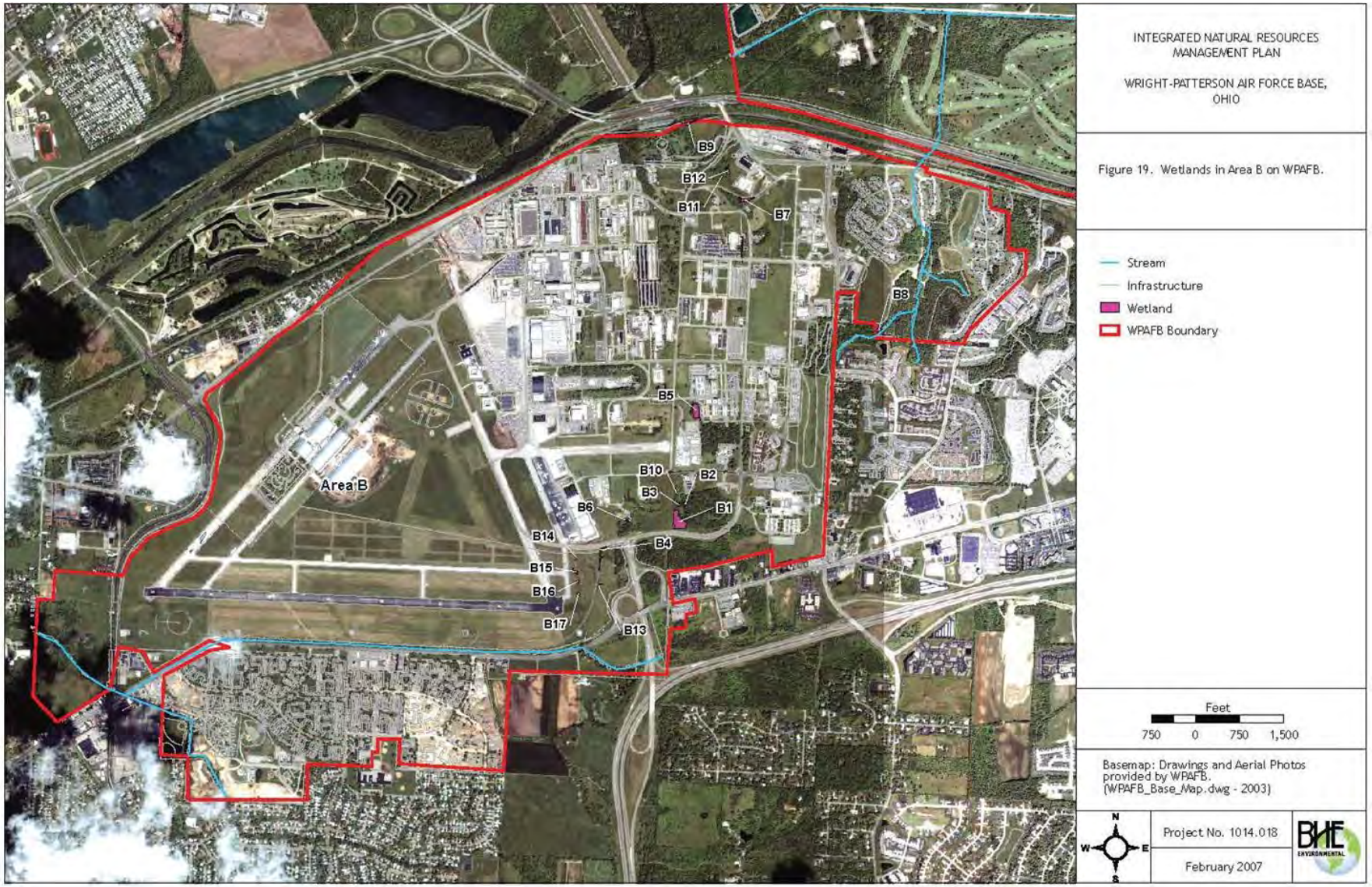

Figure 2-19. Wetlands in Area B on Wright-Patterson Air Force Base.

2.3.6 Other Natural Resource Information

No other biological surveys inventories at this time.

2.4 Mission and Natural Resources

2.4.1 Natural Resource Constraints to Mission and Mission Planning

Protection of certain resources on federally owned lands, including WPAFB, is required by federal laws. Failure to comply with federal laws related to the protection/conservation of natural resources can result in criminal and civil penalties, legal injunctions on activities, and restrictions on land use.

Achieving and maintaining environmental quality is an essential part of the AF mission. The Air Force is committed to conducting its activities in accordance with national environmental policies (AFPD 32-70). This commitment imposes certain constraints on the AF mission and is built into the integrated planning process. When required, the AF mission may override natural resources issues. Existing natural resources and foreseeable natural resources management activities are considered in installation planning.

It is USAF policy to partner with federal and state resource agencies to develop proactive strategies for impact avoidance and habitat management. This proactive approach helps maintain a healthy ecosystem by averting population declines that may lead to listing species as threatened or endangered, and loss of sensitive/unique natural communities.

Unless properly managed, the following natural resources on WPAFB may result in constraints to the base military mission.

2.4.1.1 Threatened and Endangered Species

The ESA prohibits take of federally listed species, which includes certain impacts to habitat for listed species, without a permit. Federally listed species including the Indiana bat and northern long-eared bat are present on WPAFB. The base provides suitable roosting habitat (forest) and foraging habitat for these species. The base has integrated measures for avoiding take and conserving habitat for the Indiana bat and northern long-eared bat into project planning and land management processes.

The clubshell mussel is a federal endangered species, with a range that includes the Mad River. Subfossil shells have been documented at WPAFB, documenting historic occurrence in the area, but no live specimens have been detected during mussel surveys on base (BHE 1999a; 3D/I 1998; USFWS 2014) and this species is considered extirpated from the Mad River.

The eastern massasauga, which historically occurred in the WTC and potentially could still occur on WPAFB, was recently listed as a threatened species under the ESA. WPAFB has integrated measures to minimize impacts to the eastern massasauga and its habitat during project planning and land management activities.

WPAFB conducts surveys for these species and has developed an educational pamphlet about federally listed and candidate species on the base. Continuing pro-active, frequent coordination with regulatory agencies and minimizing activities that potentially affect Indiana bats, northern long-eared bat, clubshell mussel, and eastern massasaugas will minimize potential constraints on the military mission.

2.4.1.2 Wetlands

Forty-five wetlands, totaling approximately 30 acres, are located on WPAFB (Section 2.3.5 Wetlands and Floodplains). Executive Order 11990 requires that federal agencies minimize any significant action that contributes to the loss or degradation of wetlands and that action be initiated to enhance their natural value. The Air Force seeks to preserve the natural values of wetlands while carrying out its mission. To comply with AFPD 32-70, all activities on WPAFB must conform to Sections 404 and 401 of the Clean Water Act and the applicable sections of the Ohio Administrative Code (BHE 2005a). Wetlands that are determined to be hydrologically isolated from other waters of the United States, and therefore not regulated under the Clean Water Act, are regulated under Section 6111.021 of the Ohio Revised Code (Table 2-3, Table 2-4, Figure 2-17, Figure 2-18, Figure 2-19).

Where permits are required, WPAFB must obtain all necessary permits prior to impacting wetlands. Once permits are issued, WPAFB must comply with all permit conditions. When impacts to wetlands are unavoidable, a compensatory mitigation plan may be required, and monitoring of mitigation sites would likely be required for a period of up to 5 years. Potential mitigation locations on Base property have been established as reported by HGS Engineering, Inc. (2011).

2.4.1.3 Hazards to Aircraft

Maintaining safe airspace, airfields, and taxiways is critical to the military mission at WPAFB. Birds, wildlife, and vegetation are natural resources that may affect airfield safety and restrict the mission if not properly managed. To minimize bird/wildlife air strike hazards (BASH), WPAFB implements a comprehensive BASH Plan that involves prevention, monitoring, and reduction of bird/wildlife hazards. Methods used to minimize bird/wildlife hazards include harassment and depredation. Maintaining compliance with pertinent Ohio and Federal regulations, especially pertaining to migratory birds, is critical to avoiding penalties that may affect BASH activities, and thereby the military mission. WPAFB coordinates BASH activities with the ODNR and the US Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), and obtains permits from the USFWS. Airfield Management/Flight Safety, in conjunction with USDA Wildlife Services, is now providing a full-time airport biologist on WPAFB airfield. The Base Natural Resources Manager supports development and implementation of the BASH Plan.

Encroachment of vegetation into the path of aircraft also potentially restricts the WPAFB military mission. Trees and shrubs that obstruct the airfield glideslope and clear zone must be trimmed or removed. Tree trimming and clearing on WPAFB has potential to affect the Indiana bat and northern long-eared bat, federally listed species. Coordination with the USFWS may be required before trees are affected (See Section 7.4 Management of Threatened and Endangered Species, Species of Concern, and Habitats). Should it be necessary, the Base Natural Resources Manager will lead coordination with the USFWS, either through the EIAP or consultation pursuant to Section 7.0 Natural Resources Program Management of the ESA, to ensure compliance with the ESA before trees are removed.

2.4.1.4 Floodplains

Approximately 80 percent of WPAFB lies within the Mad River floodplain. Most of Area A is behind Huffman Dam and subject to flooding. Portions of the parking apron, runway, and operations buildings are in the 100-year floodplain. The Miami Conservancy District (MCD) controls the flood protection system in the Great Miami River Watershed and has the right to back water on and over property upstream of Huffman Dam, including onto WPAFB. The MCD has established policies for activities within the floodplain, with which WPAFB complies. In accordance with EO 11988 Floodplain Management, WPAFB

avoids construction of new buildings or structures within the floodplain unless there is no practicable alternative. When fill material is used within the floodplain, it is collected from within the floodplain to ensure no net gain or loss of soils within the retention basin. In accordance with EO 11988, accepted flood protection measures must be incorporated into all new construction within the floodplain to reduce the risk of flood-associated damages. Use and storage of hazardous materials within the floodplain must be carefully controlled and documented. Proposed new construction activities within the floodplain on WPAFB are reviewed via the EIAP, and guidelines of the FEMA document Further Advice on EO 11988 Floodplain Management are followed.

2.4.2 Land Use

Wright-Patterson Air Force Base covers 8,145 acres. The base is divided into two areas, each with a diversity of land uses but with one primary focus of activity: Area A supports administrative activities, airfield operations, maintenance, and civil engineering activities; and Area B focuses on research and development. The base is divided into 12 major land-use categories, as follows.

- Active and inactive airfield 1,767 acres
- Aircraft operations and maintenance 255 acres
- Research and development 302 acres
- Industrial 359 acres
- Administration 363 acres
- Community services 428 acres
- Community commercial 91 acres
- Medical services 46 acres
- Housing 523 acres
- Outdoor recreation 1,477 acres
- Open space 1,865 acres
- Water 129 acres

A detailed description of land uses is provided in the WPAFB General Plan (Woolpert LLP 2001).

WPAFB contains two airfields. The airfield at Patterson Field, in Area A, is the principal site for aircraft operations at WPAFB. The airfield at Wright Field in Area B is used for the arrival of aircraft for the National Museum of the United States Air Force. Portions of the airfield in Area B are used for vehicle circulation and parking. Both airfields have associated taxiways and glideslopes associated with safety and airfield operations clearance zones.

The Warfighter Training Center (WTC) covers approximately 93 acres in the southwest corner of Area A. It is the only area on WPAFB currently used for military training and readiness exercises. Training exercises simulate deployments for periods of a few hours to several weeks (Pacific Environmental Services 1998). The WTC contains barracks, storage facilities, a mock runway, gravel roads, parking areas, and a latrine. The WTC is managed by the 788th CES/CEX. Training conducted in the WTC between 1993 and 1998 included battlefield civil exercises, medical evacuation activities, explosive ordnance disposal, use of pyrotechnics and weapons simulators, weapons qualifications, heavy equipment training, digging/trenching, and encampments (Pacific Environmental Services 1998).

Over 2,500 acres of WPAFB are undeveloped primarily due to a variety of constraints including over 2,000 acres within the 100-year floodplain of the Mad River. These areas are used for recreation, airfield activities,

and open space. Huffman Prairie and the Huffman Prairie Flying Field also are undeveloped due to the special characteristics of those areas. The Huffman Prairie is a 109-acre remnant native prairie containing rare plant and animal species, which is designated an Ohio Natural Landmark. The Huffman Prairie Flying Field, covering approximately 84 acres adjacent to the Huffman Prairie is part of the Dayton Aviation Heritage National Historical Park. It is listed on the National Register of Historic Places (NRHP) and was designated a National Historic Landmark in 1990. Areas of the Huffman Flying Field were seeded with clover in an effort to provide additional pollinator habitat.

2.4.3 Current Major Mission Impacts on Natural Resources

Air Quality

Air quality on and near WPAFB is generally good and is typically affected by air pollutant emissions from vehicle traffic, fumes from wastewater treatment plants, industrial sources, and construction activities (HQAFRC 2004). WPAFB is within a maintenance area for ozone (O_3) and fine particulate matter (PM2.5 Annual), and is within an attainment area for carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter (PM2.5 24-hour, PM10 24-hour). WPAFB is classified as a major source of criteria pollutants under Title V of the Clean Air Act (CAA). Due to recent changes in major source determinations for Hazardous Air Pollutants (HAPs), specifically USEPA's rescinded "Once In Always In" policy, WPAFB has been able redesignate to an area source of HAPs which has allowed for the relief of Maximum Achievable Control Technology or MACT standards primarily effecting the requirements of the boilers on base. Another reason WPAFB was able to take advantage of this new relief was due to the elimination of coal fired boilers, and a transition to natural gas in 2017. WPAFB's air emissions inventory includes over 1,200 emission sources. Of these, approximately 175 are included in the Base's Title V permit application, which was originally submitted to the Ohio EPA in February 1996 in accordance with CAA requirements. Many of the Title V sources are insignificant, including emergency generators, small boilers, paint booths, fueling operations, and laboratory fume hoods. The Title V Permit was most recently renewed and issued in September 2021. The new Title V Permit has a total of 21 significant units: 14 boilers, 3 painting operations, 1 non-emergency generator, and 3 research combustion operations.

Water Quality

Groundwater

Due to the hydrogeologic characteristics of the installation, there is significant potential for contaminants from past hazardous waste sites to reach the underlying unconfined aquifers. The Huffman Dam well field and the City of Dayton's well field on Rohrer's Island have the greatest potential for contamination. Remedial actions for past hazardous waste sites are in place and all sites are currently deemed non-threatening to environmental receptors.

In 1994, WPAFB Installation Restoration Program (IRP) established groundwater monitoring under the Base-wide Monitoring Program (BMP) to address monitoring efforts on a regional scale. Data collected as part of the BMP form a data set to evaluate the trends in the organic and inorganic chemicals of concern in the groundwater and to evaluate the progress of ongoing remedial actions throughout WPAFB. The IRP is committed to restoring environmental quality where groundwater resources have been impacted by contaminant migration. Therefore, any additional sites identified by the IRP may be subject to remedial

actions as appropriate. All remedial actions involving the removal of groundwater are coordinated with the WPAFB Civil Engineering, Environmental Division.

In compliance with the requirements of the Safe Drinking Water Act and OEPA regulations, WPAFB has implemented a Wellhead Protection Plan (WHPP) dated 2001. Wright-Patterson Air Force Base's WHPP goal is to maintain the quality of drinking water by managing pollutant sources within the 5-year travel area of the base well fields. The WHPP identifies potential pollutant sources and the management practices implemented to prevent contaminant migration.

In addition, a Memorandum of Understanding (MOU) was established between the Cities of Fairborn and Dayton for well field protection in 1993 and was renewed in 2001, 2006, and 2011. The MOU commits WPAFB to preventing introduction of hazardous substances into the public water supply of the cities of Fairborn and Dayton. Consequently, there are no current mission operations that may potentially affect groundwater. The decision was made in 2016 by Environmental Management leadership, in conjunction with JA to not renew the MOU.

Per- and polyfluoroalkyl substances (PFAS) have become a major topic of concern at WPAFB since the 'forever' chemical was detected the base wdrinking water supply in 2016. Since that time, many studies/project have been conducted and results indicate that year of using certain types of fire fighting foam has caused several areas of contamination on-base. The City of Dayton filed a lawsuit in 2020 against WPAFB and DoD.

Surface Water

Primary surface water resources on WPAFB are the Mad River and its tributaries (Hebble and Trout Creeks and Mud Run), and Bass, Gravel, Lower Twin, and Upper Twin lakes. Descriptions of surface water resources are provided in Section 2.2.4 Hydrology.

The OEPA has designated the portion of the Mad River that flows through WPAFB as warm water habitat, agricultural and industrial water supply, and primary contact recreation (Ohio Administrative Code Chapter 3745-1-21). Mud Run is also designated warm water habitat, and Hebble and Lilly Creeks are designated modified warm water habitat (OEPA 2005). According to sampling performed by the OEPA in 2003, the section of the Mad River between River Mile 13.1 and 0.3, which includes the section within WPAFB, is in full attainment for aquatic life use (OEPA 2005). Mud Run is in full attainment for aquatic life use except for a segment near the confluence with the Mad River that is affected by discharge from a Portland Cement Landfill (OEPA 2005). Hebble Creek is in full attainment for aquatic life use (OEPA 2005). Lilly Creek is in partial attainment for aquatic life use; habitat and flow alteration, organic enrichment, and urban runoff are listed as factors affecting Lilly Creek (OEPA 2005). In much of the Mad River watershed, including the mainstem and tributaries on WPAFB, the Primary Contact Recreation use was not attained due to high concentrations of bacteria (OEPA 2005). Detailed information regarding chemical water quality and sediment testing in the Mad River mainstream and tributaries can be found in the OEPA report (2009). The OEPA established a Total Maximum Daily Load (TMDL) of effluent for the Mad River (OEPA 2009). The TMDL specifies the maximum number of pollutants that the Mad River can receive while still meeting water quality standards and will allocate pollutant loadings among point and non- point sources.

WPAFB affects surface water resources via runoff from the storm water system and non-point sources. Materials with potential to come in contact with storm water on WPAFB include liquid fuels (e.g., diesel, jet fuel, and gasoline), coal, aircraft deicing fluid, lubrication oils and other machine maintenance fluid, solid waste, road salt, sodium formate, sodium acetate, and potassium acetate. Drainage from some areas

on base with potentially contaminated rainwater is directed to the sanitary sewer system for treatment prior to discharge. Runoff in fuel/oil storage and refueling areas flows through oil/water separators before discharge to sanitary sewers.

WPAFB has established a Storm Water Pollution Prevention Team to manage storm water issues and prevent pollution. The base implements a Storm Water Management Plan (SWMP), a base-wide Storm Water Pollution Prevention Plan (SWP3), and construction site-specific SWP3s to comply with applicable federal and state regulations (Shaw 2021) WPAFB also implements a Spill Prevention Control and Countermeasures (SPCC) Plan that is part of the Integrated Contingency Plan (ICP)(SAIC 2016).

Currently, WPAFB is in compliance with the CWA and Ohio Regulations governing water pollution control. There are no recent notices of violation. Detailed description of water resources protection is discussed in Section 7.5 Water Resource Protection.

2.4.3.1 Noise

Construction Program

Building construction, modification, and demolition work can cause considerable noise emissions. A variety of sounds come from cranes, cement mixers, welding, hammering, boring, and other work processes. Construction equipment and building operations are often poorly silenced, but quickly become a part of the ambient noise levels heard every day.

Aircraft Operations

Aircraft operations are the primary source of noise associated with a military air installation. The level of noise exposure is related to a number of variables, including the aircraft type, engine power setting and afterburner use, altitude flown, direction of the aircraft, flight track, temperature, relative humidity, frequency, and time of operation (day vs. night). The DoD develops noise contours to assess the compatibly of aircraft operations with surrounding land use. The Air Force utilizes NOISEMAP, the DoD standard model, for assessing the operational noise footprint from military aircraft operations at air installations. Planning contours are based on reasonable projections of future missions and operations. As part of the 2022 WPAFB Air Installation Compatible Use Zone (AICUZ) Study, WPAFB has chosen to utilize the planning contour that has historically been associated with the installation. The existing noise contours are codified by the local municipalities along with imaginary surface criteria. These planning contours reflect the long term (5 to 10 year) operational noise footprint for projected aircraft operations. While operations have changed slightly over time, the runway dimensions have stayed consistent. The Wright-Patterson Comprehensive Planning Platform (CPP) depicts the noise contours. All recent complaints regarding aircraft noise has been coordinated with 445 AW/PA and resolved with the complainant. Aircraft operations and flight tracks are depicted in the 2022 AICUZ study, there are no known impacts to natural resources.

2.4.3.2 Invasive Species

Invasive species are prominent in some areas of WPAFB. Invasive vegetation (e.g., bush honeysuckles and tree of heaven) often suppresses forest regeneration and control of invasive species may be required for regeneration to proceed. Because forest on WPAFB may provide habitat (roost trees, flight corridors, foraging areas) for the federally endangered Indiana bat and threatened northern long-eared bat, presence of invasive species that suppress forest regeneration has implications for endangered species management on WPAFB. Invasive plant species, as well as invasive pests (e.g. emerald ash borer, gypsy moth, Asian long horned beetle, Spotted Lantern Fly) threaten the forests on the base. Invasive plant species also infest

several wetlands along the Mad River corridor; control of invasive plants is an effective practice for enhancing wetland resources on the base. Management strategies for preventing further impacts to natural resources from invasive species are described in Section 7.11 Integrated Pest Management Program.

2.4.3.3 Vegetation Management for Airfield Operations

Encroachment of vegetation into the path of aircraft also potentially restricts the WPAFB military mission. Grass adjacent to the airfield is regularly mowed to maintain clear lines of sight. Trees and shrubs that obstruct the airfield glideslope and clear zone must be trimmed or removed occasionally.

2.4.4 Potential Future Mission Impacts on Natural Resources

The future long-range land-use plan for WPAFB reflects two major concepts: (1) consolidate to the extent possible existing functions into an efficient land use pattern and (2) preserve both short- and long-range flexibility for the expansion of current missions or the acceptance of new missions. The WPAFB General Plan (Woolpert LLP 2001) describes conceptual plans for potential future changes in use of lands and facilities. Area Development Plans were prepared for 13 specific areas. The conceptual plans include identifying new uses for existing buildings, removal of structures, and construction/expansion of new structures.

Whether for capital improvement or other activities, construction projects that disturb ground and alter land uses may affect natural resources. When specific projects are planned in sufficient detail, WPAFB will initiate the EIAP pursuant to compliance with NEPA. This INRMP will support the EIAP analysis.

3.0 ENVIRONMENTAL MANAGEMENT SYSTEM

The USAF environmental program adheres to the Environmental Management System (EMS) framework and its Plan, Do, Check, Act cycle for ensuring mission success. Executive Order (EO) 13834, *Efficient Federal Operations*; DoDI 4715.17, *Environmental Management Systems*; AFI 32-7001, *Environmental Management*; and International Organization for Standardization (ISO) 14001 standard, *Environmental Management Systems—Requirements with guidance for use*, provide guidance on how environmental programs should be established, implemented, and maintained to operate under the EMS framework.

The natural resources program employs EMS-based processes to achieve compliance with all legal obligations and current policy drivers, effectively manage associated risks, and instill a culture of continual improvement. The INRMP serves as an administrative operational control that defines compliance-related activities and processes.

4.0 GENERAL ROLES AND RESPONSIBILITIES

General roles and responsibilities that are necessary to implement and support the natural resources program are listed in the table below. Specific natural resources management-related roles and responsibilities are described in appropriate sections of this plan. In particular, see Section 7.0 Natural Resources Program Management for details regarding roles and responsibilities for Natural Resources Program management.

Office/Organization/Job Title (Listing is not in order of hierarchical responsibility)	**Installation Role/Responsibility Description**
Wing Commander (88ABW/CC)	• Approves and signs the final INRMP. • Certifies or delegates to designee the annual review of the INRMP as valid and current. • Controls access and use of installation natural resources.
AFCEC Natural Resources Media Manager/SME/Subject Matter Specialist (SMS)	• Confirms that WPAFB Natural Resources Program operations are coordinated and conducted using ecosystem management principles in accordance with applicable laws and instructions and this INRMP. • Ensures that WPAFB reviews, updates, and maintains the INRMP. • Maintains project programming necessary to support requirements established in this INRMP in current and out years. • Provide program and technical support to the WPAFB Natural Resources Manager.
Installation Natural Resources Manager/POC	• Approves the final INRMP. • Ensures that INRMP policies and programs are implemented at WPAFB. • Facilitates the annual review and update of the INRMP. • Ensures that threatened and endangered plant and animal species are protected. • Ensures that wetlands and other sensitive habitats of plant and animal species are protected.
Installation Security Forces	• Enforces all base, local, state and federal laws/regulations.
Installation Unit Environmental Coordinators (UECs); see AFI 32-7001 for role description	• Serve as the EMS conduit between the installation environmental function and their unit. • Manage and monitor the EMS requirements for the unit, including providing any information required for installation environmental and sustainability performance indicators.

Office/Organization/Job Title (Listing is not in order of hierarchical responsibility)	**Installation Role/Responsibility Description**
Installation Wildland Fire Program Manager	• Serve as the primary point of contact between the installation and AFCEC/CZOF for all matters concerning wildland fire. • Initiate and ensure appropriate installation coordination and timely completion of the WFMP annual review • Coordinate with the AFCEC/CZOF WSM lead to identify NWCG training requirements needed to implement the installation WFMP. • Submit requests for Incident Qualification Cards to AFCEC/CZOF for instalations personnel not employed by Fire Emergency Services as specified in the installation WFMP. • Responsible for acquiring required approvals of Agency Administrator Ignition Authorization and Prescribed Burn Go/No Go Checklist prior to initiation of a prescribed burn. • Report significant wildfire incidents on the installation as soon as practicable to the RFMO.
Base Civil Engineer (88 CEG/CL)	• Approves and signs the final INRMP as Wing Commander appointed designee
Civil Engineering Community Planning (88 CEG/CENPL)	• Responsible for developing, implementing, and managing the WPAFB Comprehensive Plan, which is comprised of the General Plan, Component Plans, Special Plans and Studies, and Maps. • The INRMP is included in the Special Plans & Studies category. Ultimately the Comprehensive Plan provides installation leadership with a broad-based, detailed, and systematic framework for critical installation development decision making.
Civil Engineering Storm Water Program (88 CEG/CEIEA)	• Develops and implements the Storm Water Pollution Prevention Plan, and oversees compliance with Base NPDES permits, which are the principal mechanisms for maintaining quality of surface and groundwater resources on WPAFB. • Receives Notice of Intent forms for proposed projects involving ground disturbance and ensures pollution prevention control measures are in place.

Office/Organization/Job Title (Listing is not in order of hierarchical responsibility)	**Installation Role/Responsibility Description**
Civil Engineering Entomology Supervisor (88 CES/CEOIE)	• Responsible for developing and maintaining the WPAFB Pest Management Program in accordance with applicable laws and instructions. • Conducts Pest Management operations (excluding golf courses) and supervise all pesticide applications. • Ensures proper coordination with the Base Natural Resources Manager regarding spraying for mosquitoes. • Annually reports pesticide usage to AFCEC/COSC and compile annual records for reporting Measures of Merit.
88 Force Support Squadron (88 FSS)	• Manages recreational activities, including outdoor recreation (except for dispersed outdoor recreation, which is addressed by the NRM). • Handles lodge, campground, and picnic area reservations; equipment check out; and maintenance of outdoor recreation facilities. Coordinates with the 88 CEG/CEIEA to request funds for maintaining or improving dispersed outdoor recreation facilities.
Golf Course Superintendent (88 FSS/FSWG)	• Responsible for maintenance of the Prairie Trace and Twin Base golf courses and conducts pest management operations on the golf courses in accordance with the Integrated Pest Management Plan.
Bioenvironmental Engineering (88 OMRS/SGXB)	• Responsible for industrial hygiene and occupational health on WPAFB. • Interfaces with CE Pest Management as it pertains to the Integrated Pest Management Program. • This program performs water and air monitoring of pest control facilities.
Hazardous Material Management (88 CEG/CEIEC)	• Manages the overall hazardous material management program for the installation. • Interfaces with natural resources management as it pertains to the Integrated Pest Management Program. • This program evaluates and authorizes requests for new pesticides; receives Material Safety Data Sheets on pesticides; and ensures that all training, certifications, and personal protective equipment for pesticide applicators are appropriate and updated.
Geographic Information Systems (GIS) Management (88 CEG/CEIE)	• Manages and maintains an extensive database of geospatial information available to support natural resources management and land-use planning.

Office/Organization/Job Title (Listing is not in order of hierarchical responsibility)	**Installation Role/Responsibility Description**
USFWS	• USFWS Ohio Field Office and Region 3 Office reviews draft documents.WPAFB specifically requests input from the USFWS Ohio Field Office annually during INRMP reviews and updates. • The Region 3 INRMP Coordinator reviews the final plan and signs it to signify mutual agreement with the INRMP as it pertains to conservation and management of fish and wildlife resources on WPAFB. • WPAFB coordinates with the USFWS Ohio Field Office during implementation of the INRMP to share information about the presence and management of threatened and endangered species, migratory birds, and other fish and wildlife.
Ohio Department of Natural Resources	• Reviews draft documents, and ODNR Office of Real Estate and Land Management will sign the final plan, signifying mutual agreement with the INRMP as it pertains to conservation and management of fish and wildlife resources on WPAFB. WPAFB specifically requests input from the ODNR annually during INRMP reviews and updates. • WPAFB coordinates with the ODNR during implementation of the INRMP to share information about the presence and management of rare species and other fish and wildlife.

5.0 TRAINING

USAF installation NRMs/POCs and other natural resources support personnel require specific education, training, and work experience to adequately perform their jobs. Section 107 of the Sikes Act requires that professionally trained personnel perform the tasks necessary to update and carry out certain actions required within this INRMP. Specific training and certification may be necessary to maintain a level of competence in relevant areas as installation needs change, or to fulfill a permitting requirement.

Installation Supplement—Training

- NRMs at Category I installations must take the course DoD Natural Resources Compliance, endorsed by the DoD Interservice Environmental Education Review Board and offered for all DoD Components by the Naval Civil Engineer Corps Officers School (CECOS). See http://www.netc.navy.mil/centers/csfe/cecos/ for CECOS course schedules and registration information. Other applicable environmental management courses are offered by the Air Force Institute of Technology (http://www.afit.edu), the National Conservation Training Center managed by the USFWS (http://www.training.fws.gov), and the Bureau of Land Management Training Center (http://training.fws.gov)
- Natural resource management personnel shall be encouraged to attain professional registration, certification, or licensing for their related fields, and may be allowed to attend appropriate national, regional, and state conferences and training courses
- All individuals who will be enforcing fish, wildlife, and natural resources laws on USAF lands must receive specialized, professional training on the enforcement of fish, wildlife, and natural resources in compliance with the Sikes Act. This training may be obtained by successfully completing the Land Management Police Training course at the Federal Law Enforcement Training Center (http://www.fletc.gov/)
- Individuals participating in the capture and handling of sick, injured, or nuisance wildlife should receive appropriate training, to include training that is mandatory to attain any required permits
- Personnel supporting the BASH program should receive flight line drivers training, training in identification of bird species occurring on airfields, and specialized training in the use of firearms and pyrotechnics as appropriate for their expected level of involvement
- The DoD supported publication Conserving Biodiversity on Military Lands-A Handbook for Natural Resources Managers (http://dodbiodiversity.org) provides guidance, case studies, and other information regarding the management of natural resources on DoD installations

Natural resources management training is provided to ensure that installation personnel, contractors, and visitors are aware of their role in the program and the importance of their participation to its success. Training records are maintained IAW the Recordkeeping and Reporting section of this plan. Below are key natural resources management-related training requirements and programs:

- WPAFB Newcomers Training hosted quarterly by the EMS Program

6.0 RECORDKEEPING AND REPORTING

6.1 Recordkeeping

The installation maintains required records IAW Air Force Manual 33-363, *Management of Records*, and disposes of records IAW the Air Force Records Management System (AFRIMS) records disposition schedule (RDS). Numerous types of records must be maintained to support implementation of the natural resources program. Specific records are identified in applicable sections of this plan, in the Natural Resources Playbook, and in referenced documents.

6.2 Reporting

The installation NRM is responsible for responding to natural resources-related data calls and reporting requirements. The NRM and supporting AFCEC Natural Resources Media Manager and SMS should refer to the Environmental Reporting Playbook for guidance on execution of data gathering, quality control/quality assurance, and report development.

7.0 NATURAL RESOURCES PROGRAM MANAGEMENT

This section describes the current status of the installation's natural resources management program and program areas of interest. Current management practices, including common day-to-day management practices and ongoing special initiatives, are described for each applicable program area used to manage existing resources. Program elements in this outline that do not exist on the installation are identified as not applicable and include a justification, as necessary.

Installation Supplement—Natural Resources Program Management

Natural Resources Management at WPAFB is the responsibility of the 88 Civil Engineer Group, Installation Management Division, Environmental Branch, Environmental Assets Section (88 CEG/CEIEA). Within the Environmental Branch is the Natural Resources Management Program. The Cultural Resources Management, Water Quality, and Environmental Planning programs are also within the Installation Management Division.

The Base Natural Resources Manager implements natural resources management planning, funding requests, and projects at the base level. The Base Natural Resources Manager is responsible for developing, implementing, and updating the INRMP. The Base Natural Resources Manager is the primary point of contact with the USFWS and ODNR for coordination involving fish and wildlife management, impact analyses (e.g., pursuant to the EIAP), and threatened and endangered species management. Currently, 3 full-time employees are responsible for implementation of the natural resources program. Two full-time Environmental Technician are assigned to the 88 CEG/CEIEA to implement projects, gather data, and otherwise support the activities of the Base Natural Resources Manager (NRM).

Other WPAFB organizations and personnel with responsibilities that interface with natural resources management are described below.

Civil Engineering Storm Water Program (88 CEG/CEIEA)

The 88 CEG/CEIEA is responsible for management and regulatory compliance associated with stormwater and wastewater. The Storm Water Program Manager develops and implements the Storm Water Pollution Prevention Plan, and oversees compliance with Base NPDES permits, which are the principal mechanisms for maintaining quality of surface and groundwater resources on WPAFB. The Storm Water Program receives Notice of Intent formsfor proposed projects involving ground disturbance and ensures pollution prevention controlmeasures are in place.

Civil Engineering Entomology Supervisor (88 CES/CEOIE)

The 88 CES/CEOIE is responsible for developing and maintaining the WPAFB Pest Management Program in accordance with applicable laws and instructions. Specifically, this entails

- conducting Pest Management operations (excluding golf courses) and supervising all pesticide applications;
- ensuring proper coordination with the Base Natural Resources Manager regarding spraying for mosquitoes; and
- annually reporting pesticide usage to AFCEC/COSC and compiling annual records for reporting Measures of Merit.

Civil Engineering Community Planning (88 CEG/CENPL)

The 88 CEG/CENPL is responsible for developing, implementing, and managing the WPAFB Comprehensive Plan, which is comprised of the General Plan, Component Plans, Special Plans & Studies, and Maps. To carry out these responsibilities, this office employs a widely inclusive process involving all base organizations that develop and support specific planning documents or products that impact WPAFB lands, facilities, and resources. The INRMP is oneof many such documents and is included in the Special Plans & Studies category. Ultimatelythe Comprehensive Plan provides installation leadership with a broad-based, detailed, and systematic framework for critical installation development decision making.

88 Force Support Squadron (88 FSS)

The 88 FSS/FSC manages recreational activities, including outdoor recreation (except for dispersed outdoor recreation, which is addressed by the NRM). The Force Support Squadron handles lodge, campground, and picnic area reservations; equipment check out; and maintenance of outdoor recreation facilities. The Rod and Gun Club is associated with the Force Support Squadron, which coordinates with the 88 CEG/CEIEA to request funds for maintaining or improving dispersed outdoor recreation facilities.

Golf Course Superintendent (88 FSS/FSWG)

The 88 FSS/FSCG is responsible for maintenance of the Prairie Trace and Twin Base golf courses, and conduct pest management operations on the golf courses in accordance with theIntegrated Pest Management Plan.

Bioenvironmental Engineering (88 AMDS/SGPB)

The 88 AMDS/SGPB is responsible for industrial hygiene and occupational health on WPAFB. Interface with natural resources management pertains to the Integrated Pest Management Program. This program performs water and air monitoring of pest control facilities.

Hazardous Material Management (88 CEG/CEIEC)

The 88 CEG/CEIEC manages the overall hazardous material management program for the installation. Interface with natural resources management pertains to the Integrated Pest Management Program. This program evaluates and authorizes requests for new pesticides;receives Material Safety Data Sheets on pesticides; and ensures that all training, certifications, and personal protective equipment for pesticide applicators are appropriateand updated.

Geographic Information Systems (GIS) Management (88 CEG/CEIE)

The 88 CEG/CEIE manages and maintains an extensive database of geospatial information available to support natural resources management and land use planning.

Non-governmental Partners

WPAFB natural resources management is supported by other non-governmental partners. For example, The Nature Conservancy assisted in developing a management plan for Huffman Prairie and Fiver Rivers Metroparks assists in implementing management and monitoring at Huffman Prairie.

Federal Agencies

WPAFB partners with multiple federal agencies to implement natural resources management on base. WPAFB coordinates with the USFWS on surveys and management strategies for projects that may affect

federally listed endangered and threatened species. In recent years WPAFB provided funding to the USFWS Ohio Ecological Service Field Office to carry out stream and wetland monitoring, flora and fauna surveys at Huffman Prairie, and mussel surveys.

When WPAFB development projects will result in placement of fill in waters of the U.S. coordination with the U.S. Army Corps of Engineers (USACE) occurs. The USACE completes jurisdictional determinations of wetlands, issues Clean Water Act Section 404 and Rivers and Harbors Act Section 10 permits for impacts to waters of the U.S., and monitors compliance with permit conditions.

State Agencies

WPAFB partners with ODNR on many projects. ODNR Division of Wildlife assists in implementing and ensuring compliance with hunting and fishing regulations on base. Prescribed burns are conducted at Huffman Prairie with support from ODNR Division of Forestry. Prior to implementing any construction activities, WPAFB consults with ODNR's Natural Heritage Database. For projects that may impact state-listed species, WPAFB coordinates with ODNR Division of Wildlife and Division of Real Estate and Land Management.

When WPAFB development projects will result in impacts to state-regulated streams or wetlands, coordination with Ohio EPA occurs. Ohio EPA issues Clean Water Act Section 401 and Isolated Wetlands permits for impacts to streams and wetlands and monitors compliancewith permit conditions. WPAFB also coordinates with Ohio EPA on National Pollutant Discharge Elimination System (NPDES) permits and Storm Water Pollution Protection Permitswhen

7.1 Fish and Wildlife Management

Applicability Statement

This section applies to all USAF installations that maintain an INRMP. The installation is required to implement this element.

Program Overview/Current Management Practices

Approximately 1,890 acres of WPAFB are managed for fish and wildlife. Forest, prairie/old field, wetland, and aquatic habitats on WPAFB support game, non-game, and federally or state-listed species of fish and wildlife. While active management of the forest and prairie is focused primarily upon providing suitable habitat for listed species (e.g., Indiana bat, blazing star stem borer), those areas also provide habitat for common species of game and non-game wildlife. Primary goals of fish and wildlife management at WPAFB are maintaining the whitetail deer, pheasant, and sport fish populations at desirable levels and maintaining habitat for hunting and fishing.

7.1.1 Hunting and Fishing

The Base Conservation Committee was established in 1958 and has since been changed to the Natural Resources Working Group. This group meets quarterly to establish policies, and work with the Base Natural Resources Manager to plan and implement the fishing and hunting programs on base, particularly the stocking of pheasants and fish.

Hunting is allowed within eight designated areas totaling approximately 1,060 acres (Figure 7-1). All hunting seasons, rules and regulations on base are within the ODNR, Division of Wildlife regulations. The primary game species is white-tailed deer. Approximately 30 deer are taken from WPAFB annually. Most recently 25 were harvested by hunters and 3 dead individuals were recorded from car strikes/found dead

for a total harvest of 28. Small game and waterfowl hunting is also allowed on WPAFB. Small game and waterfowl may be hunted within seasons specified by the ODNR and only in specific locations designated by WPAFB. Recreational trapping is allowed in order to aid in managing furbearers. A licensed shooting preserve of 266 acres was used for "put and take" pheasant hunting in the past, but this has been discontinued.

The licensed shooting preserve would benefit from more frequent management or enhancement actions. WPAFB plans to partner with local conservation organizations, such as Pheasants Forever or Quail Unlimited to perform enhancement activities on 50 acres of the Licensed Shooting Preserve every-other year. These conservation organizations retain the services of biologists and other wildlife professionals on staff and routinely provide volunteer labor, equipment, and supplies to aid in this type of activity.

Hunters purchase annual base hunting permits on-line at **https://wpafb.isportsman.net/**; approximately 300 annual hunting licenses are purchased each year. Fees are collected with WPAFB hunting and fishing permits, in accordance with the Sikes Act. The funds are used for expenses associated with the program and are the only source of funding for the hunting and fishing programs. Hunters must also purchase the appropriate hunting licenses from ODNR-DOW.

Appropriate management of the white-tailed deer herd on WPAFB helps sustain the revenue from hunting permits, which supports the hunting and fishing program. Maintaining the deer population at a desired level supports the WPAFB military mission by minimizing potential for collisions with aircraft or vehicles. An overabundance of deer may result in destruction of native flora, increased aircraft and vehicle strike hazards, and destruction of ornamental or recreational plantings (e.g., gardens). Because some areas are not fenced, and the base fences are not deer-proof, the number of deer on WPAFB is variable. Updated base instruction required hunters hunting within the perimeter fence to sign in/out at designated location. Hunters take deer to state check stations off WPAFB but are required to report their take to the WPAFB Natural Resources Manager, who maintains a database of deer killed on base. Estimates of the number of deer on WPAFB enable the development of controlled management strategies to maintain deer at a harvestable, but non-nuisance, level.

Annually from 2011–2016, WPAFB had conducted a controlled archery hunt in the vicinity of Twin Base Golf Course to better manage the deer herd. Deer surveys were conducted during spring and fall 2011–2014 by 88 CEG/CEIEA and USDA-WS to establish harvest levels. WPAFB plans to continue semi-annual deer surveys in order to maintain the deer herd at an acceptable level and determine the need for controlled archey hunts. The controlled archery deer hunt was not conducted the past several years due to Twin Base Golf Course remaining open during the winter and the COVID pandemic in 2020. Plans are currently underway to conduct a controlled archery hunt during the 2022-2023 hunting season.

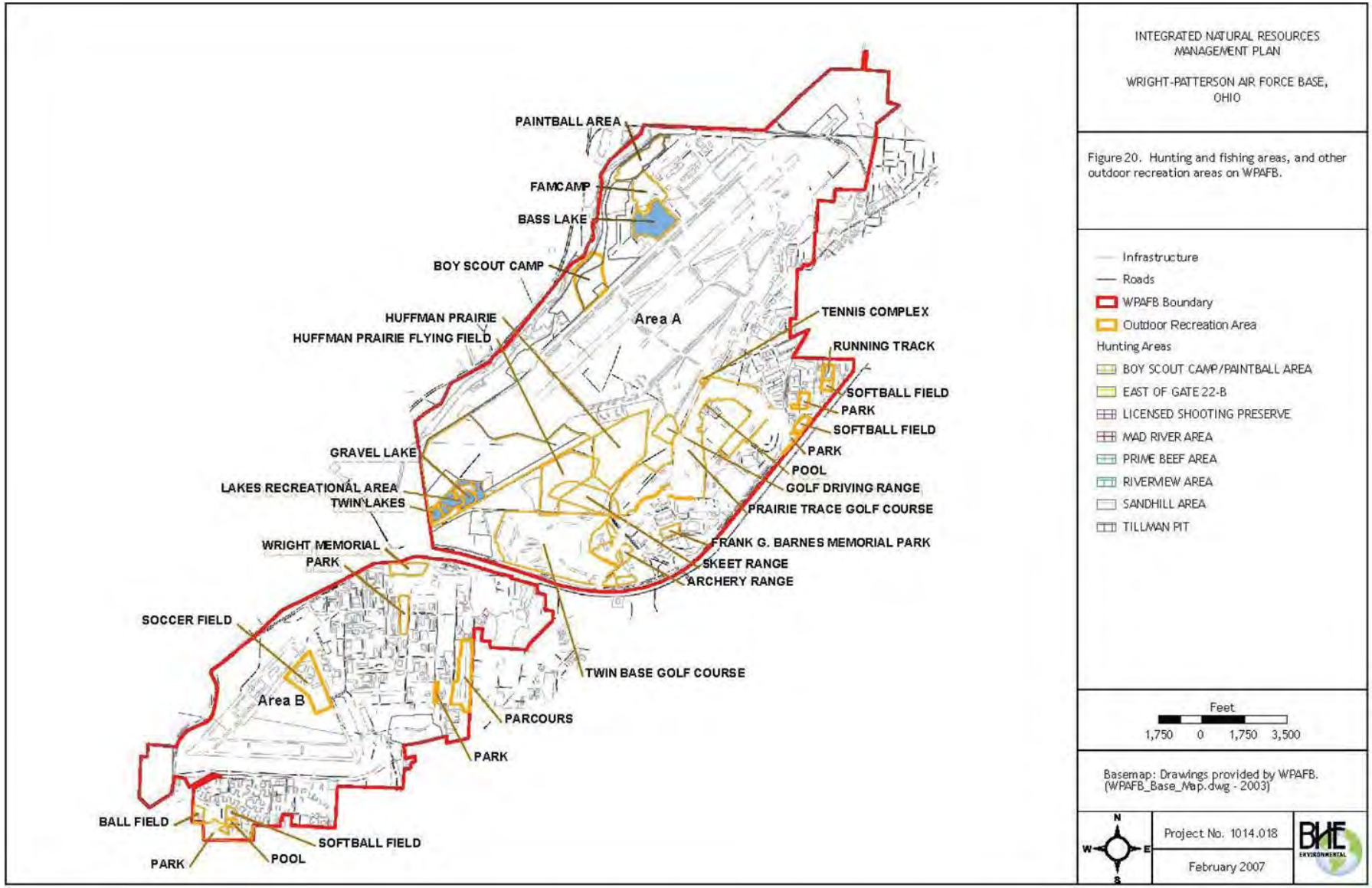

Figure 7-1. Hunting and fishing areas, and other outdoor recreation areas on Wright-Patterson Air Force Base.

Fishing in the lakes of WPAFB is also a popular recreational activity. Fish are stocked in Gravel Lake, Lower Twin Lake and Bass Lake. In spring and fall, an average of 600 pounds of rainbow trout is stocked, with approximately 75 percent put in Gravel Lake and 25 percent in Bass Lake. In the summer, an average of 750 pounds of channel catfish is stocked with 75 percent going into Lower Twin Lake and 25 percent in Bass Lake. For the past several years, approximately 1,200 base annual fishing permits and 500 daily (24-hour) permits are sold annually. Fishing is also permitted along a 4-mile stretch of the Mad River that runs through the northern part of Area A of the base. Fishing rules and regulations are compliant with state laws or are more restrictive. WPAFB sets limits for the number and minimum size of walleye, bass, trout, catfish, and bullhead caught. All anglers 12 and older must carry a WPAFB fishing permit, and those 16 and older a State of Ohio fishing license, except for U.S. Armed Forces veterans and disabled persons.

Sustaining sport fisheries helps provide the revenue for hunting and fishing programs. Funds for stocking lakes are generated by the sale of hunting and fishing permits. Bass Lake provides a good quality fishing resource. However, use of Gravel and Lower Twin lakes has declined in recent years due to infestation of aquatic vegetation and poor water quality.

7.1.2 Enforcement of Fish and Wildlife Regulations

The 88 SFS Operating Instruction 32-7064 Security Forces Fish and Wildlife Protection Program guides enforcement of fish and game laws on WPAFB. Base Security Forces enforce Ohio, federal, and WPAFB fish and game laws. Base Security Forces monitor hunting and fishing areas, check permits/licenses, and issue citations to violators.

7.1.3 Protection of Migratory Birds

The Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755) as amended (MBTA) prohibits pursuing, hunting, taking, capturing, killing, selling, transporting, or attempting to do any of the former actions to a migratory bird, or the eggs, nest, or parts of a migratory bird, without a permit. The MBTA lists 1007 species protected under the Act.

Executive Order (EO) No. 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (10 January 2001) requires federal agencies to consider the effect of their actions on migratory birds. Each Federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations are directed to develop and implement a MOU with the USFWS that promotes the conservation of migratory bird populations. The MOU shall (1) support the conservation intent of the MBTA; (2) restore and enhance the habitat of migratory birds; (3) design migratory bird habitat and population conservation principles, measures, and practices, into INRMPs; (4) ensure NEPA evaluates the effects of actions and agency plans on migratory birds, with emphasis on species of concern; and (5) consult with the USFWS to minimize the intentional and unintentional take of species of concern.

In accordance with the 2003 National Defense Authorization Act (P.L. 107-314), MBTA requirements shall not apply to the incidental taking of a migratory bird by a member of the Armed Forces during a military readiness activity. Department of Defense activities other than military readiness activities are not exempt from ‘take’ and are required to obtain a Special Purpose Permit for each action. Intentional takes of migratory birds require a depredation permit issued by the USFWS and are also subject to NEPA and EIAP. Wildlife control in support of the BASH Plan must be consistent with AF guidance found in AFI 91-202 and Department of Air Force Instruction (DAFI) 91-212. Nuisance wildlife control must be coordinated with the state fish and wildlife agency and may require a state depredation permit.

The DoD participates in the Federal Partners-in-Flight Program for the conservation of neotropical migratory birds. In accordance with the MBTA and EO No. 13186, AF installations will avoid or minimize the negative impact of AF actions on migratory birds and take active steps to protect birds and restore or enhance their habitat whenever possible. Habitat enhancement and/or restoration activities include, but are not limited to invasive species removal, native tree species plantings and restrictions on tree cutting/removal.

Activities on WPAFB are not expected to have measurable negative effect on migratory bird populations. Bird depredation occurs primarily during BASH reduction and authorized hunting activities. BASH reduction efforts, described below in Section 7.12 Bird/Wildlife Aircraft Strike Hazard, are critical to maintaining safe aircraft operations at WPAFB. The WPAFB BASH Plan is consistent with AFI 91-202 and DAFI 91-212. Bird depredation for BASH reduction purposes is conducted under USFWS permits and in coordination with the USDA APHIS Wildlife Services. WPAFB Airfield Management tracks all bird depredation activities to ensure compliance with permits.

Hunting of waterfowl and other birds is managed in strict compliance with Ohio and Federal regulations. In addition to the Ohio and WPAFB hunting licenses, waterfowl hunters must also have in their possession a signed Ohio Wetlands Habitat Stamp (proof of HIP Certification completed and Ohio Wetlands Habitat Stamp purchased) and a signed Federal Migratory Bird Stamp. Birds affected by BASH reduction activities and hunting typically are species with locally abundant populations (e.g., Canada geese, pigeons, mourning doves).

Over 100 species of birds are known to inhabit a variety of habitats on WPAFB (Appendix C). New posts with signs identifying bird survey locations were installed in Huffman Prairie starting in 2018 with remaining posts installed prior to the breeding bird survey initiated in mid-May 2019.

7.1.4 Habitat Management for Fish and Wildlife

WPAFB strives to maintain a mosaic of native habitat types in undeveloped portions of the base. Native prairie and old field, forest, wetland, and aquatic habitat types provide a variety of vegetation species and structures, food sources, shelter, and nesting locations for a diverse assemblage of animals, birds and insects (Section 2.3.3 Fish and Wildlife, Appendix C). Maintaining diverse and functional habitats on the base will continue to support the endemic wildlife, fish, and insects. WPAFB has identified several opportunities to manage habitat to support fish and wildlife, while simultaneously supporting the military mission of the base. At the Wright Brother's Memorial an area has been selected to convert maintained lawn to pollinator/prairie habitat. This area was frost seeded in early spring 2019. Additional plantings of seedings and potted stock occurred at the memorial in 2019. In addition, three additional monarch way stations were planted on base in 2019.

Huffman Prairie provides habitat for grassland birds, numerous moths and butterflies and other pollinators, reptiles, and mammals. WPAFB has managed Huffman Prairie in accordance with the plan developed by TNC in 2001 (TNC 2001a). In 2007, AMEC developed a Huffman Prairie Assessment and Work Plan. HGS Engineering updated the AMEC plan in November 2010 and another update was provided in 2016 (Nolin 2016). Management involves primarily prescribed burning and mowing to maintain native vegetation and minimize woody species. To promote vegetative diversity, a small area in section 4 was designated as a wild plum management unit in 2019. This area has a variety of rare native woody plants such as wild plum and sweet crabapple. An area of approximately 0.25 acre was defined by a mowed path and no management will occur for a few years in this area.

Management activities are designed to minimize adverse effects to wildlife; burning and mowing in Huffman Prairie occurs outside the summer season, when most grassland birds nest. Only portions of the prairie are burned at once so vegetation in the other portions remains to provide refuge for pollinators, birds, and other prairie inhabitants. Burning is limited to the late fall, winter and early spring seasons because of the potential presence of the eastern massasauga. In accordance with the USFWS, burns can only occur between 01 November and 15 March, and soil temperatures at a four-inch depth above 9 °C (48.2 °F) curtail burning activities. Two sections of the prairie were burned in December 2018. Units 2 and 3, totaling 58.5 acres, were burned in February 2020. Burn Units A1 and A6 were burned for the first time in February 2020.

Approximately 815 acres of forest currently exist on WPAFB (Figure 2-6, Figure 2-7). Forest provides suitable habitat for a variety of wildlife including the bald eagle, Indiana bat, and northern long-eared bat. Along the Mad River and its tributaries, trees are an important component of riparian and riverine habitats because they provide shade, stabilize stream banks, and protect water quality. WPAFB does not operate a forestry program, and removal of trees from woodlots on the base is prohibited. In most cases, forest is allowed to regenerate and mature, particularly along the Mad River. WPAFB is working to eradicate invasive species (e.g., bush honeysuckles) that may suppress forest regeneration. In recent years, removal of invasive species including honeysuckle (*Lonicera* spp.) in the riparian zone along the Mad River has been implemented. Approximately 20 acres were cut and sprayed during 2014, approximately 100 acres were cut and sprayed during 2015 (Figure 7-2), and 15 acres were cut in 2016 (Figure 7-3). To expand the acreage of forest along the Mad River corridor, mowing will be ceased in selected areas to allow natural succession to occur. While a primary purpose of allowing forest regeneration is to provide habitat for threatened and endangered species, it will also provide habitat for woodland birds, insects, large and small mammals, amphibians, and reptiles, and will enhance habitat used by fish and wildlife in the Mad River corridor.

As with forests, WPAFB is working to eradicate invasive species in wetlands on WPAFB. Approximately 30 acres of wetlands, primarily forested or dominated by emergent vegetation, exist in Areas A and B (Table 2-3, Table 2-4). Wetlands provide essential breeding, spawning, nesting, and wintering habitats for many fish and wildlife species.

Wetlands also play an important role in maintaining water quality. Presence of invasive species degrades the function and value of the wetland. Of 44 wetlands on WPAFB, 12 are infested with invasive plants (Table 7-1). An additional 10-acre wetland in Huffman Prairie currently supports non-native wetland plants and would benefit from management actions to restore native vegetation. WPAFB will continue to control invasive species in wetland B1 and B3, in the riparian zones of stream 2, 4, 5, and 6, along the Mad River floodplain, and in Huffman Prairie via herbicide treatment and seeding/planting where appropriate.

Eradication of invasive plants in selected wetlands and riparian zones will improve the wetland function, and the habitat suitability for species inhabiting wetlands, including the Federal endangered Indiana bat, Federal threatened northern long-eared bat, State endangered smooth green snake and king rail, and State species of concern Henslow’s sparrow, bobolink, and sedge wren.

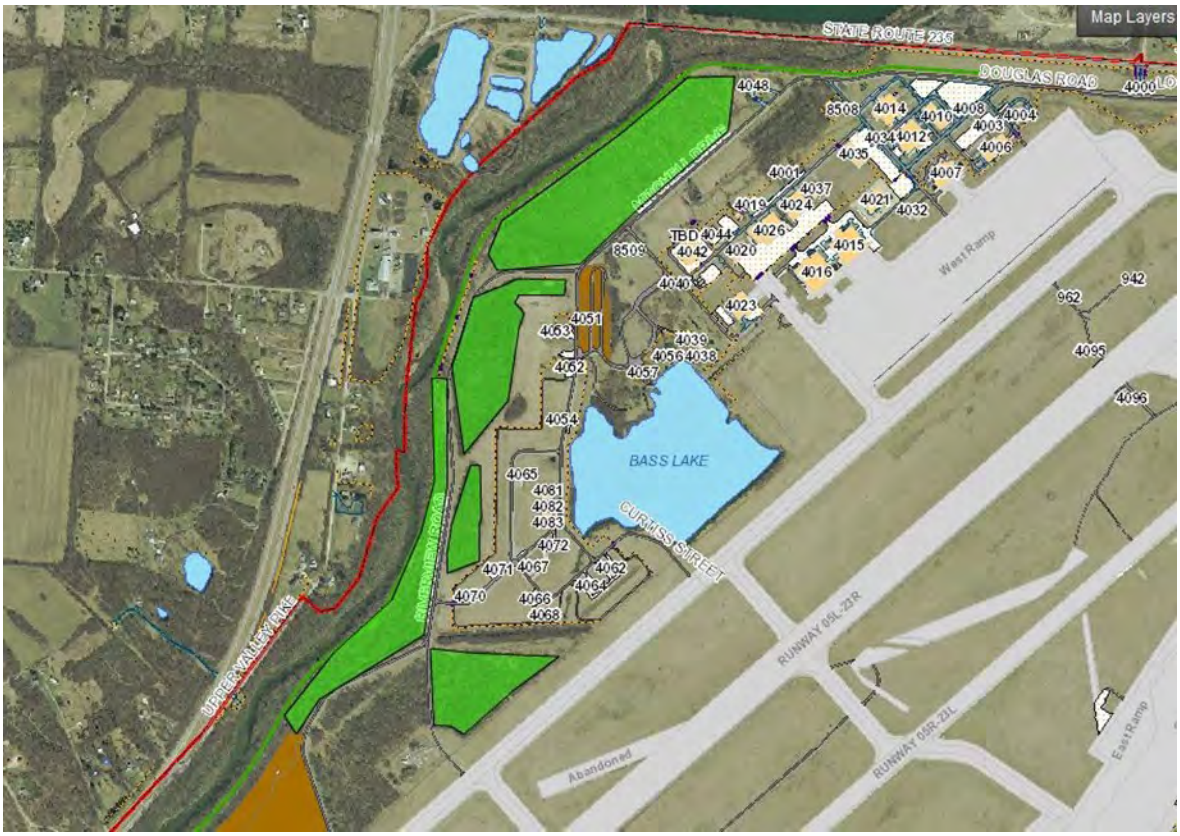

Figure 7-2. Invasive species treatment areas (green) in 2014–2020.

Figure 7-3. Invasive species treatment areas (aqua) in 2016 and 2020.

Table 7-1. Wetlands on WPAFB that are infested with invasive plants.

Wetland	Invasive Species
B2	Amur honeysuckle
B3	Amur honeysuckle
B7	Amur honeysuckle
B10	Amur honeysuckle
C2	Common reed, narrow-leaf cattail
C5	Amur honeysuckle, common reed, autumn olive, Japanese honeysuckle
C6	Common reed, narrow-leaf cattail
C15	Amur honeysuckle
C18	Amur honeysuckle
C19	Reed canary grass
C22	Reed canary grass
C24	Common reed, narrow-leaf cattail

Source: BHE 2005a.

Between FY 2017–2021 invasive species management in wetlands and along the forested riparian zone of the Mad River will continue to be implemented. During 2016, 15 acres were treated for invasives (Figure 7-3, Figure 7-4). Previously in 2014–2015, 100 acres were treated (Figure 7-2). During spring 2018, 44.5 acres will be treated for invasives if adequate funding is received (Figure 7-5). During 2018 13.5 acres will be treated for invasives (Figure 7-6) and spot treatment will occur on the 44.5 acres treated in 2017. During 2019, 14 acres were treated for invasives (Figure 7-7) and spot-treatment occurred on the 13.5 acres treated in 2018.

In addition, Amur Honeysuckle was treated in and surrounding wetland C-18 at the Warfighter Training Center (Figure 7-8) During 2020, 13.75 acres will be treated for invasives (Figure 7-9), as well as in the Warfighter Training Center and spot treatment will occur on the 14 acres treated in 2019 (Figure 7-7). In 2021, 10.5 acres will be treated for invasives (Figure 7-10) and spot treatment will occur on the 13.75 acres treated in 2020, and in the Warfighter Training Center. During 2022, spot treatment will occur on the 101.25 acres treated from 2016–2021.

Honeysuckle was removed along Trout Creek and replanted with saplings of 65 native species. In addition, two patches of *Ailanthus* near Huffman Prairie were treated during the fall of 2018 (Nolin 2018). *Ailanthus* resprouts were treated again in spring 2019 and additional activity to remove honeysuckle along Trout Creek and plant Ohio native seedlings occurred as part of an earth day activity in 2019.

WPAFB has evaluated the quality of Gravel and Twin lakes for the purpose of identifying the need for, and approach to, restoration projects designed to enhance fisheries and recreation (BHE 2005b). Infestation of aquatic vegetation in Gravel Lake impairs fishing and negatively affects the fishery in the lake. Lower Twin Lake has no aquatic vegetation, but the water is excessively turbid, which can impair feeding and growth of sport fish, and is disagreeable to fishermen. WPAFB will investigate vegetation control techniques in Lower Twin Lake if it becomes a constant problem.

Figure 7-4. Additional area of invasive species treatment (aqua) in 2016 and 2018.

Figure 7-5. Areas treated for invasive species (aqua) in 2021.

Figure 7-6. Areas treated for invasive species (aqua) in 2018.

Figure 7-7. Areas treated for invasive species (aqua) in 2022.

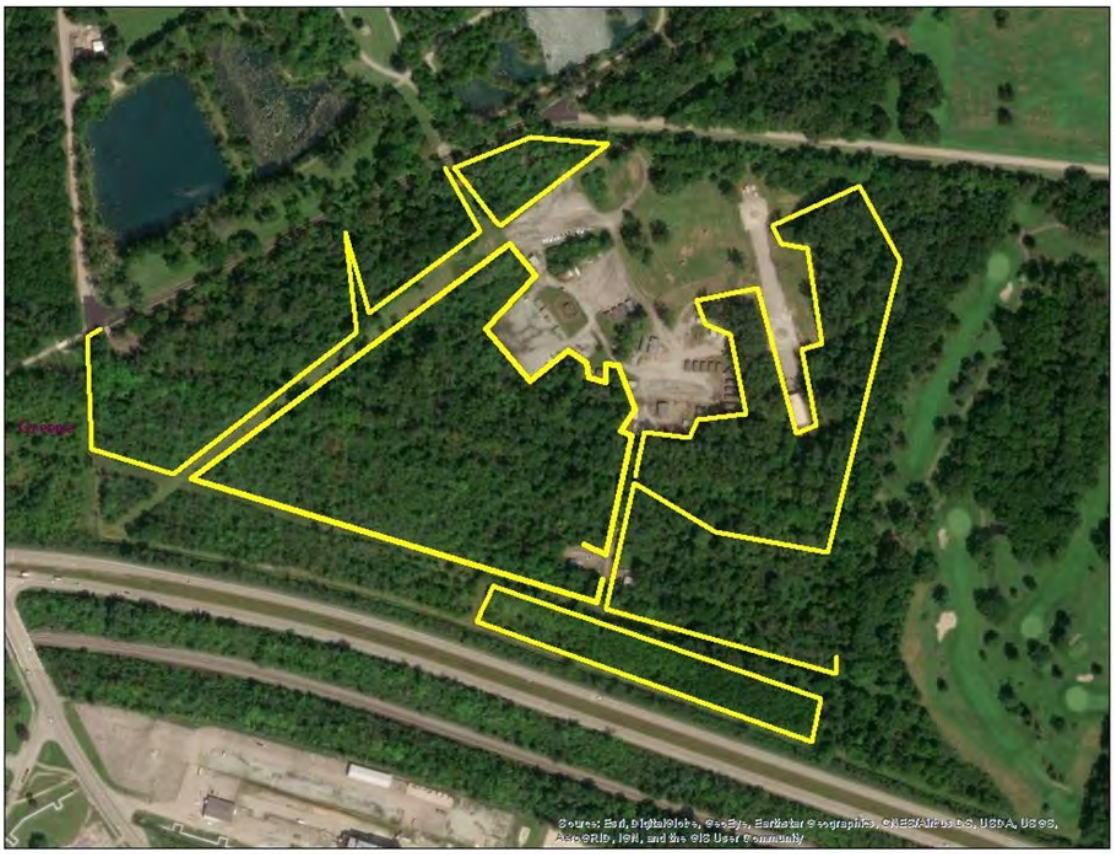

Figure 7-8. Area in WTC treated for invasive species in 2019.

Figure 7-9. Area to be treated for invasive species (aqua) in 2022.

Figure 7-10. Area in WTC treated for invasive species in 2021.

Figure 7-11. Areas to be treated for invasive species (aqua) in 2021.

Improving the recreational and aesthetic value of these lakes is likely to increase visitation by fishermen. Surveys conducted in 2004 indicate both lakes could be converted from put and take trout fisheries to warm water fisheries for native species such as largemouth bass, bluegill, red ear sunfish, and channel catfish (BHE 2005b). While WPAFB has no immediate plans to convert the lakes to warm water fisheries, it may be an option for future fisheries enhancement. Plans for lake habitat management and enhancement must avoid making the lakes more attractive to waterfowl, which can pose a hazard to aircraft on the Area A runway.

7.1.5 Management of Nuisance Wildlife

Wildlife may present problems at WPAFB on golf courses, airfields, and landscaped areas. Ground hogs (*Marmota monax*) are the most significant wildlife pest. Ground squirrels (*Spermophilus tridecemlineatus*), raccoons (*Procyon lotor*), opossums (*Didelphus virginianus*), chipmunks (*Tamius striatus*), striped skunks (*Mephitis mephitis*), Canada geese (*Branta Canadensis*), and tree squirrels (*Sciurus niger*, *S. carolinensis*, *Tamiasciurus hudsonicus*), occasionally become nuisances. Most cases of nuisance wildlife are handled by golf course superintendents, WPAFB Entomology Group, or Airfield Management.

In addition, USDA- Wildlife Services, in conjunction with 88 ABW Flight Safety office, began having a full-time Airport Biologist on-site at WPAFB. The USDA-WS biologist can and will provide nuisance wildlife services , once all other means have been exhausted.The Base Commander approved a new Air Rifle Use Plan for Pest Management on WPAFB in 2014. This has been added as an appendix in the Integrated Pest Management Plan.

Vertebrate wildlife causing a nuisance in the golf courses or landscaped areas are live-trapped and euthanized by WPAFB Entomology Group, as prescribed in the Integrated Pest Management Plan. Other examples of wildlife nuisances are the skunks in the Brick Quarters Area and the geese around buildings and Turtle Pond. Geese are controlled with coyote decoys. When necessary, rodenticides approved by the 88 CEG/CEIEA are used, in accordance with guidelines in the IPMP, to alleviate the problem. Use of pesticides against vertebrate wildlife at WPAFB is minimal; animal and insect management results in only about 5 percent of the total pesticide active ingredient applied by Entomology (WPAFB, 2016b). The WPAFB Integrated Pest Management Program is described in detail in Section 7.11 Integrated Pest Management Program.

Annually from 2011–2016, WPAFB has conducted a controlled archery hunt in the vicinity of Twin Base Golf Course in order to better manage the deer herd. WPAFB plans to continue this management practice in order to maintain the deer herd at an acceptable level that does not exceed carrying capacity.

Wildlife can cause strike hazards for airfield operations, endangering human lives. Coyotes, foxes, groundhogs, and white-tailed deer pose ground strike hazards for aircraft on landing and takeoff. Birds on the airfield and in the proximate airspace pose the greatest hazard for aircraft. WPAFB implements a comprehensive BASH program to minimize, manage, and report hazards caused by birds and wildlife on the base. The BASH program is described in detail in Section 7.12 Bird/Wildlife Aircraft Strike Hazard.

7.2 Outdoor Recreation and Public Access to Natural Resources

Applicability Statement

This section applies to all USAF installations that maintain an INRMP. The installation is required to implement this element.

Program Overview/Current Management Practices

Non-dispersed outdoor recreation on WPAFB is managed/maintained by the 88 FSS. Funds for wildlife-related outdoor recreation (i.e., stocking fish) originate from sales of hunting and fishing licenses. Occasionally, the Natural Resources Management Program funds projects related to outdoor recreation such as brochures about wildlife watching in Huffman Prairie. Figure 7-1 shows the location of all outdoor recreation areas located on WPAFB. 88 FSS also operates an equipment rental service (from Building 95 in Area A) and outdoor adventure programs.

Public access to most of WPAFB's outdoor recreational resources is limited to DoD employees, guests, family members, reservists, retirees, and contract employees only. Current mission requirements facilitate the need to restrict public access to portions of WPAFB. However, the Wright Memorial Hill in Area B and the Huffman Prairie Flying Field in Area A are open to the public.

The Twin Base and Prairie Trace golf courses are maintained by the Golf Course Superintendents and are funded and managed separately from other outdoor recreational facilities.

Recreational facilities and areas are designated as Class I (developed recreation areas), Class II (dispersed recreation areas), and Class III (special interest areas) according to multiple use potential and ecosystem sustainability (AFMAN 32-7003).

Class I areas (developed recreation areas) are suitable for intensive recreational activities, including campgrounds, sports fields, picnic areas, walking trails, and water sports areas. The Services Division manages most of the Class I recreational facilities on WPAFB. Class I activity areas at WPAFB include:

- A campground (FAMCAMP) in the Bass Lake Recreation Area. Forty sites are available year-round to recreational vehicles such as tent trailers, travel trailers, and other manufactured or modified vehicles for overnight accommodations. The FAMCAMP offers electric power, water, and sewer hook-ups, as well as a central laundry and shower facility, and a dump station.
- The Rod and Gun Club north of Hebble Creek Road. The Rod and Gun Club maintains 10 firing ranges, only seven of which can be used due to proximity to Skeel Avenue and the Huffman Prairie Flying Field. The Rod and Gun Club provides hunter education courses, holds tournaments, and assists with management of hunting and fishing programs.
- One lodge, eight picnic pavilions and several other picnic areas. The Services Division coordinates reservation of lodges and pavilions.
- The Bass Lake Recreation Area, which covers 42 acres and provides facilities for picnicking, sand volleyball, horseshoes, and fishing.
- Outdoor swimming pools at the Officer's Club and The Prairie housing area; a running track; and numerous ball fields.

Class II areas provide less intensive recreational activities such as hunting, fishing, primitive camping, bird watching, and jogging. Off-road vehicles (ORVs), including mountain bikes ridden off designated paths, are prohibited on WPAFB. The Environmental Branch manages most Class II recreation areas, which include:

- Hunting areas. Eight areas across WPAFB are available for hunting big game (white-tailed deer) and small game (squirrel, rabbit, woodcock), and waterfowl. All hunting seasons, rules and regulations on base are within the ODNR, Division of Wildlife regulations as well as USFWS regulations and in many cases are more restrictive. Hunting permits must be obtained from theWPAFB iSportsman on-line permit sales platform, **https://wpafb.isportsman.net/**, though the

fees are collected into WPAFB's Fish and Wildlife (F&W) reimbursable account. The Environmental Branch manages habitat to support game populations and enhance hunting and expenditure of funds from the F&W fund.

- Fishing areas located at Bass, Gravel, and Twin lakes, and the Mad River. Bass, Gravel, and Lower Twin lakes are stocked regularly with fish. With few exceptions, adult anglers must carry both a WPAFB fishing permit and a State of Ohio fishing license and creel limits set by WPAFB for certain species must be observed. WPAFB fishing permits are available at the WPAFB iSportsman on-line permit sales platform, **https://wpafb.isportsman.net/.** The fees are collected into WPAFB's F&W reimbursable account.
- The Boy Scout Camp, located southwest of Bass Lake, is a primitive camping area for use only by Boy Scout troops. Portable toilets and potable water faucets are available as amenities.
- A fitness path for walking, jogging, or biking has recently been completed that connects the Five Rivers MetroPark outside WPAFB with the Huffman Prairie Flying Field within the base. The path improves public access to the field and other outdoor recreation on WPAFB.
- Wildlife watching is available to the public at Huffman Prairie, the Huffman Prairie Flying Field, and the Wright Memorial, during times when those areas are accessible to the general public.

Class III areas contain valuable ecological, archaeological, historic, or scenic features that require protection. Class III areas are not necessarily restricted from access but are managed to protect the resource and restricted when required. Class III areas on WPAFB include:

- Wright Memorial Hill, which contains the Wright Brothers Memorial. The Memorial is open to the public via an unmanned gate at Kauffman Avenue. Adjacent to the Memorial is a group of six Native American mounds, which is listed on the National Register of Historic Places. The memorial was transferred to the Air Force from the Miami Conservancy District in 1978.
- Huffman Prairie Flying Field is part of the Dayton Aviation Heritage National Historical Park. It is listed on the National Register of Historic Places and was designated a National Historic Landmark in 1990. The field, covering approximately 84 acres is where the Wright brothers perfected the airplane and created the world's first airport after their return from Kitty Hawk, North Carolina in 1903. In 1904 and 1905, the Wright brothers learned to control and maneuver their powered machine and taught themselves to fly on the Huffman Prairie Flying Field. The Wright Company School of Aviation was operated there between 1910 and 1916. Many of the world's first pilots were trained here, including some of America's first military pilots. The Huffman Prairie Flying Field includes a replica of the 1905 hangar and interpretive displays retrace the Wright Brothers' footsteps and flight path. Huffman Prairie Flying Field is accessed through Gate 16-A, off State Route 444. The site is open to the public from 0600 to 2200 hours every day but Wednesday. The site is also occasionally closed for other base-related reasons.

Outdoor recreation facilities provide a valuable resource that supports the morale and welfare of the WPAFB community. They also provide an opportunity for public outreach and education about natural resources on WPAFB.

7.3 Conservation Law Enforcement

Applicability Statement

This section applies to all USAF installations that maintain an INRMP. The installation is required to implement this element.

Program Overview/Current Management Practices

Base Security Forces oversee implementation of all Ohio, federal, and WPAFB fish and game laws on base and coordinate with ODNR Wildlife Officers if issues warrant. WPAFBI 32-7064 (2020) Hunting, Fishing & Boating at Wright Patterson Air Force Base guides enforcement of fish and game laws on WPAFB. Installation Security oversees wildlife law enforcement. A Chief Hunting Liaison serves as the main liason between the NRMP and SFS as well as conducting periodic checks of the hunting and fishing areas on WPAFB. At least two enlisted personnel serve as Hunting Liaisons for the base. Hunting Liaisons conduct periodic checks of lakes and other fishing areas during fishing season, and check hunters and hunting areas during hunting season. The Chief Hunting Liaison participates in the Natural Resources Working Group to maintain current knowledge about natural resources management goals and policies. No WPAFB Security Forces members are currently CLEO certified. NRMP has requested 88 SFS designate individual to attent FLMPT class.

The Archaeological Resources Protection Act (ARPA) prohibits digging in or removal of artifacts from archaeological sites as a felony offense. The installation Base Commander will vigorously enforce the federal laws and Air Force regulations prohibiting the unpermitted collection of artifacts. WPAFB will continue to educate persons employed or living at WPAFB of the provisions of ARPA and of the felony penalties to which violators are subject.

If looting of vandalism at archaeological sites is reported to the Cultural Resources Manager (CRM), the CRM will notify Base Security Forces, who will secure the site. An ARPA qualified archeologist will conduct an archaeological damage assessment and provide an archaeological value determination to Base Security Forces and CRM. After the crime scene has been fully investigated and the investigation is concluded, the CRM, State Historic Preservation Office and qualified archaeologist will determine the best course of action to treat the archaeological site. Base Security Forces and 88 ABW/JA will determine if the case moves forward through the judicial system.

7.4 Management of Threatened and Endangered Species, Species of Concern, and Habitats

Applicability Statement

This section applies to USAF installations that have threatened and endangered species on USAF property. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

Management of threatened and endangered species and their habitat on WPAFB is a chief concern of the WPAFB Natural Resources Management Program. WPAFB complies with the ESA and U.S. AF Guidance regarding conservation of federally listed species and their habitat (AFPD 32-70 and AFMAN 32-7003). The base also coordinates with the ODNR regarding conservation of state-listed animals and plants. Primary goals are to avoid or minimize adverse effects to federally listed species and minimize conflicts between listed species and the military mission. WPAFB also strives to support recovery of federally listed species by funding surveys, monitoring programs, and habitat restoration. The base seeks to maintain adequate suitable habitat for populations of federally listed species, and, when possible, candidates for federal listing and species listed by the State of Ohio.

WPAFB actively manages for three federally listed species (Indiana bat, northern long-eared bat, and eastern massasauga). No critical habitat has been designated (as defined in the ESA) on WPAFB for any federally listed species. WPAFB also manages for four additional species listed in Ohio as endangered. Descriptions of the species are provided in Section 2.3.4 Threatened and Endangered Species and Species of Concern, and in Appendix C.

7.4.1 Agency Coordination

WPAFB maintains frequent coordination with the USFWS, Ohio Field Office, and the ODNR, Division of Wildlife, as required by AFMAN 32-7003. Interagency coordination is crucial to WPAFB's efforts to avoid impacts to threatened and endangered species. Both agencies are routinely contacted during the EIAP.

Also, in accordance with AFMAN 32-7003, WPAFB involved both agencies early in the planning of this INRMP. WPAFB requested each agency provide input for managing threatened and endangered species, and other natural resources addressed in this Plan while undergoing the 5-year update.

Agency comments were received (Appendix B) and are incorporated into this INRMP. Annual updates to the INRMP will also be coordinated with both agencies and comments will be incorporated into the document. Additional coordination occurred with ODNR Division of Forestry to develop an urban reforestation plan for the Wright Brother's Memorial.

7.4.2 Species-Specific Management Strategies

7.4.2.1 Indiana Bat and Northern Long-eared Bat

The Indiana bat is listed as endangered, and the northern long-eared bat is listed as threatened by the State of Ohio and the USFWS. Throughout the range of the Indiana bat and northern long-eared bat, conservation and recovery objectives are being implemented on federal lands and during federal activities pursuant to section 7 of the ESA. A primary objective in the Agency Draft Revised Indiana Bat Recovery Plan (USFWS 2007) is protection of caves and abandoned mines considered important hibernacula. Though a recovery plan has not yet been developed for the northern long-eared bat, it uses caves and mines for hibernation, similar to the Indiana bat. Many of the caves and mines most important to Indiana bats have been gated or otherwise protected to reduce human disturbance during winter (USFWS 1997). Conservation of summer habitat is also a component of the Agency Draft Revised Indiana bat Recovery Plan. In certain areas, federal lands, such as National Forests and National Wildlife Refuges are being managed for protection of Indiana bat summer habitat by protecting streamside forests and providing trees of the correct species and size for Indiana bat roosting (USFWS 1997). Northern long-eared bats also use trees and forested areas for roosting and foraging during the summer and would benefit from protection and management of forest habitat. Two BradenBark artificial bat roost structures were installed in Area A during July 2019. This will provide additional roosting opportunities for bats.

The DoD has established a Memorandum of Understanding with Bat Conservation International (Appendix D). Bat Conservation International is an organization established to promote conservation, education, and research initiatives involving bats and their ecosystems (www.batcon.org). The MOU establishes a policy of cooperation and coordination between the two organizations.

The Agency Draft Revised Indiana Bat Recovery Plan indicates silvicultural practices should favor conservation of an adequate number of suitable roost trees. Special attention should be given to preserving large-diameter dead trees at forest edges or in forest openings. The Missouri Department of Conservation and the USFWS Indiana Field Office issued recommendations for management of forests to provide Indiana bat roosting and foraging habitat (Appendix D). These recommendations can be helpful in development of forest management strategies in other states, including Ohio. However, because the summer habitat requirements of the Indiana bat and northern long-eared bat still are not completely understood, forest management strategies to conserve or enhance Indiana bat and northern long-eared bat habitat on WPAFB will be developed on a site-specific basis in coordination with the USFWS Ohio Field Office. Certain forest

management activities may affect these species. Consultation with the USFWS, pursuant to section 7 of the ESA is required when a proposed project may affect a federally listed species.

Management and protection of resources used by Indiana bats and northern long-eared bats at WPAFB are primarily accomplished through restriction of activities conducted on the base. Formal ESA section 7 consultation has not been required for any activities on WPAFB to date.

Existing WPAFB management guidelines for Indiana bat summer habitat protect forested areas and provide roost trees and forest cover for Indiana bats. WPAFB restricts ground-disturbing activities and allows natural forest regeneration to occur along the Mad River and Trout Creek. The base allows riparian forest to develop on each side of the river in most areas.

Noxious or exotic vegetation (e.g., bush honeysuckles) that suppresses forest regeneration is being controlled in selected areas on WPAFB, including within forest along the Mad River. Once invasive control work has been implemented, native trees are planted to encourage regeneration of habitat. Restored riparian areas will provide flight corridors, roosts, and foraging areas for Indiana bats, and protect water quality and thereby protect Indiana bat prey. These measures should be similarly effective at protecting northern long-eared bat habitat.

To conserve habitat for Indiana bats and northern long-eared bats, the base

- prohibits timber harvest and retains all snags/cavity trees unless they pose a safety hazard or compromise the military mission;
- requires coordination with the WPAFB's Natural Resources Manager for activities or projects that require tree removal in forested areas or small woodlots;
- prohibits instream gravel operations in the Mad River;
- conducts periodic restoration projects along riparian corridors and tree-lined roadways (e.g., applying herbicide to kill bush honeysuckles, then planting native trees) that may serve as roosting and foraging habitat for Indiana bats;
- uses, to the maximum extent practicable when planting trees in natural (e.g., not improved or semi-improved) areas, the tree species included on the list of "Suggested Native Tree Species for Indiana Bat Habitat" provided by the USFWS Ohio Field Office (Table 7-2);
- restricts the use of aerial application or fogging with pesticides (currently, there is no aerial spraying or fogging on base property; should the need arise due to an insect-transmitted disease outbreak, aerial spraying and/or fogging will be conducted primarily in populated areas of the base and coordinated with WPAFB's Natural Resources Manager and the USFWS, if appropriate); and
- avoids removal of suitable Indiana bat roost trees (i.e., trees with exfoliating bark) encountered to the maximum extent practicable and prohibits cutting between 1 April and 1 October to avoid incidental take of roosting bats. For all projects involving effects to trees (including tree trimming and maintenance), the Natural Resources Manager uses a flow chart (Figure 7-12) to determine potential effects of management on Indiana bats and the need for consultation with the USFWS.

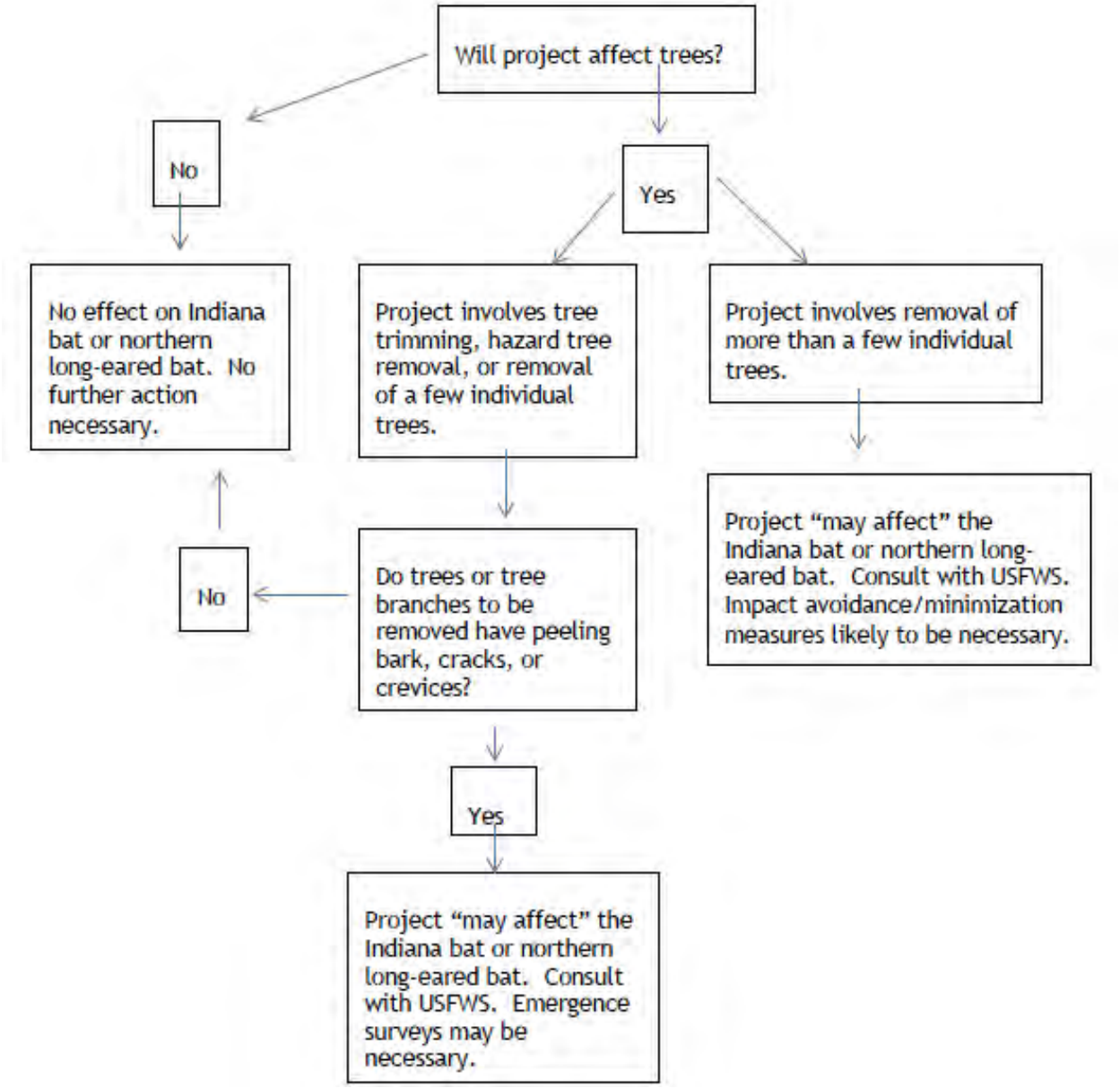

Figure 7-12. Flow chart used to determine potential effects of management on Indiana bats and the need for consultation with the U.S. Fish and Wildlife Service.

When evaluating if a specific project may affect Indiana bats or northern long-eared bats, the USFWS considers both direct and indirect effects to summer roosting habitat. Direct effects to bats could occur if suitable habitat was removed during the summer when bats are actively using that habitat. Indirect effects to summering bats could occur from loss of available forest habitat at any time of year. Negative effects of summer habitat loss would be greatest when maternity colonies, such as that inhabiting WPAFB, are involved. When removal of suitable summer habitat is proposed, the USFWS may request measures to avoid, minimize, and compensate for the habitat loss before concurring that the proposed project will not adversely affect the Indiana bat or northern long-eared bat. Avoidance and minimization measures may include avoiding clearing during specified seasons, conducting emergence surveys, and preservation of

forest in a portion of the proposed project area. Compensatory measures, such as replanting forest, protection of other suitable habitat, and educational outreach programs may also be required.

Should consultation with the USFWS be necessary, WPAFB may implement measures to avoid, minimize, or compensate for effects to Indiana bats and northern long-eared bats, including restricting tree clearing to 1 October through 31 March when bats are absent from summer habitat, preservation of other forested habitat, restoring forest by planting native trees, and conducting education and outreach programs. Should emergence surveys be necessary to evaluate presence of bats in a particular tree, methods provided by the USFWS Ohio Field Office will be implemented (Appendix D). The need for, and extent of, such measures would be determined on a project-specific basis in consultation with the USFWS.

To improve understanding of Indiana bat and northern long-eared bat presence and habitat use on WPAFB, the base will periodically monitor the species. Base-wide mist net surveys, in conjunction with radio telemetry studies, will be conducted at least every 5 years. Acoustic surveys may be used to provide information on bat activities within specific areas of the base with approval of the USFWS Ohio Field Office. These surveys do not replace, and are not replaced by, mist net surveys that may be requested to evaluate presence of bats in a specific proposed project area. The level of effort and methods for mist net surveys will be coordinated with the USFWS Ohio Field Office; methods will follow the most current Indiana bat summer survey guidelines at http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html.

WPAFB has been participating in ODNR's annual state-wide bat acoustic surveys along driving transects. Surveys have been completed from 2013–2017 at WPAFB. Generally, transects are driven along 30-mile routes three nights in July and bat acoustic calls are recorded using Anabat units and roof mounted microphones. In 2019 the survey occurred in Area A during August. This survey effort will be continued in future years to monitor bat population status at WPAFB and within the state.

Data collected during mist net and acoustic surveys and telemetry, including the species, age and gender of bats captured, and location of captures and roost trees will be used to determine habitat use by Indiana bats and northern long-eared bats on WPAFB. Based upon results of mist net surveys and radiotelemetry studies, management strategies may be adapted to ensure effective protection of Indiana bats and northern long-eared bats and their habitat on base.

7.4.2.2 Bald Eagle

Bald eagle recovery plans were implemented in five regions in the lower 48 states: Pacific, Southwest, Northern States, Southeast, and Chesapeake Bay area. Recovery plans are intended to increase numbers of nesting pairs and protect habitat for this species. Captive breeding and reintroduction of eagles through hacking have been successful in increasing numbers of eagles and numbers of breeding pairs (Green 1985). The bald eagle is currently a federal species of concern and is protected under the Migratory Bird Treaty Act (16 U.S.C.703-712) and the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d).

At present, bald eagles are found on WPAFB only during sporadic visits, and no key breeding or winter sites, feeding perches, or roosts occur on WPAFB. However, as eagle numbers increase within Ohio, bald eagle activity may increase on or near WPAFB in the future. Conservation measures for WPAFB address winter and summer habitat requirements of bald eagles. Substantial data support management recommendations for nesting bald eagles (Green 1985, USFWS 1983), but limited information is available regarding managing wintering eagles and their habitat. Guidelines for managing winter habitat on WPAFB focus on maintaining habitat quality and limiting disturbance at sites frequented by eagles. If bald eagles nest on the base, this INRMP will be revised to address specific management issues at that time.

To provide habitat for bald eagles, the base

- conserves riparian habitat along the Mad River and its tributaries, and the Area A lakes by prohibiting development in these areas;
- prohibits instream gravel operations in the Mad River;
- prohibits removal of existing tall, large-diameter trees; and
- conducts periodic forest restoration along riparian zones to promote natural forest regeneration and growth of larger trees.

Personnel on WPAFB who are responsible for monitoring bird and wildlife near the airfield (e.g., Airfield Management, Air Control Tower) may observe bald eagles on or near WPAFB. Bald eagle sightings will be reported to, and recorded by, the WPAFB Natural Resources Manager. The Natural Resources Manager will prepare a brief educational discussion for the Bird Hazard Working Group (BHWG) that provides descriptions and photographs of bald eagles, including juveniles that lack the characteristic white head and tail. The Natural Resources Manager will periodically remind the BHWG that bald eagle sightings must be reported, including the date, time, approximate location, number of birds sighted, and their general behavior (e.g., perching, flying).

7.4.2.3 Mussels

The clubshell, rayed bean (*Villosa fabalis*) and snuffbox (*Epioblasma triquetra*) are all listed as endangered by the State of Ohio and the USFWS. While clushell subfossil shells have been found in the Mad River adjacent to WPAFB, rayed bean and snuffbox are known to occur in the Great Miami River watershed but have not been detected at WPAFB to date.

Conservation measures for the clubshell, rayed bean, and snuffbox primarily focus upon preventing removal or disturbance, and protection of habitat. Although these mussels are of no commercial value, they have been affected in the past by incidental take. It is illegal in Ohio to collect any mussels (listed or unlisted) without a state permit authorizing the collection. Ohio has closed its waterways to all commercial collecting of mussels. The USFWS advocates restoration of some of the species' habitat through repair of riparian habitat and control of nonpoint source pollution, research to identify the species' habitat requirements and fish host, development of propagation and reintroduction techniques, research to determine population viability thresholds, surveys to assess the condition of existing populations, and identification of potential reintroduction areas (USFWS 1995).

WPAFB most recently surveyed the Mad River in 2014 and no federally listed mussels were found.

WPAFB funded a survey of mussels in the base's aquatic habitats including the Mad River (3D/I 1998, BHE 1999a). Identification of relict shells indicates past presence of the clubshell mussel, but no live individuals were identified. Additionally, a mussel survey was conducted during 2014 but did not detect any federally listed species (USFWS 2014). While WPAFB does not implement specific conservation measures for these mussels, measures in place to protect water quality in the Mad River and its tributaries are designed to maintain aquatic habitat suitable for aquatic organisms, including freshwater mussels. Prohibitions on gravel removal also help protect mussel habitat. Specific water quality protection measures are discussed in Section 7.5 Water Resource Protection.

7.4.2.4 Eastern Massasauga Rattlesnake and Smooth Green Snake

The eastern massasauga rattlesnake is listed as an endangered species by the State of Ohio and as a threatened species by the USFWS, while the smooth green snake is State endangered. Both species typically use grassland or prairie habitat, and both have been documented at WPAFB.

The USFWS published a document titled The Eastern Massasauga Rattlesnake: A Handbook for Land Managers (Johnson et al. 2000). The Handbook provides land managers a foundation for identifying site-specific conservation actions for massasaugas and contains the most current management guidance available. A copy of the Handbook is located in the 88 CEG/CEIEA office.

Protecting suitable, occupied habitat is critical to conservation of the eastern massasauga. Threats to eastern massasaugas include alteration (e.g., draining or filling) of wetlands, vegetative succession (i.e., conversion of grassland to shrub or forest), fluctuating water levels during the winter hibernation period, and, under certain conditions, mowing, disking, or burning in prairies and old fields. Management recommendations found in the Handbook for Land Managers (Johnson et al. 2000) include those listed below.

- Provide a complex of interspersed, relatively open habitat (areas where most vegetation cover is less than 1.6 feet tall) with areas of relatively greater cover (grass, shrub or trees greater than 1.6 feet tall). Burning, mechanical clearing, and other techniques may be necessary to keep woody growth in check.
- Avoid fragmenting suitable habitat.
- Avoid draining or reducing groundwater levels, particularly during winter.
- Seek opportunities to connect patches of suitable habitat with corridors of fallow field or food plot.
- Raise mowers so that vegetation is cut no lower than 4–6 inches above the ground to avoid hitting most massasaugas and other snakes. Mow during periods when snakes are less active, preferably before snakes become active in the spring or after activity has ceased in the fall. Mow during periods of the day when snakes are inactive, mainly between 1100 and 1500 hours during the summer when most snakes will be under cover.
- Limit disking to winter or following summer migration.
- Limit prescribed burning to winter, preferably after November 1 and before 15 March. During these dates, burns should be avoided when soil temperatures at a four-inch depth are above 9 °C (48.2 °F). If burns are proposed outside of the standard dates, coordination with ODNR and USFWS must occur first.

In the past 20 years, reports of massasauga sightings have been limited to the WTC and the Twin Base Golf Course in Area A of WPAFB (Figure 2-13; Terri Lucas, former WPAFB Natural Resources Manager, pers. comm.). Therefore, conservation measures and management for this species continues to focus on this general area of the base. To protect massasaugas and their habitat, WPAFB has restricted new development and other ground-disturbing activities within the WTC. Maintenance of Huffman Prairie and old fields, as well as avoiding impacts to wetlands on WPAFB will help continue to provide habitat for the eastern massasauga.

Other than habitat destruction and degradation, the greatest threat to massasaugas may come from people who deliberately kill snakes (Johnson et al. 2000). Environmental education is a key component to massasauga management in terms of modifying attitudes and behavior of base staff, trainees, and visitors. An educated person is much more likely to act (and react) in a more positive manner toward snake-human confrontations and will better support management goals and practices. Enlightened base users/visitors often provide information, sighting records, photographs, behavioral descriptions, and other usable data. In November 2000, WPAFB began distributing an educational brochure about threatened and endangered species to individuals training within the WTC along with a map showing sensitive areas within the WTC (Appendix E). In March 2010 the WPAFB Endangered Species Brochure was updated to reflect more accurate information. The brochure has a photograph and description of a massasauga, and it informs base users/visitors that this snake is docile and typically will not strike unless provoked. The brochure also

provides contact information for the Natural Resource Manager, so sightings of a massasauga or other rare species may be reported.

Smooth green snakes have been detected in an around Huffman Prairie in recent years. The species depends on grassland and prairie habitat, so continued management of Huffman Prairie and the surrounding areas may benefit this species. While ensuring that habitat management occurs to maintain prairie areas in suitable conditions, it is also important to consider the timing of management activities. For example, conducting prescribed burns when smooth green snakes are active could injure or kill individuals. Implementing the burning and mowing recommendations described for eastern massasaugas should also help to protect smooth green snakes.

Another potential threat to snakes as well as other reptile species is vehicular traffic. Reptiles may be run over as they traverse roads due to their slow movement. Several species of snakes have been documented as roadkill on Pylon Road which is located immediately west of Huffman Prairie. During the 2020 field season, three Dekay's brown snakes were observed as roadkill from a section of Pylon Road (Seymour, pers. Communication, 2021).

Both the eastern massasauga and smooth green snake rely on moist conditions during portions of their lifecycles and could benefit from restoration of ephemeral wetlands and historic groundwater regimes in places where they currently or historically occurred. As noted above, hydrological modifications have likely impacted the vegetation and habitat within Huffman Prairie. There is a 10 acre area in the northwest portion of Huffman Prairie that was historically wet prairie that could benefit from hydrological restoration (e.g., plug drainage tiles and culvert to Trout Creek), and would improve habitat for listed snakes. Additionally, there is an approximately 70-acre old field area west of Huffman Prairie, along Prairie Road where smooth green snakes occur. There is only one small swale in the center of the site that was wet during surveys in 2019, and water only persisted for a day or so. No other wetlands were observed in this large field during coverboard placement or surveys. Smooth green snake populations in this field could benefit from restoration/creation of ephemeral wetlands in this area.

Understanding the current distribution of eastern massasauga’s and smooth green snakes on WPAFB is crucial to effective management of the species on the base. From 2009–2014 a multi-year, systematic base-wide herpetological survey was conducted by herpetologist Jeff Davis in cooperation with ODNR and USFWS. The survey was jointly funded by USFWS and WPAFB. The survey involved placement of cover boards in spring, and monitoring cover boards between April and October (Davis 2015). On WPAFB, survey areas included the WTC, Twin Base Golf Course, the vicinity of Twin Lakes and Gravel Lake, Huffman Prairie, Sand Hill, Flight Field, Bayou Road, and Symmes Road, all areas of suitable habitat for the snakes. During the survey, no eastern massasauga rattlesnakes were found, however 123 records of smooth green snake were recorded (Davis 2015).

WPAFB provided funding to the USFWS to conduct herpetological surveys during 2019. USFWS biologists detected smooth green snakes in Huffman Prairie and in an old field area west of Huffman Prairie, along Prairie Road. Surveys were also conducted at TBGC. No eastern massasaugas were documented at any of the survey locations (Seymour 2020). Snake species as well as amphibian species documented at the base from 2020 forward are also being entered into HerpMapper, which is an application designed to gather and share information about reptile and amphibian observations across the planet.

It is possible that eastern massasauga has been extirpated from WPAFB, though suitable habitat still exists. WPAFB proposes to conduct periodic surveys every four years to continue evaluating the status of the eastern massasauga and the smooth green snake on the base.

7.4.2.5 Blazing Star Stem Borer, Pollinators, Henslow's sparrow, Bobolink, and Sedge Wren

The Blazing Star Stem Borer is listed as endangered in the State of Ohio. Henslow's sparrow, bobolink, and sedge wren are all listed as Species of Concern in the State of Ohio. Henslow's sparrow is a federal "Bird of Conservation Concern" (USFWS 2008). All these species occur in and around Huffman Prairie as do a wide variety of other native pollinators.

Range-wide conservation measures for blazing star stem borer have focused on protecting known populations by protecting the prairie remnants they inhabit. In particular, land managers are encouraged to protect an adequate amount of the food plant (i.e., *Liatris* spp.; Figure 7-13) and to divide prairie habitat into smaller burn units, so that no *Papaipema* site is entirely burned in a single year. Likewise, food plants spread over a large area or in several discrete patches reduce the risk from predators and parasitoids as compared to a comparable number of plants in a single dense patch. Almost all *Papaipema* specialists have commented on the fire sensitivity of *Papaipema* eggs and assume there will be high mortality in fall, winter, or spring burn units (Cuthrell 1999). The distribution of the *Papaipema* population among the various burn units will likely vary from year to year as the distribution of the food plant changes; therefore, the entire patch of suitable habitat should not be burned during a single year. The rotation of burn units should also ensure protection of other native pollinator populations and their habitats. In addition, blazing star seed should be distributed throughout all of the burn units to ensure that patches of this plant are available in every burn cycle. Survey for signs of *Papaipema larava* will be conducted in July and August. Adults should be surveyed for using black lights in September and October.

Figure 7-13. Hole created by blazing star stem borer at base of dead liatris, August 2016.

Old fields on WPAFB may provide suitable habitat for the blazing star stem borer. Old fields on WPAFB will be surveyed to identify *Liatris* growing outside Huffman Prairie. Surveys for *Liatris* will occur during summer (July–August) when the plant flowers. If *Liatris* are found in old fields, plans for maintenance will be reviewed to minimize risk to blazing star stem borers that may be present. During annual seed collecting at Huffman Prairie, *Liatris* seeds will be collected and re-seeded in Huffman Prairie the following year.

A variety of pollinators including birds and insects such as bees utilize Huffman Prairie for habitat. In 2015, honeybee hives were placed along Marl Road, adjacent to Huffman Prairie. Swarm traps were placed in areas A and B and 2 swarms of honeybees were captured. During the 2020 field season a honeybee swarm was observed in Huffman Prairie (Finfera, personal communication, 2020). This swarm was captured and relocated to a different area of the base. Honeybees swarm when the population is large. This indicated that the populations of honeybees at the base are growing. Native bees will utilize bare ground as well as woody debris for roosting sites. Many bumble bees are present throughout much of the growing season. For these

species it is important to have nectar and pollen sources available from spring through fall. Spring ephemerals in forest habitat as well as early blooming trees can provide early nectar and pollen. Controlling woody invasive species such as honeysuckle to allow for native plant growth will be beneficial to early spring species. Prescribed fire can be beneficial to species that nest in bare ground as it is easier to locate and excavate a nest site. Additional research is still needed to determine the diversity of pollinators that use the Huffman Prairie site. While native bees conduct a high portion of the pollination other insect species such as beetles and flies are also important pollinators.

Henslow's sparrow, bobolink, and sedge wren will also benefit from maintaining and managing prairie habitat within and near Huffman Prairie. Controlling woody invasive species and restoring native prairie plant diversity will benefit these species. While Henslow's sparrow habitat is fire dependent over the long term, in the short-term fire can be detrimental to nesting sparrows which utilize the litter layers for nesting. Rotating burning one quarter of Huffman Prairie every year should allow sufficient buildup of litter in unburned areas to provide nesting habitat. Targeted woody vegetation control is another method to ensure that Huffman Prairie remains suitable for grassland nesting birds.

7.4.2.6 Upland Sandpiper

The upland sandpiper is listed as endangered in the State of Ohio and is a federal "Bird of Conservation Concern" (USFWS 2008). Upland sandpipers may nest in the grassy areas in and around the airfield. During the breeding bird surveys that occur in Huffman Prairie every four years, breeding surveys for this species will also be conducted in the grassy areas adjacent to the airfield. Surveys should occur between 15 April and 31 July. The audio/visual surveys should be conducted by a person familiar with upland sandpiper identification by both sight and sound. One survey point should be taken every 825 feet along the airfield perimeter within potential habitat. The audio/visual survey should last at least six minutes at each point. At least three repetitions should be performed on separate days within the same breeding season. The audio/visual survey can begin a half hour prior to sunrise but must be completed no later than three hours after sunrise. The audio/visual survey should only occur during suitable weather conditions, which include no precipitation and wind speeds less than 12 miles per hour.

7.4.2.7 King Rail

The king rail is listed as endangered in the State of Ohio and likely nests in wetland areas on base. During the breeding bird surveys that occur in Huffman Prairie every four years, breeding surveys for king rail will also be conducted in areas with suitable habitat, following the Standardized North America Marshbird Monitoring Protocol (Conway 2011). In general, the survey will occur at each location, three times during the breeding season—once during each of the following timeframes: 1 May–14 May; 15 May–31 May; and 1 June–14 June. Surveys involve a passive point-count survey followed by series of 1-minute segments during which marsh bird calls are broadcast into the marsh following a standardized approach. Calls of king rail and other marsh birds will be documented and nests located if possible.

7.4.2.8 Huffman Prairie Management Plan

Huffman Prairie is a rather undisturbed, high-value prairie remnant (Ohio Prairie Association 2015) and is a State Natural Landmark and one of the largest tallgrass prairie remnants in Ohio. Despite this, introduced forage grasses, non-native forbs, and woody encroachment continually threaten to degrade the prairie and require active management.

WPAFB began restoring much of Huffman Prairie's native prairie flora and fauna in the 1980's. In 1990, the DoD and the National Office of TNC developed a cooperative agreement under which the Ohio Chapter

of TNC provided advisory management of Huffman Prairie. The following goals for managing Huffman Prairie were developed.

- Maximize plant diversity in the prairie and restore it to a condition similar to what existed in the 1800s, based on best available records from Van Cleve and other botanists from that era.
- Approximately 60 percent cover (minimum) by native prairie grass species.
- Approximately 20 percent cover (minimum) by native forbs and wildflowers.
- Exotic and/or nuisance species cover at < 5 percent.
- Woody species cover at < 5 percent.
- Maintain the diversity of nesting grassland birds and prairie Lepidoptera.
- Use the prairie as a tool for educating the general public about the natural history of Huffman Prairie.

Vegetation surveys (Minney 1990, 2014b), breeding bird censuses (Minney 1990, 1991, 1992, 1993, 1994, 2014a), and an inventory of Lepidoptera (Metzler and Zebold 1992, 1993, 1994) have been completed. The 1990's surveys provide baseline data which can be compared to the 2014 data collected after approximately 20 years of management actions, to gauge the effectiveness of management.

Minney (2014b) summarized the current success of management actions at Huffman Prairie:

> "The frequency and distribution in all native species life-form classes (graminoids, forbs, woody plants) increased in 2014 from the 1990 baseline. Non-native graminoids as a group decreased significantly from the 1990 baseline. Non-native forbs increased significantly, and non-native woody plants went unchanged from the baseline…Native grasses now dominate Huffman Prairie as characteristic tallgrass species such as Indian grass, big bluestem, and little bluestem showed significant increases as did the Panicum species. The dominant grasses at this site have essentially been reversed from baseline conditions; 75% non-native in 1990 to 74% native in 2014."

Despite the success in restoration to date, continued management actions are needed to maintain or improve native prairie species diversity and coverage and to control non-native and non-prairie species from encroaching.

Prescribed fire, mowing, herbicide application, plowing and reseeding, are used to restore Huffman Prairie. The following management actions will be implemented on an annual basis to maintain and enhance native prairie habitat at Huffman Prairie.

- Implement controlled burns on at least ¼, but not more than ½ of Huffman Prairie between 1 November and 15 March. During these dates, burns should be avoided when soil temperatures at a 4-inch depth are above 9 °C (48.2 °F). These dates and temperatures are designed to avoid impacts to eastern massasauga, smooth green snake, and grassland nesting birds. If burns are proposed outside of the standard dates and temperatures, coordination with ODNR and USFWS must occur first. If, due to weather or other unpredictable conditions, controlled burns cannot be implemented, then the area will be mowed instead. Units 1 and 2 of Huffman Prairie were burned in winter 2016–2017.
- The following spring, apply herbicide to areas just burned/mowed.
- In spring, disk area burned/mowed/treated with herbicide, and drill native warm-season and cool-season grass and native forb seed.
- In late summer/early fall, collect seed heads of native forbs throughout the prairie.
- Spot-treat woody plants and other non-native species within Huffman Prairie with herbicide.

- A buffer area of mowed grass is maintained along the north and south sides of Huffman Prairie to minimize encroachment of woody species into the prairie. The buffer area is mowed at least once per year.

About 10 acres of Unit 4 were frost-seeded with nearly 100 pounds of unprocessed seed in early 2018 (Nolin 2018). In 2018 nearly three pounds of seed from eight species of prairie plants were collected from Huffman Prairie. In 2019, 2 pounds of 8 species were collected and over 13 pounds of 17 different species were collected in 2020. These seeds will be processed and then seeded back at the prairie. With the large number of seed collected, this will be used to enhance the area north of Marl Road. Within the 10-acre wet prairie area in the northwest portion of Huffman Prairie, there is a need to restore hydrology (plug drainage tiles and culvert to Trout Creek), control non-prairie species by targeted herbicide application, and plant with native wet prairie seed. WPAFB will consider this project and associated constraints in future years.

To continue documentation of the success of prairie management actions, to monitor the response of state-listed species that occur in Huffman Prairie, and to implement adaptive management actions if needed, monitoring will occur periodically.

A baseline vegetation inventory was conducted in 1990 (Minney 1990), and sampling was conducted in 1997, 1999, 2000, and 2001 (TNC 2001b), and 2014 (Minney 2014b). Methods for vegetation monitoring along eight transects, as well as data analysis, are described by Minney (1990). In summary, a 100-meter interval grid with fence posts placed at transect intersections was established across the entire site. Transects (100m) running roughly on the east/west axis between grid points are sampled at 10-meter intervals with a 0.5 m by 1.0 m rectangular quadrat. All species found within the quadrat (plot) are recorded. Sampling of approximately 350 plots over about 4 days occurs between late July and early September. Structured vegetation monitoring will occur every four years and will indicate areas to focus future management actions compared to areas where management has been effective. It will also identify any new potential threats to restoration actions such as new non-native species, changes in hydrology, etc.

Additionally, each year an informal habitat and species assessment will occur in collaboration with other agencies involved in Huffman Prairie management (e.g., Five Rivers Metropark, USFWS, etc.). Observations from experts will help determine effectiveness of past management activities and inform next year's management plan.

A series of baseline breeding bird censuses were conducted by Minney (1990–1994) to document short-term variability in nesting bird populations and species composition within Huffman Prairie. A follow-up survey was conducted in 2014 to compare to the baseline data, to document response of breeding birds to habitat management within Huffman Prairie (Minney 2014a). Survey methods are described in Robbins (1970), but in summary Huffman Prairie was overlain with 100-meter grid maps. Singing males and other territorial breeding behavior were mapped on field sheets, after several site visits male territories are determined by the singing male clusters. Territories for each species are recorded then mapped on a species composite map of the plot and tallied. Surveys occur from mid-May through early August over approximately eight days. Between the 1990's and 2014, species composition changed only slightly with one new breeding species and two absent species (Minney 2014a). The abundance of dickcissel and red-winged blackbird increased significantly, while sedge wren and indigo bunting increased slightly (Minney 2014a). Bobolink and song sparrow decreased significantly, while American goldfinch, willow flycatcher and eastern meadowlark decreased slightly (Minney 2014a). The relative abundance of both grassland and shrub/successional breeding territories remained stable (Minney 2014a), though management is targeting reduction in shrub/successional habitat, and thus decreases in shrub/successional bird breeding territories should be expected. Henslow's sparrow was not detected in 2014, but was only a sporadic nester in the

1990's. It is a state-endangered species that requires a 2–3 year litter layer for nesting, and thus may benefit from rotating burns among quadrants every fourth year.

Breeding bird surveys will be conducted every four years to continue to evaluate status of grassland nesting birds, density of grassland bird territories, and document breeding status of state-listed species.

Surveys for moths and butterflies (Lepidoptera) are conducted to evaluate presence of prairie endemic species, particularly the blazing star stem borer. Surveys of Huffman Prairie from 1992–1996 documented 23 species of butterfly and over 100 species of moth including blazing star stem borer (Metzler and Ziebold 1995; Metzler 1995). Briefly, the survey methods include use of black light traps placed at dusk and retrieved the following dawn, malaise traps in place in late afternoon for a 24-hour period with samples collected at dusk and late afternoon; bait traps with decaying and fermenting fruit hung from trees at dusk and retrieved at midnight; pheromone traps baited with synthetic female moth pheromones placed during daylight hours; and butterfly nets along a transect during daylight hours.

Lepidoptera surveys will be conducted every 4 years and will include both day and night collections to ensure diurnal and nocturnal species are sampled. In 2015, 2016, and 2020 monitoring of bees, butterflies, and moths was conducted at Huffman Prairie to further document the diversity of pollinators. Currently, 55 species of butterflies and skippers, 105 species of moth, and 42 species of bees have been documented (USFWS 2015b, Spring 2017, USFWS 2018b, USFWS 2021).

7.5 Water Resource Protection

Applicability Statement

This section applies to USAF installations that have water resources. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

Groundwater and surface water resources on and near WPAFB are critical to sustaining the military mission, as well as the natural resources on the base. Protection of water resources involves measures for both surface water and groundwater resources. Protection of water resources involves management of the body of water (e.g., lake, stream) as well as management of the watershed in which the resources are located.

The aquifers within the Great Miami watershed are the sole source of drinking water for nearly 600,000 Dayton area residents. The Mad River follows the course of the Mad River Buried Valley Aquifer. Northwest of WPAFB Area B, and south of Huffman Dam, is the Rohrer's Island Well Field, a drinking water aquifer for the city of Dayton. WPAFB obtains potable water for nearly all residences and facilities from on-base wells. The base owns and operates three water collection, treatment, storage, and distribution systems (Woolpert LLP 2001). Wells are drilled 50 to 80 feet into the aquifer underlying the base (Woolpert LLP 2001). Non-potable wells provide water for irrigation of the golf courses and other limited uses (Woolpert LLP 2001). New wells cannot be drilled on WPAFB due to existing groundwater contamination beneath the base (Woolpert LLP 2001). Collection and treatment of water from the Mad River may be considered should demand for additional potable water increase (Woolpert LLP 2001).

The Environmental Branch has identified wellhead protection areas for the drinking water wells on WPAFB. The OEPA has reviewed and endorsed the proposed wellhead protection area for WPAFB. WPAFB also has Memoranda of Understanding with the cities of Fairborn and Dayton to protect portions of municipal wellhead protection areas that overlie base lands.

The Memoranda require a biennial inventory of all regulated substances falling within the 1-year capture zone. Approval must be coordinated for construction occurring within the one-year capture zone (Woolpert LLP 2001).

The Mad River is the primary surface water resource on WPAFB. The Mad River and its tributaries on WPAFB (Hebble Creek, Trout Creek, and Mud Run), and the four lakes on WPAFB provide recreational value for canoeing, hunting, and fishing, as well as habitat for plants and wildlife. Maintaining the ecological integrity of the Mad River and its tributaries, as well as the quality of lakes, is a principal management concern for the Natural Resources Management Program.

The primary focus of water resources protection on WPAFB is preventing pollution of groundwater and surface water by hazardous substances. Existing contaminated areas have been identified and are subject to ongoing remediation under the IRP (Woolpert LLP 2001).

Prevention of additional contamination is the focus of the WPAFB Storm Water Program. The primary potential sources of inputs to water resources include the storm water and wastewater management systems. To a lesser extent, ground disturbance associated with construction or agriculture, and pest management activities have potential to affect the quality of water resources.

7.5.1 Storm Water Management

WPAFB contains a 190-mile storm water collection and drainage system consisting of open drainage ditches, swales, culverts, and buried pipe (Woolpert LLP 2001). Twenty-three storm water drainage areas with defined discharge points (outfalls) are located through the base. The outfalls discharge to the Mad River, Hebble Creek, Trout Creek, and Bass Lake. All of the outfalls are permitted under WPAFB's NPDES Permit. In the eastern, northern, and western portions of Area A, storm water flows primarily overland to undefined (non-point) discharge points along the Mad River, Hebble Creek, and an unnamed stream (Shaw 2011a). All storm water runoff from WPAFB ultimately flows into the Mad River.

As described in Section 2.4.3 Current Major Mission Impacts on Natural Resources there is potential for numerous hazardous materials used on WPAFB to contact storm water and, eventually, surface water or groundwater.

WPAFB has established a Storm Water Pollution Prevention Team to manage storm water issues and prevent pollution. WPAFB has developed a Storm Water Management Plan (SWMP; Shaw 2011a) and a Storm Water Pollution Prevention Plan (SWPP; Shaw 2011b) in compliance with the provisions of the federal CWA, its implementing regulations, and the Ohio Water Pollution Control Act. The SWMP provides guidance for minimizing the potential for contaminants to contact storm water. Measures include monitoring storm water outfalls in accordance with the NPDES permit; public education, outreach, and participation; detection and elimination of illicit discharges; pre- and post-construction site runoff control; and pollution prevention measures. The SWP3 addresses best management practices for storm water during specific activities and processes, such as aircraft deicing.

A SPCC Plan was developed in 2000 and updated in 2006 (SAIC 2006) and 2011 (Shaw 2011b). The SPCC Plan provides guidelines for minimizing the potential for spills on base, to prevent any spill from leaving the base, and to ensure that the cause of any spill is corrected. WPAFB also maintains greater than 600 site-specific spill plans. WPAFB personnel and contractors are educated about storm water pollution prevention. Public outreach, including brochures, training, signage, and community events are described in the SWMP.

Water quality is monitored in accordance with WPAFB's NPDES permit, which requires monthly or biweekly sampling at the 23 permitted outfalls. Samples include testing for suspended and dissolved solids,

oil and grease, glycol (deicing fluid), and several semi-volatile organic chemicals, and measurement of pH, DO, and temperature.

The WPAFB Storm Water Management Program actively seeks opportunities to reduce the discharge of pollutants from base operations that could adversely impact storm water quality. Over the last 2 years, over a half-dozen base-wide processes and activities that may result in a release of pollutants have been evaluated to review current management practices and determine potential areas of improvement. These processes have included coal storage at the 31240 and 20770 Heating Plant Complexes, aircraft deicing at the East and West Ramps, base-wide oil/water separator management, jet fuel use at the Area B Gun Range, waste fry oil management at all WPAFB restaurants, vehicle wash stations, and septic systems.

In addition to chemical pollutants, soil erosion and runoff of sediment-laden storm water may affect surface water bodies. Most upland areas on WPAFB do not have high potential for significant soil erosion. However, sites where soil is exposed, such as construction sites, may contribute soil to storm water runoff. For projects involving disturbance of land 1 acre or greater in size, a Notice of Intent must be filed, a NPDES permit for construction must be issued, and a site-specific SWP3 must be developed, implement, and enforced. The Storm Water Program Manager reviews the site-specific SWP3s. Typical storm water runoff controls for construction sites include silt fences, detention ponds, rock berms, drainage swales, and hay bales. Storm Water Program personnel periodically evaluate construction sites to ensure SWP3s are implemented.

Prompt revegetation of disturbed sites minimizes the potential for soil erosion and runoff. Projects on WPAFB that result in vegetation removal and soil disruption must be restored with appropriate seed, and in some cases topsoil, during the spring or fall. The Base Natural Resources Manager must approve seed selection and timing of planting. Temporary or “cover crop” seeding is not acceptable unless it is used for the purpose of temporarily stabilizing the soil until the project is completed.

7.5.2 Wastewater Management

Wastewater treatment is conducted by municipal wastewater treatment facilities operated by the cities of Fairborn and Dayton (Woolpert LLP 2001). There are three primary and several smaller lift stations on WPAFB that facilitate the gravity transfer of wastes. Long-term capital improvement projects are ongoing to improve the sanitary sewer system on the base. The system is being upgraded to reduce the risk of infiltration from floodwater and runoff.

The Storm Water/Wastewater Program completed a cross connection study to identify areas where sanitary and storm water systems connect.

7.5.3 Other Activities Potentially Affecting Water Resources

Pesticides and fertilizers used in agricultural, grounds maintenance, and pest management activities may reach surface and groundwater resources via storm water runoff. While use of pesticides is necessary at WPAFB, the base implements Integrated Pest Management principles to minimize the quantity and frequency of pesticide use. Pesticides and fertilizer applied to leased agricultural fields are controlled in accordance with guidelines of the Land Management Regulation that accompanies the lease, and pesticide use in agricultural fields must be reported annually to WPAFB. All pesticide application personnel are certified or in training to be certified as applicators. Areas in which pesticides are used frequently (i.e., golf courses) maintain site-specific spill plans to prevent and manage spills (WPAFB 2016b). The WPAFB IPMP (WPAFB 2016b) specifically addresses sensitive areas of concern including wetlands. Before

pesticides may be applied in or near wetlands, the EIAP must be completed, and the Base Natural Resources Manager must approve the proposed application.

7.6 Wetland Protection

Applicability Statement

This section applies to USAF installations that have existing wetlands on USAF property. This section **IS** applicable to this installation.

7.6.1 Wetland Resources on Wright-Patterson Air Force Base

The 2009 Update to Wright-Patterson Air Force Base Wetland Management Plan (WMP, BHE 2010) includes results of the 2009 delineation of wetlands within the installation. Three previous wetland delineations had been completed on WPAFB in 1994 (3DE 1994), 1999 (BHE 2000b) and 2004 (BHE 2005a). The WMP was prepared to protect and enhance the wetland resources on WPAFB, and to ensure that installation activities comply with federal, state, and local wetland regulations.

Wetland areas were mapped in 2015, and no additional streams or wetlands were discovered. In subsequent years, wetland mapping and functional assessments will be updated for approximately 2,000 acres of the base each year so that the entire base would be updated within a 5-year period. Results of the mapping and functional assessments are compared among years to assess trends of the habitat quality and health of wetlands on WPAFB. Functional assessments will be conducted following Ohio EPA's Ohio Rapid Assessment Method for Wetlands, Version 5.0 (Mack 2001).

7.6.1.1 Wetlands on the Airfield

Wetlands on/within active airfields are discouraged due to the BASH threat. Careful planning and consideration are given to any actions near to the airfield to ensure that birds and waterfowl are not attracted to the airfield.

7.6.1.2 Wetlands along Mad River

Twelve wetlands (C12, C13, C15, C16, C17, C19, C20, C21, C22, C28, C29, and C29A) were identified along the Mad River on WPAFB (Figure 2-17, Figure 2-18). There have been some changes in the size, configuration, and number of wetlands along the Mad River since the 2005 WMP, due most likely to the dynamics of the floodplain (BHE 2000b, 2005a and 2010). Of the wetlands identified along the Mad River corridor in the last two delineations, a total of 5.6 acres of wetlands was identified in 2005, and a total of 6.25 acres was identified in 2010. The ORAM category of the wetlands remained nearly the same during the 5-year period. Each of the new wetlands is of high or moderate functional value.

The Mad River corridor is outside of the airfield and designated training ranges, and these wetlands are thus generally unimpacted by activities occurring on the installation. WPAFB currently manages these wetlands through a hands-off approach, as they are essentially protected by their location within the landscape and maintained by frequent spring flooding of the Mad River. However, three of the wetlands located in this area (wetlands C15, C20, and C27) are located along Landfill 12 where a portion of forest has been cleared to improve site distance for the nearby airfield.

The wetlands along the Mad River are the highest quality of those identified on the installation, and two of the largest wetlands on WPAFB (C15 and C22) are located there. Three of the wetlands along the Mad River were designated ORAM Category 3 wetlands (C15, C19, and C22), and two were between categories 2 and 3 (C28 and C29), which typically signifies moderate to high ecological value and a diversity of

wetland functions. The remainder of the wetlands along the Mad River is ORAM Category 2 wetlands that provide moderate ecological functions and values. All of the 12 wetlands located along the Mad River but one (Wetland C27) contained a forested (PFO) component. However, many of these wetlands support invasive species (as defined by ODNR et al. 2000), including Amur honeysuckle (*Lonicera maackii*) around wetlands C15 and C17, garlic mustard (*Alliaria officinalis*) around wetland C17, and reed canary grass (*Phalaris arundinacea*) within wetlands C19 and C22.

7.6.1.3 Wetlands in Training Areas

Wetland C18 is located within the WTC, and is the only wetland identified within a training area. Wetland C18 is a PFO, Category 2 wetland that is seasonally flooded by Hebble Creek that flows near its northern boundary (Figure 2-18). Wetland C18 is the largest wetland on the installation (6.02 acres) and appears to possess relatively high ecological quality, enhanced by its large size and the diversity of vegetative cover types. The primary impacts to this wetland are from pedestrian training activities, which are anticipated to be minor and temporary.

Amur honeysuckle was the primary invasive exotic species encountered in the WTC, within and adjacent to wetland C18. All training within the WTC is conducted within the developed footprint of the training area and any proposed new activities outside of the developed footprint would be coordinated with the Environmental office.

7.6.1.4 Wetlands in Sandhill Area

Wetlands C1, C2, C4, C5, C6, and C24 were identified in the Sandhill area in the northeastern portion of Area A near Landfill 9 (Figure 2-17). There has been an increase in the wetland acreage in the Sandhill area from approximately 0.59 acre in 2000 (BHE 2000b) to 3.63 acre in 2004, and a reduction in 2010 to 3.24 acres. Some wetlands identified in the 2000 WMP and the 2005 WMP were not identified during the 2010 investigation, as the former wetland areas had no signs of hydrology and no longer contained hydrophytic vegetation.

Wetlands identified within the Sandhill area are generally of lower quality, as the landscape in the area has been disturbed and modified over the years by mining, the Landfill operation, and the glideslope tree removal that occurred in 2002/2003 (IT and BHE 2002). All of the wetlands in the area were Category 2 or Modified Category 2 wetlands that likely provide low to moderate ecological functions. Most of the wetlands in the Sandhill area are relatively small (less than 0.2 acre) except wetlands C6 and C24, which are approximately 0.54 acre and 2.35 acres in size, respectively (Table 2-3). All of the wetlands in the Sandhill area contained a component of emergent vegetation (PEM), except wetland C1 that was a scrub-shrub (PSS) wetland. Most of the wetlands in the area were dominated by or contained invasive species (ODNR et al. 2000), including: common reed (*Phragmites australis*) in wetlands C2, C5, C6, C24; narrow-leaf cattail (*Typha angustifolia*) in wetlands C2, C6, and C24; and Amur honeysuckle, Japanese honeysuckle (*Lonicera japonica*), and autumn olive (*Elaeagnus umbellata*) in wetland C5. However, some wetlands in the Sandhill area (C1 and C2) may be important for amphibian breeding as they appear to have standing water in late winter and spring and are free of fish.

7.6.1.5 Wetlands in Gravel Lake Area

Three wetlands were identified in the Gravel Lake area in 2004: C11A, C11B, and C26 (Figure 2-18). The acreage of wetlands in the Gravel Lake area has decreased from 5.34 acres in 2000 (BHE 2000b) to 1.37 acres in the 2005 WMP (BHE 2005a) and to 0.35 acres in 2010. One additional wetland was identified in the Gravel Lake area in the upper portions of the historic Upper Twin Lake, C26 (BHE 2005a). However,

four small wetlands identified in the 2000 WMP in the Gravel Lake area, C7, C8, C9, and C10 (BHE 2000b), were not identified during 2004 investigations, and C11A and C11B had disappeared in 2010; none of these former wetland areas had signs of wetland hydrology nor were they dominated by hydrophytic vegetation.

The largest acreage change in the Gravel Lake area was because portions of wetland C11 that had been delineated in the 2000 WMP (BHE 2000b) did not contain hydrology indicators in 2004, and the wetland was therefore split into two wetlands, C11A and C11B. Thus, the total acreage of wetland C11 was reduced from 4.93 acres in the 2000 WMP (BHE 2000b) to 0.21 acre in the 2005 WMP (BHE 2005a). These two wetlands were not evident in 2010.

These former wetland areas in the Gravel Lake area are all located near the EW-1 extraction well north of Lower Twin Lake that currently processes contaminated groundwater from Landfill 5 and has been operational since 1999. Additionally, the City of Dayton has three groundwater extraction wells below Huffman Dam that are actively operated and have been in operation for over 10 years (S. Siegal, pers. commun.). Given the significantly higher extraction rate of these City of Dayton wells and the large cone of depression that they create in the area, it may be reasonable to conclude they are reducing wetland acreage by lowering groundwater levels in the Gravel Lake area. The EW-1 extraction well may be affecting groundwater levels as well, though most likely at a much lower rate.

Wetlands C11A and C11B were in an abandoned gravel pit on the north side of Gravel Lake in the southwestern portion of Area A. These two wetlands were small (approximately 0.01 and 0.20 acre). Wetlands C11A and C11B both fell between ORAM Categories 1 and 2, and thus likely provided low to moderate ecological functions.

Wetland C26 is primarily a PEM wetland located within the upper portions of the historic Upper Twin Lake, an old gravel pit. Portions of the wetland that are adjacent to the water channels that now exist within the former lake area contain limited open water (POW) wetland, while a small area along the northwest portion of this wetland is dominated by scrub-shrub vegetation. Wetland C26 currently covers approximately 0.35 acres and is a Modified Category 2 wetland, a wetland capable of possessing moderate habitat quality.

Wetland C26 will likely continue to decrease in size as silt accumulates within the boundaries of Upper Twin Lake, displacing open water areas with shallow water/saturated conditions and eventually dry land. This wetland likely provides cover for juvenile fish and breeding sites and cover for aquatic invertebrates at times when there is sufficient water exchange with Lower Twin Lake.

7.6.1.6 Wetlands in Developed Areas

Area B wetlands (B1 through B7 and B9 through B18) (Figure 2-19) and wetland C21 (Figure 2-17) are in the developed portions of WPAFB. These wetlands persist in proximity to a high level of human activity, and several are components of storm water management.

Eighteen wetlands were identified in Area B in 2010, seventeen wetlands were identified in Area B in 2004 and 10 in 2000 (BHE 2000b). Four newly identified wetlands (B14, B15, B16, and B17) formed on a slope east of Area B's inactive airfield and west of wetlands B4 and B13 between 2004 and 2009. Underground drainage features or seeps may have led to the formation of these small wetlands, and the regular spacing of wetlands B14–B17 creates an artificial appearance that may indicate anthropogenic conditions were responsible for their formation.

The wetlands identified in the developed portions of WPAFB are of generally low quality due to their proximity to human activities. A majority of the Category 1 wetlands identified on the installation were found in the developed areas (wetlands B12 and B14, B15, B16, and B17), and the remainder of the developed-area wetlands were determined to be ORAM Category 2, Modified 2, or wetlands falling between categories 1 and 2 (Table 2-3, Table 2-4). Wetland B9 is located on the grounds of the Wright Memorial and is routinely mowed, as are wetlands B11, B12, B14, B15, B16, B17, and portions of B7. Wetlands B14, B15, B16, and B17 are near the Area B Airfield and must be mowed to minimize wildlife strikes on the airfield. However, to enhance their functional value, wetlands B9, B11, B12, and B17 are no longer mowed, and natural vegetation regeneration has been allowed to occur since 2005.

Nuisance/noxious vegetation is generally not prevalent in wetlands in the developed portions of the installation. Although Amur honeysuckle was identified within wetlands B2, B3, B7, and B10, this invasive shrub has been removed from much of the area surrounding these wetlands since the fall field survey in 2004. A majority of the wetlands in these areas were dominated by emergent vegetation, while the remainder contained forested (B1, B2, and B10), scrub-shrub (B3 and B8), or aquatic bed (C21) vegetation (Table 2-3, Table 2-4). Wetland B1 also has an open water component that may provide breeding habitat for fish and other aquatic organisms. Wetland C21 located as a littoral shelf in Bass Lake also likely provides cover for larval and juvenile fish present in the lake, as well as habitat for aquatic invertebrates that serve as food for fish.

7.6.2 Wetland Restoration and Enhancement

Expansion of the number of wetlands on WPAFB generally is not consistent with mission requirements, as wetlands may attract waterfowl and other birds that may increase the potential for BASH. However, expansion, restoration or creation of certain wetlands may be considered in the future at specific locations to mitigate for losses of wetlands or similar reasons.

Wetland expansion may be accomplished through restoration of former wetland areas or creation of new wetland areas adjacent to existing wetlands. Wetlands near Gravel Lake are prime candidates for restoration; altering hydrology near Wetlands C11A and C11B will likely expand the wetland acreage.

Wetland enhancement within the Mad River floodplain began in 2010 and continues. Wetland enhancement actions are specifically targeting removal of invasive plants including Amur honeysuckle, common reed, and reed canary grass (see discussion in Section 7.2 Outdoor Recreation and Public Access to Natural Resources).

Successful enhancement efforts, such as the removal of nuisance vegetation, will result in a long-term improvement in wetland quality. Bush honeysuckle in and around Wetland C18, in the WTC, was treated with glyphosate in 2019. Additional application of herbicide to honeysuckle in WTC is planned for November 2021.

A 10-acre wetland-like area in Huffman Prairie currently supports non-native wetland plants and would benefit from management actions to restore native vegetation. Within this area, WPAFB intends to review the methods for restoring hydrology (plug drainage tiles and culvert to Trout Creek), control non-prairie species by targeted herbicide application, and plant native wet prairie seed. Eradication of invasive plants will improve the wetland function, and the habitat suitability for species inhabiting wetlands, including the state endangered smooth green snake and king rail, and state species of concern Henslow’s sparrow, bobolink, and sedge wren.

7.6.3 Wetland Permitting

There are no current plans that involve impacts to streams or wetlands. Any future impacts to streams or wetlands would require permits under CWA Section 404/401 and/or a General Isolated Wetland Permit (Levels 1, 2 or 3) from the State of Ohio. The Base Natural Resources Manager is responsible for obtaining wetland permits. Examples of activities that may require a permit include stream relocations, road crossings, streambank protection, boat ramp construction, ditching, and mechanical tree clearing in a wetland.

One recent Section 401/404 permit existed for WPAFB: Area B -BRAC (#2007-744- GMR/073238). Compensatory mitigation for this permit was completed in 2011 and included stream and wetland restoration and/or preservation of Stream 1(A), 2, 4, 5, and 6, and Wetland B3 and B1. Monitoring occurred from 2012–2018. As of 2018, all mitigation performance standards required by the permit were met, and WPAFB was released from any additional monitoring obligations. All mitigation sites are marked in the field with signage prohibiting mowing. Annual maintenance of these site will continue, to ensure that performance standards continue to be met. OEPA released WPAFB from the permit in 2020.

7.6.4 Stream Resources on Wright-Patterson Air Force Base

Based on the Wetland and Stream Management Plan (BHE 2010, Tab 5—Wetland and Stream Management Plan), there are 13 streams within Area A and 13 streams within Area B at WPAFB. The streams listed in Area A are comprised of 6 perennial streams, 6 intermittent streams and 1 intermittent/perennial stream. Streams listed for Area B are 1 perennial stream, 2 intermittent/perennial streams, 5 intermittent streams, 1 ephemeral/intermittent stream and 4 ephemeral streams. Field work for identification and mapping of additional wetlands and streams occurred during 2015, and new information will be incorporated into subsequent revisions of the INRMP. Any placement of fill in jurisdictional streams requires a 401/404 permit from the USACE and the OEPA.

WPAFB is implementing several projects to improve water quality and wildlife habitat along stream corridors. During 2015 WPAFB funded a study to evaluate the Mad River and Hebble Creek riparian areas to identify areas that could be stabilized using natural channel design principles. Although bank erosion was not identified in Hebble Creek, a high, eroding bank on the left descending bank of the Mad River is present northwest of Bass Lake. This erosion is a result of the river returning to its original natural pattern following extensive channelization between 1958 and 1964. Around 2005, large concrete blocks (rip-rap) were placed at the toe of the slope along a portion of the eroding bank. The rip-rap appears to have slowed down erosion, and monitoring in 2017 and 2018 measured an average erosion rate of approximately 4 cm/year. However, monitoring in 2019 revealed a significant bank failure at the upstream end of eroding bank where no rip-rap is present. Willow and dogwood stakes were planted in 2018–2020 where the bank lacked rip-rap. However, these plantings were largely unsuccessful, as almost all stakes died. This eroding bank will continue to be qualitatively monitored semi-annually to determine if bank stabilization is necessary. In addition, as funding allows, native shrubs and understory trees will be planted in the honeysuckle treatment areas along the Mad River. Riparian restoration will benefit the federally endangered Indiana bat, northern long-eared bat, and clubshell mussel, as well as state-listed migratory birds that may stopover at WPAFB during migration.

7.7 Grounds Maintenance

Applicability Statement

This section applies to USAF installations that perform ground maintenance activities that could impact natural resources. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

Grounds maintenance at WPAFB follows the guidelines set forth in AFOSH 91-10, Chapter 3, as well as the Grounds Maintenance Standards set forth by AFMC HQ. Grounds maintenance activities interface with natural resources management in the following aspects:

Application of pesticides should be in accordance with the IPMP (WPAFB 2016b) which limits use of pesticides to the minimum practicable amount. Application of pesticides near sensitive ecological areas (e.g., wetlands) is restricted as described in the IPMP.

Selection of plants, trees, and shrubs for landscaping should consider management goals for the Indiana bat and northern long-eared bat (Table 7-2), emphasis on the use of native species (Table 7-3 , Table 7-4, Table 7-5) and avoidance of noxious or invasive species (Table 7-6, Table 7-7).

Mowing in old fields/unimproved grounds should be in accordance with management guidelines for the eastern massasauga (Section 7.4 Management of Threatened and Endangered Species, Species of Concern, and Habitats).

Mowing in Areas A and B should consider, to the extent practicable, the location of wetlands, while meeting military mission requirements.

Management of trees and forest must be in accordance with requirements for conserving habitat suitable for the Indiana bat and northern long-eared bat (Section 7.4 Management of Threatened and Endangered Species, Species of Concern, and Habitats). Removal of trees and vegetation in the airfield glideslope must comply with Indiana bat and northern long-eared bat habitat conservation guidelines.

Huffman Prairie is managed as unimproved grounds with specific ecological goals that are different from other unimproved areas. No mowing, herbicide application, or other maintenance is conducted in that area without prior approval from the Natural Resources Manager.

Grounds maintenance crews may be of assistance with identification and eradication of invasive species in forest and wetland habitats.

7.7.1 General Maintenance

Grounds maintenance personnel are responsible for grounds maintenance and management on approximately 8,100 acres of WPAFB to maintain healthy grass, trees, and plants, and ensure the base has a neat, clean, and professional appearance. Duties include landscape designs and plans; mowing, pruning and edging; maintenance of trees, shrubs, grass, and plants; control of weeds, harmful insects, and diseased plants; trash/litter removal; restoration of damaged landscape areas. The grounds maintenance crew is responsible for applying pesticides, herbicides, and fertilizers. Activities are conducted on enhanced improved, improved, semi-improved, and unimproved grounds. The grounds maintenance crew is responsible for maintaining trees and shrubs at appropriate heights along the airfield glideslope. Grounds maintenance personnel also are available to support reforestation and wildlife habitat improvement as time allows.

Table 7-2. Suggested native tree species to restore or enhance Indiana bat habitat.

Common Name	Scientific Name	Common Name	Scientific Name
River birch*	*Betula nigra*	Sugar maple*	*Acer saccharum*
Eastern cottonwood	*Populus deltoids*	Black oak*	*Quercus velutina*
American elm	*Ulmus americana*	Post oak	*Quercus stellata*

Slippery elm	*Ulmus rubra*	Red oak*	*Quercus rubra*
Bitternut hickory	*Carya cordiformis*	Shingle oak	*Quercus imbricaria*
Shagbark hickory*	*Carya ovata*	White oak*	*Quercus alba*
Shellbark hickory	*Carya laciniosa*	Sassafras	*Sassafras albidum*
Black locust*	*Robinia pseudoacacia*	Sycamore*	*Plantanus occidentalis*
Red maple*	*Acer rubrum*	Black willow	*Salix nigra*
Silver maple*	*Acer saccharinum*		

Source: U.S. Fish and Wildlife Service, Ohio Field Office.
*Species available from the Ohio Division of Forestry.

Table 7-3. Native shrubs recommended for installation following herbicide treatment of Amur honeysuckle.

Common Name	Scientific Name	Planting Habitat
American hazelnut	*Corylus Americana*	Edges of woods, open fields
Spice-bush	*Lindera benzoin*	Along streams, moist woods, bottom lands
Ninebark	*Physocarpus opulifolius*	Open fields, edges of woods
Downy serviceberry	*Amelanchier arborea*	Open fields
Cockspur thorn	*Crataegus crus-galli*	Open fields
Shrubby cinquefoil	*Pentaphylloides floribunda*	Moist, well-drained soils
Prairie rose	*Rosa setigera*	Open fields
Swamp rose	*Rosa palustris*	Wetlands, woods
Wild rose	*Rosa Carolina*	Open fields
Wild plum	*Prunus Americana*	Edges of woods
Redbud	*Cercis Canadensis*	Open fields, edges of woods
False indigo-bush	*Amorpha fruticose*	Edges of wetlands
Smooth sumac	*Rhus glabra*	Along slopes
Wahoo	*Euonymus atropurpureus*	Open woods, well-drained soils
American bittersweet	*Celastrus scandens*	Open fields
American bladdernut	*Staphylea trifolia*	Moist woods
Lance-leaf buckthorn	*Rhamnus lanceolate*	Edges of woods, along streams
Shrubby St. John's wort	*Hypericum spathulatum*	Open fields
Gray dogwood	*Cornus racemose*	Open fields, edges of moist woods
Roughleaf dogwood	*Cornus drummondi*	Open fields, edges of moist woods
Alternate-leaf dogwood	*Cornus alternifolia*	Open fields, edges of moist woods
Buttonbush	*Cephalanthus occidentalis*	Wetlands, edges of ponds
Black-haw	*Viburnum prunifolium*	Edges of woods, open fields

Source: Geiger and Guggenbiller 2000.

Table 7-4. Native grasses and herbs recommended for installation following herbicide treatment or other removal of teasel and Canada thistle and/or in tallgrass prairie restoration habitats.

Common Name	Scientific Name	Common Name	Scientific Name
Big bluestem	*Andropogon gerardii*	Western sunflower	*Helianthus occidentalis*
Side-oats grama	*Bouteloua curtipendula*	Ox-eye sunflower	*Heliopsis helianthoides*
Nodding wild rye	*Elymus canadensis*	Dense blazing star	*Liatris spicata*
Little bluestem	*Schizachryium scoparium*	Pale spiked lobelia	*Lobelia spicata*
Indian grass	*Sorghastrum nutans*	Wild bergamont	*Monarda fistulosa*
Prairie cord grass	*Spartina pectinata*	Beardtongue	*Penstemon digitalis*
Rough dropseed grass	*Sporobolus asper*	Purple obedient plant	*Physostegia virginiana*
Purple milkweed	*Asclepias purpurascens*	Narrow-leaved mountain mint	*Pyncanthemum tenuifolium*
New England aster	*Aster novae-angliae*	Grey-headed sunflower	*Ratibida pinnata*
Partridge pea	*Chamaecrista fasciculata*	Prairie dock	*Silphium terebinthinaceum*
Tall coreopsis	*Coreopsis tripteris*	Whorled rosinweed	*Silphium trifoliatum*
Purple coneflower	*Echinacea purpurea*	Ohio goldenrod	*Oligoneuron ohioense*
Flowering spurge	*Euphorbia corollata*	Riddell's goldenrod	*Oligoneuron riddellii*
Biennial gaura	*Gaura bieniss*	Spiderwort	*Tradescantia ohiensis*
Saw-tooth sunflower	*Helianthus grosseserratus*		

Source: The Ohio State University 1998.

Table 7-5. Native sedges, grasses, rushes, and herbs recommended for installation following herbicide treatment of invasive wetland grasses and herbs and/or in emergent palustrine wetland restoration areas.

Common Name	Scientific Name	Common Name	Scientific Name
Bristly sedge	*Carex comosa*	American water plantain	*Alisma subcordatum*
Fringed sedge	*Carex crinita*	Swamp milkweed	*Asclepias incarnata*
Hop sedge	*Carex lupulina*	Smooth aster	*Aster laevis*
Lurid sedge	*Carex lurida*	Nodding beggartick	*Bidens cernua*
Fox sedge	*Carex vulpinoidea*	Spotted joe pye weed	*Eupatorium maculatum*
Fowl mannagrass	*Glyceria striata*	Common boneset	*Eupatorium perfoliatum*
Common rush	*Juncus effusus*	Great blue lobelia	*Lobelia siphilitica*
Switch grass	*Panicum virgatum*	Square-stemmed monkey flower	*Mimulus ringens*
Hardstem bulrush	*Schoenoplectus acutus*	Ditch stonecrop	*Penthorum sedoides*
Softstem bulrush	*Schoenoplectus tabernaemontani*	Swamp dock	*Rumex verticillatus*
Dark green bulrush	*Scirpus atrovirens*	Broadleaf arrowhead	*Sagittaria latifolia*
Wool grass	*Scirpus cyperinus*	Blue vervain	*Verbena hastata*
Prairie cord grass	*Spartina pectinata*		

Source: The Ohio State University 1998

Table 7-6. Invasive plant species observed on Wright-Patterson Air Force Base.

Common Name	Scientific Name	Habitat
Tree-of-heaven	*Ailanthus altissima*	Woods, wasteground*
Garlic mustard	*Alliaria petiolata*	Woods, wasteground, Huffman Prairie
Smooth brome	*Bromus inermis*	Huffman Prairie
Junegrass	*Bromus tectorum*	Wasteground, Huffman Prairie
Nodding thistle	*Carduus nutans*	Wasteground
Canada thistle	*Cirsium arvense*	Huffman prairie, fields, wasteground, Twin Base Golf Course
Teasel	*Dipsacus sylvestris*	Fields, wasteground, Huffman Prairie
Russian olive	*Elaeagnus angustifolia*	Woods, wasteground, fields
Autumn olive	*Elaeagnus umbellata*	Huffman Prairie, woods, wasteground, fields
Quack grass	*Elymus repens*	Huffman Prairie
Common St. John's wort	*Hypericum perforatum*	Fields
Butter-and-eggs	*Linaria vulgaris*	Wasteground, Huffman Prairie
Japanese honeysuckle	*Lonicera japonica*	Woods, wasteground, Huffman Prairie
Amur honeysuckle	*Lonicera maackii*	Huffman Prairie, woods, wasteground
Morrow honeysuckle	*Lonicera morrowii*	Woods, wasteground
Tatarian honeysuckle	*Lonicera tatarica*	Woods, wasteground
Purple loosestrife	*Lythrum salicaria*	Banks of Mad River, islands
White sweet clover	*Melilotus alba*	Huffman Prairie, fields, wasteground
Yellow sweet clover	*Melilotus officinalis*	Huffman Prairie, fields, wasteground
Eutrophic water nymph	*Najas minor*	Ponds, lakes
Reed canary grass	*Phalaris arundinacea*	Wet areas
Common reed	*Phragmites australis*	Wet areas
Japanese knotweed	*Polygonum cuspidatum*	Wasteground
Common buckthorn	*Rhamnus cathartica*	Woods, wasteground
Curly pondweed	*Potamogeton crispus*	Ponds, lakes, Mad River
European alder buckthorn	*Rhamnus frangula*	Wasteground
Multiflora rose	*Rosa multiflora*	Fields, wasteground, woods
Johnson grass	*Sorghum halepense*	Fields, wasteground
Narrow-leaved cattail	*Typha angustifolia*	Wet areas

Source: BHE 1999b.

*Wasteground includes developed areas, areas maintained as lawns or otherwise landscaped, and golfcourses (excluding roughs along fairways).

Table 7-7. State of Ohio noxious weeds observed on Wright-Patterson Air Force Base.

Common Name	Scientific Name	Habitat
Nodding thistle	*Carduus nutans*	Wasteground*
Canada thistle	*Cirsium arvense*	Huffman prairie, fields, wasteground,Twin Base Golf Course
Poison hemlock	*Conium maculatum*	Wet areas, fields, wasteground,Huffman Prairie
Wild carrot	*Daucus carota*	Fields, wasteground, Huffman Prairie
Ox-eye daisy	*Leucanthemum vulgare*	Wasteground
Purple loosestrife	*Lythrum salicaria*	Banks of Mad River, islands
Wild parsnip	*Pastinaca sativa*	Fields, wasteground, Huffman Prairie
Wild mustard	*Sinapsis arvensis*	Wasteground
Johnson grass	*Sorghum halepense*	Fields, wasteground
Grape vines	*Vitis spp.*	Woods

Sources: BHE 1999b, ODNR 2005b.
*Wasteground includes developed areas, areas maintained as lawns or otherwise landscaped, and golf courses (excluding unmaintained roughs along fairways).

Enhanced improved, improved, and semi-improved grounds on WPAFB contain turf grasses and ornamental plantings and require intensive to regular maintenance. Regular mowing of turf grasses creates additional maintenance concerns such as soil compaction, susceptibility to drought, and susceptibility to disease and insect infestations. Proper planting and maintenance (e.g., proper mowing heights, dethatching, aeration, and irrigation) ensure a vigorous lawn that is resistant to many of these problems.

Landscapes on enhanced improved, improved, and semi-improved grounds on WPAFB have been designed to reduce overall maintenance by decreasing unnecessary pruning, irrigation, and application of fertilizers and pesticides. Vegetation is mechanically controlled (i.e., mowing, cutting, and weed trimming) to the maximum extent possible, given available labor. Native plants are used in landscaping when possible, depending on site compatibility, maintenance requirements, and compatibility with safety guidelines. Lists of native plant species recommended for use in landscaped areas are found in Table 7-3, Table 7-4, and Table 7-5. Plants considered invasive species or noxious weeds should never be used in landscaping (Table 7-6, Table 7-7).

Reductions in available labor and increases in the installation's visibility as the MAJCOM headquarters for the AFMC contribute to increased herbicide application. Reduction of pesticide use is implemented as part of the Integrated Pest Management Plan (WPAFB 2016b) and vegetation is controlled to the maximum extent possible given available labor. However, the use of pesticides on particular areas is often necessary. Once an infestation is evident in turf grasses, corrective measures must be taken that often involve chemical controls.

Herbicides are also often required for quick fixes in areas where mechanical control is not performed on a regular basis, such as in open space areas, along fence lines, on pavement, and within industrial facility and equipment storage areas (Shaw 2005b). Herbicides are an important tool in controlling invasive plants, which has been a primary goal of the Natural Resources Management Program in recent years.

WPAFB, in participation with all DoD installations, is striving to maintain stable or reduced herbicide application rates, in accordance with the DoD Measures of Merit goals for Pest Management Programs.

WPAFB was successful in reducing the amount of active ingredient of herbicide applied in FY 2002 to FY 2003. Currently, WPAFB is striving to maintain the application rate at the DoD Measures of Merit goal or lower. However, WPAFB applied more pounds of active ingredient in FY 2004, indicating difficulty meeting the goal on an annual basis (Shaw 2005b) from time to time and is not contributable any one single factor.

Herbicide use is minimized by adequately fertilizing turf areas to promote healthy grass better able to withstand disease and droughts and to compete with weeds. The Air Force Grounds Maintenance Standard indicates fertilizer must be organic and environmentally safe. Fertilizer-related non-point source pollution associated with turf grass improvements are minimized on the installation by ensuring application rates coincide with soil deficiencies.

All solid wastes associated with grounds maintenance activities are taken off WPAFB by a private contractor. Organic wastes (e.g., grass clippings) are composted, and trash is taken to an off-base landfill. The disposal of solid waste does not generate natural resource management issues on the installation.

7.7.2 Golf Course Maintenance

The WPAFB golf course superintendents maintain the 27-hole Prairie Trace Golf Course and the 18-hole Twin Base Golf Course. Use of pesticides on golf courses is addressed in the IPMP and is subject to the same pesticide reduction goals as the rest of WPAFB. Golfers have high expectations and low tolerance for less-than-ideal conditions caused by golf course pests.

Golf course superintendents use Integrated Pest Management strategies in all aspects of course maintenance, seeking non-chemical methods of prevention and control before using chemical means.

In 2003, the Prairie Trace Golf Club achieved designation as a Certified Audubon Cooperative Sanctuary by the Audubon Cooperative Sanctuary System (Zeh 2003). To reach certification, the course demonstrated that it maintains a high degree of environmental quality in several areas. These include environmental planning, wildlife and habitat management, outreach and education, chemical use reduction and safety, water conservation, and water quality management. Trees and shrubs were planted to provide habitat for wildlife, and nest boxes were installed for birds.

During the 2019 herpetological surveys, USFWS documented that TBGC had the highest diversity and numbers of herpetofauna of the three sites surveyed. Several wetland areas along the western edge of the golf course provided high quality habitat for frogs, toads, and salamanders, and large numbers of snakes were found in these areas compared to the other two sites. The USFWS encourages golf course managers to sustain the existing hydrology in these areas, despite that it may result in soggy golf course greens sometimes. Further, the USFWS encourages appropriate use of herbicides, fertilizers, and pesticides, according to product labels. Amphibians are particularly susceptible to chemical runoff, so minimizing use in and around these wetlands and always following product labels is important in protecting these diverse populations.

7.7.3 Urban Forest

The urban forest is comprised of both existing native trees in developed areas that have been preserved as well as those added as part of landscape development (AFCEE/TDD 1998). The urban forest at WPAFB is managed as part of routine grounds keeping and maintenance on the base. 137 urban forest trees that were either dead/dying or causing other problems were removed and 110 urban trees trimmed/pruned within the landscaped/developed parts of the base. A portion of WPAFB (Paige Manor/Prairies Housing Area) was struck by tornado on Memorial Day 2018. Assistance was received from ODNR-DOF Urban Strike Team

for hazard tree assessment/identification. Replacement tree plantings favor native trees and shrubs that require minimal maintenance and will not create a future hazard for aircraft. Lists of native shrubs and trees recommended for landscaping are provided in Table 7-2, Table 7-3, Table 7-4, and Table 7-5.

In July 2010 the non-native Emerald Ash Borer (EAB) was positively identified in ash trees at WPAFB. In 2013 an EAB Management Plan was compiled by the Natural Resources Manager for the urban forest areas of the base only. The plan is currently being implemented to preserve approximately 100 high value ash trees, remove other dead or dying ash trees that pose a potential safety hazard, and plant replacement trees.

7.8 Forest Management

Applicability Statement

This section applies to USAF installations that maintain forested land on USAF property. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

Forested areas of the base, covering approximately 740 acres, exist as small woodlots. Most woodlots are the Upland Hardwood or the Elm-Ash-Cottonwood timber types. Most wooded acres on WPAFB are riverine forest (360 acres) within the floodplain of the Mad River.

Forests have not been under formal management in recent years. Separate management plans written in the past, but few of the provisions were implemented. There are few trees of merchantable species or size. Nearly all forested areas on WPAFB have been designated potential habitat for the federally endangered Indiana bat and northern long-eared bat.

Removal of trees constitutes potential impacts to these bats and requires implementation of the impact assessment process described in section 7 of the ESA. Section 7.4 Management of Threatened and Endangered Species, Species of Concern, and Habitats describes the procedure for coordinating with the USFWS when a proposed project may affect one or more trees.

Clearing trees on WPAFB involves agency coordination, and potentially surveys and impact compensation measures, all of which are time-consuming and costly. The quantity and quality of forest on WPAFB will not yield revenue sufficient to offset the cost of ESA compliance. Therefore, WPAFB does not maintain a formal forestry program. Tree management is limited to removal of hazard trees, trimming, and removal of trees to ensure safety of military operations (e.g., glideslope clearing). WPAFB instituted a forestry products reutilization program to use the dead ash trees that have been cut due to Emerald Ash borer. Logs are sold as firewood for in-state use. This program diverts waste, reduces costs, and generates a revenue source. Other than this, there are no sales of forest products on WPAFB.

Existing forest, especially along the Mad River corridor, is allowed to regenerate naturally. WPAFB is actively controlling invasive species, such as Amur honeysuckle, that can suppress natural forest regeneration. To expand the acreage of forest along the Mad River corridor, mowing will be ceased in selected areas to allow natural succession to occur. Tree planting will occur in specific areas that would enhance riparian and wetlands and improve bat habitat.

7.9 Wildland Fire Management

Applicability Statement

This section applies to USAF installations with unimproved lands that present a wildfire hazard and/or installations that utilize prescribed burns as a land management tool. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

A Wildland Fire Management Plan was developed during 2014. This plan was finalized in 2019. This addresses use of prescribed fire on WPAFB and management of wildfires on WPAFB (Section Tab 1—Wildland Fire Management Plan). Mutual aid agreements with local fire management agencies have been completed and a 'Memorandum of Agreement' has been established with ODNR Division of Forestry to ensure adequate manning and equipment coverage for wildfire suppression.

Spontaneous wildfire occurs very rarely at WPAFB; those that occur are managed by the WPAFB Fire Department. Fire Department personnel are trained and meet the certification standards specified in the National Fire Protection Association Standard 1001. Areas of wildland fire concern at WPAFB have been mapped, but since all areas have either paved roads, paved airfields, manicured/mowed lawn or other man-made barriers, wildland fire is a very low threat at WPAFB. Areas subject to wildland fire risk are generally small (less than 500 acres) and generally have low fuel loads (WPAFB 2015).

Prescribed fire is used as described in Section 7.4 Management of Threatened and Endangered Species, Species of Concern, and Habitats to maintain Huffman Prairie. Prescribed fire is the primary tool used to maintain native prairie species and minimize the spread of non-native species. Prescribed fire is coordinated, set, and monitored by the Natural Resources Management personnel, with support from the WPAFB Fire Department and the ODNR Division of Forestry. The prescribed fire checklist describes necessary notifications and preparations prior to initiating a fire on the prairie. In particular, the NRM must apply for a permit from the Regional Air Pollution Control Agency (RAPCA) in Dayton, and coordinate with the Cultural Resources Management Program, the Fire Department, and the Airfield.

One or two quadrants of Huffman Prairie are burned between 1 November and 15 March each year. Conducting the burn during this time allows for control of undesirable vegetation, removal of organic litter (e.g., dead leaves), and restoration of desirable prairie species, while protecting state-listed reptiles, insects, and birds. The quadrants are bordered by firebreaks approximately 10-feet wide that are established and maintained by mowing. The firebreaks are mowed only during the burning season; with mowing suspended between June and September to allow warm season prairie grasses to flower and set seed.

Because of the presence of the smooth green snake (state endangered) and the possible presence of the federal threatened massasauga in the prairie area, burning windows are typically limited to 1 November–15 March, when snakes are hibernating. Burning is also avoided when soil temperatures at a four-inch depth are above 9 °C (48.2 °F) according to USFWS guidance. Flexibility of these dates may be possible but burning should be kept to late October to mid-March to avoid potential impacts to this species. If burns are proposed outside of the standard dates, coordination with ODNR and USFWS must occur first. Additional areas are being considered for application of prescribed fire in coming years. In accordance with the wildland fire management plan, the first new area proposed for a controlled burn is an area near building 4046, and the timeframe is 2018. This proposal was coordinated with the resource's agencies in April 2013. Prescribed fire is also being looked at as a possible management tool for other areas on WPAFB. Specifically, a 20-acre section of woods located in the western edge of Area A that had invasive species

removal performed in 2010 is being considered, as is an area in the clear zone along the flight line at the north end of the airfield.

7.10 Agricultural Outleasing

Applicability Statement

This section applies to USAF installations that lease eligible USAF land for agricultural purposes. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

Most of the soils on WPAFB are poorly suited for farming and are generally not farmed (SCS 1978a, b). Prime farmland soils cover approximately 1,340 acres on WPAFB (Table 2-1, Figure 2-3). Little agriculture is conducted on WPAFB because farming practices conflict with the AF mission or natural resources management goals. WPAFB does not lease lands for grazing.

Agricultural outleases exist on 99.5 acres in the northeast section (Sandhill area) of the base. This area is divided into two parcels that have historically been farmed by one lessee. Crops are typically corn and soybeans. The duration of the lease is 5 years. Agricultural leases are managed by the WPAFB Civil Engineering Real Estate Office, in cooperation with the USACE, Louisville KY District. Annual Lease payments are deposited into the AF reimbursable agricultural fund. Deposited funds are then utilized to maintain and/or improve the area of the agriculture outlease through invasive species control/management.

In coordination with the Natural Resources Conservation Service, WPAFB developed Land Use Regulations that are included in agricultural lease agreements. Land Use Regulations are protective of natural resources on WPAFB because they are designed to minimize soil erosion, promote water conservation practices, and control use of pesticides and herbicides. Under the Land Use Regulations, agricultural lessees are required to ensure the following actions.

- Maintain the leased land in good condition and free from weeds, brush, washes, gullies, and other erosion that is detrimental to the value of the premises for agricultural purposes.
- Cut no timber, conduct no mining operations, remove no sand, gravel, or kindred substances from the premises.
- Commit no waste of any kind nor in any manner substantially change the contour or condition of the premises except changes required to accomplish soil and water conservation measures.
- Obtain approval in writing from WPAFB before application of pesticides or herbicides.
- Do not remove or disturb, or cause or permit to be removed or disturbed, any historical, archeological, architectural, or other cultural artifacts, relics, remains or objects of antiquity. The lessee shall immediately notify WPAFB in the event such items are discovered on the premises and will protect the site and the material from further disturbance until otherwise notified by WPAFB.
- Maintain soil and water conservation structures in existence upon the premises at the beginning of, or that may be constructed during the term of this lease and take appropriate measures to prevent or control soil erosion with the premises. Any soil erosion occurring outside the premises resulting from the activities of the lessee shall be corrected by the lessee as directed in writing by the Base Civil Engineer. Annual compliance inspections are completed and documented utilizing USACE form 3131 dated Aug 2014.

7.11 Integrated Pest Management Program

Applicability Statement

This section applies to USAF installations that perform pest management activities in support of natural resources management (e.g., invasive species, forest pests, etc.). This section **IS** applicable to this installation.

Program Overview/Current Management Practices

WPAFB uses Integrated Pest Management (IPM) whenever possible to minimize the environmental effects of pesticide usage. The IPM approach is more proactive than reactive and involves pest prevention, surveillance, minimal chemical application, evaluation, and redesign. The IPM approach reduces the use of toxic chemicals on the installation, thus improving environmental quality and reducing the costs of pesticide purchases but also potentially increasing labor requirements. An Integrated Pest Management Plan (IPMP) was completed in 2011 and then updated in 2016 by WPAFB in-house staff. The IPMP provides a written framework through which pest problems and control procedures are addressed at WPAFB. The plan outlines pest management roles and responsibilities, describes IPM practices related to pests encountered on the installation, and provides details on specific pesticides used (WPAFB 2016b).

Although pesticide reduction is being implemented as part of the overall pollution prevention program, the use of pesticides on particular areas is often necessary. Pest management at WPAFB is administered by the Civil Engineering, Operations, and Maintenance Division Entomology Section (88 CES/CEOIE) that performs base-wide pesticide management, and the Prairie Trace and Twin Base (88 FSS/FSWG) golf course superintendent that oversee pest management on the golf courses (WPAFB 2020). All application personnel are certified or in training to be certified as applicators. The AFMC Command Entomologist functions as the Pest Management Consultant on WPAFB, ensuring the IPMP is updated and maintained, while the Natural Resources Program Manager (88 CEG/CEIEA), in conjunction with the CES/CEOIE Supervisor ensures the IPMP is implemented.

7.11.1 Pest Species

The Entomology Section provides pest management for insect problems and infestations, and removes pest birds, rodents, and other animals on the installation. Many insect pest problems are minimized through proper maintenance and sanitation, as well as the placement of barriers. The insect pests the Entomology Section deals with on WPAFB are summarized in the IPMP and include ants, bees, wasps, cockroaches, fleas, flies, mosquitoes, spiders, and termites. However, the largest volume of pesticides applied by the Entomology Section on the installation is as herbicide for vegetation management ranging up to 95% of the total pesticide active ingredient applied. Herbicides are required for quick fixes in areas where mechanical control is not performed on a regular basis, such as in less used open space areas, along fence lines, on pavement and airfields, and within industrial facilities and equipment storage areas. In 2021, WPAFB developed a background paper on possible fogging of mosquitos.

The golf course superintendents maintain the installation’s two golf courses and utilize IPM techniques to control turf diseases, turf and non-turf insects, unwanted vegetation, fungi, algae, moles, and small rodents. Integrated Pest Management strategies are applied in golf course management on WPAFB to maintain optimal turf conditions, protect other vegetation, and promote golfer satisfaction.

7.11.2 Sensitive Areas of Concern

The IPMP specifically addresses pest management in sensitive areas of concern (WPAFB 2016b). Any pest control activities within or in the vicinity of the 19.8 acres of wetlands on WPAFB trigger the EIAP to assess the environmental impacts of pesticide application. All pesticide management at both Wright Memorial Hill and Huffman Prairie Flying Field require approval by the Cultural Resources Program Manager (88 CEG/CEIEA) as these areas are cultural resources.

Pest management activities are restricted within areas where federally listed and candidate species, and state-listed species are known or suspected to be located. Forested areas and woodlots provide potential summer roosting habitat for the federally endangered Indiana bat and threatened northern long-eared bat (Figure 2-9, Figure 2-10). Several additional areas were also determined to be potential habitat for the eastern massasauga (federal threatened) and blazing star stem borer (state endangered) (Figures 10, 13–15). All pesticide applications during any time of year in these areas designated as Indiana bat and northern long-eared bat habitat or potential habitat for the eastern massasauga or blazing star stem borer on WPAFB require coordination with the Base Natural Resources Manager. In addition, should any of the other known federally or state listed, or candidate species known to occur on WPAFB (Table 2-2) be encountered, the Base Natural Resources Manager must be consulted.

7.11.3 Invasive Species

Invasive species are “alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health” (AFMAN 32-7003). The Ohio Environmental Protection Agency defines non-native species as those that, by scientific evidence, were not present in the state just prior to European exploration and settlement, i.e. around 1750. Invasive species addressed in this INRMP include invasive plants and aquatic and terrestrial invasive wildlife. Invasive species are generally non-native species able to spread rapidly and infest large areas. Invasive plant species generally grow quickly, produce abundant fruit, spread rapidly, and germinate and disperse seeds effectively (ODNR 2005b).

All natural habitats in Ohio are impacted by invasive species. Without proper restraints, invasive species threaten native plant and animal species by replacing native species and altering or degrading the natural habitat. In woodlands, species such as garlic mustard, Amur honeysuckle, Japanese stilt-grass, Japanese honeysuckle, and tree-of-heaven are displacing native wildflowers, tree, and shrub seedlings. In wetlands, purple loosestrife, narrow leaved cattail, Phragmites, reed canary grass, flowering rush and glossy buckthorn disrupt native plant communities. Grasslands are threatened by numerous invasive plants including autumn-olive, multiflora rose, Canada thistle, smooth brome grass, common and cut-leaved teasel, and yellow and white sweet clover (Ohio Invasive Plant Council [OIPC] 2015). Control and restoration of areas encroached upon by invasive species is often required to protect native natural resources. Executive Order 13112 Invasive Species (3 February 1999) requires federal agencies to prevent the introduction of invasive species, and control and minimize the economic, ecological, and human health impacts caused by invasive species.

7.11.3.1 Known Distribution of Invasive Species

Twenty-nine invasive plant species have been observed on WPAFB during botanical inventories and surveys of wetlands and lakes (BHE 1999b TNC 2001b, BHE 2005a, BHE 2005b). Invasive species occur in forest, waste areas, old fields, Huffman Prairie, along the banks of the Mad River, in Twin Base Golf Course, and in some lakes (Table 7-6). Several wetlands are infested with Amur honeysuckle and other invasive plant species (Table 7-1).

Nine of the Ohio State Targeted species have been observed in the Montgomery-Greene County areas of Ohio, as have many of the well-established species and at least two of the Watch-List species (TNC 2010). Diligent observation will be required to maintain the ecological integrity of the installation's native biological diversity.

As of 2010, the only invasive animals observed on WPAFB were the European starling (*Sturnus vulgaris*) and the English sparrow (*Passer domesticus*) which are found throughout the installation. In 2010 the invasive emerald ash borer was detected on the base and has caused significant impacts to base ash trees.

7.11.3.2 Invasive Species Control

Invasive vegetation (e.g., bush honeysuckles) often suppresses forest regeneration; control of invasive species may be required for regeneration to proceed. Restored riparian areas provide flight corridors, roosts, and foraging areas for Indiana bats, and protect water quality and thereby protect Indiana bat prey. Control of invasive species infesting wetlands in the Mad River corridor is an effective practice for enhancing wetland resources on the base.

Three species of invasive exotic plants have invaded wetlands along the Mad River: Amur honeysuckle, common reed, and reed canary grass (BHE 2005a, OIPC 2015). In April 2019, invasive species were removed from 60.6 acres in Area A and Sandhill with follow up treatment in October 2019, to spray 91.2 acres of invasive species in Area A and Sandhill. Within Area A native Ohio trees were planted in areas where invasive species management had occurred in April and November. The presence and control of specific species is described in detail below.

Although purple loosestrife (*Lythrum salicaria*) and garlic mustard (*Alliaria officinalis*), which are nuisance species (ODNR et al. 2000), were identified during wetland surveys in 2000 (BHE 2000b), neither species appears to have significantly infested wetlands (BHE 2005a). Those species will be monitored, and control will be prioritized to prevent significant infestation.

Amur Honeysuckle

Amur honeysuckle (*Lonicera maackii*) and two other exotic bush honeysuckles (*Lonicera tatarica* and *L. morrowii)* are major plant pests throughout the base. Infestation of Amur honeysuckle is prevalent in certain wetlands, which degrades the value of the wetland (Table 7-1). In forest infestations of Amur honeysuckle can retard natural woodland regeneration. In 2004, a base-wide Amur honeysuckle eradication program was initiated to control this species in selected upland portions of Areas A and B. As of 2012, Amur honeysuckle has been removed from several areas of potential Indiana Bat roosting areas. Portions of some wetland areas are planned for honeysuckle eradication including the northern portion of Wetland C18 and portions of wetlands B4 and B13. Other wetland areas targeted for future honeysuckle eradication include the rest of Wetland C18, as well as wetlands B2, B3, B7, B10, C5, and the forest surrounding wetlands C15 and C17.

Control of Amur honeysuckle is conducted primarily through mechanical removal and foliar or stump application of herbicide. Woody stems are removed to open the understory and reduce potential fire hazards. Any other pesticides not included in the IPMP or listed above must be approved by AFMC and/or AFCEC/COSC prior to use.

Invasive Grasses

Common reed and reed canary grass are found in dense monocultures in wetlands along the Mad River. Wetlands C19 and C22 are infested with reed canary grass. Some wetlands in the Sandhill area are infested with common reed, including wetlands C2, C5, C6, and C24.

Control will be achieved primarily with repeated foliar applications of herbicides to eradicate plants and seeds. Again, aquatic herbicides Accord®, Glypro®, and Rodeo® may be used in wetlands. Any other pesticides not included in the IPMP or listed above must be approved by AFMC and/or AFCEC/COSC prior to use.

Herbicides were used experimentally in 1996 in an approximate 2.5-acre area to reduce the extent of smooth brome (*Bromus inermis*) and may be used for future control of invasive brome, fescue (*Festuca* sp.), and quack grass (*Elymus repens*) (TNC 2001a).

7.11.4 Noxious Weeds

Noxious weeds are "any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment" (AFI32-7064). No noxious weeds on the federal list (7 CFR 360.200) are present on the installation; however, 10 plant species listed as noxious by the Ohio Department of Agriculture are located within WPAFB (Table 7-7). Of particular concern are noxious weeds such as Canada thistle (*Cirsium arvense*) and wild parsnip (*Pastinaca sativa*) present in Huffman Prairie. Prescribed burning and/or mowing are techniques used to reduce the cover of woody species and control the encroachment of non-native and invasive species in Huffman Prairie.

7.11.4.1 Emerald Ash Borer

The emerald ash borer (EAB) is an invasive insect native to Asia. The small metallic green beetle was first discovered in 2002 in Michigan, and since then has spread to several other states. It was first detected in Ohio in 2003 and its presence at WPAFB was confirmed in July 2010, at which time the WPAFB EAB Management Plan was developed (WPAFB 2010a). The purpose of this plan is to prevent, eliminate, and/or reduce the spread of the EAB at WPAFB. WPAFB is attempting to mitigate the disruption to its urban trees (trees located along streets/medians, right of ways, parks, and buildings/housing areas) caused by the infestation of the EAB. Taking a proactive approach to this issue enables WPAFB to minimize the risk to public safety and property while managing its natural resources and addressing base needs in an efficient and effective manner.

The plan included the following actions to address the EAB infestation.

- Create an urban ash tree inventory.
- Establish methods to delay the spread of the EAB.
- Establish methods to minimize the aesthetic and environmental impacts of the EAB.
- Establish methods to minimize the financial impacts to WPAFB.
- Establish a tree protective plan and potential alternatives.
- Establish methods of educating the public about the threat, spread and response to the EAB.

As a result of the plan, approximately 100 ash trees in preferred locations are being treated with insecticide to keep them alive. The treatment is applied to each tree every two years. Based on the current application schedule, approximately 50 trees are treated each year.

Treatment will continue indefinitely. In 2018, 42 ash trees were treated for protection against the emerald ash borer. In 2019, another 50 urban ash trees were treated. No ash trees were treated in 2020 due to the COVID-19 pandemic.

Tree inventories will continue each year for the next 3 years. As a result of the current tree inventory, hundreds of dead and dying ash trees were identified for removal. Dead trees located in urban areas that posed a potential safety hazard were removed in 2014. Each year new tree inventories are completed and new dead or dying ash trees are added to the inventory. Any trees that are determined to be safety hazards will be removed in order of priority during 2016–2018. Coordination with resource agencies will occur prior to removal to ensure no adverse effects to federally listed species, specifically the Indiana bat and northern long-eared bat. Harvested ash trees may be sold as firewood.

Replacement trees are being planted in areas where ash was the dominant species. All new plantings will conform to the 10-20-30 tree species diversity rule and be selected from the WPAFB Approved Tree/Planting List. This rule specifies that new tree/shrub plantings should contain no more than 10% of the same species, no more than 20% from the same genus and no more than 30% from the same family.

7.12 Bird/Wildlife Aircraft Strike Hazard (BASH)

Applicability Statement

This section applies to USAF installations that maintain a BASH program to prevent and reduce wildlife-related hazards to aircraft operations. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

Adjacent to aircraft runways and taxiways on WPAFB are 750 acres of unimproved grounds,

19.8 acres of wetlands, and 55 acres of lakes, all of which may attract birds and wildlife. Waterfowl and raptors pose the most significant hazards to aircraft. Pigeons, doves, killdeer, flocking birds, deer, groundhogs, and coyotes are also potentially hazardous. Management of BASH is the responsibility of WPAFB 88 ABW Aviation Safety (88 ABW/SEF), in conjunction with Airfield Operations (88 OSS/O5AM) and Natural Resource Management personnel. Several organizations on WPAFB cooperate to prevent and manage hazards.

The Bird/Wildlife Hazard Working Group (BHWG) convenes semi-annually to discuss local bird and wildlife problems and control methods; initiate actions to reduce hazards; and implement changes in operations procedures. The BHWG includes representatives from Flight Safety, Airfield Operations Flight, the Environmental Branch (to include the NRM), all base flying organizations, the USDA Animal and Plant Health Inspection Service.

The WPAFB BASH Plan provides guidance for minimizing hazards of bird (resident and migratory) and wildlife strike hazards to aircraft on the base. The Plan outlines responsibilities for training, communicating hazards and strikes, managing hazardous birds and wildlife, and managing natural resources to avoid attracting birds/wildlife to the airfield. The latter two elements relate to natural resources management and are the focus of discussion herein.

The 88 ABW/SEF collects and disseminates trend data to BHWG and flying units. It leads annual surveys within and adjacent to the airfield fence. Surveys are conducted throughout the year to identify attractants to birds/wildlife, such as standing water, areas needing vegetation control, open dumpsters or other food sources, and perch sites. 88 ABW/SEF investigates nesting sites in Area A, identifies areas with excessive ground hog activity, and identifies birds and wildlife that may create hazards to flight operations.

The BASH Plan describes measures to control environmental factors potentially attracting hazardous birds/wildlife to the airfield. Unauthorized feeding of wildlife is prohibited in all areas of WPAFB.

The Wildlife Exclusion Zone (Figure 7-14) encompasses the boundaries of WPAFB Area A to include the Mad River Area and the North approach/departure corridor up to Sand Hill. The zone encompasses Patterson Field, where presence of birds is most hazardous. Large waterfowl (individuals weighing 4 pounds or greater) within the Wildlife Exclusion Zone require immediate dispersal and/or lethal control. The Wildlife Exclusion Zone includes all four lakes on WPAFB. Dispersal methods mainly include the use of pyrotechnics and/or loud sound-producing devices such as sirens and/or air-horns.

Figure 7-14. Wildlife Excusion Zone around Area A Airfield.

Large waterfowl (individuals weighing 4 pounds or greater) within the wildlife exclusion zone require immediate dispersal and/or lethal control. The wildlife exclusion zone includes all four lakes on WPAFB.

Grass within the airfield is maintained between 7 and 14 inches tall to discourage foraging flocks of birds and minimize rodent populations. Vegetation near ditches and drains is removed, and trees or shrubs that may attract birds are removed within the airfield boundaries. Shrubs that may attract browsing deer are removed from the area within 10 feet of the airfield boundary. Perching sites, such as trees, shrubs, and fence posts are removed from the airfield to the extent possible. When possible, areas on the airfield that contain standing water are drained or filled.

Carcasses are removed from the airfield to prevent attracting scavenger birds and mammals. Populations of rodents are controlled within the airfield to prevent attracting raptors and coyotes. The airfield fence is maintained to minimize the presence of deer, coyotes, and other mammals on the airfield.

For birds/wildlife that pose hazards to aircraft operations, the BASH Plan describes several non-lethal and lethal methods for removing the hazard. Typically, at least one non-lethal dispersal method is used before lethal methods are implemented. In 2018 a short-eared owl collided with a C-17. To discourage bird use of the area, the northern portion of the prairie was mowed in April 2018. The owls then left the area but returned in mid-December (Nolin 2018).

The 88th Operation Support Squadron Commander maintains overall responsibility for executing the bird/wildlife control program, including scheduling animal control teams for depredation activities in a manner sensitive to public relations. The 88th Airfield Operations Flight executes the bird/wildlife control program. The Tower watches for potentially hazardous bird/wildlife activities and relays sightings to Base Operations and arriving/departing aircraft. Airfield Management dispatches animal control teams that include qualified and properly trained personnel. The USDA APHIS assists the 88th ABW/SEF with surveys to identify potential hazards, recommendations for appropriate animal controls, training in use of pyrotechnics and firearms, depredation of birds/wildlife. Airfield Management must coordinate with 88 SFS and 88 ABW/CE before using firearms for bird/wildlife depredation outside the airfield fence.

The 88 CEG/CEIEA supports implementation of the BASH Plan. Responsibilities include those listed below.

- Participate in the BHWG.
- If requested by BHWG, NRM coordinate with the ODNR to obtain depredation permits for birds and deer.
- Monitor compliance with applicable laws and prevent violations of existing local ordinances, statues, or the ESA.
- Coordinate with Civil Engineering on improvements or modifications to airfield areas involving control of vegetation, surface water resources, and habitat for birds and wildlife.
- Maintain a process to dispose of bird and wildlife carcasses at a location on WPAFB. 88 CES/CEOIE maintains a dumpster at Facility 278 for disposing of carcasses. All carcasses must be double-bagged and sealed prior to placement in the dumpster.

As a member of the BHWG, the WPAFB Natural Resources Manager provides guidance regarding potential effects of proposed environmental management (e.g., removal of vegetation in ponds, filling wet areas) to threatened and endangered species, fisheries, wetlands, and other natural resources. In some instances, proposed methods to control bird/wildlife hazards may require permits from regulatory agencies (e.g., Clean Water Act Section 401/404 permit).

USDA conducted a 3-year study at WPAFB and 7 other installations regarding the use of switchgrass near airfields. Switchgrass requires less management and is thought to be less attractive to wildlife compared to standard turf grass, resulting in cost savings and reduction in hazard to aircraft. Switchgrass may also be cut and sold for biofuel, bedding, etc., potentially generating a revenue source. Multiple treatment and control plots are being monitored for birds and mammals using multiple methods. Implementation began in 2015 and concluded in 2018. A final summary and recommendations were provided in 2019mby the principal investigator.

When planning habitat restoration activities (e.g., wetland expansion or enhancement) the Natural Resources Manager considers whether proposed actions may increase potential hazards near the airfield. No habitat modifications will be conducted that are likely to increase the number of waterfowl in the no-waterfowl zone. The Natural Resources Manager will also manage the hunting program to maintain the deer population as levels that minimize the potential for interference with aircraft.

Animal control activities associated with BASH have potential to affect outdoor recreation at Huffman Prairie Flying Field. Huffman Prairie Flying Field is within the no waterfowl zone, where non-lethal and lethal control techniques may be required to ensure safe aircraft operations. If the use of firearms is required, Huffman Prairie Flying Field will be evacuated and/or closed to the public until control measures are complete. 88 ABW/CC is responsible for determining when Huffman Prairie Flying Field must be evacuated/closed. At a minimum, animal control teams will contact the 88 CEG/CEIEA, which will notify the Dayton Aviation Heritage National Historical Park when the Huffman Prairie Flying Field is closed/evacuated by order of the 88 ABW/CC.

7.13 Coastal Zone and Marine Resources Management

Applicability Statement

This section applies to USAF installations that are located along coasts and/or within coastal management zones. This section **IS NOT** applicable to this installation.

7.14 Cultural Resources Protection

Applicability Statement

This section applies to USAF installations that have cultural resources that may be impacted by natural resource management activities. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

Numerous prehistoric and historic-era cultural resources are present within the boundaries of WPAFB. As a result of archaeological and historic architecture surveys and investigations conducted over the past 20 years, 100 percent of potentially significant areas on WPAFB have been examined for cultural resources.

Field surveys conducted between 1990 and 2004 resulted in the identification of 17 prehistoric sites previously not inventoried within WPAFB. Two of these sites are prehistoric mounds that have been listed on the National Register of Historic Places (NRHP) since the 1970s. The Wright Brothers Memorial Mound Group (33-GR-30) is a series of prehistoric-era mounds located at the Wright Memorial in Area B. The Wright-Patterson Mound (33GR31) is in Area B. Of the remaining 15 sites, one is eligible for the NRHP, one is potentially eligible to be listed in the NRHP, and the remaining 13 sites are not eligible for inclusion on the NRHP (WPAFB 2011). Currently, there are no known sites on WPAFB that require ongoing American Indian consultation. Detailed description of the locations, methods, and findings of

archaeological surveys is provided in the WPAFB Integrated Cultural Resources Management Plan (WPAFB 2021).

In addition to archaeological investigations, an effort has been made to locate and document the modern archaeological footprint of the historic-era cultural landscape. An initial map and documentary study undertaken in 1990 identified 115 locations within WPAFB potentially containing archaeological evidence of the historic-era utility of these landforms. Further study of these locations during 1995 and 1996 indicated only 35 were in potentially undisturbed, accessible locations. Several locations comprised one large archaeological site, and field surveys resulted in identification of 17 historic-era archaeological sites, with one site eligible, one site potentially eligible, and 15 sites not eligible for the NRHP (WPAFB 2006). In 2005, 22 of the remaining sites were investigated. Twenty locations were destroyed or not found, and two were determined to be ineligible for the NRMP after further testing.

An historic building baseline inventory was completed for all extant structures dating to 1955. The base contains approximately 266 historic buildings, primarily dating to WWII or earlier. Almost all of these structures are part of the three historic districts (Brick Quarters, Fairfield Air Depot and Wright Field) that are spread across the base. WPAFB also completed an evaluation of the Cold War significance of its primary laboratory site facilities. A total of 26 extant buildings on WPAFB are potentially eligible for NRHP listing due to their contextual relationship to the Cold War utility of the base (WPAFB 2011).

In addition, WPAFB is the home of Huffman Prairie Flying Field (HPFF), site of the Wright brothers' 1904–1905 development of the world's first practical airplane. This site is a National Historic Landmark and is part of the Dayton Aviation Heritage National Historical Park (DAHNHP). The site is owned by the Air Force but interpreted by the National Park Service (NPS). The HPFF is the only historic landscape on WPAFB that is listed on the NRHP. Other potential historic landscapes on WPAFB are the Wright Memorial, Turtle Pond in the Brick Quarters Historic District, and the Wright Field Historic District.

7.14.1 Protection of Cultural Resources

Several Federal laws and regulations govern protection of cultural resources, including but not limited to the National Historic Preservation Act (NHPA) (1966), the Archaeological and Historic Preservation Act (1974), the American Indian Religious Freedom Act (1978), the Archaeological Resources Protection Act (1979), and the Native American Graves Protection and Repatriation Act (1990).

The WPAFB cultural resources program is managed by the Environmental Branch. AFMAN 32-7003 requires that an Integrated Cultural Resources Management Plan (ICRMP) be implemented at WPAFB. The ICRMP is updated annually and revised every 5 years. The base is required to maintain a minimum of one permanent staff member meeting the qualifications outlined in 36CFR61 in the Environmental Branch as the Cultural Resources Manager (CRM). The CRM is responsible for managing the cultural resources program at WPAFB and for implementing the ICRMP. The CRM maintains regular contact with the MAJCOM, maintains liaison with base organizations, and conducts all coordination with the State Historic Preservation Office (SHPO) and the Advisory Council on Historic Preservation (ACHP). The CRM is the primary contact with the NPS regarding management of the HPFF and the Wright Memorial.

Protection of cultural resources is required during implementation of all activities on base, including natural resources management. WPAFB must protect sites, structures, districts, or landscapes listed or eligible for listing on the NRHP. Potentially eligible sites that have not been fully evaluated must be protected until necessary investigations are complete. Ideally, all WPAFB undertakings should avoid the boundaries of NRHP-eligible archaeological sites, which are listed in Section 8.4 of the ICRMP. Generally, sites left in the ground are indirectly preserved and protected.

The implementing regulations (36 CFR 800) for Section 106 of the NHPA state that if an undertaking could change, in any way, the characteristics that qualify the property for inclusion in the NRHP, for better or worse, it is considered to have an "effect." There are two classes of activities that could be initiated on WPAFB that might impact historic contexts. One class is the routine maintenance of buildings that is done in-house by the user/tenant.

The second class consists of construction work and requested building maintenance initiated with a Base Civil Engineering Work Request (AF Form 332), which may include natural resources management activities. WPAFB must consider potential effects to cultural resources from direct or indirect disturbance, including fencing, landscaping, changes in soil erosion patterns, or increased visitation. Completed AF Forms 332 are reviewed by a Work Order Review Board composed of representatives from Civil Engineering, Environmental Management, Safety, and Bioenvironmental Engineering. The EIAP Technical Support attends these meetings and identifies the work requests that require further review by specialists within the Environmental Branch, including the CRM. The CRM receives a copy of work requests relevant to historic properties. The CRM determines whether the proposed project may affect cultural resources and, if warranted, coordinates with the SHPO. Additional details of the compliance procedures are included in the ICRMP (WPAFB 2021). As a National Historic Landmark, the HPFF is afforded the greatest level of protection possible. It is critical the Natural Resources Management Program coordinate with the CRM in the event of activities that may affect the HPFF, including prescribed burning of Huffman Prairie.

In the event of an inadvertent or unanticipated discovery of buried cultural objects or human remains, persons responsible for the activity that resulted in the discovery (construction contractor, permittee, etc.) stop all work in the area and simultaneously contact Security Forces and the CRM for consultation and implementation of the appropriate laws. Federal laws and AF regulations prohibit the unpermitted collection of artifacts; digging in or removal of artifacts from archaeological sites is a felony offense. The use of metal detectors on WPAFB is prohibited except for official uses, or otherwise specifically permitted by the Base Commander. Section 7,4 of the ICRMP provides a detailed list of steps to be taken if an unanticipated discovery of cultural resources occurs.

Noncompliance with the ICRMP or federal cultural resources laws may result in court injunctions and project delays. Unauthorized removal of artifacts from archaeological sites and willful neglect of cultural resources may result in civil or criminal lawsuits. Sanctions may be levied against WPAFB should the base fail to enforce federal cultural resources laws.

7.15 Public Outreach

Applicability Statement

This section applies to all USAF installations that maintain an INRMP. The installation is required to implement this element.

Program Overview/Current Management Practices

The 88 ABW Office of Public Affairs has primary responsibility for public outreach, including distribution of information about natural resources. WPAFB provides information on natural resources management on the base using a variety of media. WPAFB's public website: **http://www.wpafb.af.mil/units/cev/index.asp** contains links to endangered species, hunting and fishing, Huffman Prairie, and natural resources management information. Extensive information about hunting and fishing locations, permits, and stocking dates is provided. Public outreach is also accomplished with periodic articles in the *Skywrighter*, the WPAFB newspaper.

The Natural Resources Program has created a Facebook page as another avenue to make public/releasable information available to the base populace. It serves as a tool to keep interested parties up to date on recreational information and highlights some of the interesting natural resources related work happening on base.

In June 2017, the Natural Resources Program presented its first Pollinator Expo to raise awareness of the importance of pollinators and what is being done on base to support them. Additional expos were held in June 2018 and 2019. The expo was planned for June 2020 during pollinator week, however due to the pandemic this was cancelled in 2020 and 2021. Plans are currently in development for conducting the event in 2022.

The Natural Resources Program has developed a brochure to educate the public about threatened and endangered species on WPAFB. The brochure summarizes natural history of the Indiana bat, bald eagle, clubshell, eastern massasauga , and the blazing star stem borer moth, and the importance of conserving these species and their habitat on the base (Appendix E). The brochure is posted on the Environmental Branch sharepoint and is distributed by the Environmental Branch Office at base and community functions and to incoming members of the WPAFB community.

The Optimization and Planning Branch occasionally holds public meetings as part of the EIAP to inform the public of certain proposed activities on WPAFB. Public meetings are advertised in the Dayton Daily News.

In addition, quarterly Environmental Advisory Board meetings are held at the Fairborn Library, where Natural Resource issues are presented to the public from time to time.

7.16 Climate Change Vulnerabilities

Applicability Statement

This section applies to USAF installations that have identified climate change risks, vulnerabilities, and adaptation strategies using authoritative region-specific climate science, climate projections, and existing tools. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

Climate change is referred to by the national Academy of Sciences as any significant changein measures of climate (such as temperature, precipitation, or wind) lasting for an extendedperiod (decades or longer). Given the role of natural ecosystems in military training and testing, it is essential to ensure the continued function of ecosystems in the face of climate change to maintain military readiness.

WPAFB will utilize existing tools to assess the potential impacts of climate change to natural resources on the installation and will maintain adaptive management strategies to ensure thelong-term sustainability of resources. Due to the high variability in projected outcomes associated with climate change, it will be necessary to be prepared for a plausible range of future climates. Successful climate adaptation will be reliant upon the ability to adjust management strategies to meet conservation goals and objectives as we are faced with system transformations. Long term, such transformations may generate a need to manage forthe sustainment of ecological function, rather than historical assemblages of flora and fauna.

Current goals and action items in relation to managing for climate change include the management/eradication of invasive species as described in this INRMP. Future projects aimed at the control of invasive species will further aid in improving and maintaining the resiliency of the natural

resources at WPAFB. Expanding upon and improving existing habitats will also aid in reducing the impacts of climate change to ecosystems and ecological processes.

7.17 Geographic Information Systems (GIS)

Applicability Statement

This section applies to all USAF installations that maintain an INRMP, since all geospatial information must be maintained within the USAF GeoBase system. The installation is required to implement this element per AFI 32-10112.

Program Overview/Current Management Practices

The 88 CEG/CEIEA maintains an extensive database of geospatial information available to support natural resources management and land use planning. The database maintained by the 88 CEG/CEIEA is linked to the Civil Engineering Plans and Programs Office to ensure continuity between offices.

The Environmental Branch's GIS is operated on an Oracle platform and is manipulated using ESRIs ArcGIS Platform. Following recent migration of databases from the former Microstation format, geospatial data used by the 88 CEG/CEIEA is compliant with the current CADD/GIS Center's Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE). Geospatial data is projected in either the NAD 83 datum, Ohio South State Plane projection, with measurement units in feet or WGS 84 datum, UTM Zone 16, with measurements in meters.

The WPAFB GIS databases are updated to ensure current information is available to support project planning. High Resolution Aerial photography (3 inch) is flown for WPAFB every 3 years with the most current collected in Nov 2019 for the entire base.

Data included in the 88 CEG/CEIEA GIS system that is associated with natural resources management includes the following layers:

- WPAFB boundary
- Rivers, streams, other drainages
- Lakes and ponds
- Wetlands
- The Mad River 100-year floodplain
- Soils
- Vegetative cover types (forest, prairie)
- Land use categories
- Outdoor recreation areas, including hunting areas
- Wellhead protection zones
- NPDES outfalls and sampling areas
- Drinking Water Production Wells
- Installation Restoration Protection Sites and Monitoring Wells
- National Parks, Historic Districts, Facilities, and Landscapes
- Archaeological Sites
- Threatened & Endangered Species Potential Habitat

8.0 MANAGEMENT GOALS AND OBJECTIVES

The installation establishes long term, expansive goals and supporting objectives to manage and protect natural resources while supporting the military mission. Goals express a vision for a desired condition for the installation's natural resources and are the primary focal points for INRMP implementation. Objectives indicate a management initiative or strategy for specific long or medium range outcomes and are supported by projects. Projects are specific actions that can be accomplished within a single year. Also, in cases where off-installation land uses may jeopardize USAF missions, this section may list specific goals and objectives aimed at eliminating, reducing, or mitigating the effects of encroachment on military missions. These natural resources management goals for the future have been formulated by the preparers of the INRMP from an assessment of the natural resources, current condition of those resources, mission requirements, and management issues previously identified. Below are the integrated goals for the entire natural resources program.

The installation goals and objectives are displayed in the 'Installation Supplement' section below in a format that facilitates an integrated approach to natural resource management. By using this approach, measurable objectives can be used to assess the attainment of goals. Individual work tasks support INRMP objectives. The projects are key elements of the annual work plans and are programmed into the conservation budget, as applicable.

Installation Supplement—Management Goals and Objectives

GOAL 1 MANAGE NATURAL RESOURCES ON WPAFB IN ACCORDANCE WITH APPLICABLE FEDERAL AND STATE LAWS, AND AIR FORCE GUIDANCE, IN A MANNER THAT SUPPORTS THE WPAFB MISSION AND CONSERVES NATURAL HABITATS AND NATIVE SPECIES ON THE BASE.

Objective 1.1 Implement the WPAFB INRMP in accordance with AFMAN 32-7003.

Project 1.1.1 During the first quarter of each fiscal year (FY), review the INRMP and complete the annual checklist to document progress toward INRMP objectives. Communicate the year's progress and any changes in INRMP information or goals to the 88 ABW Commander, the USFWS Ohio Field Office, and the ODNR. Solicit feedback on the INRMP from the Natural Resources Working Group, the USFWS Ohio Field Office, and the ODNR. Complete updates to the INRMP as necessary and obtain signatures.

Objective 1.2 Maintain the Environmental Branch GIS database to provide accurate and current geospatial data that supports natural resources management and land use planning.

Project 1.2.1 During the second quarter of each year, review/update GIS information to ensure accuracy.

GOAL 2 PROTECT FEDERAL AND STATE LISTED AND CANDIDATE SPECIES AND THEIR HABITAT ON WPAFB.

Objective 2.1 Ensure base-wide awareness of the presence of listed species and the conservation measures in place to avoid impacts to listed species and their habitat on the base.

*The public website **http://www.wpafb.af.mil/units/cev1** has information/brochures available concerning threatened and endangered species and their habitats.*

Project 2.1.1 By the end of the second quarter each year, prepare and submit an article for the WPAFB Skywrighter about listed species on WPAFB, the importance of protecting and recovering listed species, the role of the AF and WPAFB in management and conservation, and sources of additional information.

Objective 2.2 Periodically monitor the presence of threatened and endangered species on WPAFB to improve the understanding of the species' presence and habitat use on base.

Project 2.2.1 During the third or fourth quarter every fourth year beginning in FY 2022 conduct base-wide mist net survey/radio telemetry study/emergence study at 12 sites to assess the presence of Indiana bats. Prior to conducting surveys, coordinate with the USFWS Ohio Field Office to gain concurrence on proposed survey methods. Summer surveys will be conducted between 1 June and 15 August and according to agency-approved protocols.

Project 2.2.2 During the second quarter of every fourth year beginning in FY 2022 conduct herpetological surveys for federal and state-listed species to document status on WPAFB. Target species include eastern massasauga and smooth green snake.

Project 2.2.3 Breeding bird surveys will be conducted every four years beginning in FY 2023 to evaluate presence of grassland nesting birds, density of grassland bird territories, and document breeding status of state-listed species including king rail and upland sandpiper.

Project 2.2.4 Vegetation, moth and butterfly surveys will be conducted every 4 years beginning in FY 2024 to evaluate presence of prairie endemic plant and animal species, particularly the blazing star stem borer and other pollinators.

Project 2.2.5 Participate, as needed in ODNR's state-wide bat acoustic surveys along driving transects.

Objective 2.3 Enhance habitat for Indiana bat on WPAFB.

Project 2.3.1 Develop invasive species management methods specific to honeysuckle control/eradication in forested areas along the Mad River corridor in order to enhance forested areas to improve habitat suitable for summer roosting Indiana Bats. Describe specific methods in annual update to INRMP.

Project 2.3.2 During the third and fourth quarters of each year, conduct invasive species control/eradication in forested and wetland areas, consistent with INRMP invasive species management methods, particularly along the Mad River corridor, to encourage natural forest regeneration and improve habitat for Indiana bats.

Project 2.3.3 For areas where invasive species control/eradication has taken place, the following year a suitable number of Ohio native trees and shrubs that are included on the USFWS' "Suggested Native Tree Species for

Indiana Bat Habitat" will be planted in order to discourage regeneration of invasive species as well as enhance the habitat.

Project 2.3.4 As part of the annual invasive species removal projects, ensure that areas treated the previous year are re-visited to gauge effectiveness of prior year treatment. Re-treat with herbicide or mowing as necessary.

Objective 2.4 Continue managing Huffman Prairie and selected old fields to enhance habitat for nesting grassland birds, prairie Lepidoptera including blazing star stem borer and other pollinators, eastern massasauga, and smooth green snake. Develop in-house resources to enable WPAFB to perform annual prescribed burns on Huffman Prairie without the need to rely on outside agencies.

Project 2.4.1 At the beginning of the second quarter of each year, review plans and schedules for prescribed burning and/or mowing on Huffman Prairie and mowing in old fields. Ensure the schedule and methods are planned to minimize effects to the eastern massasauga, smooth green snake, blazing star stem borer and state-listed nesting birds.

Project 2.4.2 Evaluate opportunities for additional prescribed burning in areas identified in the Wildland Fire Management Plan to benefit listed species such as eastern massasauga, smooth green snake, and blazing star borer.

Project 2.4.3 WPAFB personnel will obtain and/or renew the necessary certifications and equipment to become certified in performing prescribed burns of Huffman Prairie. This will allow the prescribed burns to be performed on a more regular basis and not rely solely on outside agencies for execution.

Project 2.4.4 NR Technician to attend ODNR Division of Forestry training (S190/S130/L180) to meet the requirements to participate in prescribed burns.

Project 2.4.5 Procure required personal protective equipment such as Nomex clothing, work gloves, hard hats, and fire line packs needed to perform prescribed burns.

Project 2.4.6 Procure required field equipment to perform prescribed burns.

Project 2.4.7 Implement controlled burns on at least ¼, but not more than ½ of Huffman prairie between 1 November and 15 March each year. Burns should be avoided when soil temperatures at a four-inch depth are above 9 °C (48.2 °F). If, due to weather or other unpredictable conditions, controlled burns cannot be implemented, then the area will be mowed instead.

Project 2.4.8 During spring of each year, apply herbicide to Huffman Prairie areas just burned/mowed the prior fall/winter.

Project 2.4.9 During spring of each year, disk areas of Huffman Prairie burned/mowed/herbicide treated, and drill native warm-season and grass and native forb seed. Plant patches of liatris near existing liatris plants.

Project 2.4.10 In late summer/early fall, collect seed heads of native forbs throughout the prairie, including liatris.

Project 2.4.11 In fall, spot-treat woody plants and other non-native species within Huffman Prairie with herbicide.

Project 2.4.12 Mow grass buffer area along the north and south sides of Huffman Prairie at least once per year.

Project 2.4.13 Conduct controlled burns in wooded areas where invasive species management has previously been conducted.

Project 2.4.14 Each year, conduct informal habitat and species assessments in collaboration with other agencies involved in Huffman Prairie management (e.g., Five Rivers Metropark) to document effectiveness of past management activities and to inform next year's management plan.

Project 2.4.15 During each prairie vegetation survey, identify liatris plants that may provide habitat for the blazing star borer. Utilize a hand-held GPS unit to map concentrations of the plant. Create a method to ensure that to the extent practical, mowing in areas containing liatris is avoided during the summer and fall in which the plant is observed.

Project 2.4.16 Coordinate with the local USDA Natural Resources Conservation Service (NRCS) for available equipment offered for loan to complete prairie management activities.

Project 2.4.17 Coordinate with Five Rivers Metro Parks on prairie management activities.

Project 2.4.18 Use the prairie as a tool for educating the general public about the natural history of Huffman Prairie.

Objective 2.5 Enhance habitat for the monarch butterfly (Danaus plexippus) and other pollinators.

Project 2.5.1 Where compatible with habitat management activities, incorporate milkweed species (Asclepias spp.) and other nectaring plants into planting plans.

Objective 2.6 Protect natural habitat and avoid impacts to listed species during grounds maintenance activities on WPAFB.

Project 2.6.1 During the third quarter of each year, conduct an annual review to ensure implementation of the IPMP in terms of minimizing the amount of active ingredient (AI) applied during grounds maintenance activities

Project 2.6.2 Each year at the beginning of the third quarter, prepare and distribute an informational hand-out to the grounds maintenance, landscaping, and certified pesticide applicators informing them of the importance of natural habitat and endangered species on WPAFB. The hand-out will encourage the planting of native species as well as highlight the species of exotic invasive plants found on base.

Project 2.6.3 Dead trees located in urban areas that pose a potential safety hazard will be inventoried and added to a priority list for removal. Each year WPAFB will coordinate with USFWS and ODNR prior to removal to ensure no adverse effects to Indiana bats result from tree removal.

Project 2.6.4 Remove priority dead trees between October 1 and March 31 each year between FY 2022–2026.

Project 2.6.5 Annually in spring plant replacement trees after removal of dead trees in priority areas.

Project 2.6.6 Annually treat 50 urban ash trees with insecticide targeting emerald ash borer.

Project 2.6.7 Ensure annual review of Base Facility Standard (BFS) is performed and includes wording to ensure that all measures are taken to avoid planting any invasive species during construction site renovation/restoration. All new construction projects shall follow the guidance of the BFS.

GOAL 3 AS CONSISTENT WITH THE MISSION, PROTECT AND IMPROVE WATER RESOURCES AND WETLAND HABITATS ON WPAFB.

Objective 3.1 Prevent pesticide pollution in surface waters.

Project 3.1.1 Ensure storage and application of pesticides is compliant with site-specific spill prevention plans and the WPAFB Integrated Pest Management Plan (IPMP).

Project 3.1.2 Minimize pesticide applications in and near wetlands, lakes, and streams. Where pesticides are used to control invasive plants or otherwise restore aquatic habitats, ensure that the minimum effective concentration and quantity is used.

Objective 3.2 Prevent soil erosion into rivers and streams.

Project 3.2.1 FY 2022, implement monitoring and management of invasive species within riparian coridoors.

Project 3.2.2 Conduct semi-annual erosion monitoring of rivers and streams on the installation.

Project 3.2.3 Plant Ohio native vegetation species in riparian areas where invasive specie management action have taken place the previous year.

Objective 3.3 Implement wetland and stream management methods.

Project 3.3.1 Wetland mapping and functional assessments will be completed for approximately 2,000 acres of the base each year so that the entire base would be updated within a 5-year period. Results of the mapping and functional assessments are compared among years to assess trends of the habitat quality and health of wetlands on WPAFB.

Project 3.3.2 By the fourth quarter each year continue planning activities for enhancement/restoration of base wetlands to increase the value of existing wetlands.

Project 3.3.3 Annually, WPAFB will implement projects to control invasive species, in particular Amur honeysuckle, common reed, and reed canary grass, in approximately 25 acres of wetlands in Table 7-1 and in Huffman Prairie via herbicide treatment and seeding/planting where appropriate.

Project 3.3.4 Annually, implement projects to increase woody plant diversity in floodplain and wetland forests on WPAFB, including adjacent to the Mad River and in and surrounding Wetland C-18 at the Warfighter Training Center.

Project 3.3.5 In February 2022, reintroduce wood frogs to Wetland C-18 via translocation of egg masses.

Objective 3.4 Maintain compliance with Department of the Army 404 and Ohio EPA 401 permits, including stream and wetland mitigation activities.

Project 3.4.1 Monitor stream and/or wetland mitigation as required by any future Department of the Army 404 and Ohio EPA 401 permits.

Project 3.4.2 Conduct annual maintenance (e.g., invasive species treatment) at existing mitigation sites (Wetland B1 and B3, Stream 2, 4, 5, and 6), to ensure continued achievement of performance standards.

Objective 3.5 Monitor current PFAS water contamination issue in regards to fish and mammals being pursued by base recreationalists.

Project 3.5.1 Conduct fish tissue sampling in Bass Lake during the 2nd or 3rd quaerter of FY22.

Project 3.5.2 Continue monitoring and evaluating PFAS levels in fish and mammals in areas of the base with known surface water contamination, as determined by the RI/HA being conducted by AFCEC/CZO.

GOAL 4 FULLY SUPPORT THE WPAFB BASH (BIRD AIRCRAFT STRIKE HAZARD) PROGRAM.

Objective 4.1 Ensure the WPAFB BASH Plan complies with laws and regulations associated with natural resources by participating in Bird Hazard Working Group (BHWG) and/or Air Operations Board (AOB) Meetings.

Project 4.1.1 Inform the BHWG if proposed activities may require permits or coordination with state or federal natural resources agencies. Lead the agency or permitting coordination when necessary.

Project 4.1.2 When planning habitat enhancement or restoration activities (e.g., wetland restoration), analyze the potential for increasing BASH near airfields

Project 4.1.3 The WPAFB Natural Resources Manager will contact the ODNR Division of Wildlife in March each year to discuss results of the bald eagle survey on the Mad River and determine if bald eagle presence near WPAFB is increasing.

Project 4.1.4 Annually, the Natural Resources Manager will prepare a brief educational discussion for the Bird Hazard Working Group about bald eagle identification and reporting of sightings on and near the airfield.

Project 4.1.5 88 ABW/SEF collects and disseminates trend data to BHWG and flying units. It leads annual surveys within and adjacent to the airfield fence. Surveys are conducted throughout the year to identify attractants to birds/wildlife, such as standing water, areas needing vegetation control, open dumpsters or other food sources, and perch sites. 88 ABW/SEF investigates nesting sites in Area A, identifies areas with excessive ground hog activity, and identifies birds and wildlife that may create hazards to flight operations.

Project 4.1.6 USDA WS develop Whitetail Deer Management Plan for WPAFB in order to manage population in the event future PFOS/PFOA remedial investigations reveal recreational sport hunting no longer viable management tool.

GOAL 5 PROMOTE OUTDOOR RECREATIONAL OPPORTUNITIES ON WPAFB.

Objective 5.1 Continue providing sport fishing and hunting opportunities on areas previously established/identified as approved for hunting and fishing on WPAFB.

Project 5.1.1 Pending PFAS investigations and sampling of fish tissue and lake water, during the first and second quarters each year, stock Bass and Gravel Lakes with rainbow trout. Number of fish purchased for stocking will depend on determined stocking recommendations, as potentially limited by the number of permits old during the previous year.

Project 5.1.2 Pending PFAS investigations and sampling of fish tissue and lake water, during the third quarter each year stock channel catfish in Bass and Lower Twin lakes. Number of fish purchased for stocking will depend on determined stocking recommendations, as potentially limited by the number of permits sold during the previous year.

Project 5.1.3 In FY 2023 investigate vegetation control techniques in Lower Twin Lake.

Objective 5.2 Maintain the population of whitetail deer at a population that is acceptable for safety concerns, carrying capacity of the land and to allow maximum utilization by base hunters.

Project 5.2.1 Continue providing archery deer hunting opportunities on previously approved areas.

Project 5.2.2 Annually in the first quarter, conduct controlled archery deer hunting in the woodlots surrounding Twin Base Golf Course in conjunction with state seasons, as needed.

Project 5.2.3 During the fourth quarter of each year, update the hunting area map, as areas open for hunting can/will change due to changing mission requirements.

Project 5.2.4 During FY 2022, 2023, 2024, 2025, and 2026, work with 88 SFS to facilitate better hunter access and entry points to the area between the western edge of the base and the Mad River.

Objective 5.3 Enhance the natural areas located within the Licensed Shooting Preserve to eliminate/reduce the number of invasive species and to restore the area so that surviving pheasants and other upland game find the habitat more suitable for habitation.

Project 5.3.1 During third quarter FY 2022, 2023, 2024, 2025, and 2026, partner with local conservation organizations, such as USFWS, Metroparks, Greene County USDA Natural Resources Conservation Service (NRCS), Pheasants Forever or Quail Unlimited to evaluate, plan and implement restoration of the open-field habitat areas to native prairie conditions on 50 acres of the Licensed Shooting Preserve.

Project 5.3.2 In FY 2022, 2023, 2024, 2025, and 2026, partner with the Ohio Department of Natural Resources (ODNR) Division of Wildlife (DOW) to determine the possibility of participating in the Bobwhite Quail Trap and Release Program as a release site once the restoration work has been completed in the open-field areas of the licensed shooting preserve.

Objective 5.4 Provide equal access to hunting and fishing areas on WPAFB for disabled persons, provided topographic, vegetative, and water resources allow equal access without substantial modification to the natural environment.

Project 5.4.1 By the fourth quarter of each year, look into ways to fund handicapped hunting equipment opportunities to be available for disabled hunters.

9.0 INRMP IMPLEMENTATION, UPDATE, AND REVISION PROCESS

9.1 Natural Resources Management Staffing and Implementation

9.1.1 Implementation

Per AFMAN32-7003, Chapter 3, INRMP implementation will occur after review and coordination with internal stakeholders, local representatives of the USFWS, state fish and wildlife agency, and NOAA Fisheries where applicable, making the document Sikes Act compliant. At a minimum the NR's manager will conduct an annual review summary consisting of (1) A summary of the specific INRMP accomplishments since the last review; (2) an annual work plan for implementing the INRMP that includes the current year and at least two future fiscal years; (3) a statement that sufficient numbers of qualified NR's management personnel and resources are available; and (4) a summary of the required INRMP updates that will be incorporated into the INRMP to keep the INRMP current in operation and effect for the management of installation natural resources.

9.1.2 Natural Resources Management Staffing

The 88 CEG/CEIEA employs a single full-time professional Natural Resources Manager and two full-time Environmental Technicians. A single full-time Entomology Supervisor and five trained certified pesticide applicators implement the IPMP. The WPAFB Natural Resources Management Program has been successfully implemented at that staffing level, and WPAFB expects to implement the program, as described in this INRMP, using the same staff.

Beginning in late FY12, USFWS began performing NR's management type work at WPAFB through a DoD level MOA. This arrangement is scheduled to continue until no longer agreeable between the parties. Support from contractors will be sought on a project-specific basis as a last resort, if USFWS or non-government organizations are unable to complete the work.

9.2 Monitoring INRMP Implementation

The WPAFB INRMP will be considered fully implemented when the installation

- receives funds for high-priority projects;
- executes high priority projects in accordance with the timeframes designated in the INRMP;
- ensures that sufficiently trained professional natural resources management personnel are available for implementing the INMRP; and
- annually reviews and updates the INRMP, documenting accomplishments undertaken each year and coordinating with base organizations and public agencies as needed.

To monitor INRMP implementation and progress toward goals, the base Natural Resources Manager will complete an annual review. The annual review assesses if projects in the previous year's work plan were accomplished, and if not, moves them into future years' work plans. Additionally, the annual review checks relative order and workload within each year's work plan for appropriateness, creates the next work plan and reviews the management methods within the INRMP to determine if updates are needed or if any factual info has changed. The following steps will be completed annually.

1) During the first quarter of each year, review the INRMP document and complete the annual checklist found in Appendix F to document progress toward INRMP objectives.

2) Communicate the year's progress to the WPAFB Natural Resources Working Group, the USFWS Ohio Field Office, and the ODNR, and request their recommendations on changes to the plan.

3) Complete the annual review checklist found in Appendix F to document agency coordination and changes to the military mission or regulatory requirements that require an interim update of the INRMP.

4) Provide a brief report of the annual review to the Wing Commander or designated alternate, who will sign the updated INRMP as valid and current.

The INRMP is a working document in which adaptive management principles are used to ensure goals, objectives, and projects are realistic and effective. INRMP goals, objectives, and projects may be adjusted based upon changes to the military mission, monitoring or survey results, new data, or regulatory changes. Based upon the annual review of INRMP projects, the base Natural Resources Manager may recommend modifications to the INRMP. If modifications are limited to changes in projects, an interim update of the INRMP is not necessary. However, if significant changes are made to goals or objectives, the INRMP document must be updated in coordination with the USFWS Ohio Field Office and ODNR.

9.3 Annual INRMP Review and Update Requirements

In accordance with DoDI 4715.03 and AFMAN 32-7003, the INRMP must be reviewed annually to ensure that mission goals are achieved, verify that projects were implemented, and necessary new management requirements are established. This INRMP review process involves coordination between the installation natural resources personnel and external agencies. If the installation mission or any of its natural resources management issues change significantly after the original INRMP is developed, a major revision to the INRMP is required. The need to accomplish a major revision is normally determined during the annual review with USFWS and the appropriate state natural resources agency. The NRM/POC documents the findings of the annual review in an Annual INRMP Review Summary and obtains signatures from the coordinating agencies on those findings. By signing the Annual INRMP Review Summary, the collaborating agency representatives assert concurrence with the findings. If any agency declines to participate in an on-site annual review, the NRM submits the INRMP for review along with the Annual INRMP Review Summary document to the agency via official correspondence and request return correspondence with comments/concurrence.

To accomplish the annual review, the USFWS, the state, and the NRM/Section conduct an Annual INRMP Review Meeting, which takes place in person with representatives for each agency. Individuals may telephone or video call if they cannot attend in person. During this meeting, the NRM/Section updates the external stakeholders/parties with the end of the year execution report and coordinates future work plans and any necessary changes to management methods, etc. All parties review the INRMP and begin preliminary collaborative work on updating the INRMP (new policies, procedures, impacts, mitigations, etc.) as applicable.

At a minimum, the WPAFB Natural Resources Manager and the 88 ABW Commander designee will assess whether changes have occurred in the military mission, condition of natural resources, environmental compliance regulations, goals and objectives, or other factors that significantly affect implementation of the INRMP. The Natural Resources Manager will coordinate annually with the USFWS Ohio Field Office, and the ODNR regarding the status of INRMP projects, and the need for revisions to the document.

The annual review summary will consist of (1) a summary of the specific INRMP accomplishments since the last review; (2) an annual work plan for implementing the INRMP that includes the current year and at

least two future fiscal years; (3) a statement that sufficient numbers of qualified NR's management personnel and resources are available; and (4) a summary of the required INRMP updates that will be incorporated into the INRMP to keep the INRMP current in operation and effect for the management of installation natural resources.

An INRMP update consists of minor edits that provide current information or adjusts implementation timelines that would not result in changes to management goals and objectives that are substantively different than those previously agreed to by the cooperating agencies and would not result in environmental consequences different from those in the existing INRMP. Minor update requirements are identified during the annual INRMP review and coordination. An INRMP update documents minor changes agreed to by the partners on how the INRMP will be implemented and does not represent a change in the scope of the INRMP. Mutual agreement by cooperating agencies that an updated INRMP remains current as to operation and effect with respect to the Sikes Act is documented by signatures to the Annual INRMP Review Summary document. An INRMP update does not require public review and comment on the decision to continue implementing the INRMP as updated. Annual updates will be coordinated with ODNR and the USFWS Ohio Ecological Services Field Office.

An INRMP must be revised if changes in the installation mission or land use that would alter the bio geophysical environment such that significant edits need to be made to ensure that the INRMP reflects the current natural resources management requirements and appropriate program goals and objectives. Revise an INRMP if a change in land use or condition would result in environmental impacts not anticipated by the parties to the INRMP when the INRMP was last reviewed as to operation and effect. The need for an INRMP revision is determined during the annual INRMP review. Provide an opportunity for the public to review and comment on a draft INRMP revision. For new and revised INRMPs, mutual agreement by a cooperating agency is documented by the signature of an authorized representative from each agency (ODNR and USFWS) on the signature page for the INRMP, or by written correspondence.

10.0 ANNUAL WORK PLANS

The INRMP Annual Work Plans are included in this section. The work plan projects are listed by fiscal year, including the current year and four succeeding years. For each project and activity, a specific timeframe for implementation is provided (as applicable), as well as the appropriate funding source and priority for implementation. The work plans provide all the necessary information for building a budget within the USAF framework. Priorities are defined as follows:

- High: The INRMP signatories assert that if the project is not funded the INRMP is not being implemented and the USAF is non-compliant with the Sikes Act; or that it is specifically tied to an INRMP goal and objective and is part of a "Benefit of the Species" determination necessary for Endangered Species Act (ESA) Sec 4(a)(3)(B)(i) critical habitat exemption.
- Medium: Project supports a specific INRMP goal and objective and is deemed by INRMP signatories to be important for preventing non-compliance with a specific requirement within a natural resources law or by EO 13112, *Exotic and Invasive Species*. However, the INRMP signatories would not contend that the INRMP is not being implemented if not accomplished within the programmed year due to other priorities.
- Low: Project supports a specific INRMP goal and objective, enhances conservation resources or the integrity of the installation mission, and/or supports long-term compliance with specific requirements within natural resources law; but is not directly tied to specific compliance within the proposed year of execution.

Annual Work Plans

Project Number	Description	OPR	Funding Source	Priority Level	FY
1.1.1	During the first quarter review the INRMP and complete the annual checklist to document progress toward INRMP objectives. Communicate the year's progress and any changes in INRMP information or goals to the 88 ABW Commander, the USFWS Ohio Field Office, and the ODNR. Solicit feedback on the INRMP from the Natural Resources Working Group, the USFWS Ohio Field Office, and the ODNR. Complete updates to the INRMP as necessary.	CEI, IST	In-house	High	22, 23, 24, 25, 26
1.2.1	During the second quarter, review/update GIS information to ensure accuracy.	CEI, IST	In-house	Low	22, 23, 24, 25, 26
2.1.1	By the end of the second quarter, prepare and submit an article for the WPAFB *Skywrighter* about listed species on WPAFB, the importance of protecting and recovering listed species, the role of the AF and WPAFB in management and conservation,and sources of additional information.	CEI, IST	In-house	Low	22, 23, 24, 25, 26

Project Number	Description	OPR	Funding Source	Priority Level	FY
2.2.1	Conduct base-wide mist net survey/radio telemetry study/emergence study at 12 sites to assess the presence of Indiana bats and northern long-eared bats. Prior to conducting surveys, coordinate with the USFWS Ohio Field Office to gainconcurrence on proposed survey methods. Summer surveys will be conducted between 1June and 15 August and according to agency-approved protocols.	CEI, IST	ZHTVOS019C1	Medium	22
2.2.2	Conduct herpetological surveys for federaland state-listed species to document status on WPAFB. Target species include eastern massasauga rattlesnake and smooth green snake.	CEI, IST	ZHTVOS019C2 ZHTVOS019C6	Medium	22, 26
2.2.4	Breeding bird surveys will be conducted to evaluate presence of grassland nesting birds, densityof grassland bird territories, and document breedingstatus of state-listed species including king rail and upland sandpiper.	CEI, IST	ZHTVOS019C3	Medium	23
2.2.5	Vegetation, moth and butterfly surveys willbe conducted every 4 years beginning in FY 2016 to evaluate presence of prairie endemic plant and animal species, particularly the blazing star stem borer.	CEI, IST	ZHTVOS0192C4	Medium	24
2.2.5	Vegetation monitoring will be conducted to evaluate the effectiveness of invasive plant removalin various areas on WPAFB and provide recommendations on future management actions.	CEI, IST	ZHTVOS0192C5	Medium	25
2.2.6	Annually participate in ODNR's state-widebat acoustic surveys along driving transects.	CEI, IST	In-house	Medium	22, 23, 24, 25
2.3.2	During the third and fourth quarters, conduct invasive species management on 100acres of forested and wetland areas along the Mad River corridor.	CEI, IST	ZHTVOS0184C3, ZHTVOS0184C4, ZHTVOS0184C0	High	23, 24, 25
2.3.3	Plant Ohio native trees included on the USFWS' "Suggested Native Tree Species for Indiana Bat Habitat" to discourage regeneration of invasive species in 100 acres of riparian habitat along the Mad River at a rate of 10 containerized trees per acre.	CEI, IST	ZHTVOS0193C2, ZHTVOS0193C3, ZHTVOS0193C4, ZHTVOS0193C5 ZHTVOS0193C6	High	22, 23, 24, 25, 26
2.3.4	Re-treat with herbicide or mowing as necessary the 100 acres previously treated for invasive species that received mechanical treatment during 2020–2022.	CEI, IST	ZHTVOS0184C2, ZHTVOS0184C3, ZHTVOS0184C4, ZHTVOS0184C5 ZHTVOS0184C6	High	22, 23, 24, 25, 26

Project Number	Description	OPR	Funding Source	Priority Level	FY
2.4.1	At the beginning of the second quarter, review plans and schedules for prescribed burning and/or mowing on Huffman Prairie and mowing inold fields.	CEI, IST	In-house	Medium	22, 24, 25, 26
2.4.2	Evaluate opportunities for additional prescribed burning in areas to benefit listed species such as eastern massasauga rattlesnake, smooth green snake, and blazing star stem borer.	CEI, IST	In-house	Medium	22, 23, 24, 25, 26
2.4.3	WPAFB personnel will obtain and/or renew necessary certifications and equipment to become certified in performing prescribed burns ofHuffman Prairie. This will allow the prescribed burns to be performed on a more regular basis and not rely solely on outside agencies for execution.	CEI, IST	In-house	Medium	22, 23, 24, 25, 26
2.4.4	NR Technician to attend ODNR Division of Forestry training (S190/S130/L180) to meet the requirements to participate in prescribed burns.	CEI, IST	In-house	Low	22, 23, 24, 25, 26
2.4.5	Procure required personal protective equipment such as Nomex clothing, work gloves,hard hats, and fireline packs, needed to performprescribed burns.	CEI, IST	ZHTVOS0212C2, ZHTVOS0212C3, ZHTVOS0212C4, ZHTVOS0212C5 ZHTVOS0212C6	Medium	22, 23, 24, 25, 26
2.4.6	Procure required field equipment to perform prescribed burns.	CEI, IST	ZHTVOS0211C2, ZHTVOS0211C3, ZHTVOS0211C4, ZHTVOS0211C5 ZHTVOS0211C6	Medium	22, 23, 24, 25, 26
2.4.7	Implement controlled burns on at least ¼, but not more than ½ of Huffman prairie between November 1 and March 15 each year. Burns should be avoided when soil temperatures at a four-inch depth are above 9 °C (48.2 °F). If, due to weather or other unpredictable conditions, controlled burns cannot be implemented, then the area will be mowed instead.	CEI, IST	In-house	Low	22, 23, 24, 25, 26
2.4.8	During spring of each year, apply herbicide to invasive species at Huffman Prairies areas just burned/mowed the prior fall/winter.	CEI, IST	ZHTVOS0163C2, ZHTVOS0163C3, ZHTVOS0163C4, ZHTVOS0163C5 ZHTVOS0163C6	Medium	22, 23, 24, 25, 26

Project Number	Description	OPR	Funding Source	Priority Level	FY
2.4.9	During spring of each year, disk areas of Huffman Prairie burned/mowed/herbicided, and drill native warm-season and cool-season grass and native forb seed. Plant patches of liatris near existing liatris plants.	CEI, IST	In house	Medium	22, 23, 24, 25, 26
2.4.10	In late summer/early fall, collect seedheads of native forbs throughout the prairie, including liatris.	CEI, IST	ZHTVOS0163C2, ZHTVOS0163C3, ZHTVOS0163C4, ZHTVOS0163C5 ZHTVOS0163C6	Medium	22, 23, 24, 25, 26
2.4.11	In fall, spot-treat woody plants and othernon-native species within Huffman Prairie with herbicide.	CEI, IST	ZHTVOS0163C2, ZHTVOS0163C3, ZHTVOS0163C4, ZHTVOS0163C5 ZHTVOS0163C6	Medium	22, 23, 24, 25, 26
2.4.12	Mow grass buffer area along the north and south sides of Huffman Prairie at least once per year.	CEI, IST	In house	Medium	22, 23, 24, 25, 26
2.4.14	Conduct informal habitat and species assessments in collaboration with other agenciesinvolved in Huffman Prairie management to document effectiveness of past management activities and to inform next year's management plan.	CEI, IST	ZHTVOS0163C2, ZHTVOS0163C3, ZHTVOS0163C4, ZHTVOS0163C5 ZHTVOS0163C6	Medium	22, 23, 24, 25, 26
2.4.15	During each prairie vegetation survey, identify liatris plants that may provide habitat for the blazing star stem borer. Utilize a hand-held GPS unit to map concentrations of the plant. To the extent practical, avoid mowing areas containing liatris during the summer and fall in which the plant is observed.	CEI, IST	ZHTVOS0163C2, ZHTVOS0163C3, ZHTVOS0163C4, ZHTVOS0163C5 ZHTVOS0163C6	Medium	22, 23, 24, 25, 26
2.4.16	Coordinate with the local USDA Natural Resources Conservation Service (NRCS) for available equipment offered for loan to complete prairie management activities.	CEI, IST	In-house	Low	22, 23, 24, 25, 26
2.4.17	Coordinate with Five Rivers Metro Parks on prairie management activities.	CEI, IST	In-house	Medium	22, 23, 24, 25, 26
2.4.18	Use the prairie as a tool for educating the general public about the natural history of Huffman Prairie.	CEI, IST	In-house	Low	22, 23, 24, 25, 26
2.5.1	Where compatible with habitat management activities, incorporate milkweed species (*Asclepias spp.*) and nectaring plants into planting plans.	CEI, IST	In-house	Low	22, 23, 24, 25, 26

Project Number	Description	OPR	Funding Source	Priority Level	FY
2.6.1	Conduct annual review during third quarter of each year to ensure implementation of the IPMP regarding minimizing the amount of active ingredient(AI) applied during grounds maintenance activities.	CEI, IST	In-house	Medium	22, 23, 24, 25, 26
2.6.2	At the beginning of the third quarter, prepare and distribute an informational hand-out to the grounds maintenance, landscaping, and certifiedpesticide applicators informing them of the importance of natural habitat and endangered species on WPAFB.	CEI, IST	In-house	Low	22, 23, 24, 25, 26
2.6.3	Inventory dead trees located in urban areasthat pose a potential safety hazard and add to a priority list for removal. If potential bat roost tree(s), coordinate with USFWS prior to removal to ensure no adverse effects to Indiana bats or northern long-eared bats result from tree removal.	CEI, IST	In-house	High	22, 23, 24, 25, 26
2.6.4	Remove priority dead trees betweenOctober 1 and March 31.	CEI, IST	In-house	Medium	22, 23, 24, 25, 26
2.6.5	Annually in spring plant replacement treesafter removal of dead trees in priority areas.	CEI, IST	In-house	Medium	22, 23, 24, 25, 26
2.6.6	Annually treat 50 urban ash trees with insecticidetargeting emerald ash borer.	CEI, IST	In-house	Medium	22, 23, 24, 25, 26
2.6.7	Ensure review of Base Facility Standard (BFS) is performed and includes wording to ensure that all measures are taken to avoid planting any invasive species during construction site renovation/restoration. All new construction projects shall follow the guidance of the BFS.	CEI	In-house	Low	22, 23, 24, 25, 26
3.1.1	Ensure storage and application of pesticidesis compliant with site-specific spill prevention plansand the IPMP.	CEI	In-house	Medium	22, 23, 24, 25, 26
3.1.2	Minimize pesticide applications in and near wetlands, lakes, and streams, except where pesticides are used to control invasive plants or otherwise restore those habitats.	CEI	In-house	Medium	22, 23, 24, 25, 26
3.2.1 3.2.2 3.2.3	Implement monitoring and management of invasive species within riparian coridoors. Conduct semi-annual erosion monitoring of rivers and streams on the installation. Plant Ohio native vegetation species in riparian areas where invasive specie management action have taken place the previous year.		ZHTVOS0213C2, ZHTVOS0213C3, ZHTVOS0213C4 ZHTVOS0213C5 ZHTVOS0213C6		22, 23, 24, 25, 26

Project Number	Description	OPR	Funding Source	Priority Level	FY
3.3.3	Treat bush honeysuckle in and adjacent to Wetland C-18 at the Warfighter Training Center.		ZHTVOS0213C2, ZHTVOS0213C3, ZHTVOS0213C4 ZHTVOS0213C5 ZHTVOS0213C6		22, 23, 24, 25, 26
3.3.4	Plant approximately 200 native trees and shrubs in the Mad River floodplain and in and adjacent to Wetland C-18 at the Warfighter TrainingCenter.		ZHTVOS0213C2, ZHTVOS0213C3, ZHTVOS0213C4 ZHTVOS0213C5 ZHTVOS0213C6		22, 23, 24, 25, 26
3.3.5	In February 2022, reintroduce Wood Frogs to Wetland C-18 via translocation of egg masses. Monitor success of reintroduction		ZHTVOS0213C2, ZHTVOS0213C3		22, 23
3.4.2	Conduct annual maintenance (e.g., invasive species treatment) at existing mitigation sites (Wetland B1 and B3, Stream 2, 4, 5, and 6), to ensure continued achievement of performance standards.		ZHTVOS0213C2, ZHTVOS0213C3, ZHTVOS0213C4 ZHTVOS0213C5 ZHTVOS0213C6		22, 23, 24, 25, 26
3.5.1	Conduct fish tissue sampling for fish in Bass Lake in regards to the current PFAS/PFOA water contamination issue.	**In-house/FWS**	In-house F&W funds		22
3.5.2	Continue monitoring and evaluating PFAS levels in fish and mammals in areas of the base with known surface water contamination, as determined by the RI/HA being conducted by AFCEC/CZO.	**CEI, IST**	New project		23, 24, 25 26
4.1.1	Inform the BHWG if proposed activities may require permits or coordination with state or federalnatural resources agencies. Lead the agency or permitting coordination when necessary.	CEI, IST	In-house	Medium	22, 23, 24, 25, 26
4.1.2	When planning habitat enhancement or restoration activities (e.g., wetland restoration),analyze the potential for increasing BASH near airfields.	CEI, IST	In-house	Medium	22, 23, 24, 25, 26
4.1.3	The WPAFB Natural Resources Manager will contact the ODNR Division of Wildlife in March each year to discuss results of the bald eagle survey on the Mad River and determine if bald eagle presence near WPAFB is increasing.	CEI, IST	In-house	Medium	22, 23, 24, 25, 26

Project Number	Description	OPR	Funding Source	Priority Level	FY
4.1.4	The Natural Resources Manager will preparea brief educational discussion for the Bird Hazard Working Group about bald eagle identification and reporting of sightings on and near the airfield.	CEI, IST	In-house	Medium	22, 23, 24, 25, 26
4.1.5	88 ABW/SEF collects and disseminates trend data to BHWG and flying units. It leads annual surveys within and adjacent to the airfield fence. Surveys are conducted throughout the year to identify attractants to birds/wildlife, such as standing water, areas needing vegetation control, open dumpsters or other food sources, and perch sites. 88 ABW/SEF investigates nesting sites in Area A, identifies areas with excessive ground hog activity, and identifies birds and wildlife that may create hazards to flight operations.	88A BW/ SEF	In-house	Medium	22, 23, 24, 25, 26
5.1.1	During the first and second quarters each year, stock Bass and Gravel Lakes with rainbow trout. Number of fish purchased for stocking will depend on available funding, based upon the numberof permits sold during the previous year.	CEI	In-house, utilizing Fish and Wildlife Reimbursable funds	Low	23, 24, 25, 26
5.1.2	During the third quarter each year stock channel catfish in Bass and Lower Twin lakes. Number of fish purchased for stocking will depend onavailable funding, based upon the number of permits sold during the previous year.	CEI	In-house utilizing Fish and Wildlife reimbursable funds	Low	23, 24, 25
5.2.1	Continue providing archery deer hunting opportunities on previously approved areas.	CEI, IST	In-house	Low	22, 23, 24, 25, 26
5.2.2	In the first quarter, conduct controlled archery deer hunting in the woodlots surrounding Twin Base Golf Course in conjunction with state seasons.	CEI, IST	In-house	Low	22, 23, 24, 25, 26
5.2.3	During the fourth quarter, update the hunting area map, as areas open for hunting can/will change due to changing mission requirements.	CEI, IST	In-house	Low	22, 23, 24, 25, 26
5.2.4	Work with 88 SFS to facilitate better hunter access and entry points to the area between the western edge of the base and the Mad River.	CEI, IST	In-house	Low	22, 23, 24, 25, 26
5.2.5	By fourth quarter conduct a vulnerability assessment for Conservation Law Enforcement Program needs on-base.	CEI, IST	In-house	Low	23

Project Number	Description	OPR	Funding Source	Priority Level	FY
5.3.1	During third quarter Partner with local conservation organizations, such as USFWS, Metroparks, Greene County USDA Natural ResourcesConservation Service (NRCS), Pheasants Forever or Quail Unlimited to evaluate, plan and implement restoration of the open-field habitat areas to nativeprairie conditions on 50 acres of the Licensed Shooting Preserve.	CEI, IST	In-house	Low	22, 23, 24, 25, 26
5.3.2	Partner with the Ohio Department of Natural Resources (ODNR) Division of Wildlife (DOW)to determine the possibility of participating in the Bobwhite Quail Trap and Release Program as a release site once the restoration work has been completed in the open-field areas of the licensed shooting preserve.	CEI, IST	In-house	Low	22, 23, 24, 25, 26
5.4.1	By the fourth quarter of each year, look into ways to fund handicapped hunting equipment opportunities to be available for disabled hunters.	CEI, IST	In-house	Low	22, 23, 24, 25, 26

***Natural Resources Standard Titles by PB28 Code (excluding CZT/CZC titles)**

INRP	MMA	T&E	MNRA	WTLD
P&F, CN	Mgt, Species	Mgt, Habitat	Compliance Public Notification	Mgt, Wetlands / FloodPlains
Interagency/Intraagency, Government, Sikes Act	Interagency/Intraagency, Government, Sikes Act	Mgt, Species	Plan Update, Other	Monitor Wetlands
Interagency/Intraagency, Government, Sikes Act, CLEO	Outsourced Environmental Services, CN	Mgt, Invasive Species	Recordkeeping, Other	Interagency/Intraagency, Government, Sikes Act
Outsourced Environmental Services, CN	Supplies, CN	Mgt, Nuisance Wildlife	Outreach	Outsourced Environmental Services, CN
Supplies, CN	Supplies, CN, CLEO	Interagency/Intraagency, Government, Sikes Act		

Supplies, CN, CLEO	Vehicle Leasing, CN	Interagency/Intraagency, Government, Sikes Act, CLEO		
Equipment Purchase / Maintain, CN		Outsourced Environmental Services, CN		
Vehicle Leasing, CN		Supplies, CN		
Vehicle Fuel & Maintenance, CN		Supplies, CN, CLEO		
Mgt, Wildland Fire		Equipment Purchase / Maintain, CN		
Plan Update, INRMP		Vehicle Leasing, CN		
Plan Update, Other		Vehicle Fuel & Maintenance, CN		
Mgt, Habitat		Plan Update, Other		
Mgt, Species		Environmental Services, CN		
Mgt, Invasive Species				
Mgt, Nuisance Wildlife				
Recordkeeping, Other				
Environmental Services, CN				

11.0 REFERENCES

11.1 Standard References (Applicable to all USAF installations)

- AFMAN 32-7003, *Environmental Conservation*
- Sikes Act
- eDASH Natural Resources Program Page
- Natural Resources Playbook
- DoDI 4715.03, *Natural Resources Conservation Program*
- AFI 32-1015, *Integrated Installation Planning*
- AFI 32-10112, *Installation Geospatial Information and Services (IGI&S)*

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12.0 ACRONYMS

12.1 Standard Acronyms (Applicable to all USAF installations)

- eDASH Acronym Library
- Natural Resources Playbook—Acronym Section
- U.S. EPA Terms & Acronyms

12.2 Installation Acronyms

ABW	Air Base Wing
AF	Air Force
AFI	Air Force Instruction
AFPD	Air Force Policy Directive
AFMC	Air Force Materiel Command
AFPAM	Air Force Pamphlet
AFRL	Air Force Research Laboratory
AICUZ	Air Installation Compatible Use Zone
APHIS	Animal and Plant Health Inspection Service
BASH	Bird/Wildlife Aircraft Strike Hazard
BEEF	Base Engineer Emergency Force
BHWG	Bird Hazard Working Group
BMP	Best Management Practices
BRAC	Base Realignment and Closure Act
CEIAP	Civil Engineering, Installation Management Division, Asset Accountability Branch,Real Property Section
CEI	Civil Engineering Installation Management Division
CEOIE	Civil Engineering, Operations Division, Infrastructure Systems Section, Entomology Branch
CEIE	Civil Engineering, Installation Management Division, Environmental Branch
CEIEA	Civil Engineering, Installation Management Division, Environmental Branch, Environmental Assets Section
CEIEC	Civil Engineering, Installation Management Division, Environmental Branch, Environmental Compliance Section
CFR	Code of Federal Regulations
CRM	Cultural Resources Manager
CWA	Clean Water Act
dbh	Diameter at Breast Height
DO	Dissolved Oxygen
DoD	Department of Defense
DODI	Department of Defense Instruction
ECAMP	Environmental Compliance Assessment and Management Program
EIAP	Environmental Impact Analysis Process
EO	Executive Order

ESA	Endangered Species Act
ESMP	Endangered Species Management Plan
ESOHC	Environmental, Safety, and Occupational Health Council
FY	Fiscal Year
GIS	Geographic Information Systems
GPS	Global Positioning System
HQ AFMC	Headquarters Air Force Materiel Command
ICRM	Integrated Cultural Resources Manager
INRMP	Integrated Natural Resources Management Plan
IPM	Integrated Pest Management
IPMP	Integrated Pest Management Plan
IRP	Installation Restoration Program
IST	Installation Support Team
MAJCOM	Major Command
MBTA	Migratory Bird Treaty Act
MCD	Miami Conservancy District
MFH	Military Family Housing
MOU	Memorandum of Understanding
MSL	Mean Sea Level
NASIC	National Air and Space Intelligence Center
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPDES	National Pollution Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRM	Natural Resources Management
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
ORAM	Ohio Rapid Assessment Method
pers. comm.	personal communication
PEM	Palustrine Emergent
PSS	Palustrine Scrub-Shrub
PFO	Palustrine Forested
POW	Palustrine Open Water
SPCC	Spill Prevention Control and Countermeasures
SWMP	Storm Water Management Plan
SWP3	Storm Water Pollution Prevention Plan
TBGC	Twin Base Golf Course
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAF	United States Air Force
USDA	U.S. Department of Agriculture

USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WHPP	Wellhead Protection Plan
WMP	Wetland Management Plan
WPAFB	Wright-Patterson Air Force Base
WNS	White-nose syndrome
WTC	Warfighter Training Center

13.0 DEFINITIONS

13.1 Standard Definitions (Applicable to all USAF installations)

- Natural Resources Playbook—Definitions Section

13.2 Installation Definitions

- *Add unique state, local, and installation-specific definitions.*

14.0 APPENDICES

14.1 Standard Appendices

14.1.1 Appendix A. Annotated Summary of Key Legislation Related to Design and Implementation of the INRMP.

Federal Public Laws and Executive Orders	
National Defense Authorization Act of 1989, Public Law (P.L.) 101-189; Volunteer Partnership Cost-Share Program	Amends two Acts and establishes volunteer and partnership programs for natural and cultural resources management on DoD lands.
Defense Appropriations Act of 1991, P.L. 101-511; Legacy Resource Management Program	Establishes the "Legacy Resource Management Program" for natural and cultural resources. Program emphasis is on inventory and stewardship responsibilities of biological, geophysical, cultural, and historic resources on DoD lands, including restoration of degraded or altered habitats.
EO 11514, *Protection and Enhancement of Environmental Quality*	Federal agencies shall initiate measures needed to direct their policies, plans, and programs to meet national environmental goals. They shall monitor, evaluate, and control agency activities to protect and enhance the quality of the environment.
EO 11593, *Protection and Enhancement of the Cultural Environment*	All Federal agencies are required to locate, identify, and record all cultural resources. Cultural resources include sites of archaeological, historical, or architectural significance.
EO 11987, *Exotic Organisms*	Agencies shall restrict the introduction of exotic species into the natural ecosystems on lands and waters which they administer.
EO 11988, *Floodplain Management*	Provides direction regarding actions of Federal agencies in floodplains, and requires permits from state, territory and Federal review agencies for any construction within a 100-year floodplain and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for acquiring, managing and disposing of Federal lands and facilities.
EO 11989, *Off-Road vehicles on Public Lands*	Installations permitting off-road vehicles to designate and mark specific areas/trails to minimize damage and conflicts, publish information including maps, and monitor the effects of their use. Installations may close areas if adverse effects on natural, cultural, or historic resources are observed.

EO 11990, *Protection of Wetlands*	Requires Federal agencies to avoid undertaking or providing assistance for new construction in wetlands unless there is no practicable alternative, and all practicable measures to minimize harm to wetlands have been implemented and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; and (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.
EO 12088, *Federal Compliance with Pollution Control Standards*	This EO delegates responsibility to the head of each executive agency for ensuring all necessary actions are taken for the prevention, control, and abatement of environmental pollution. This order gives the U.S. Environmental Protection Agency (US EPA) authority to conduct reviews and inspections to monitor federal facility compliance with pollution control standards.
EO 12898, *Environmental Justice*	This EO requires certain federal agencies, including the DoD, to the greatest extent practicable permitted by law, to make environmental justice part of their missions by identifying and addressing disproportionately high and adverse health or environmental effects on minority and low-income populations.
EO 13112, *Invasive Species*	To prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.
EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*	The USFWS has the responsibility to administer, oversee, and enforce the conservation provisions of the Migratory Bird Treaty Act, which includes responsibility for population management (e.g., monitoring), habitat protection (e.g., acquisition, enhancement, and modification), international coordination, and regulations development and enforcement.
United States Code	
Animal Damage Control Act (7 U.S.C. § 426-426b, 47 Stat. 1468)	Provides authority to the Secretary of Agriculture for investigation and control of mammalian predators, rodents, and birds. DoD installations may enter into cooperative agreements to conduct animal control projects.
Bald and Golden Eagle Protection Act of 1940, as amended; 16 U.S.C. 668-668c	This law provides for the protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession and commerce of such birds. The 1972 amendments increased penalties for violating provisions of the Act or regulations issued pursuant thereto and strengthened other enforcement measures. Rewards are provided for information leading to arrest and conviction for violation of the Act.
Clean Air Act, (42 U.S.C. § 7401– 7671q, July 14, 1955, as amended)	This Act, as amended, is known as the Clean Air Act of 1970. The amendments made in 1970 established the core of the clean air program. The primary objective is to establish Federal standards for air pollutants. It is designed to improve air quality in areas of the country which do not meet federal standards and to prevent significant deterioration in areas where air quality exceeds those standards.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (Superfund) (26 U.S.C. § 4611–4682, P.L. 96-510, 94 Stat. 2797), as amended	Authorizes and administers a program to assess damage, respond to releases of hazardous substances, fund cleanup, establish clean-up standards, assign liability, and other efforts to address environmental contaminants. Installation Restoration Program guides cleanups at DoD installations.
Endangered Species Act (ESA) of 1973, as amended; P.L. 93-205, 16 U.S.C. § 1531 et seq.	Protects threatened, endangered, and candidate species of fish, wildlife, and plants and their designated critical habitats. Under this law, no federal action is allowed to jeopardize the continued existence of an endangered or threatened species. The ESA requires consultation with the USFWS and the NOAA Fisheries (National Marine Fisheries Service) and the preparation of a biological evaluation or a biological assessment may be required when such species are present in an area affected by government activities.
Federal Aid in Wildlife Restoration Act of 1937 (16 U.S.C. § 669–669i; 50 Stat. 917) (Pittman-Robertson Act)	Provides federal aid to states and territories for management and restoration of wildlife. Fund derives from sports tax on arms and ammunition. Projects include acquisition of wildlife habitat, wildlife research surveys, development of access facilities, and hunter education.
Federal Environmental Pesticide Act of 1972	Requires installations to ensure pesticides are used only in accordance with their label registrations and restricted-use pesticides are applied only by certified applicators.
Federal Land Use Policy and Management Act, 43 U.S.C. § 1701–1782	Requires management of public lands to protect the quality of scientific, scenic, historical, ecological, environmental, and archaeological resources and values; as well as to preserve and protect certain lands in their natural condition for fish and wildlife habitat. This Act also requires consideration of commodity production such as timbering.
Federal Noxious Weed Act of 1974, 7 U.S.C. § 2801–2814	The Act provides for the control and management of non-indigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.
Federal Water Pollution Control Act (Clean Water Act [CWA]), 33 U.S.C. §1251–1387	The CWA is a comprehensive statute aimed at restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Primary authority for the implementation and enforcement rests with the US EPA.
Fish and Wildlife Conservation Act (16 U.S.C. § 2901–2911; 94 Stat. 1322, PL 96-366)	Installations encouraged to use their authority to conserve and promote conservation of nongame fish and wildlife in their habitats.
Fish and Wildlife Coordination Act (16 U.S.C. § 661 et seq.)	Directs installations to consult with the USFWS, or state or territorial agencies to ascertain means to protect fish and wildlife resources related to actions resulting in the control or structural modification of any natural stream or body of water. Includes provisions for mitigation and reporting.
Lacey Act of 1900 (16 U.S.C. § 701, 702, 32 Stat. 187, 32 Stat. 285)	Prohibits the importation of wild animals or birds or parts thereof, taken, possessed, or exported in violation of the laws of the country or territory of origin. Provides enforcement and penalties for violation of wildlife related Acts or regulations.

Leases: Non-excess Property of Military Departments, 10 U.S.C. § 2667, as amended	Authorizes DoD to lease to commercial enterprises Federal land not currently needed for public use. Covers agricultural outleasing program.
Migratory Bird Treaty Act 16 U.S.C. § 703–712	The Act implements various treaties for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds is unlawful without a valid permit.
National Environmental Policy Act of 1969 (NEPA), as amended; P.L. 91-190, 42 U.S.C. § 4321 et seq.	Requires federal agencies to utilize a systematic approach when assessing environmental impacts of government activities. Establishes the use of environmental impact statements. NEPA proposes an interdisciplinary approach in a decision-making process designed to identify unacceptable or unnecessary impacts on the environment. The Council of Environmental Quality (CEQ) created Regulations for Implementing the National Environmental Policy Act [40 Code of Federal Regulations (CFR) Parts 1500– 1508], which provide regulations applicable to and binding on all Federal agencies for implementing the procedural provisions of NEPA, as amended.
National Historic Preservation Act, 16 U.S.C. § 470 et seq.	Requires federal agencies to take account of the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places (NRHP). Provides for the nomination, identification (through listing on the NRHP), and protection of historical and cultural properties of significance.
National Trails Systems Act (16 U.S.C. § 1241–1249)	Provides for the establishment of recreation and scenic trails.
National Wildlife Refuge Acts	Provides for establishment of National Wildlife Refuges through purchase, land transfer, donation, cooperative agreements, and other means.
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd–668ee)	Provides guidelines and instructions for the administration of Wildlife Refuges and other conservation areas.
Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001–13; 104 Stat. 3042), as amended	Established requirements for the treatment of Native American human remains and sacred or cultural objects found on Federal lands. Includes requirements on inventory, and notification.
Rivers and Harbors Act of 1899 (33 U.S.C. § 401 et seq.)	Makes it unlawful for the USAF to conduct any work or activity in navigable waters of the United States without a federal permit. Installations should coordinate with the U.S. Army Corps of Engineers (USACE) to obtain permits for the discharge of refuse affecting navigable waters under National Pollutant Discharge Elimination System (NPDES) and should coordinate with the USFWS to review effects on fish and wildlife of work and activities to be undertaken as permitted by the USACE.
Sale of certain interests in land, 10 U.S.C. § 2665	Authorizes sale of forest products and reimbursement of the costs of management of forest resources.

Soil and Water Conservation Act (16 U.S.C. § 2001, P.L. 95-193)	Installations shall coordinate with the Secretary of Agriculture to appraise, on a continual basis, soil/water-related resources. Installations will develop and update a program for furthering the conservation, protection, and enhancement of these resources consistent with other federal and local programs.
Sikes Act (16 U.S.C. § 670a–670l, 74 Stat. 1052), as amended	Provides for the cooperation of DoD, the Departments of the Interior (USFWS), and the State Fish and Game Department in planning, developing, and maintaining fish and wildlife resources on a military installation. Requires development of an INRMP and public access to natural resources and allows collection of nominal hunting and fishing fees. NOTE: AFI 32-7064 sec 3.9. Staffing. As defined in DoDI 4715.03, use professionally trained natural resources management personnel with a degree in the natural sciences to develop and implement the installation INRMP. (T-0). 3.9.1. Outsourcing Natural Resources Management. As stipulated in the Sikes Act, 16 U.S.C. § 670 et. seq., the Office of Management and Budget Circular No. A-76, Performance of Commercial Activities, August 4, 1983 (Revised May 29, 2003) does not apply to the development, implementation and enforcement of INRMPs. Activities that require the exercise of discretion in making decisions regarding the management and disposition of government owned natural resources are inherently governmental. When it is not practicable to utilize DoD personnel to perform inherently governmental natural resources management duties, obtain these services from federal agencies having responsibilities for the conservation and management of natural resources.
DoD Policy, Directives, and Instructions	
DoD Instruction 4150.07 *DoD Pest Management Program* dated 29 May 2008	Implements policy, assigns responsibilities, and prescribes procedures for the DoD Integrated Pest Management Program.
DoD Instruction 4715.1, *Environmental Security*	Establishes policy for protecting, preserving, and (when required) restoring and enhancing the quality of the environment. This instruction also ensures environmental factors are integrated into DoD decision-making processes that could impact the environment, and are given appropriate consideration along with other relevant factors.
DoD Instruction (DoDI) 4715.03, *Natural Resources Conservation Program*	Implements policy, assigns responsibility, and prescribes procedures under DoDI 4715.1 for the integrated management of natural and cultural resources on property under DoD control.

OSD Policy Memorandum, 17 May 2005— *Implementation of Sikes Act Improvement Amendments: Supplemental Guidance Concerning Leased Lands*	Provides supplemental guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD. The guidance covers lands occupied by tenants or lessees or being used by others pursuant to a permit, license, right of way, or any other form of permission. INRMPs must address the resource management on all lands for which the subject installation has real property accountability, including leased lands. Installation commanders may require tenants to accept responsibility for performing appropriate natural resource management actions as a condition of their occupancy or use, but this does not preclude the requirement to address the natural resource management needs of these lands in the installation INRMP.
OSD Policy Memorandum, 1 November 2004— *Implementation of Sikes Act Improvement Act Amendments: Supplemental Guidance Concerning INRMP Reviews*	Emphasizes implementing and improving the overall INRMP coordination process. Provides policy on scope of INRMP review, and public comment on INRMP review.
OSD Policy Memorandum, 10 October 2002— *Implementation of Sikes Act Improvement Act: Updated Guidance*	Provides guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD and replaces the 21 September 1998 guidance Implementation of the Sikes Act Improvement Amendments. Emphasizes implementing and improving the overall INRMP coordination process and focuses on coordinating with stakeholders, reporting requirements and metrics, budgeting for INRMP projects, using the INRMP as a substitute for critical habitat designation, supporting military training and testing needs, and facilitating the INRMP review process.
USAF Instructions and Directives	
32 CFR Part 989, as amended, and AFI 32-7061, Environmental Impact Analysis Process (EIAP)	Provides guidance and responsibilities in the EIAP for implementing INRMPs. Implementation of an INRMP constitutes a major federal action and therefore is subject to evaluation through an Environmental Assessment or an Environmental Impact Statement.
AFI 32-1015, *Integrated Installation Planning*	This publication establishes a comprehensive and integrated planning framework for development/redevelopment of Air Force installations..
AFMAN 32-7003, *Environmental Conservation*	Implements AFPD 32-70, *Environmental Quality;* DoDI 4715.03, *Natural Resources Conservation Program*; and DoDI 7310.5, *Accounting for Sale of Forest Products*. It explains how to manage natural resources on USAF property in compliance with Federal, state, territorial, and local standards.
AFI 32-10112 *Installation Geospatial Information and Services (IGI&S)*	This instruction implements Department of Defense Instruction (DoDI) 8130.01, Installation Geospatial Information and Services (IGI&S) by identifying the requirements to implement and maintain an Air Force Installation Geospatial Information and Services program and Air Force Policy Directive (AFPD) 32-10 Installations and Facilities.

AFPD 32-70, *Environmental Quality*	Outlines the USAF mission to achieve and maintain environmental quality on all USAF lands by cleaning up environmental damage resulting from past activities, meeting all environmental standards applicable to present operations, planning its future activities to minimize environmental impacts, managing responsibly the irreplaceable natural and cultural resources it holds in public trust and eliminating pollution from its activities wherever possible. AFPD 32-70 also establishes policies to carry out these objectives.
Policy Memo for Implementation of Sikes Act Improvement Amendments, HQ USAF Environmental Office (USAF/ILEV) on January 29, 1999	Outlines the USAF interpretation and explanation of the Sikes Act and Improvement Act of 1997.

14.2 Installation Appendices

14.2.1 Appendix B. Agency Correspondence

14.2.2 Appendix C. Listed animal species observed on Wright-Patterson Air Force Base or species with potential to occuron base.*

*Listed animals are rare species that have been given an official designation by the U.S. Fish and Wildlife Service (protected under the Endangered Species Act) and/or the Ohio Department of Natural Resources, Division of Wildlife.

Appendix C1. Definitions for abbreviations used in Appendices C2-C24.

Designation	Designating Organization	Definition
E	USFWS	Federally endangered
E	ODNR	Endangered in Ohio
T	USFWS	Federally threatened
T	ODNR	Threatened in Ohio
P	USFWS	Proposed for federal listing
C	USFWS	Candidate for federal listing
SSA	USFWS	Species Status Assessment being conducted to determine iflisting is warranted
SC	ODNR	Species of Concern—A species or subspecies which might become threatened in Ohio under continued or increased stress. Also, a species or subspecies for which there is some concern but for which information is insufficient to permit an adequate status evaluation. This category may contain species designated as a furbearer or game species but whose statewide population is dependent on the quality and/or quantity of habitat and is notadversely impacted by regulated harvest.
SC	USFWS	Species of Concern—A species or subspecies which might become threatened in Ohio under continued or increased stress. Also, a species or subspecies for which there is some concern but for which information is insufficient to permit an adequate status evaluation
SI	ODNR	Special Interest—A species that occurs periodically and is capable of breeding inOhio. It is at the edge of a larger, contiguous range with viable population(s) within the core of its range. These species have no federal endangered or threatened status, are at low breeding densities in the state, and have not been recently released to enhance Ohio's wildlife diversity. With the exception of efforts to conserve occupied areas, minimal management efforts will be directed for these species because it is unlikely to result in significant increases in theirpopulations within the state.
BCC	USFWS	Bird of conservation concern, 2008—A species, subspecies, and populations of migratory nongame bird that, without additional conservation actions, is likely to become candidates for listing under the EndangeredSpecies Act (ESA) of 1973.

Appendix C2. Listed mammals known, or with potential to occur at WPAFB.

Common Name	Scientific Name	Occurrence	Federal Status	State of Ohio Status
Indiana bat	*Myotis sodalis*	Known	E	E
Big brown bat	*Eptesicus fuscus*	Known	—	SC
Tri-colored bat	*Perimyotis subflavus*	Known	SSA	SC
Little brown bat	*Myotis lucifugus*	Known	SSA	SC
Northern long-eared bat	*Myotis septentrionalis*	Known	T	T
Eastern small-footed Myotis	*Myotis leibii*	Known	—	SC
Silver-haired bat	*Lasionycteris noctivagans*	Known	—	SC
Badger	*Taxidea taxus*	Potential	—	SC
Star-nosed mole	*Condylura cristata*	Potential	—	SC
Red bat	*Lasiurus borealis*	Known	—	SC
Hoary bat	*Lasiurus cinereus*	Known	—	SC
Evening bat	*Lycticeius humeralis*	Known	—	SI

Source: BHE 1999a, Bat Conservation and Management, Inc. 2012, CIRE 2017, ODNR 2016a, USFWS 2019.

Appendix C3. Mammals observed at WPAFB.

Common Name	Scientific Name	Location
Indiana bat	*Myotis sodalis*	Area A
Big brown bat	*Eptesicus fuscus*	Base-wide
Tri-colored bat	*Perimyotis subflavus*	Area A
Little brown bat	*Myotis lucifugus*	Area A
Red bat	*Lasiurus borealis*	Base-wide
Hoary bat	*Lasiurus cinereus*	Area A
Northern long-eared bat	*Myotis septentrionalis*	Base-wide
Eastern small-footed Myotis	*Myotis leibii*	Base-wide
Silver-haired bat	*Lasionycteris noctivagans*	Base-wide
Evening bat	*Lycticeius humeralis*	Base-wide
Groundhog	*Marmota monax*	Base-wide
Coyote	*Canis latrans*	Base-wide
Raccoon	*Procyon lotor*	Base-wide
Southern flying squirrel	*Glaucomys volans*	Base-wide
Eastern fox squirrel	*Sciurus niger*	Base-wide
Eastern grey squirrel	*Sciurus carolinensis*	Base-wide
Red squirrel	*Tamiasciurus hudsonicus*	Twin Lakes Campground
Thirteen-lined ground squirrel	*Citellus tridecemlineatus*	Base-wide
Eastern chipmunk	*Tamias striatus*	Base-wide
Opossum	*Didelphis marsupialis*	Base-wide
White-tailed deer	*Odocoileus virginianus*	Base-wide
Eastern cottontail rabbit	*Sylvilagus floridanus*	Base-wide
Beaver	*Castor canadensis*	Trout & Lilly Creeks , Mad River
Muskrat	*Ondatra zibethica*	Bass Lake, Hebble Creek and Mad River
Eastern mole	*Scalopus aquaticus*	Base-wide
House mouse	*Mus musculus*	Boy Scout Camp/WTC
Short tail shrew	*Blarina brevicauda*	Base-wide
Least shrew	*Cryptotis parva*	Area A
White-footed mouse	*Peromyscus leucopus*	Base-wide
Deer mouse	*Peromyscus maniculatus*	Base-wide
Meadow jumping mouse	*Zapus hudsonius*	Area A
Red fox	*Vulpes fulva*	Twin Base GC/WTC
Striped skunk	*Mephitis mephitis*	Area A
Mink	*Mustela vison*	Area A (Prairie Road)
Long tail weasel	*Mustela frenata*	WTC
Meadow vole	*Microtus pennsylvanicus*	Base-wide
Porcupine	*Erethizon dorsatum*	Area B
Bobcat	*Felis Rufus*	Sandhill Area

Source: 3D/I 1998, BHE 1999a, Bat Conservation and Management, Inc, 2012, Davis 2015, CIRE 2017,USFWS 2018a, Warner 2021

Appendix C4. Listed birds known, or with potential to occur at WPAFB.

Common Name	Scientific Name	Occurrence	Federal Status	State of Ohio Status
Bald eagle	*Haliaeetus leucocephalus*	Known	SC	-
Blackburnian warbler	*Dendroica fusca*	Known	-	SI
Bobolink	*Dolichonyx oryzivorus*	Known	-	S
Brown creeper	*Certhia American*	Known	BC	CSI
Canada warbler	*Wilsonia Canadensis*	Known	C	SI
Common tern	*Sterna hirundo*	Known	BCC	E SC
Cerulean warbler	*Dendroica cerulean*	Known	BCC	
King rail	*Rallus elegans*	Known	-	E
Kirtland's warbler	*Dendroica kirtlandii*	Potential	-	E
Henslow's sparrow	*Ammodramus hensloii*	Known	BCC	SC
Loggerhead shrike	*Lanius ludovicianus*	Potential	-	E
Magnolia warbler	*Dendroica magnolia*	Known	-	SI
Northern harrier	*Circus cyaneus*	Known	-	E
Prothonatory warbler	*Protonotaria citrea*	Known	-	SC
Purple finch	*Carpodacus purpureus*	Known	-	SI
Red-breasted nuthatch	*Sitta carolinensis*	Known	-	SI
Sedge wren	*Cistothorus platensis*	Known	BCC	SC
Sharp-shinned hawk	*Accipiter striatus*	Known	-	SC
Upland sandpiper	*Bartramia longicauda*	Known	-	E

Source: BHE 1999a, ODNR 2016a

Appendix C5. Birds observed at WPAFB. Species listed by the USFWS or State of Ohio are in bold font.

Common Name	Scientific Name	Spring	Summer	Fall
Acadian flycatcher	*Empidonax virescens*	X	X	
American coot	*Fulica Americana*	X		
American crow	*Corvus brachyrhynchos*	X	X	X
American goldfinch	*Carduelis tristis*	X	X	X
American kestrel	*Falco sparverius*	X	X	X
American redstart	*Setophaga ruticilla*	X		X
American robin	*Turdus migratorius*	X	X	X
American wigeon	*Anas americana*	X		
Bald eagle	*Haliaeetus leucocephalus*	X	X	X
Barn swallow	*Hirundo rustica*	X	X	X
Belted kingfisher	*Ceryle alcyon*	X	X	X
Black-and-white warbler	*Mniotilta varia*		X	X
Black-billed cuckoo	*Coccyzus erythropthalmus*			X
Blackburnian warbler	*Dendroica fusca*			X
Black-throated blue warler	*Setophaga caerulescens*			X
Black-throated green warbler	*Dendroica virens*	X		
Blue jay	*Cyanocitta cristata*	X	X	X
Blue grossbeak	*Passerina caerulea*		X	
Blue-gray gnatcatcher	*Polioptila caerulea*	X	X	X
Blue-winged warbler	*Vermivora pinus*			X
Bobolink	*Dolichonyx oryzivorus*	X	X	
Brewer's blackbird	*Euphagus cyanocephalus*	X		
Brown creeper	*Certhia americana*	X		
Brown thrasher	*Toxostoma rufum*	X	X	X
Brown-headed cowbird	*Molothrus ater*	X	X	
Canada goose	*Branta canadensis*	X	X	X
Canada warbler	*Wilsonia canadensis*	X		
Cape May warbler	*Dendroica tigrina*			X
Carolina chickadee	*Parus carolinensis*	X	X	X
Carolina wren	*Thryothorus ludovicianus*	X	X	X
Cedar waxwing	*Bombycilla cedrorum*	X	X	X
Cerulean warbler	*Dendroica cerulean*		X	
Chestnut-sided warbler	*Dendroica pennsylvanica*	X		X
Chimney swift	*Chaetura pelagica*	X	X	X
Chipping sparrow	*Spizella passerina*	X	X	X
Cliff swallow	*Petrochelidon pyrrhonota*		X	
Common grackle	*Quiscalus quiscala*	X	X	X
Common nighthawk	*Chordeiles minor*	X	X	
Common tern	***Sterna hirundo***	X		
Common yellowthroat	*Geothlypis trichas*	X	X	X

Appendix C5. Birds observed at WPAFB. Species listed by the USFWS or State of Ohio are in bold font.

Common Name	Scientific Name	Spring	Summer	Fall
Cooper's hawk	*Accipiter cooperii*		X	
Dickcissel	*Spiza americana*		X	
Double-crested cormorant	*Phalacrocorax auritus*			X
Downy woodpecker	*Picoides pubescens*	X	X	X
Eastern bluebird	*Sialia sialis*	X		X
Eastern kingbird	*Tyrannus tyrannus*	X	X	X
Eastern meadowlark	*Sturnella magna*	X	X	X
Eastern phoebe	*Sayornis phoebe*	X	X	X
Eastern wood-pewee	*Contopus virens*	X	X	X
Empidonax flycatcher	*Empidonax sp.*	X		X
European starling	*Sturnus vulgaris*	X	X	X
Field sparrow	*Spizella pusilla*	X	X	X
Golden-crowned kinglet	*Regulus satrapa*			X
Grasshopper sparrow	*Ammodramus savannarum*	X	X	
Gray catbird	*Dumetella carolinensis*	X	X	X
Great blue heron	*Ardea herodias*	X	X	X
Great-crested flycatcher	*Myiarchus crinitus*			X
Greater yellowlegs	*Tringa melanoleuca*			X
Great horned owl	*Bubo virginianus*		X	X
Green-backed heron	*Butorides striatus*	X		X
Hairy woodpecker	*Picoides vilosus*	X		X
Henslow's sparrow	*Ammodramus henslowii*	X	X	X
Horned lark	*Eremophilia alpestris*	X	X	
House finch	*Carpodacus mexicanus*	X	X	X
House sparrow	*Passer domesticus*	X	X	X
House wren	*Troglodytes aedon*	X	X	X
Indigo bunting	*Passerina cyanea*	X	X	X
Killdeer	*Charadrius vociferus*	X	X	X
King rail	***Rallus elegans***		X	
Least flycatcher	*Empidonax minimus*		X	
Least sandpiper	*Calidris minutilla*	X		X
LeConte's sparrow	*Ammospiza leconteii*			X
Lincoln's sparrow	*Melospiza lincolnii*	X		
Magnolia warbler	*Dendroica magnolia*	X		X
Mallard	*Anas platyrhynchos*	X	X	X
Merlin	*Falco columbarius*		X	
Mourning dove	*Zenaida macroura*	X	X	X
Mourning warbler	*Ceothlypis philadelphia*			X
Muscovy duck	*Cairina moschata*	X		
Northern bobwhite	***Colinus virginianus***	X		
Northern cardinal	*Cardinalis cardinalis*	X	X	X

Appendix C5. Birds observed at WPAFB. Species listed by the USFWS or State of Ohio are in bold font.

Common Name	Scientific Name	Spring	Summer	Fall
Northern flicker	*Colaptes auratus*	X		X
Northern harrier	***Circus cyaneus***			X
Northern mockingbird	*Mimus polyglottos*	X	X	
Northern oriole	*Icteria galbula*	X	X	X
Northern rough-winged swallow	*Stelgidopteryx serripennis*	X	X	
Northern shrike	*Lanius borealis*			
Orchard oriole	*Icterus spurius*	X		
Osprey	*Pandion haliaetus*			X
Ovenbird	*Seiurus aurocapillus*			X
Palm warbler	*Dendroica palmarum*	X		
Peregrine falcon	*Falco peregrinus anatum*	X	X	X
Pine warbler	*Dendroica pinus*		X	
Prairie warbler	*Dendroica discolor*	X		X
Prothonotary warbler	*Protonotaria citrea*		X	
Purple finch	*Carpodacus purpureus*		X	
Red-bellied woodpecker	*Melanerpes carolinus*	X	X	X
Red-breasted nuthatch	*Sitta carolinensis*			X
Red-eyed vireo	*Vireo olivaceus*	X	X	X
Red-headed woodpecker	*Melanerpes erythrocephalus*	X		
Red-tailed hawk	*Buteo jamaicensis*	X	X	X
Red-winged blackbird	*Agelaius phoeniceus*	X	X	X
Ring-necked pheasant	*Phasianus colchicus*	X	X	
Rock dove	*Columba livia*			X
Rose-breasted grosbeak	*Pheucticus ludovicianus*		X	
Rough-winged swallow	*Stelgidopteryx serripennis*	X	X	
Ruby-crowned kinglet	*Regulus calendula*	X		
Ruby-throated hummingbird	*Archilochus colubris*	X	X	X
Rufous-sided towhee	*Pipilo chlorurus*	X	X	X
Savannah sparrow	*Passerculus sandwichensis*	X	X	X
Scarlet tanager	*Piranga olivacea*	X	X	
Sedge wren	*Cistothorus platensis*		X	
Sharp-shinned hawk	*Accipiter striatus*			
Short-eared owl	*Asio flammeus*			X
Solitary sandpiper	*Tringa solitaria*	X		X
Song sparrow	*Melospiza melodia*	X	X	X
Summer tanager	*Piranga rubra*			X
Swainson's thrush	*Catharus ustulatus*	X		
Swamp sparrow	*Melospiza georgiana*		X	X
Tennessee warbler	*Vermivora peregrine*	X		
Tree swallow	*Tachycineta bicolor*	X	X	X

Appendix C5. Birds observed at WPAFB. Species listed by the USFWS or State of Ohio are in bold font.

Common Name	Scientific Name	Spring	Summer	Fall
Tufted titmouse	*Parus bicolor*	X	X	X
Turkey vulture	*Cathartes aura*	X	X	X
Upland sandpiper	***Bartramia longicauda***		X	
Veery	*Catharus fuscescens*			X
Vesper sparrow	*Pooecetes gramineus*			X
Warbling vireo	*Vireo gilvus*	X	X	X
White-breasted nuthatch	*Sitta carolinensis*	X	X	X
White-eyed vireo	*Vireo griseus*	X	X	
White-throated sparrow	*Zonotrichia albicollis*	X		X
Willow flycatcher	*Empidonax traillii*		X	
Wilson's warbler	*Wilsonia pusilla*	X		X
Wood duck	*Aix sponsa*	X	X	
Wood thrush	*Hylocichla mustelina*		X	X
Woodcock	*Scolopax minor*	X	X	
Yellow warbler	*Dendroica petechial*	X	X	
Yellow-bellied sapsucker	***Sphyrapicus varius***			X
Yellow-billed cuckoo	*Coccyzus americanus*	X	X	
Yellow-rumped warbler	*Dendroica coronata*	X		X
Yellow-throated vireo	*Vireo valvifrons*	X		

Source: 3D/I 1998, BHE 1999a, AMEC 2007, Minney 2014, ODNR 2016a, Nolin 2018, Seymour 2020.

Appendix C6. Listed reptiles known, or with potential to occur at WPAFB.

Common Name	Scientific Name	Occurrence	Federal Status	Ohio Status
Woodland box turtle	*Terrapene c. Carolina*	Known	—	SC
E. massasauga rattlesnake	*Sistrurus catenatus*	Known	T	E
Kirtland's snake	*Clonophis kirtlandii*	Potential	—	T
Smooth greensnake	*Opheodrys vernalis*	Known	—	E
Spotted turtle	*Clemmys gutatta*	Potential	—	T

Source: BHE 1999a, Davis 2015, ODNR 2016a, Seymour 2020.

Appendix C7. Reptiles observed at WPAFB.

Common Name	Scientific Name	Location	Time of Observation		
			Spring	Summer	Fall
Eastern garter snake	*Thamnophis s. sirtalis*	Base-wide	X	X	X
Northern water snake	*Nerodia s. sipedon*	Base-wide wet areas, shoreline and islands of Mad River	X	X	X
Black rat snake	*Elaphe o. obsoleta*	Sandhill area, landfill 8 & 10		X	
Smooth greensnake	*Opheodrys vernalis*	Area A	X	X	X
E. massasaugarattlesnake	*Sistrurus catenatus*	Area A		X	X
Dekay's Brownsnake	*Storeria dekayi*	Area A	X	X	X
Eastern milksnake	*Lampropeltus trianulum*	Area A			
Eastern box turtle	*Terrapene c. carolina*	Woodland Hill, Sandhill, Area near Boy Scout Camp	X	X	
Snapping turtle	*Chelydra serpentina*	Base-wide wet areas, Mad River and tributaries	X	X	X
Eastern spiny softshell turtle	*Apalone s. spinifera*	Hebble Creek, Mad Riverand tributaries	X	X	X
Midland painted turtle	*Chrysemys picta marginata*	Area B pond, Gravel Lake, Mad River and tributaries	X	X	
Five-lined skink	*Eumeces fasciata*	Forest west of Landfill 11	X		

Source: 3D/I 1998, BHE 1999a, Davis 2015, Seymour 2020

Appendix C8. Listed amphibians with potential to occur at WPAFB.

Common Name	Scientific Name	Occurrence	Federal Status	Ohio Status
Blue-spotted salamander	*Ambystoma laterale*	Unknown	—	E
Four-toed salamander	*Hemidactylium scutatum*	Unknown	—	SC
Hellbender	*Cryptobranchus alleganiensis*	Unknown	SC	E

Source: BHE 1999a, ODNR 2016a

Appendix C9. Amphibians observed at WPAFB.

Common Name	Scientific Name	Location	Time of Observation		
			Spring	Summer	Fall
Green frog	*Rana clamitans melanota*	Areas A and B	X	X	X
Leopard frog	*Lithobates pipiens*	Twin Base GolfCourse	X	X	X
Bullfrog	*Rana catesbeiana*	Bass Lake, Mad Riverand Tributaries	X	X	X
American Toad	*Bufo americanus*	Hebble Cr., TroutCr., Landfill 11, TBGC, Prairie Rd East	X	X	X
Southern two-lined salamander	*Eurycea cirrigera*	Along Trout Creek		X	
Eastern Redback Salamander	*Plethodon cinereus*	Twin Base GolfCourse		X	
Small-mouthed Salamander	*Ambystoma texanum*	Twin Base GolfCourse	X	X	
Gray treefrog	*Hyla sp.*	Near Landfill 11,TBGC		X	
Blanchard's cricket frog	*Acris crepitans blanchardii*	North of Landfill 11,TBGC		X	

Source: 3D/I 1998, BHE 1999a, Davis 2015, Seymour 2020.

Appendix C10. Listed fishes with potential to occur at WPAFB.

Common Name	Scientific Name	Occurrence	Federal Status	State of Ohio Status
Tonguetied minnow	*Exoglossum laurae*	Mad River	—	T
Iowa darter	*Etheostoma exile*	Miami County	—	E

Source: BHE 1999a, ODNR 2016a.

Appendix C11. Fish captured and/or stocked at WPAFB.

Common Name	Scientific Name	Mad River[1]	Lower Hebble Creek	Upper Hebble Creek	Unnamed Tributary to Hebble Creek	Mud Run	Trout Creek	Unnamed Trib. To Mad Rover[2]	Lower Twin Lake	Bass Lake
Gizzard shad	*Dorosoma cepedianum*	X							X	X
Redfin pickerel	*Esox americanus*	X								
Central stoneroller	*Campostoma anomalum*	X	X	X	X	X	X	X		
Goldfish	*Carassius auratus*			X	X					
Common carp	*Cyprinus carpio*	X		X	X					
Spotfin shiner	*Cyprinella spiloptera*	X	X			X				
Striped shiner	*Luxilus chrysocephalus*	X	X	X		X				
Sand shiner	*Notropis stramineus*	X		X		X				
Bluntnose minnow	*Pimephales notatus*	X	X		X	X				
Fathead minnow	*P. promelas*		X		X					
Central mudminnow	*Umbra limi*						X			
Blacknose dace	*Rhinichthys atratulus*	X	X	X		X	X	X		
Creek chub	*Semotilus atromaculatus*	X	X	X	X	X	X	X		
White sucker	*Catostomus commersoni*	X	X	X	X	X	X	X		
Northern hog sucker	*Hypentelium nigricans*	X	X	X		X	X			
Quillback	*Carpoides cyprinus*	X								
Redhorse sucker	*Moxostoma* sp.		X							
Spotted sucker	*Minytrema melanops*									X
Channel catfish	*Ictalurus punctatus*								X	X
Yellow bullhead	*Ameiurus natalis*		X							
Rainbow trout	*Oncorhynchus mykiss*									X
Brown trout	*Salmo trutta*									X
Blackstripe topminnow	*Fundulus notatus*									X
White bass	*Morone chrysops*									X
Rockbass	*Ambloplites rupestris*	X				X				
Green sunfish	*Lepomis cyanellus*	X	X	X	X	X	X	X	X	

Appendix C11. Fish captured and/or stocked at WPAFB.

Common Name	Scientific Name	Mad River[1]	Lower Hebble Creek	Upper Hebble Creek	Unnamed Tributary to Hebble Creek	Mud Run	Trout Creek	Unnamed Trib. To Mad Rover[2]	Lower Twin Lake	Bass Lake
Bluegill	*L. macrochirus*	X	X	X	X	X	X		X	X
Redear sunfish	*L. microlophus*						X		X	
Longear sunfish	*L. megalotis*		X							
Pumpkinseed	*L. gibbosus*									X
Largemouth bass	*Micropterus salmoides*	X	X	X	X	X			X	X
White crappie	*Pomoxis annularis*	X								X
Black crappie	*P. nigromaculatus*	X								X
Greenside darter	*Etheostoma blennioides*	X	X			X				
Rainbow darter	*E. caeruleum*	X	X	X		X	X			
Johnny darter	*E. nigrum*					X				
Banded darter	*E. zonale*	X	X			X				
Fantail darter	*E. flabellare*		X	X						
Mottled sculpin	*Cottus bairdi*	X	X			X	X			
Total No. Species		**23**	**20**	**14**	**10**	**18**	**11**	**5**	**6**	**12**

Sources: 3D/I 1998, BHE 1999a, Ohio EPA 1994, USFWS 2016.

[1] Mad River in the vicinity of WPAFB, Greene County.

[2] Includes upper and lower reaches.

Appendix C12. Listed mussels known, or with potential to occur at WPAFB.

Common Name	Scientific Name	Occurrence	Federal Status	State of Ohio Status
Clubshell	*Pleurobema clava*	Known (subfossil)	E	E
Northern riffleshell	*Epioblasma rangiana*	Potential	E	E
Rabbitsfoot	*Quadrula cylindrical*	Potential	T	E
Sheepnose	*Plethobasus cyphus*	Potential	E	E
Pondhorn	*Uniomerus tetralasmus*	Potential	—	T
Salamander mussel	*Simpsonaias ambigua*	Potential	—	SC
Rayed bean	*Villosa fabalis*	Potential	E	E
Wavyrayed lampmussel	*Lampsilis fasciola*	Potential	—	SC
Snuffbox	*Epioblasma triquetra*	Potential	E	E
Kidneyshell	*Ptychobranchus*	Potential	—	SC
Elktoe	*Alasmidonta marginata*	Potential	—	SC

Sources: 3D/I 1998, BHE 1999a, ODNR 2016a.

Appendix C13. Mussel shells found during qualitative surveys of the Mad River at WPAFB during June 1998.

Common Name	Scientific Name	Condition[1]
Clubshell	*Pleurobema clava*	SF
Kidneyshell	*Ptychobranchus fasciolaris*	SF
Spike	*Elliptio dilitata*	SF,F
Rainbow	*Villosa iris*	SF
Fluted shell	*Lasmigona costata*	SF,R
Cylindrical papershell	*Anodontoides ferussacianus*	F
Threeridge	*Amblema plicata*	SF
Giant floater	*Pyganodon grandis*	SF,F
Plain pocketbook	*Lampsilis cardium*	SF
Fat pocketbook	*Lampsilis siliquoidea*	SF,F
Elktoe	*Alasmidonta marginata*	SF
Slippershell	*Alasmidonta viridis*	SF,R
Squawfoot	*Strophitus undulates*	SF
Asian clam	*Corbicula fluminea*	F,R,L

Source: 3D/I 1998.

[1] SF=subfossil; R=relict; F=fresh dead; L=living.

Appendix C14. Subfossil mussel shells found in a midden near the mouth of Trout Creek at WPAFB on 13 October 1998.

Common Name	Scientific Name	Number
Clubshell	*Pleurobema clava*	25
Kidneyshell	*Ptychobranchus fasciolaris*	11
Spike	*Elliptio dilitata*	31
Rainbow	*Villosa iris*	1
Slippershell	*Alasmidonta viridis*	1

Source: BHE 1999a.

Common Name	Scientific Name
Kidneyshell	*Ptychobranchus fasciolaris*
Spike	*Elliptio dilitata*
Rainbow	*Villosa iris*
Flutedshell	*Lasmigona costata*
Cylindrical papershell	*Anodontoides ferussacianus*
Fat mucket	*Lampsilis siliquoidea*
Asian clam*	*Corbicula fluminea*

*Non-native invasive species

Appendix C16. Listed arthropods known, or with potential to occur at WPAFB.

Common Name	Scientific Name	Occurrence	Federal Status	Ohio Status	Season	Habitat/Plants
Two-spotted skipperbutterfly	*Euphyes bimacula*	Unk.	—	SC	Late Jun–Mid-Jul	Open moist habitat – Sedge
Monarch butterfly	*Danaus plexippus*	Known	C	—	Jul–Oct	Prairie, open areas – *Asclepias* spp.
Purplish copper butterfly	*Lycaena helloides*	Unk.	—	E	Mid-May–Mid-Oct	Herb polygonaceae
Swamp metalmarkbutterfly	*Calephelis muticum*	Unk.	—	E	Mid-Jul–Aug	Swamp/bog, wet meadow – Compositae
Regal fritillary butterfly	*Speyeria idalia*	Unk.	—	E	Jun–Early Sep	Wet meadows/moist prairie – Violaceae
Silver-bordered butterfly	*Boloria selene*	Unk.	—	T	Mid-May–Mid-Sep	Moist meadows – Violaceae
Unexpected cycnia	*Cycnia inopinatus*	Unk.	—	E	Jun–Aug	Milkweed
Graceful underwing moth	*Catocala gracilis*	Unk.	—	E	Jul–Sep	Blueberries
Blazing star stem borer (Beer's noctuid)	*Papaipema beeriana*	Known	—	E	Aug–Sep	Prairie endemic; *Liatris* spp.
Black arches moth	*Melanchra assimilis*	Unk.	—	E	Jun–Aug	Alder, fern, birch, goldenrods, willows
Pointed sallow moth	*Epiglaea apiata*	Unk.	—	E	Late Aug–Nov	Cranberry
Pink-streak moth	*Faronta rubripennis*	Unk.	—	T	Au.–Sep	Grasses
Buck moth	*Hemileuca maia*	Unk.	—	SC	Oct–Nov	Oaks
One-eyed sphinx moth	*Smerinthus cerisyi*	Unk.	—	SC	May–Jul	Pear, plum, poplar, and willow
Large paectes moth	*Paectes abrostolella*	Unk.	—	SC	Apr–Oct	Sweetgum
Slender clearwing moth	*Hemaris gracilis*	Unk.	—	SI	May–Aug	Blueberry
Subflava sedge borer moth	*Archanara subflava*	Unk.	—	SI	Jul–Sep	Bulrushes and rushes
Bracken borer moth	*Papaipema pterisii*	Unk.	—	SC	Aug–Sep	Bracken fern
Osmunda borer moth	*Papaipema speciosissima*	Unk.	—	SC	Sep–Oct	Flowering ferns
Moth	*Tarachidia binocula*	Known	—	SC	Jun–Jul	Prairie endemic
Purple arches moth	*Polia purpurissata*	Unk.	—	SC	Jul–Sep	Alder, blueberry, birch, woody plants
Scurfy quaker moth	*Homorthodes f. furfurata*	Unk.	—	SC	Apr–Aug	Maple, wild cherry

Appendix C16. Listed arthropods known, or with potential to occur at WPAFB.

Common Name	Scientific Name	Occurrence	Federal Status	Ohio Status	Season	Habitat/Plants
Hine's emerald dragonfly	*Somatochlora hineana*	Unk.	E	E	Late Jun–Late Jul	Streams, wetlands
Plains clubtail dragonfly	*Gomphurus externus*	Mont. Co.	—	E	Summer	Streams, wetlands
Seepage dancer damselfly	*Argia bipunctulata*	Clark Co.	—	E	Summer	Streams, seeps, and wetlands
Cobblestone tiger beetle	*Cicindela marginipennis*	Unk.	—	T	Summer	Cobblestone sandbars
Tiger beetle	*Cicindela hirticollis*	Unk.	—	T	Summer	Sandy beaches near fast moving water.
Tiger beetle	*Cicindela cuprascens*	Unk.	—	SC	Summer	Sandy beaches near fast moving water.
American burying beetle	*Nicrophorus americanus*	Unk.	E	E	Mid-Jun–Early Jul	Forest, open field, and pasture
Sloan's crayfish	*Orconectes sloanii*	Mont. Co.	—	T	Summer	Streams
Northern crayfish	*Orconectes virilis*	Unk.	—	SC	Summer	Streams and lakes

Source: BHE 1999a, ODNR 2016a, USFWS 2021.

Appendix C17. Butterfly species collected or observed at WPAFB in 1997, 1998, 1999, 2017, and 2019 at Huffman Prairie in 2015, 2016, 2019, and 2020.

Common Name	Scientific Name	WPAFB Area(s)	Huffman Prairie
Sleepy orange	*Abaeis nicippe*		X
Delaware skipper	*Anatrytone logan*		X
Least skipper	*Ancyloxpha numitor*		X
Hackberry butterfly	*Asterocampa c. celtis*	C	X
Tawny emperor	*Asterocampa c. clyton*	C	
Sachem skipper	*Atalopedes campestris*		X
Meadow fritillary	*Boloria b. bellona*	C	X
Spring azure	*Celastrina l. ladon*	B, C	
Summer azure	*Celastrina neglecta*		X
Common wood nymph	*Cercyonis pegala alope*	C	
Silvery checkerspot	*Chlosyne n. nycteis*	C, TBGC	X
Orange sulphur	*Colias eurytheme*	B	X
Clouded sulphur	*Colias philodice*		X
Southern dogface	*Colias cesonia*		X
Eastern-tailed blue	*Cupido comyntas*		X
Monarch butterfly	*Danaus plexippus*	C	X
Silver spotted skipper	*Epargyreus c. clarus*	B	X
Wild indigo duskywind	*Erynnis baptisiae*		X
Horace's dusky wing	*Erynnis horiatus*		X
Varigated fritillary	*Euptoieta claudia*		X
Eastern tailed blue	*Everes c. comyntas*	B	X
Fiery skipper	*Hylephila phyleus*		X
Common buckeye	*Junonia coenia*		X
American snout	*Libytheana carinenta*		X
Viceroy	*Limentis archippus archippus*	C	X
Red spotted purple	*Limenitis arthemis astyanax*	B	
Bronze copper	*Lycaena hyllus*	C	
Little wood satyr	*Megisto c. cymela*	B	
Swarthy skipper	*Nastra iherminier*	C	X
Mourning cloak	*Nymphalis a. antiopa*	C	
Milbert's tortoise shell	*Nymphalis m. milberti*	C	
Giant swallowtail	*Papilio cresphontes*	B	X
Tiger swallowtail	*Papilio g. glaucus*	B, C	X
Black swallowtail	*Papilio polyxenes asterius*	C, TBGC	X
Spicebush swallowtail	*Papilio t. troilus*	B	
Cloudless sulfur	*Phoebis sennae eubule*		X
Common sootywing	*Pholisora catullus*		X

Appendix C17. Butterfly species collected or observed at WPAFB in 1997, 1998, 1999, 2017, and 2019 at Huffman Prairie in 2015, 2016, 2019, and 2020.

Common Name	Scientific Name	WPAFB Area(s)	Huffman Prairie
Northern pearl crescent	*Phyciodes pascoensis*	B	
Pearl crescent	*Phycoides t. tharos*	C	X
European cabbage white	*Pieris rapae*	B, C	X
Northern golden skipper	*Poanes h. hobomok*	B	X
Peck's skipper	*Polites coras*	B	X
Tawny-edged skipper	*Polites themistocles*	C	X
Comma	*Polygonia comma*	C	
Question mark	*Polygonia interrogationis*	C	
Little glassy wing	*Pompeius verna*	C	
Checkered white	*Pontia portodice*		X
Common checkered skipper	*Pyrgus communis*		X
Hickory hairstreak	*Satyrium caryaevorum*	C	
Great spangled fritillary	*Speyeria c. cybele*	B	
Gray hairstreak	*Strymon melinus*		X
European skipper	*Thymelicus lineola*	C	
Red admiral	*Vanessa atalanta rubria*	C	X
Painted lady	*Vanessa cardui*		X
Northern broken dash	*Wallengrenia egeremet*	B	

Source: 3D/I 1998, BHE 1999a, USFWS 2015, Rothschild 2016, Seymour 2020, USFWS 2021.
* Observed as a larva.

Appendix C18. Moth species observed at Huffman Prairie in 2020.

Scientific Name	Common Name	Huffman Prairie
Achyra rantalis+	Garden webworm	X
*Actias luna^*	Luna moth	
Anagrapha falcerifera+	Celery Looper Moth	X
Apatelodes torrefacta+	Spotted Apatelodes Moth	X
*Athetis tarda^*	Slowpoke moth	X
*Aristotelia salicifungiella**		X
*Atteva aurera^*	Ailanthus webworm	X
*Automeris io^*	IO moth	
*Buccalatrix simulans**		X
Caenurgina crassiuscula+	Clover looper	X
Caenurgina erechtea+	Forage looper	X
Chlorochlamys chloroleucaria+	Blackberry Looper Moth	X
*Cisseps fulvicollis^*	Yellow collared scape moth	X
*Costaconvexa centrostrigaria^*	Bent-line carpet	X
Ctenucha virginica+	Virginia ctenucha	X
Cycnia collaris+	Unexpected cycnia	X
*Dargida rubipennis^*	Pink streak	X
*Desmia funeralis^*	Grape leaffolder	X
Disclisioprocta stellata+	Somber carpet moth	X
*Epiblema tripartitana**		X
Estigmene acrea+	Salt marsh moth	X
Euchaetes egle+	Milkweed Tussock Moth	X
*Eucosma giganteana**		X
*Eucosma matutina**		X
*Eucosma nandana**		X
*Eucosma vagana**		X
Eusarca confusaria^+	Confused eusarca	X
Galgula partita+	Wedgling moth	X
Haematopis grataria+	Chickweed geometer	X
*Haploa lecontei^*	Leconte's haploa	
*Haploa reversa**		X
*Helcystogramma hystricella**		X
*Hypercompe scribonia^*	Giant woolly bear	
*Hysterosia villana**		X
*Lacinipolia renigera^*	Kidney-spotted minor	X
*Luperina stipata**		X
*Lychnosea intermicata**	Speckled lamplighter	X
*Mellilla xanthometata^*	Orange wing	X

Appendix C18. Moth species observed at Huffman Prairie in 2020.

Scientific Name	Common Name	Huffman Prairie
Microcrambus elegans+	Elegant grass veneer	X
Nomophila nearctica+	Lucerne moth	X
Ogdoconta cinereola^	Common pinkband	X
Orthonama obstipata+	Gem moth	X
Pachysphinx modesta^	Modest sphinx	
Papaipema arctivorens^	Northern burdock borer moth	X
*Papaipema beeriana**	Blazing star stem borer	X
Phalaenostola larentioides+	Black-banded owlet moth	X
*Platynota stultana**		X
Pleuroprucha insulsaria+	Common tan wave	X
Polygrammodes flavidalis^	Ironweed root moth	X
Ponometia erastrioides^	Small bird-dropping moth	X
Pyrrharctia isabella+	Isabella tiger moth larva	X
Schinia trifascia+	Three-lined Flower Moth	X
Scopula inductata+	Soft-lined wave	X
*Scrobipalpula artemisiella**		X
Sitochroa palealis^+	Carrot seed moth	X
*Sonia canadana**		X
Sparganothis sulfureana+	Sparganothis fruitworm moth	X
Spilosoma virginica+	Virginian tiger moth larva	X
Spragueia leo+	Common spragueia moth	X
Stereomita andropogonis+		X
*Tarachidia binocula**		X
Tarachidia candefacta^	Malana leafroller	X
*Tarachidia tortricina**		X
Udea rubigalis+	Celery leftier moth	X
Urola nivalis+	Snowy urola moth	X
Xanthotype urticaria^	False crocus geometer	X

Sources: * Metzler 1997, ^ USFWS 2018, + USFWS 2021.

Appendix C19. Uncommon moth species collected at WPAFB in 1992, 1993, 1994, and 1999.

Scientific Name	Common Name	Color of Trap Light	Season
Acrolepiopsis leucoscia		Black	Spring
Aethes obliquana		Black	Fall
Agonopterix pteleae		Black	Summer
Aristotelia psoraleae		—	—
Bryotropha branellla		Black	Summer
Buccalatrix staintonella		—	—
Calosima melanostriatella		Black	Summer
Carolella sartana	Broad-patch Carolella moth	Black	Fall
Coleophora texanella		Black	Summer
Cosmopterix dapifera		Black	Summer
Cosmopterix montisella		Black	Summer
Cycnia tenera	Delicate cycnia	White/Black	Summer/Fall
Deidamia inscripta	Lettered sphinx moth	Black	Spring
Dichrorampha sedatana		Black	Spring
Epiblemma tandana		Black	Summer
Eucosma heathiana		Black	Summer
Frumenta nundinella		Black	Summer
Glyphidocera wrightorum		Black	
Gnorimoschema busckiella		Black	Summer
Grammia virgo	Virgin tiger moth	White/Black	Summer
Haltsidota tessellaris	Banded tussock moth	Black	Summer
Helcystogramma chambersella		Black	Summer
Hellula rogatalis	Cabbage webworm moth	Black	Summer
Hypoprepia fucosa	Painted lichen moth	Black	Summer
Isophrictis rudbeckiella		Black	Summer
Paonias myops	Small-eyed sphinx moth	Black	Summer
Peoria roseotinctella		Black	Summer
Phalonia aurorana		Black	Fall
Phycitodes albatella reliquella		Black	Summer/Fall
Pseudopostega cretea		Black	Summer
Scrobipalpa atriplicella	Goosefoot groundling moth	Black	Summer
Scrobipalpula henshawiella		Black	Summer
Smerinthus jamaicensis	Twin-spotted sphinx moth	Black	Spring
Synchora aerate	Wavy-lined emerald moth	White	Spring
Syncopacma palpilineella		Black	Summer
Thyraylia nana		Black	Summer
Tinea carnariella		Black	Summer
Trachysmia cartwrightana		Black	Summer
Trachysmia villana		Black	Summer

Sources: Metzler and Zebold 1995, Metzler 1997, BHE 1999a, Adamski and Metzler 2000.
Note: See 3D/I 1998 for a list of common moth species collected during surveys in the Mad Rivercorridor at WPAFB.

Appendix C20. Bees identified at WPAFB from surveys conducted in May 2015.

Family	Genus	Species
Andrenidae	*Andrena*	*commoda*
Andrenidae	*Andrena*	*lamelliterga*
Andrenidae	*Andrena*	*nasonii*
Andrenidae	*Andrena*	*phaceliae*
Andrenidae	*Andrena*	*violae*
Andrenidae	*Andrena*	*wilmattae*
Apidae	*Bombus*	*fervidus*
Apidae	*Ceratina*	*mikmaqi*
Apidae	*Eucera*	*hamata*
Apidae	*Nomada*	*cressonii*
Apidae	*Nomada*	*luteoloides*
Apidae	*Nomada*	*parva*
Colletidae	*Hylaeus*	*affinis*
Halictidae	*Agapostemon*	*texana*
Halictidae	*Agapostemon*	*virescens*
Halictidae	*Augochlorella*	*aurata*
Halictidae	*Augochloropsis*	*fulgida*
Halictidae	*Halictus*	*ligatus*
Halictidae	*Lasioglossum*	*albipenne*
Halictidae	*Lasioglossum*	*anomalum*
Halictidae	*Lasioglossum*	*callidum*
Halictidae	*Lasioglossum*	*coriaceum*
Halictidae	*Lasioglossum*	*nr. cressonii*
Halictidae	*Lasioglossum*	*nr. zephyrum*
Halictidae	*Lasioglossum*	*pilosum*
Halictidae	*Lasioglossum*	*tegulare*
Halictidae	*Lasioglossum*	*trigeminum*
Halictidae	*Lasioglossum*	*versatum*
Megachilidae	*Hoplitis*	*pilosifrons*
Megachilidae	*Hoplitis*	*producta*
Megachilidae	*Megachile*	*montivaga*
Megachilidae	*Osmia*	*conjuncta*
Megachilidae	*Stelis*	*lateralis*

Source: USFWS 2019.

Appendix C21. Bees identified at WPAFB in 2016, 2018, and 2020.

Family	Genus	Species	Taxa
Apidae+*^	*Bombus*	*Griseocollis*	*Bombus griseocollis*
Apidae+^	*Bombus*	*Impatiens*	*Bombus impatiens*
Apidae+*^	*Bombus*	*pensylvanicus*	*Bombus pensylvanicus*
Apidae*	*Melissodes*	*Bimaculate*	*Melissodes bimaculata*
Apidae+*	*Melissodes*	*Desponsus*	*Melissodes desponsus*
Apidae*	*Svastra*	*obliqua*	*Svastra (Epimelissodes) obliqua*
Halictidae*	*Halictus*	*Rubicundus*	*Halictus (Protohalictus) rubicundus*
Halictidae+	*Lasioglossum*	*Hitchensi*	*Lasioglossum* (*Dialictus*) *hitchensi*

Sources: Spring 2017, Nolin 2018, USFWS 2021.
+ 2016 observation.
* 2018 observation.
^ 2020 observation.

Appendix C22. Odonates identified at WPAFB in 1997, 1998, 1999, 2019, and 2020.

Species	Area / Location	Date
Calopteryx maculata	Base-wide	8/13/97, 6/15/98, 6/3/99
Celithemis eponina	Huffman Prairie	8/6/2020
Enallagma sp.	Areas A and B	5/25/99, 6/4/99,
Epiaeschna heros	Twin Base Golf Course	5/16/19
Epitheca cynosure	Huffman Prairie	8/6/2020
Erythemis simplicicollis	Foraging in forest openings	8/13/97, 7/1/98
Gomphus fraternus	Area A and Landfill No. 11	6/18/98, 6/2/99
Gomphus lividus	Area A and Landfill No. 11	6/18/98, 6/2/99
Hetaerina americana	Mad River corridor	8/14/97, 6/23/98
Lestes rectangularis	Mad River corridor	8/14/97
Libellula luctuosa	Mad R. corridor / Sandhill Area	8/13/97, 6/2/99
Libellula Lydia	Mad River	8/15/97, 6/17/98
Libellula pulchella	Areas A and B	8/13/97, 6//99, 5/16/19
Pachydiplax longipennis	Huffman Prairie	8/6/2020
Pantala flavescens	Mad River near Huffman Res.	8/15/97
Plathemia Lydia	Area B pond and Area A	6/2/99
Plathemia trimaculata	WTC, and Area B pond	6/17/99
Perithemis tenera	Mad River near Huffman Res.	8/13/97
Sympetrum rubicundulum	Area A, Landfill No. 11	6/18/98

Sources: 3D/I 1998, BHE 1999a, Seymour 2020, USFWS 2021.

Appendix C23. Carrion beetles captured or observed at WPAFB in 1997, 1998, 1999, 2019, and 2020.

Species	Number of Individuals	Area(s)	Date
Nicrophorus tomentosus	8	A and B	9/18/97 (in leaf litter), 6/16/98, 6/17/98, 6/1/99, 7/30/99 (on dead mallard)
Nicrophorus sayi	2	A	6/2/99 (light trap), 8/24/99 (light trap)
Nicrophorus orbicollis	3	A	6/16/98, 7/3/98 (light trap), 6/7/2019 under coverboard
Nicrophorus marginatus	3	A	7/16/2020, 9/16/2020
Silpha americana	10	A	6/16/9, 6/17/98, 7/30/99 (on dead mallard)
Silpha inaequalis	15	A	6/16/98, 6/17/98
Silpha noveboracensis	5	A	6/16/98

Sources: 3D/I 1998, BHE 1999a, Seymour 2020, USFWS 2021.

Appendix C24. Crayfishes collected at WPAFB in 1999, 2019.

Species	Gravel Lake	Upper TwinLake	Bass Lake	Hebble Creek	Trout Creek	Unnamed Tributary in Woodland Hills	Area B Pond	Unnamed Tributary to Mad River	Mud Run	Ditch along 13th St. Area B	Twin Base Golf Course
Orconectes (*P.*) *rusticus*		X	X	X				X	X		
Cambarus bartonii cavatus					X	X					
Cambaridae, unidentified										X	
Cambarus or *Fallicambarus*, unidentified											X

Sources: BHE 1999a, Seymour 2020.

14.2.3 Appendix D. Documents Pertaining to Survey and Management of Indiana Bats and Northern Long-eared Bats

https://www.fws.gov/media/indiana-bat-and-northern-long-eared-bat-conservation-researchmonitoring-needs

14.2.4 Appendix E. Wright-Patterson Air Force Base Threatened and Endangered Species Brochure

https://usaf.dps.mil/teams/21020/WPAFB/CEI/CEIE/Pages/NR.aspx

14.2.5 Appendix F. DoD Conservation Measure of Merit

Conservation Metrics

Installation Name and State:	**Wright Patterson Air Force Base, Ohio**		
Annual Update For Fiscal Year:		**2022**	
The year the most recent INRMP was completed or revised		**2017**	
Date planned for the next revision		**2022**	
Was the INRMP coordinated with appropriate military trainers andoperators?		**Y**	**N**
Were projects added to the INRMP as a result of comments frommilitary trainers and operators?		**Y**	**N**
Has annual feedback been requested from military trainers and operators?		**Y**	**N**
Has annual feedback been received from military trainers andoperators?		**Y**	**N**
Were segments of the INRMP concerning the conservation, protection,and management of fish and wildlife resources agreed to by the U.S. Fish and Wildlife Service Regional Director?		**Y**	**N**
Were projects added to the INRMP as a result of FWS comments?		**Y**	**N**
If yes, specify projects:			
Has annual feedback been requested from the FWS?		**Y**	**N**
Has annual feedback been received from the FWS?		**Y**	**N**
Were segments of the INRMP concerning the conservation, protection,and management of fish and wildlife resources agreed to by the StateFish and Wildlife agency Director?		**Y**	**N**
Were projects added to the INRMP as a result of State comments?		**Y**	**N**
If yes, specify projects:			
Has annual feedback been requested from the State fish and wildlifeagency?		**Y**	**N**

Has annual feedback been received from the State fish and wildlifeagency?	**Y**	**N**
Did the installation seek public comment on the draft INRMP?	**Y**	**N**
Were projects added to the INRMP as a result of public comment?	**Y**	**N**
If yes, specify projects:		
Does the INRMP contain a list of projects necessary to meet plan goalsand objectives, as well as timeframes for implementation of any suchprojects?	**Y**	**N**
Funding requirements in reporting FY to Implement the INRMP		
$ required for Class 0 and 1 projects		
$ funded for Class 0 and 1 projects		
$ unfunded for Class 0 and 1 projects		
$ required for Class 2 and 3 projects		
$ funded for Class 2 and 3 projects		
$ unfunded for Class 2 and 3 projects		
List of unfunded Class 0 and 1 projects >$50K:		

14.2.6 Appendix G. Air Force Manual 32-7003

https://static.e-publishing.af.mil/production/1/af_a4/publication/afman32-7003/afman32-7003.pdf

14.2.7 Appendix H. Snake Survey Reports

https://usaf.dps.mil/teams/21020/WPAFB/CEI/CEIE/Pages/NR.aspx

15.0 ASSOCIATED PLANS

15.1 Tab 1—Wildland Fire Management Plan

15.2 Tab 2—Bird/Wildlife Aircraft Strike Hazard (BASH) Plan

15.3 Tab 3—Integrated Cultural Resources Management Plan (ICRMP)

15.4 Tab 4— Integrated Pest Management Plan (IPMP)

15.5 Tab 5—Wetland and Stream Management Plan

15.6 Tab 6—Huffman Prairie Management Plan

15.7 Tab 7—Emerald Ash Borer Management Plan