



## Inventory and Monitoring Plan Loess Bluffs National Wildlife Refuge

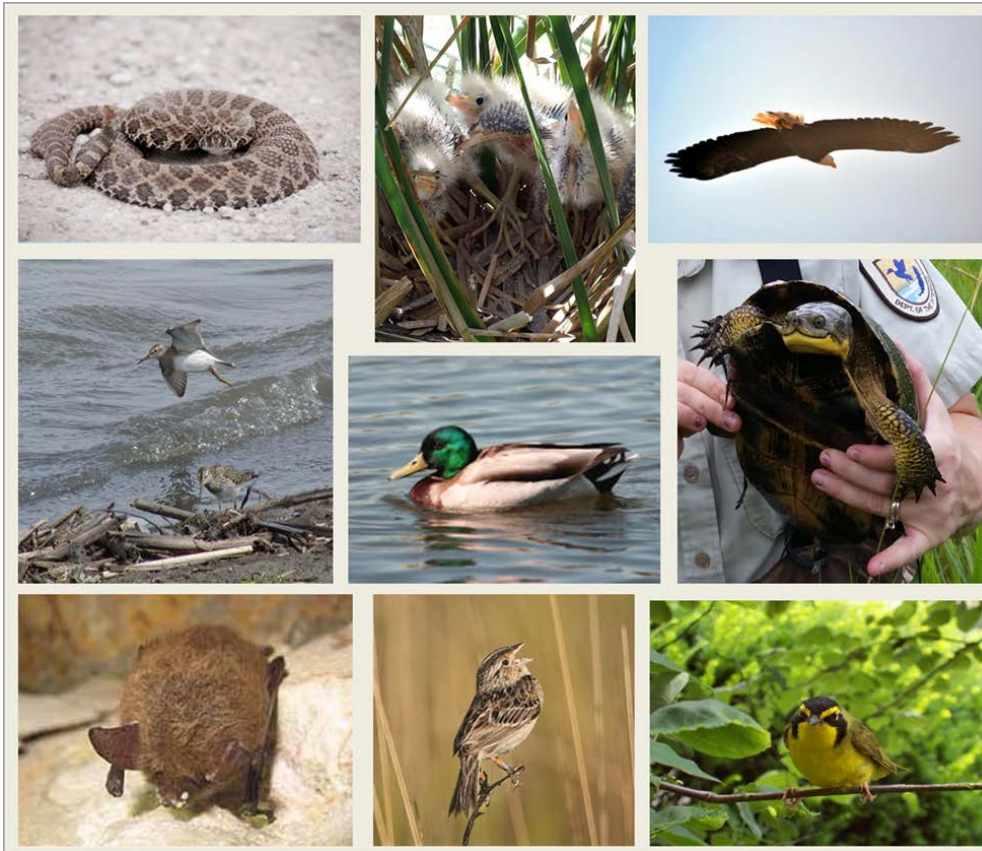


Image: Resources of concern including massasauga rattlesnake, least bittern, bald eagle, pectoral sandpiper, mallard, Blanding's turtle, northern long-eared bat, grasshopper sparrow, and Kentucky warbler. Photo courtesy: USFWS staff.








August 2018



# Loess Bluffs National Wildlife Refuge

## Inventory and Monitoring Plan

### Signature Page<sup>1</sup>

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## Contents

Signature Page .....	ii
Introduction.....	1
Methods.....	1
<i>Prioritizing and Selecting Surveys</i> .....	1
<i>Estimating Capacity</i> .....	2
Results: Selected Surveys .....	2
Box 1: List of Selected Surveys and Rationale for Selection: .....	4
Table 1. Surveys selected to conduct at Loess Bluffs National Wildlife Refuge 2018—2033. 6	
Narratives for Selected Surveys.....	10
Revising the IMP .....	29
References.....	29
Appendix A. Priority Resources of Concern and associated habitat types.....	31
Appendix B. Criteria and Weights Used to Prioritize Surveys.....	32
Appendix C. Prioritization Scores of All Ranked Surveys.....	38
Appendix D. Cost-benefit Analysis .....	39
Appendix E. Estimated Annual Costs for Implementing Surveys.....	41
Appendix F. Estimated Annual Work Schedule for Selected Surveys, January – December. ....	42
Appendix G. Non-selected Surveys.....	43
Appendix H. Refuge Condition Summaries .....	44
Appendix I. Environmental Action Statement (EAS).....	45
Appendix J. IMP Revision Signature Page.....	46

## **Introduction**

This inventory and monitoring plan (IMP) documents the surveys that will be conducted at Loess Bluffs National Wildlife Refuge from 2018 through 2033, or until the refuges' Comprehensive Conservation Plan (CCP) and Habitat Management Plan (HMP) are revised. The CCP and HMPs identify priority resources of concern and associated habitat types (Appendix A). All priority resources of concern are represented by one or more survey except for the monarch butterfly. Monarchs will not be monitored as a biological survey as defined in this document but they may be targeted through outreach efforts incorporating surveys.

The majority of surveys considered in this plan address resource management objectives identified in the Loess Bluffs NWR HMP (USFWS 2018) for these refuges. Other surveys are a continuation of past monitoring conducted for the purpose of understanding long-term trends in specific resources or are part of regional and national survey efforts. This IMP was developed according to the Inventory and Monitoring (I&M) policy (701 FW 2) for the National Wildlife Refuge System.

On January 11, 2017, U. S. Fish and Wildlife Service Director Daniel M. Ashe officially changed the name of Squaw Creek National Wildlife Refuge to Loess Bluffs National Wildlife Refuge. For this document the refuge will be referred to as Loess Bluffs National Wildlife Refuge (Loess Bluffs NWR; LBNWR; or refuge). LBNWR, located in northwest Missouri near Mound City, was established August 23, 1935, by Executive Order 7156 "in order to effectuate further the purpose of the Migratory Bird Conservation Act" and lands were to be used "as a refuge and breeding ground for migratory birds and other wildlife." This 7,440-acre refuge includes approximately 6,700 acres of floodplain. LBNWR's habitat diversity emphasizes both wetland and grassland, interspersed with stands of mixed shrubs and woodlands, managed on a scale to minimize habitat fragmentation for waterfowl, shorebirds, neo-tropical migrants, and other indigenous species. The refuge includes approximately 3,812.8 acres of wetlands; 2,175.4 acres of wet, mesic and upland prairie; 1,200.4 acres of bottomland and Loess Hill forest; and 251.4 acres of developed land.

## **Methods**

Station staff generated a list of extant and anticipated surveys by generating a list of all observational efforts to gather information on refuge resources. Survey lists provided by Region 3 Migratory Birds Division and Ecological Services were reviewed during the compilation process. This extensive list was later refined to exclude general observations (reconnaissance) of refuge resources that do not require protocols or data management. The remaining surveys were then assigned a priority score using 13 pre-defined criteria (Appendix B). Priority scores were used to assign the survey to one of three groups that ranked the surveys (Appendix C).

### ***Prioritizing and Selecting Surveys***

The priority ranking of surveys was determined during a one-day meeting at LBNWR on October 7th 2016. Refuge Manager, Lindsey Landowski, and Refuge Wildlife Biologist, Darrin

Welchert, met with Region 3 Zone Biologist, Brian Loges, to prioritize and initiate selection of the surveys. Background information for each survey was summarized in advance by the Refuge Wildlife Biologist and briefly discussed prior to prioritizing the surveys.

After refining the preliminary list down to 27 surveys, the remaining surveys were assigned a priority score using a Simple Multi-Attribute Ranking Technique (Appendix C) and 13 pre-defined criteria (Appendix B). The LBNWR staff made all decisions required to produce the survey priority scores (Appendix C).

### ***Estimating Capacity***

A cost-benefit analysis (Appendix D) was performed to evaluate the total return of potential sets of selected surveys over the life of the IMP. To determine a budget threshold, the staff responsible for completing natural resource surveys was asked to estimate the portion of their time in a typical year dedicated to the following: analysis and summary, data management, monitoring, research, and supervision. The portions of the year dedicated to the activities required for implementing surveys were converted to weeks. The time required to implement an annual iteration of a survey was also estimated using past experiences with established protocols or anticipated commitment for protocols that have yet to be developed. The total weeks of time available annually to implement surveys with current permanent staffing was estimated as 31.2 weeks. This estimate was expanded by 50% and 75% to reflect the addition of temporary but consistently-filled biotech positions. Since the portfolios were developed to document the total benefit of a set of surveys over the life of the IMP, the exercise was useful in identifying low frequency surveys with high cost efficiencies. Balancing the required commitment of the selected surveys with the resources available to the station at the time of the selection will increase the probability of survey implementation. Estimated annual costs for implementing surveys are documented in Appendix E.

### **Results: Selected Surveys**

The prioritization and cost benefit analysis were used in deliberative selection of surveys to be completed over the life of the IMP. In addition to the priority scores, the level of effort required to complete a survey as well as input from Region 3 Migratory Birds Division and Ecological Services was considered in the selection process. Selected surveys include surveys identified for completion with FY2017 levels of staffing and support. The list of surveys selected for implementation with existing resources represents a commitment to implementation by refuge staff. Box 1 provides brief rationales for all selected surveys. Changes in available capacity, CCP objectives, or other factors that alter the list of selected surveys through addition or removal of selected surveys will trigger a revision of this IMP (701 FW 2) and updates to the PRIMR database.

The process identified 18 surveys that can be completed with anticipated staffing levels and budget for the duration of this Inventory and Monitoring Plan (Table 1). An additional Management Action Survey was added after the Cost/Benefit Analysis had been completed. The selected surveys total an estimated 46.9 weeks of staff time. Most of the high ranking surveys have been selected for implementation. The North American Amphibian Monitoring Program

(NAAMP) or frog call survey was not selected because the United States Geological Survey along with Missouri Department of Conservation no longer manages or accepts data for this monitoring project. The White-tailed Deer Aging Studies was not selected because this survey is not currently ongoing and if needed may be completed by Missouri Western State University or Northwest State University as a training tool for undergraduate students. Marshbird surveys were not selected as individual surveys even though they rank as moderate priority. Marshbird surveys using the national point count method are not currently selected as survey conducted on LBNWR because the refuge conducts a marshbird/waterbird nest survey covering the same guild with a data set lasting over 20 years. Muskrat (*Ondatra zibethicus*) house surveys although they were rated lower were selected because muskrats are listed as a resource of concern and their density is linked to the maintenance of hemi-marsh habitat. The muskrat house survey takes a small amount of staff time to implement, manage data and can be incorporated into a single Integrated Waterbird Management and Monitoring Initiative survey. Deer surveys were also selected because prior to and after implementation of the deer hunting program on LBNWR deer population was much larger than (100 deer/mile<sup>2</sup>) than carry capacity and what was recommended by Missouri Department of Conservation (20-25 deer/mile<sup>2</sup>). Deer population surveys are conducted to ensure that the population stays at manageable rates. Deer are a high profile species for human dimension issues. Data related to deer harvest quotas are submitted to Missouri Department of Conservation for managed deer hunts.

An estimated annual work schedule for selected surveys is shown in Appendix F, and non-selected surveys are listed in Appendix G. Survey names were updated after the ranking exercise based on national and regional lists of standardized names and available protocols. A Refuge Condition Summary, a reporting tool to summarize status, trends, and desired conditions of the selected surveys, is provided in Appendix H. Environmental Action Statement requirements are addressed in Appendix I.

**Box 1: List of Selected Surveys and Rationale for Selection:**

Name	Rationale
Integrated Waterbird Management and Monitoring Initiative	Loess Bluffs NWR has a strong focus on wetland and waterbird management tied to purposes of the refuge.
Bat Detector Monitoring	Passive acoustic monitoring is used to assess occupancy of federally protected forest roosting bats within Loess Hills and floodplain forests.
National Vegetation Classification Standard (NVCS)	NVCS will be used to monitor broad scale habitat changes in different habitat types on the refuge.
Forest Inventory/ Forest Invasive Adaptive Management	Forest inventory will be used to inform a forest management plan. FIAM was developed to provide refuge biologists and managers with a framework for tackling invasive plants in a way that is cost-effective and compatible with policy.
Prairie Vegetation Monitoring	Prairie vegetation monitoring will be used to determine if management actions are effectively meeting composition objectives.
Water Quantity	Bathymetric maps will inform water management. Loess Bluffs NWR staff gauge, streamflow, and bathymetric data will be used to calculate yearly water use.
Landbird Survey	Landbird surveys will focus on birds listed as resources of concern on Loess Bluffs NWR.
Massasagua Geo-spatial Database	Prairie massasauga rattlesnakes ( <i>Sistrurus tergeminus tergeminus</i> ) are listed as a species of concern for wet-mesic and wet bottomland prairie habitat on Loess Bluffs NWR.
Blanding's Turtle Spatial Ecology	Blanding's turtle ( <i>Emydoidea blandingii</i> ) spatial ecology survey documents movement, habitat use, breeding ecology and assesses impact of water management actions on turtle movement.
Water Quality Monitoring	Increased sedimentation and poor water quality are factors that can severely impair the critical habitats.
Grassland Bird Transects	Grassland bird transect surveys will be conducted to monitor consequences of burning and other disturbance methods.
Wildlife Disease Monitoring	Reduce the spread of wildlife diseases including but not limited to avian cholera, avian botulism, avian influenza and snake fungal disease.

Name	Rationale
Mid-Winter Waterfowl Survey	The Mid-winter Waterfowl Survey is a nationwide effort to survey waterfowl in areas of major concentration on their wintering grounds and provide winter distribution and habitat affiliations.
Waterbird Nest Searching	Monitor marsh and water bird nesting to determine habitat utilization and effects of management on habitat.
Weekly Bald Eagle Counts	Bald eagles ( <i>Haliaeetus leucocephalus</i> ) are listed as a species of concern for bottom forest habitat on the Loess Bluffs NWR HMP.
White-tailed Deer Population Studies	White-tailed deer ( <i>Odocoileus virginianus</i> ) population studies are conducted to monitor refuge deer herd to ensure population density is within 20-25 deer per square mile. Deer are a high profile species for human dimension issues. Data related to deer harvest quotas are submitted to Missouri Department of Conservation for managed deer hunts.
Duck Energy Days	Duck Energy Days (DEDs) survey is used to determine if Loess Bluffs NWR wetland habitat contains enough waterfowl food to provide 5 million bird energy days over the fall/spring migration.
Muskrat House Count	Monitor muskrat ( <i>Ondatra zibethicus</i> ) population and location of muskrat generated hemi-marsh openings.
Management Actions	Required to document restoration and management activities.



**Table 1. Surveys selected to conduct at Loess Bluffs National Wildlife Refuge 2018—2033.**

Survey Priority <sup>1</sup>	Survey ID Number <sup>2</sup> (FF03R)	Survey Name/(Type) <sup>3</sup>	Survey Status <sup>4</sup>	Mgmt. Objective Id <sup>5</sup>	Survey Area <sup>6</sup>	Staff Time (FTE) <sup>7</sup>	Avg. Ann Cost (OPR) <sup>8</sup>	Survey Timing <sup>9</sup>	Survey Length <sup>10</sup>	Survey Coord. <sup>11</sup>	Protocol	
											Citation <sup>12</sup>	Status <sup>13</sup>
1	_SQC00-025	Integrated Waterbird Management and Monitoring Initiative (CM)	Current	HMP / 1.1, 2.1, 2.2, 2.3, 3.1, 3.2, 4.1, 4.2	Entire station	FWS: 0.12	\$0	Fall - Spring migration/ Recurring - - every year	2011- Indefinite	IWMM Coordinator	<a href="#">Loges et al. 2015</a>	(none)
2	_SQC00-027	Bat Detector Monitoring (CB)	Current	HMP / 8.1, 9.1	Entire station	FWS: 0.13	\$650	Spring - Fall/ Recurring - - every five years	2012- Indefinite	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions
3	_SQC00-031	(NVCS) National Vegetation Classification Standard (CM)	Current	HMP / 1.1, 2.1, 2.2, 2.3, 3.1, 3.2, 4.1, 4.2, 5.1, 6.1, 7.1, 8.1, 9.1	Entire station	FWS: 0.02	\$300	Summer/ Recurring - - every five years	2003- Indefinite	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions
4	_SQC00-076	Forest Inventory (CI)/ Forest Invasive Adaptive Management Program	Current	HMP / 8.1, 9.1	Multiple management units	FWS: 0.13	\$400	Summer - Fall/ Occurs one time only	2016- 2020	Darrin Welchert, Wildlife Biologist	USACE and <a href="#">Booker et al. 2017</a>	(none)
5	_SQC00-075	Prairie Vegetation Monitoring (M)	Current	HMP / 5.1, 6.1, 7.1	Multiple management units	FWS: 0.13, Other: 0.19	\$0	Summer - Fall/ Recurring - - every year	2016- Indefinite	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions

Survey Priority <sup>1</sup>	Survey ID Number <sup>2</sup> (FF03R)	Survey Name/(Type) <sup>3</sup>	Survey Status <sup>4</sup>	Mgmt. Objective Id <sup>5</sup>	Survey Area <sup>6</sup>	Staff Time (FTE) <sup>7</sup>	Avg. Ann Cost (OPR) <sup>8</sup>	Survey Timing <sup>9</sup>	Survey Length <sup>10</sup>	Survey Coord. <sup>11</sup>	Protocol	
											Citation <sup>12</sup>	Status <sup>13</sup>
6	_SQC00-111	Water Quantity (M)	Current	HMP / 1.1, 1.2, 3.1, 3.2, 4.1, 4.2	Entire station	FWS: 0.06	\$0	Sporadic or Ad Hoc	2018-2033	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions
8	_SQC00-110	Landbird Surveys (M)	Expected	HMP / 5.1, 6.1, 7.1, 8.1, 9.1	Multiple management units	FWS: 0.02	\$0	Recurring - - every three years	2020-2033	Darrin Welchert, Wildlife Biologist	<a href="#">Knutson et. al. 2015</a>	(none)
9	_SQC00-004	Massasauga Geo-spatial Database (CB)	Current	HMP / 5.1, 6.1, 11.1	Multiple management units	FWS: 0.03	\$500	Emergence / Recurring -- every year	2000-Indefinite	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions
11	_SQC00-030	Blanding's Turtle Spatial Ecology (CB)	Current	HMP / 1.1, 2.1, 3.2	Entire station	FWS: 0.06	\$0	Year round/ Recurring - - every year	2001-Indefinite	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions
12	_SQC00-013	Water Quality Monitoring (CB)	Expected	HMP / 10.1	Entire station	FWS: 0.03	\$0	Spring - Summer/ Recurring - - every year	2019-Indefinite	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions
15	_SQC00-041	Grassland Bird Transects (M)	Current	HMP / 5.1, 6.1, 7.1	Multiple management units	FWS: 0.02	\$0	Spring - Summer/ Recurring - - every year	2018-Indefinite	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions
17	_SQC00-024	Wildlife Disease Monitoring (BM)	Current	HMP / 11.1	Entire station	FWS: 0.02	\$0	Spring - Fall migration/ Sporadic or	2006-Indefinite	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions

Survey Priority <sup>1</sup>	Survey ID Number <sup>2</sup> (FF03R)	Survey Name/(Type) <sup>3</sup>	Survey Status <sup>4</sup>	Mgmt. Objective Id <sup>5</sup>	Survey Area <sup>6</sup>	Staff Time (FTE) <sup>7</sup>	Avg. Ann Cost (OPR) <sup>8</sup>	Survey Timing <sup>9</sup>	Survey Length <sup>10</sup>	Survey Coord. <sup>11</sup>	Protocol	
											Citation <sup>12</sup>	Status <sup>13</sup>
								Ad Hoc				
18	_SQC00-017	Mid-Winter Waterfowl Survey (CB)	Current	HMP / 1.1, 2.1, 2.2, 2.3, 3.1, 3.2, 4.1, 4.2	Entire station	FWS: 0.0	\$0	January/Recurring - - every year	1955-Indefinite	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions
20	_SQC00-015	Waterbird Nest Searching (M)	Current	HMP / 1.1, 2.1, 2.2, 2.3, 3.2	Entire station	FWS: 0.02	\$0	Spring - Summer/Recurring - - every year	1990-Indefinite	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions
21	_SQC00-010	Weekly Bald Eagle Counts (BM)	Current	CCP / 2.2, 2.6; HMP / 9.1	Entire station	FWS: 0.0	\$0	Weekly/Migration - Winter/Recurring - - every year	1992-Indefinite	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions
22	_SQC00-012	White-tailed Deer Population Studies (CM)	Current	CCP / 2.5	Entire station	FWS: 0.01	\$0	Recurring - - every year	1988-Indefinite	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions
23	_SQC00-112	Duck Energy Days (M)	Expected	CCP / 1.1	Multiple management units	FWS: 0.02	\$0	Recurring - - every year	2019-2033	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions

Survey Priority <sup>1</sup>	Survey ID Number <sup>2</sup> (FF03R)	Survey Name/(Type) <sup>3</sup>	Survey Status <sup>4</sup>	Mgmt. Objective Id <sup>5</sup>	Survey Area <sup>6</sup>	Staff Time (FTE) <sup>7</sup>	Avg. Ann Cost (OPR) <sup>8</sup>	Survey Timing <sup>9</sup>	Survey Length <sup>10</sup>	Survey Coord. <sup>11</sup>	Protocol	
											Citation <sup>12</sup>	Status <sup>13</sup>
26	_SQC00-011	Muskrat House Count (BM)	Current	HMP / 1.1, 2.3	Entire station	FWS: 0.0	\$0	Winter/Recurring - every year	1991-Indefinite	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions
NR	_SQC00-109	Management Actions	Current	N/A	Entire station	FWS: 0.01	\$0	Recurring - every year	1988-Indefinite	Darrin Welchert, Wildlife Biologist	(none)	Initial Survey Instructions

<sup>1</sup> The rank for each survey listed in order of priority (e.g., numeric, tiered, alpha-numeric, or combination of these). NR = not ranked.

<sup>2</sup> A unique identification number consisting of refuge code-computer assigned sequential number. Refuge code comes from the FBMS cost center identifier.

<sup>3</sup> Short titles for the survey name, preferably the same name used in refuge work plans. Also include the PRIMR code for survey type in parentheses. These are: Inventory (I), Cooperative Baseline Monitoring (CB), Monitoring to Inform Management (M), Cooperative Monitoring to Inform Management (CM), Research (R), and Cooperative Research (CR).

<sup>4</sup> Selected surveys planned for the lifespan of this IMP (i.e., Current, Expected).

<sup>5</sup> The management plan and objectives that justify the selected survey.

<sup>6</sup> Refuge management unit names, entire refuge, or names of other landscape units included in survey.

<sup>7</sup> Estimates of Service (FWS) and non-Service (Other) staff time needed to complete the survey (1 work year = 2080 hours = 1 FTE).

<sup>8</sup> Estimates of average annual operations cost for conducting the survey during the years it is conducted (e.g., equipment, contracts, travel) but not including staff time.

<sup>9</sup> Timing and frequency of survey field activities.

<sup>10</sup> The years during which the survey is conducted.

<sup>11</sup> The name and position of the survey coordinator (the Refuge Biologist or other designated Service employee) for each survey.

<sup>12</sup> Title, author, and version of the survey protocol (if there is no protocol to cite, enter None).

<sup>13</sup> Scale of intended use (Site-specific, Regional, or National) and stage of approval (Initial Survey Instructions, Complete Draft, In Review, or Approved) of the survey protocol.

## Narratives for Selected Surveys

**Survey:** Integrated Waterbird Management and Monitoring Initiative (IWMM)  
(FF03RSQC00-025)

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** 1

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 1.1, 2.1, 2.2, 2.3, 3.1, 3.2, 4.1, 4.2

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

The Integrated Waterbird Management and Monitoring Initiative protocol records bird use, water levels, vegetation, and management activities at the management unit scale. These data may be used to generate unit specific use-day estimates, document migration chronologies, and explore relationships between count data and habitat condition. Data summaries will guide state dependent decision making at the unit scale, such as choosing a soil disturbance prescription or a seasonal flood regime. Data can be used to assess the efficacy of management actions (accounting for management costs in terms of use-days for targeted populations) and support learning to improve management. Raw count data are also used to answer public inquiries regarding refuge-wide waterfowl populations. IWMM is supported by an online database that stores, manages, and reports waterbird, habitat, and management action data as a thematic node of the Avian Knowledge Network (AKN). The standardized protocol and database ensures refuge data are available for a wider range of analysis opportunities.

**What is the population or attribute of interest, what will be measured, and when?**

Biological Integrity; Other Biota; Plantae (plants); Aves (Birds); Pelecaniformes (Hérons, Ibises, Pelicans); Podicipediformes (Grebes); Charadriiformes (Plovers, Shore Birds, Gulls, Alcids, Auks, Oystercatchers); Suliformes (Cormorants); Anseriformes (Swans, Screamers, Geese, Ducks, Waterfowl); Gruiformes (Cranes, Rails); Gaviiformes (Loons); Recurring -- every year; This survey involves direct counts or estimates of waterbirds, site condition assessments, vegetation assessments, and management actions tracking for managed wetland units.

**Is this a cooperative survey? If so, what partners are involved in the survey?**

Yes, Coop Baseline Monitoring; U.S. Fish and Wildlife Service, Migratory Birds

**Survey:** *Bat Detector Monitoring (FF03RSQC00-027)*

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** 2

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 8.1, 9.1

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

Passive acoustical monitoring is used to assess forest bat communities for occupancy within Loess Hills and floodplain forest habitats. Emphasis of survey efforts will be placed upon occupancy of federally listed species including Indiana bats (*Myotis sodalis*) and northern long-eared bats (*M. septentrionalis*). This project will provide information on the geographic distribution, habitat use (when combined with forest inventory and FIAM data) and species occurrence trends of not only common but species of conservation concern on LBNWR. Once identified, optimal habitat for these species will become the goal of forest management prescriptions.

**What is the population or attribute of interest, what will be measured, and when?**

Biological Integrity; At-risk Biota; Mammalia (mammals); Chiroptera (bats); *Myotis sodalis* (Indiana bat) and *Myotis septentrionalis* (northern long-eared bat) - E- Wherever found; Recurring -- every 5 years; late Spring to early Fall

**Is this a cooperative survey? If so, what partners are involved in the survey?**

Yes, Coop Baseline Monitoring; Missouri Department of Conservation

**Survey:** *National Vegetation Classification Standard (NVCS) (FF03RSQC00-031)*

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** *03*

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 1.1, 2.1, 2.2, 2.3, 3.1, 3.2, 4.1, 4.2, 5.1, 6.1, 7.1, 8.1, 9.1,

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

National Vegetation Classification Standard (NVCS) will be used to monitor broad scale habitat changes in different habitat types on the refuge. The classification contains hierarchical levels of community specificity. The narrowest level within the classification is the Association. Classifying refuge habitat to the association level provides LBNWR with the ability to characterize species composition, identify species occurrence, habitat conditions, and physiognomy reflecting topo-edaphic conditions, climate, substrates, hydrology, and disturbance regimes. This information will be combined with the results of other surveys to identify optimal habitat types, and the effectiveness of management actions.

**What is the population or attribute of interest, what will be measured, and when?**

Landscapes (Ecosystem Pattern and Processes); Landscape Dynamics; Recurring -- every five years; Summer

**Is this a cooperative survey? If so, what partners are involved in the survey?**

Yes, Coop Monitoring to Inform Management; U.S. Geological Survey

**Survey:** *Forest Inventory and Forest Invasive Adaptive Management program (FIAM)*  
(FF03RSQC00-076)

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** 4

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 8.1, 9.1

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

Forest inventory (FI) will include characteristics such as tree species, tree height, tree diameter at breast height, tree canopy class, tree health, overstory height and closure, understory height and closure, understory species, and other notable features. These characteristics will be used to divide forest area into management units based on shared forest attributes, along with soil conditions. A management plan will be developed for each forest type and implemented. It is expected that the development of a management plan for this area will occur in the next 5-10 years and will be implemented accordingly. Results from the FI will be used to compare current forest conditions to desired stand conditions in Tables 4.2 and 4.3 of LBNWR HMP to see if conditions warrant management. FIAM was developed to provide refuge biologists and managers with a framework for tackling invasive plants in a way that is cost-effective and compatible with policy (Booker et al. 2017). FIAM formalizes a step-by-step process for 1) mapping invasive species distributions, 2) prioritizing the location of management actions, 3) treating the invasives, and 4) evaluating the effectiveness of the treatments (Booker et al. 2017).

**What is the population or attribute of interest, what will be measured, and when?**

Biological Integrity; Other Biota; Plantae (plants); Fagaceae (No common name); Occurs one time only; Summer/ Early Fall

**Is this a cooperative survey? If so, what partners are involved in the survey?**

Yes, Coop Baseline Monitoring; U.S. Fish and Wildlife Service, Region 3 FIAM



**Survey:** *Prairie Vegetation Monitoring (FF03RSQC00-075)*

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** 5

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 5.1, 6.1, 7.1

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

Prairie vegetation monitoring using 25 m belt transect protocol modified from Native Prairie Adaptive Management program will be used to determine which management action or combination of actions (prescribed burning, herbicide treatment, mechanical and/ or grazing) are most effective at promoting native grass and forb diversity. Responses to specific treatment actions (positive or negative) will be used to recommend treatment actions for the following year. Invasive species will be monitored in order to implement effective control methods. Ideal vegetative cover in prairie habitat on LBNWR includes the following <50% invasive species cover including reed canary grass (*Phalaris arundinacea*), >40% forbs and sedges, >40% tall grasses with an intent to rejuvenate prairie cordgrass (*Spartina pectinata*) habitat (>10% of the total area) of bottomland prairie.

**What is the population or attribute of interest, what will be measured, and when?**

Biological Integrity; Other Biota; Plantae (plants); Poaceae (grasses); Recurring -- every year; Summer/ Early Fall

**Is this a cooperative survey? If so, what partners are involved in the survey?**

NO

**Survey:** *Water Quantity (FF03RSQC00-111)*  
**Refuge:** *Loess Bluffs National Wildlife Refuge*  
**Priority:** 6

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 1.1, 1.2, 3.1, 3.2, 4.1, 4.2

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

Bathymetric maps will inform water management. LBNWR staff gauge, streamflow, and bathymetric data will be used to calculate the refuge's yearly water budget which ensures timing of flooding, water quantity and drawdowns meet species of concern habitat goals.

**What is the population or attribute of interest, what will be measured, and when?**

Water; Hydrology; Sporadic or Ad Hoc

**Is this a cooperative survey? If so, what partners are involved in the survey?**

NO

**Survey:** *Landbird Surveys (FF03RSQC00-110)*

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** 8

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 5.1, 6.1, 7.1, 8.1, 9.1

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

Landbird surveys will be conducted using point counts and Region 3 landbird protocol to document bird use in woodland/forest habitat with focus on birds listed as resources of concern on LBNWR. Occupancy and or density of the priority ROCs: Kentucky warblers (*Oporornis formosus*), red-headed woodpeckers (*Melanerpes erythrocephalus*), and wood thrush (*Hylocichla mustelina*) will be coupled with the forest resource inventory to expand staffs' knowledge of suitable habitat.

**What is the population or attribute of interest, what will be measured, and when?**

Biological Integrity; Other Biota; Aves (Birds); Passeriformes (Perching Birds); Piciformes (Woodpeckers); *Melanerpes erythrocephalus* (Red-headed Woodpecker); *Hylocichla mustelina* (Wood Thrush); *Oporornis formosus* (Kentucky Warbler); Recurring -- every three years;

**Is this a cooperative survey? If so, what partners are involved in the survey?**

NO

**Survey:** *Massasauga Geo-spatial Database ((FF03RSQC00-004)*

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** 9

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 5.1, 6.1, 11.1

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

Prairie massasauga rattlesnakes (*Sistrurus tergeminus tergeminus*) are listed as a species of concern for wet-mesic and wet bottomland prairie habitat on LBNWR. The massasauga geo-spatial database survey is used to determine population status (mark and recapture) and demographics (male vs. female ratios, adult vs. juvenile ratios, body condition, and reproductive status) along with habitat use, hibernacula, emergence and disease (snake fungal disease or SFD). Monitoring of SFD in prairie massasaugas is needed to thoroughly assess the spatial extent, percent of the population infected, effect on population dynamics/structure and other associated species infected. Survey results including emergence (date, soil and ambient temperature), population status/ demographics and habitat occupancy will influence management actions including but not limited to prescribed burning, mechanical and/ or herbicide treatments in regards to timing, frequency or location.

**What is the population or attribute of interest, what will be measured, and when?**

Biological Integrity; At-risk Biota; Reptilia (Reptiles); Squamata (Snakes, Amphisbaenians, Lizards); *Sistrurus tergeminus tergeminus* (Prairie Massasauga);  
Recurring -- every year; during emergent period of snakes

**Is this a cooperative survey? If so, what partners are involved in the survey?**

Yes, Coop Baseline Monitoring; Academia; Missouri Department of Conservation

**Survey:** *Blanding's Turtle Spatial Ecology (FF03RSQC00-030)*

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** *11*

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 1.1, 2.1, 3.2

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

Blanding's turtle (*Emydoidea blandingii*) spatial ecology survey is conducted using VHF transmitters and temperature data loggers to document movement (home range), habitat use (dominant vegetation, water depth, clarity, and temperature), breeding ecology and assessment of water management actions on turtle movement. Survey results will be used to make sure LBNWR provides adequate hemi-marsh and open water habitat along with water depths sufficient enough for life history needs of Blanding's turtles especially during brumation. This is a collaborative project between the refuge, Missouri Department of Conservation, Missouri Western State University, Northwest Missouri State University and other local universities.

**What is the population or attribute of interest, what will be measured, and when?**

Biological Integrity; At-risk Biota; Reptilia (Reptiles); Testudines (tortoises, terrapins, Turtles); *Emydoidea blandingii* (Blanding's Turtle); Recurring -- minimum of 5 out of 15 year time period; year round

**Is this a cooperative survey? If so, what partners are involved in the survey?**

Yes, Coop Baseline Monitoring; Academia, Missouri Department of Conservation

**Survey:** *Water Quality Monitoring (FF03RSQC00-013)*

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** 12

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 10.1

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

Increased sedimentation and poor water quality are factors that can severely impair the important habitats and the wildlife that use wetland habitats on the refuge. Reducing sedimentation and improving water quality is essential to ensuring good ecosystem health within the refuge. Working with cooperators LBNWR staff intends to reduce sedimentation from soil erosion and improve water quality on LBNWR from private lands in the 60,000 acre upstream watershed using conservation practices fostering improved soil and water uses. Previous surveys conducted in 1937, 1964, and 2002 completed by USFWS and/or the USGS showed a mean total sediment deposition of 0.047 ft/yr and a mean volume of 152 acre-ft/yr. Some areas of LBNWR have exceeded 8 ft of sediment deposition in over 65 years (Heimann and Richards 2003). The primary contributor to wetland sedimentation is Squaw and Davis creek basins along with periodic flooding from the Missouri River. Predominant land use within the watershed outside the refuge is agriculture, which contributes to the sediment load of Davis and Squaw creeks. Any information gathered in relation to sedimentation and water quality will be used to help guide management actions aimed at improving wetland management (i.e., water control structure installation, levee repair, and water depth calculations across units compared to bird use days), monitoring, and reducing sedimentation on LBNWR. If such actions are successful, wetland habitats on LBNWR will continue to be productive and resilient for use by waterfowl, shorebirds and other wetland dependent species. The refuge will partner with federal, state, local, university, and/or non-profit organizations (e.g., USGS or NRCS) to monitor water quality and sedimentation in Squaw Creek and Davis creeks through the determination of standards including, but not limited to, pH, dissolved oxygen, nitrates, phosphorus, total suspended solids, specific conductivity, turbidity and salinity. According to the EPA Water Quality Standards, the following ranges are ideal for freshwater habitats: pH (6.5-9.0); dissolved oxygen (5-7 mg/L) and nitrates (10mg/L) (EPA 1986; 2017). It is recommended that suspended solids should not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent (EPA 2017).

**What is the population or attribute of interest, what will be measured, and when?**

Water; Water Quality; Recurring -- every year; bi weekly - late Spring - late Summer

**Is this a cooperative survey? If so, what partners are involved in the survey?**

Yes, Coop Baseline Monitoring. USGS & NRCS.

**Survey:** *Grassland Bird Transects (FF03RSQC00-041)*

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** 15

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 5.1, 6.1, 7.1

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

Grassland bird transect surveys will be conducted in order to monitor consequences of burning and other disturbance methods on prairie plant assemblages of LBNWR using protocol and transects developed by Missouri River Bird Observatory. Distance sampling techniques will be employed during the late spring and summer (last two weeks of May to first two weeks of June) to determine habitat use by breeding species such as grasshopper sparrows (*Ammodramus savannarum*;  $\geq 0.054$  bird/acre), dickcissels (*Spiza Americana*;  $\geq 0.426$  birds/acre), and other associated species similar to what Ripper and Duke (2017) documented in Missouri grasslands. Disturbance methods including but not limited to prescribed burning (seasonality or frequency), herbicide treatment, mechanical, interseeding and/ or grazing will be altered if bird numbers decrease below acceptable levels.

**What is the population or attribute of interest, what will be measured, and when?**

Biological Integrity; Other Biota; Aves (Birds); Passeriformes (Perching Birds); Recurring -  
- every year; late Spring - Summer

**Is this a cooperative survey? If so, what partners are involved in the survey?**

NO

**Survey:** *Wildlife Disease Monitoring (FF03RSQC00-024)*

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** 17

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 11.1

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

Wildlife disease monitoring surveys will be used to help reduce the spread of wildlife diseases including but not limited to avian cholera, avian botulism, avian influenza and snake fungal disease. Early detection is needed to keep wildlife disease outbreaks as small as possible (collect carcasses of animals  $\geq 5$  per species or total of multiple species as recommended by ([USGS n.d. A](#)). Minimize disease transmission between subpopulations and refuge habitat types for example between refuge wetland pools and sub-populations of prairie massasauga rattlesnakes like the railroad and main wet prairie. Submission and diagnosis of avian disease cases is extremely important in identifying the causes of mortality in wild bird populations ([USGS n.d. B](#)). This information helps us to: a) determine the impacts mortality events have on avian populations, b) identify hotspots of disease on the landscape, c) develop management strategies to lessen the impacts of disease, and d) provide early warning for agents that may cause disease in livestock or humans ([USGS n.d. B](#)). Other wildlife diseases can have detrimental effects on populations especially in regards to resources of concern like the prairie massasauga rattlesnake. Of particular interest, snake fungal disease (SFD) has been emerging in certain populations of wild snakes in the eastern and Midwestern United States (USGS 2013). Symptoms of SFD were noted at LBNWR as early as 2011 with positive confirmation in prairie massasauga rattlesnakes and associated species in 2016 (Welchert et al. 2017). Further monitoring of SFD is needed to identify the extent of occurrence and the potential effect on snake populations on LBNWR including prairie massasaugas and other associated species.

**What is the population or attribute of interest, what will be measured, and when?**

Biological Integrity; Infestations and Disease; Reptilia (Reptiles); Aves (Birds); Squamata (Lizards, Amphisbaenians, Snakes); Charadriiformes (Alcids, Oystercatchers, Auks, Plovers, Shore Birds, Gulls); Anseriformes (Screamers, Ducks, Geese, Waterfowl, Swans); Sporadic or Ad Hoc; Spring and Fall migration

**Is this a cooperative survey? If so, what partners are involved in the survey?**

NO



**Survey:** *Mid-Winter Waterfowl Survey (FF03RSQC00-017)*

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** 18

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 1.1, 2.1, 2.2, 2.3, 3.1, 3.2, 4.1, 4.2

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

The Mid-winter Waterfowl Survey is a nationwide effort to survey waterfowl in areas of major concentration on their wintering grounds and provide winter distribution and habitat affiliations ([USFWS n.d.](#)). This survey also serves as a primary source of data on population trends for some species that breed in remote Arctic locations and are difficult to survey using traditional methods. Therefore, abundance indices for some of these species are obtained from surveys on wintering areas. For species not covered in other population surveys these indices provide direct inputs into management programs such as harvest management plans. When refuge biological staff conducts this survey it's done in conjunction with IWMM and under IWMM protocol. Just like the IWMM, these data may be used to generate unit specific use-day estimates, and document migration chronologies.

**What is the population or attribute of interest, what will be measured, and when?**

Biological Integrity; Other Biota; Aves (Birds); Anseriformes (Swans, Waterfowl, Screamers, Ducks, Geese); Recurring -- every year; January- one day

**Is this a cooperative survey? If so, what partners are involved in the survey?**

Yes, Coop Baseline Monitoring; U.S. Fish and Wildlife Service, Migratory Birds; Missouri Department of Conservation

**Survey:** *Waterbird Nest Searching (FF03RSQC00-015)*

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** 20

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 1.1, 2.1, 2.2, 2.3, 3.2,

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

The marsh and water bird nesting survey is used to determine habitat use and effects of management on habitat occupancy. Marsh bird nesting surveys will be conducted during breeding season on all flooded wetlands to document nesting habitat use of all relevant marsh bird species including, but not limited to, least bitterns (*Ixobrychus exilis*), pied-billed grebes (*Podilymbus podiceps*), and common gallinules (*Gallinula galeata*) Primary focus will be on nesting least bitterns which are listed as resource of concern for the HMP. At minimum, this survey records species, number of eggs/chicks, water depth, height above water and dominant vegetation for each nest detected. Associating these data with other surveys measuring including water depth and vegetation use will inform management, and ensure that the station stays within HMP prescriptions.

**What is the population or attribute of interest, what will be measured, and when?**

Biological Integrity; Other Biota; Aves (Birds); Pelecaniformes (Hérons, Ibises, Pelicans); Podicipediformes (Grebes); Gruiformes (Cranes, Rails); Recurring -- every year; spring summer during nesting

**Is this a cooperative survey? If so, what partners are involved in the survey?**

NO

**Survey:** *Weekly Bald Eagle Counts (FF03RSQC00-010)*

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** *21*

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

CCP Objectives; 2.2, 2.6 and HMP Objective: 9.1

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

Bald eagles (*Haliaeetus leucocephalus*) are listed as a species of concern for bottomland forest habitat on the LBNWR HMP. Weekly bald eagle counts are conducted to document peak numbers and bird use days in wetlands and floodplain forest habitat on the refuge. In addition, bald eagles are a high profile species which are of special interest to the public (USFWS 2005). The Bald eagle survey isn't clearly linked to habitat refuge management decisions. However, the general public is extremely interested in the information and results could inform future public use decisions. This survey is conducted in conjunction with IWMM i.e. done on the same day, at the same time and covering the same route. In addition, densities derived from this survey could be relevant to off-refuge impacts as new wind power projects are placed in the landscape.

**What is the population or attribute of interest, what will be measured, and when?**

Biological Integrity; Other Biota; Aves (Birds); Accipitriformes (Hawks); Recurring -- every year; Weekly during migration and winter

**Is this a cooperative survey? If so, what partners are involved in the survey?**

NO

**Survey:** *White-tailed Deer Population Studies (FF03RSQC00-012)*

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** 22

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

CCP Objective: 2.5

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

White-tailed deer (*Odocoileus virginianus*) population studies are conducted to monitor refuge deer herd to ensure population density is within 20-25 deer per square mile. Accurate density is difficult to determine because the population fluctuates both seasonally and annually. Past high deer densities (100-140 deer per square mile) negatively affected habitats, such as understory vegetation in the bottomland forests. Loss of understory vegetation negatively affected other species of interest. The refuge will continue monitoring the size of the herd through annual spotlight surveys in cooperation with universities and other State and federal agencies. The refuge will manage the size of the white-tailed deer herd on the refuge through controlled hunts. This survey in conjunction with the deer harvest records are used as a part of the Refuge deer management program that is responsive to public interest in this high-profile recreational species.

**What is the population or attribute of interest, what will be measured, and when?**

Biological Integrity; Other Biota; Mammalia (mammals); Artiodactyla (even-toed ungulates, artiodactyls, cloven-hoofed ungulates); Recurring -- every year; Annually- 4 times

**Is this a cooperative survey? If so, what partners are involved in the survey?**

Yes, Coop Monitoring to Inform Management; Academia; Missouri Department of Conservation

**Survey:** *Duck Energy Days (FF03RSQC00-112)*  
**Refuge:** *Loess Bluffs National Wildlife Refuge*  
**Priority:** 23

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

CCP Objective: 1.1

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

Duck Energy Days (DEDs) survey is used to determine if LBNWR wetland habitat contains enough waterfowl food (millet, smartweed, etc.) to provide 5 million bird energy days over the fall/spring migration. Assessing moist-soil seed or other preferred waterfowl food quantities documents results from wetland management techniques to promote high energy habitats. These include but are not limited to water budget, timing of drawdown, and mechanical/ herbicide treatment.

**What is the population or attribute of interest, what will be measured, and when?**

Biological Integrity; Other Biota; Aves (Birds); Anseriformes (Geese, Waterfowl, Ducks, Screamers, Swans); Recurring -- every year;

**Is this a cooperative survey? If so, what partners are involved in the survey?**

NO

**Survey:** *Muskrat Houses (FF03RSQC00-011)*

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** 26

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 1.1, 2.1, 2.3

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

Monitor muskrat (*Ondatra zibethicus*) population and location of muskrat eat-out areas to determine general information regarding population density (with a minimum of  $0.28 \pm 0.16$  muskrat houses/acre based on the long term average of unpublished refuge data) and response to habitat management. Muskrats function as valuable components of the wetland ecosystem, creating open areas within vegetation used by marsh birds. These areas also help to maintain a 50/50 ratio of open water and emergent vegetation which aligns with HMP Objective 2.1. It is important to monitor muskrat populations to ensure that population numbers do not increase beyond the capacity of the wetland to sustain emergent vegetation growth (Allen and Hoffman 1984). Muskrat population densities will be allowed to cycle naturally or will be controlled using water management i.e. drawdowns when emergent vegetation is <25%.

**What is the population or attribute of interest, what will be measured, and when?**

Biological Integrity; Other Biota; Mammalia (mammals); Rodentia (rodents); Recurring -- every year; Winter-one day

**Is this a cooperative survey? If so, what partners are involved in the survey?**

NO

**Survey:** *Management Actions (FF03RSQC00-109)*

**Refuge:** *Loess Bluffs National Wildlife Refuge*

**Priority:** *NR*

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives: 1.1, 2.1, 2.2, 2.3, 3.1, 3.2, 4.1, 4.2, 5.1, 6.1, 7.1, 8.1, 9.1, 10.1, 11.1

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

This survey documents habitat management and restoration activities completed by refuge staff for the current fiscal year. The survey is also retroactive capturing available legacy management actions completed by the refuge or by other entities prior to refuge acquisition. Current fiscal year activities will be organized by annual work plans while legacy information existing in multiple forms will be archived as part of an on-going effort by the Division of Natural Resources and Conservation Planning to secure management history of refuge properties in ServCat. Information will be collected at the greatest available detail required to inform future assessments of long term habitat restorations.

**What is the population or attribute of interest, what will be measured, and when?**

Recurring -- every year; December

**Is this a cooperative survey? If so, what partners are involved in the survey?**

NO

## Revising the IMP

The Project Leader will review the refuge capacity and status of surveys annually and determine which of the selected surveys will be implemented in that year. The PRIMR database was updated along with this IMP; it will be updated as approved protocols are linked to the selected surveys and when surveys are added or removed from the set of selected surveys.

The IMP will be revised according to I&M Policy and as CCP and HMP plans are modified (see Appendix J). An IMP revision is triggered when surveys are added or removed from the set of selected surveys. IMP revisions require signatures from refuge staff, Regional I&M staff, Regional Refuge Biologist/Natural Resources Division Chief, but not the Refuge Supervisor or Regional Chief of Refuges.

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## Appendix A. Priority Resources of Concern and associated habitat types.

The following species and natural communities were identified as priority resources of concern in Table 3.4 of the 2016 Loess Bluffs NWR HMP (USFWS 2018).

<i>Resource of concern</i>	Loess/ Glacial Till Prairie	Bottomland Prairie	Wet Shoreline Mud Flats	Wet Shoreline Marsh	Marsh	Bottomland Forest	Transitional Edge	Loess/Glacial Till Forest
Monarch Butterfly	x	x						
Grasshopper Sparrow	x	x						
Dickcissel	x	x						
Prairie Massasauga		x						
Short-eared Owl		x						
Hudsonian Godwit			x					
Pectoral Sandpiper			x					
Black Tern				x				
Mallard				x				
Snow Goose				x				
Trumpeter Swan				x				
Least Bittern					x			
Muskrat					x			
Bald Eagle						x		
Red-headed Woodpecker						x		
Wood Thrush						x	x	
Northern Long-eared Bat						x	x	x
Kentucky Warbler						x		x

## Federally listed Threatened or Endangered Species

<i>Species</i>	<i>Status</i>
Least tern	<i>Sterna antillarum</i> Endangered
Piping Plover	<i>Charadrius melodus</i> Endangered
American peregrine falcon	<i>Falco peregrinus anatum</i> Recovery
Bald eagle	<i>Haliaeetus leucocephalus</i> Recovery

## Appendix B. Criteria and Weights Used to Prioritize Surveys

Each criterion is grouped under one of eight themes that describe a survey's general contribution to a refuge's or broader needs. Rating values (1—2, 1—3, or 1—4) that are used to score each survey are also given for each criterion. NOTE: The 24 criteria recommended by the NRPC were reduced to the following 13 for use in Region 3. The additional 11 criteria were removed because they would not apply to refuges in the Midwest, were redundant with other criteria, or would not add discrimination among surveys in the Midwest.

### Refuge Priorities and Management Needs

#### 1. CCP or Other Management Plan Objectives

How many refuge CCP or other management plan objectives (e.g., HMP, NRMP, Fire Management Plan, Recovery Plan, Integrated Pest Management Plan) are met by the focus of this survey?

*Example 1: A survey of staff gauge readings for water levels in representative units can be used to evaluate a range of wetland habitat objectives including seasonal, emergent, and permanent types.*

*Example 2: An Early Detection Rapid Response survey can be used to discover the presence of highly invasive plant species in multiple refuge habitats.*

1. Does not address an objective
2. Addresses one objective
3. Addresses two objectives
4. Addresses three or more objectives

#### 2. Management Utility (Decision Support) for the Refuge

Does the survey provide data for recurring management decisions, especially as part of an existing decision framework that is implemented on a regular basis?

*Surveys providing information to either directly evaluate or serve as indicators of high-priority management actions can be considered as earning a 3 or 4 rating for this criterion.*

1. No set application for the refuge
2. May have management implications, but they are not explicitly defined
3. Has management implications, but no current decision framework
4. Part of an existing adaptive management decision framework

### Partner Priorities and Management Needs

#### 3. FWS Programs

Does the survey provide information that directly contributes to evaluating the status and trends of resources that are a priority for another FWS regional or national program (e.g., Migratory Birds, Fisheries, Water Resources/Hydrology *other than ESA species*)?

*Example 1: North American Breeding Bird Survey, North American Amphibian Monitoring program, Mid-Winter Waterfowl Survey, and Circumpolar Biodiversity Monitoring Network are priority surveys for regional or national FWS programs.*

1. Does not address a management priority identified by a FWS regional or national program or initiative
2. Addresses a management priority identified by 1 FWS regional or national program or initiative
3. Addresses a management priority identified by 2 FWS regional or national programs or initiatives

4. Addresses a management priority identified by  $\geq 3$  FWS regional or national programs or initiatives

#### **4. FWS Partners**

Does the survey address an identified priority of a conservation partner, such as a Landscape Conservation Cooperative(s) (LCC), state agencies, or other conservation partner?

*These priorities should be obtained from documents such as the State Wildlife Action and Joint Venture plans. The staff should document where they obtained these priorities and if they were high- or medium-level priorities. The refuge itself does not count as a partner.*

1. Does not focus a management priority identified by FWS partners (e.g., LCC, state agency)
2. Focus on a management priority identified by one FWS partner (e.g., LCC, state agency)
3. Focus on a management priority identified by two FWS partners (e.g., LCC, state agency)
4. Focus on a management priority identified by three or more FWS partners (e.g., LCC, state agency)

### **Ecological Applications**

#### **5. FWS Surrogate Species**

Does the survey focus on a surrogate species selected by the FWS?

*These should include any focal, indicator, any other surrogate concept that has been designated and used by the FWS (e.g., JV focal species).*

1. No
2. Yes, one FWS surrogate species
3. Yes, two FWS surrogate species
4. Yes, three or more FWS surrogate species

#### **6. Refuge Processes**

Does the survey focus on an ecological process (e.g., fire, water temperature, climate) that is changing at a rate that is important to the refuge?

1. No
2. Yes, one significant ecological process
3. Yes, two or more significant ecological processes

#### **7. Survey Breadth**

The focus of the survey is:

1. A single species or abiotic parameter
2. Multi-species or multi-abiotic parameters
3. A community – multi-trophic level or biota
4. An ecosystem – biotic community and abiotic parameters

### **Additional Legal Mandates**

#### **8. Listed species or vegetation communities**

Is the objective of the survey a species or vegetation community federally listed under ESA, state listed (threatened or endangered only), ranked by the state's natural heritage program (S1 or S2 rank only), globally ranked by NatureServe (G1 or G2 rank only), or globally listed on the IUCN Red List of Threatened Species (Critically Endangered, Endangered, or Vulnerable only)?

1. Not state, federally or globally ranked
2. Yes, state listed or ranked by state's natural heritage program
3. Yes, globally listed by NatureServe or IUCN
4. Yes , federally listed under the ESA as threatened or endangered

## Immediacy of Need

### 9. Controversy

Does the survey support decision-making to address an action or management decision related to refuge resources that is controversial to an external party?

*Note: Document why the refuge staff knows or suspects an action is controversial because the interpretation can vary from person to person. Controversy can be associated with the general public, specific interest group(s) (e.g., animal rights activist, cooperative farmers), or one or more conversation partners. This criterion is focused on a high level of known or suspected controversy from outside interests where the Service could be litigated, refuge actions that could result in a precedent setting action, or severely damage a working relationship with the state or other conversation partner. This criterion does not pertain to suspected or known issues among refuge staff members and/or other FWS employees. Examples of controversy include changes to livestock grazing, predator control, and changes to harvest regulations or water allocation.*

1. Not controversial and little to no potential for controversy
2. Not currently controversial, but potentially or suspected of controversy
3. Known controversy, but data or immediate management action is not currently needed but may be in the near future
4. Pressing controversy; data required to support immediate management action

### 10. Threat

Does the survey support decision-making to monitor and mitigate a known or suspected threat to refuge resources?

*Note: This criterion scores surveys addressing known or suspected threats. It does not apply to baseline monitoring intended to detect new (i.e., unknown) threats or changes. If surveys are determined from a Natural Resources Management Plan (e.g., R8), focus on the threat reduction strategies identified in that plan and use adopt the scoring strategy shown in parentheses. Examples of threats may include invasive species, pollutants or toxins, and climate change.*

1. No existing threat or potential for a threat to Refuge resources (the survey does not relate to threat reduction strategies)
2. No known threat, but potential for a threat to Refuge resources (Yes, supports decision making to address a threat reduction strategy with a score of \_\_\_\_ [e.g. 2.5])
3. Known threat to Refuge resources, but immediate management action is not currently needed but may be in the near future (Yes, supports decision making to address a threat reduction strategy with a score of \_ [e.g. 3.0])
4. Urgent threat to Refuge resources; immediate data are needed to support management action (Yes, supports decision making to address a threat reduction strategy with a score of \_\_\_\_ [e.g. 3.5])

## Scope and Scale

### 11. Baseline data

Does the survey provide high-priority information that contributes to baseline data needs?

*Example: Inventories of species guilds (e.g., invertebrates, plants, reptiles) or abiotic parameters (soils, waters).*

1. No
2. Yes

## 12. Spatial Scale

What is the largest scale at which survey results will be applied for resource management?

*Note: Only surveys with a protocol that establishes methods for data management and analysis are scored higher than a 1. The area of inference for larger-scale surveys (e.g., North American Amphibian Monitoring Program) should be considered from the refuge perspective unless the refuge directly contributes to analyses at a larger scale. This criterion is applicable to surveys covering areas on and adjacent to the refuge. Example: If a refuge participates and contributes to a regional survey involving neighboring US Forest Service lands, then this criterion would apply.*

1. Small scale: Applicable to only a single refuge or sites on a refuge
2. Medium scale: Applicable to a few refuges, a refuge complex, or includes the refuge and a small area beyond the refuge boundary
3. Large scale: Applicable to multiple refuges/complexes across an entire ecoregion, LCC, or region
4. Continental scale: Component of a large landscape level survey (e.g., North American Breeding Bird Survey, North American Amphibian Monitoring Program, and Circumpolar Biodiversity Monitoring Network)

## Protocol

### 13. Protocol development & data management, analysis, and reporting

At what stage of development is the protocol development, data management, analysis, and reporting?

1. Survey has no written protocol, data management, analysis, and/or reporting
2. Written protocol is in development (drafted)
3. Written protocol is in formal review
4. There is a published record or I&M approved protocol

## Terms Used in the Prioritization Criteria

For Criterion #1, refuge purpose is defined within the National Wildlife Refuge System Mission and Goals and Refuge Purposes policy (601 FW 1).

The NWRS Improvement Act defines “purposes of the refuge” as the “purposes specified in or derived from the law, proclamation, Executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit.”

Refuges acquired under the authority of general conservation laws take on the purpose of the law. Examples of such laws include the Endangered Species Act of 1973, as amended; the Migratory Bird Conservation Act; the Fish and Wildlife Act of 1956, as amended; the Fish and Wildlife Coordination Act, as amended; the Emergency Wetlands Resources Act of 1986; and the Alaska National Interest Lands Conservation Act of 1980. Executive orders and proclamations, Secretary’s Orders, public land orders, and refuge-specific legislation generally declare the purpose(s) of the refuge, sometimes broadly (e.g., “as a preserve and breeding ground for native birds”) and sometimes very specifically (e.g., “to protect and preserve in the national interest the Key deer and other wildlife resources in the Florida Keys”).

As written in the Wilderness Act of 1964, the purposes of the Act are to be “within and supplemental” to the purpose(s) of those refuges with designated wilderness. We interpret this to mean the wilderness purposes become additional purposes of the refuge, yet apply only to those areas of the refuge designated as wilderness. Wilderness designations provide additional considerations for determining the administrative and management actions we need to take to achieve a refuge’s purpose(s) on designated wilderness areas within the Refuge System.

Throughout the criteria, the term refuge refers to one or more refuges in the NWRS. Based upon 601 FW 1, a refuge is defined as “...all lands, waters, and interests therein administered by the Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas managed by the Refuge System for the protection and conservation of fish and wildlife, including threatened and endangered species, as determined in writing by the Director of the Service, by Secretary’s Order, or so directed by the President.”

Definitions of refuge management activities and refuge uses derived from the Compatibility policy (603 FW 2.6) that apply to all refuges:

**Table B-1.** Weight Applied to Prioritization Criteria.

The following 13 criteria were weighted by refuge staff at Loess Bluffs NWR (relative values in parentheses with highest values representing criteria that are most important to refuge staff) and used to rank surveys through a Simple Multi-Attribute Ranking Technique (SMART tool).

	<b>Criteria</b>	<b>Station-specific weight</b>	<b>Comparison to even weight</b>
1	CCP or Other Management Plan Objectives	0.13	0.05
2	Management Utility	0.09	0.02
3	FWS Program Need	0.03	-0.04
4	FWS Partner Need	0.07	-0.01
5	FWS Surrogate Species	0.09	0.01
6	Refuge Processes	0.09	0.01
7	Survey Breadth	0.07	0.00
8	Listed Species or Vegetation Communities	0.10	0.03
9	Controversy	0.05	-0.03
10	Threat	0.10	0.03
11	Baseline Data	0.03	-0.05
12	Spatial Scale	0.10	0.02
13	Data Management, Analysis, and Reporting	0.05	-0.03



## Appendix C. Prioritization Scores of All Ranked Surveys

Values used to prioritize and select the surveys likely to be conducted through 2031 at Loess Bluffs National Wildlife Refuge. Prioritization scores were generated for candidate surveys by refuge staff using 13 criteria for each survey (Appendix B). Candidate surveys represent specific surveys or general information needs and were not always associated with specific protocols. Groups A, B, C, D, and E represent the >90<sup>th</sup>, >80<sup>th</sup>, >70<sup>th</sup>, >50<sup>th</sup>, and <50<sup>th</sup> percentiles respectively. Surveys with a historic status has been discontinued as stand-alone surveys and incorporated into other surveys.

**Table C-1** Ranking of priority scores from the SMART tool for all considered surveys.

<i>Survey</i>	<i>Final Rank</i>	<i>Final Score</i>	<i>Group</i>
IWMM	1	0.729	a
Bat Detector	2	0.661	a
NVCS	3	0.555	b
Forest Inventory	4	0.540	b
wet prairie veg	5	0.520	c
water quantity	6	0.519	c
Weekly Shorebird Counts (Part of IWMM in 2011)/ International Shorebird Survey (ISS)	7	0.500	c
Landbirds	8	0.453	c
Massasauga Geo-spatial Database	9	0.431	d
Secretive Marshbirds	10	0.410	d
Blanding's Turtle Spatial Ecology	11	0.404	d
Water Quality	12	0.353	d
BBS (vacant)	13	0.344	d
NA Amphibian Monitoring Program	14	0.322	e
Grassland Bird Transects	15	0.313	e
Cover Board	16	0.295	e
Avian Influenza (Wildlife Disease Monitoring)	17	0.261	e
Midwinter Waterfowl Survey	18	0.255	e
Bees	19	0.243	e
Waterbird Nest	20	0.218	e
Bald eagle	21	0.184	e
White-tailed Deer Population	22	0.179	e
Duck Energy Days	23	0.156	e
Small Mammal	24	0.088	e
Beaver Lodge	25	0.068	e
Muskrat Houses	26	0.064	e
White-tailed Deer Aging	27	0.017	e

## Appendix D. Cost-benefit Analysis

The following table includes results from direct selections and linear programming approaches (all optimized sets). The optimized portfolios used the total of all frequency adjusted scores as an objective function. Main constraints included costs (weeks) and surveys selected prior to solving the linear function (summation of frequency adjusted scores across all surveys). Portfolios represent sets of selected surveys as IMP variants.

**Table D-1.** Parameters framing IMP portfolios presented in Table C-2.

Portfolio	Parameters
1	Top-down selection from ranked list
2	Top 10 selection
3	All surveys selected
4	Optimized for maximum benefit
5	Optimized constrained to select top 2 by rank
6	Optimized constrained to select top 5 by rank
7	Optimized constrained to 50% staff time
8	Top-down selection from ranked list 75% staff time
9	Top-down selection from ranked list 50% staff time
10	Optimized constrained to IWMM
11	Optimized constrained to bats
12	Optimized constrained to IWMM, prairie, FI, massasauga, and blandings
13	Optimized constrained to IWMM and bats
14	Top-down selection from ranked list 1.75 staff time
15	Optimized for maximum benefit 1.75 staff time
16	Optimized constrained to select top 2 by rank 1.75 staff time
17	Optimized constrained to select top 5 by rank 1.75 staff time
18	Optimized constrained to select top 12 by rank 1.75 staff time
19	Optimized constrained to bats IWMM, prairie, FI, massasauga, and blandings 1.75 staff time
20	Top-down selection from ranked list 1.5 staff time
21	Optimized for maximum benefit 1.5 staff time
22	Optimized constrained to select top 2 by rank 1.5 staff time
23	Optimized constrained to select top 5 by rank 1.5 staff time
24	Optimized constrained to select top 12 by rank 1.5 staff time
25	Optimized constrained to bats IWMM, prairie, FI, massasauga, and blandings 1.5 staff time
F	Final Selection

**Table D-2** Efficiencies in terms of frequency adjusted total benefit for 25 potential IMP portfolios and the final selected set (F).  
Portfolios (x= selected surveys) were created by direct selections or by solving for optimal sets (maximum benefit within constraints)  
as described in table C-1. Benefit scores are derived from the ranking results presented in table B-1.

Survey Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	F
IWMM	x	x	x		x	x		x	x	x		x	x	x	x	x	x	x	x	x		x	x	x	x	x
Bat Detector	x	x	x		x	x		x	x		x		x	x		x	x	x		x		x	x	x		x
NVCS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Forest Inventory	x	x	x	x		x		x				x		x	x	x	x	x	x	x	x	x	x	x	x	x
wet prairie veg	x	x	x			x						x		x	x		x	x	x	x	x		x	x	x	x
water levels (summer)		x	x	x	x		x			x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Weekly Shorebird Counts (Part of IWMM in 2011)/ ISS	x	x	x	x				x		x	x			x	x	x	x	x	x	x	x	x		x	x	
Landbirds		x	x	x	x		x		x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Massasauga Geo-spatial Database		x	x	x			x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Secretive Marshbirds		x	x	x	x					x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	
Blanding's Turtle Spatial Ecology			x									x		x	x	x		x	x	x	x			x	x	x
Water Quality			x	x						x	x			x	x	x	x	x	x	x	x	x	x	x	x	x
BBS (vacant)	x		x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
NA Amphibian Monitoring Program	x		x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Grassland Bird Transects			x	x	x		x			x	x		x	x	x	x	x	x	x	x	x	x	x		x	x
Cover Board			x	x	x	x	x			x	x	x	x	x	x	x	x	x	x		x	x	x		x	
Avian Influenza			x	x	x	x	x			x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x
Midwinter Waterfowl Survey	x		x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bees			x	x	x		x			x	x	x	x	x	x	x	x	x	x		x	x	x		x	
Waterbird Nest			x	x	x		x			x	x		x	x	x	x	x	x	x		x	x	x		x	x
Bald eagle			x	x						x	x			x	x	x	x		x		x	x				x
White-tailed Deer Population			x	x	x		x			x	x			x	x	x	x	x	x		x	x	x		x	x
DEDs			x	x	x		x			x	x		x	x	x	x	x	x	x		x	x			x	x
Small Mammal			x	x	x		x			x	x		x		x	x	x	x	x		x	x	x		x	
Beaver Lodge	x		x	x	x	x	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	
Muskrat Houses	x		x	x	x	x	x			x	x	x			x	x	x	x	x	x	x	x	x	x	x	x
White-tailed Deer Aging	x	x	x		x	x		x	x	x		x	x	x	x	x	x	x	x	x		x	x	x	x	
Benefit	0.60	0.35	1.04	1.01	0.95	0.71	0.93	0.23	0.34	1.00	1.00	0.80	0.91	0.93	1.03	1.03	1.03	1.03	1.03	0.75	1.03	1.02	0.98	0.82	1.02	0.63
Weeks/year	31.3	38.9	55.6	31.2	30.8	31.1	15.5	23.4	15.6	30.6	31.2	31.2	31.2	53.7	48.6	48.6	51.6	54.0	48.6	46.5	42.2	44.6	46.6	46.5	46.6	46.3
# Surveys	11	10	27	23	20	12	17	5	5	23	23	15	18	23	26	26	26	26	26	18	25	25	22	18	24	18

## Appendix E. Estimated Annual Costs for Implementing Surveys

(Surveys with historic status are excluded).

Survey Name	Survey Priority	Survey Status	FWS Staff Total	Total Cost
Integrated Waterbird Management and Monitoring	1	Current	\$12,308	\$12,308
Bat Detector Monitoring	2	Current	\$13,462	\$14,112
NVCS	3	Current	\$1,923	\$2,223
Forest Inventory	4	Current	\$13,462	\$13,862
Prairie Vegetation Monitoring	5	Current	\$13,462	\$32,693
Water Quantity	6	Current	\$5,769	\$5,769
Landbirds	8	Expected	\$1,923	\$1,923
Massasauga Geo-spatial Database	9	Current	\$2,885	\$3,385
Blanding's Turtle Spatial Ecology	11	Current	\$5,769	\$5,769
Water Quality Monitoring	12	Expected	\$3,269	\$3,269
Grassland Bird Transects	15	Current	\$1,923	\$1,923
Wildlife Disease Monitoring	17	Current	\$1,923	\$1,923
Mid-Winter Waterfowl Survey	18	Current	\$385	\$385
Waterbird Nest Searching	20	Current	\$2,308	\$2,308
Weekly Bald Eagle Counts	21	Current	\$77	\$77
White-tailed Deer Population Studies	22	Current	\$1,154	\$1,154
Duck Energy Days	23	Expected	\$1,923	\$1,923
Small Mammal Survey	24	Future	\$2,404	\$2,904
Beaver Lodge Counts	25	Future	\$192	\$192
Muskrat Houses	26	Current	\$192	\$192
Management Actions	NR	Current	\$1,010	\$1,010
			<b>Staff Total</b>	<b>Total Cost</b>
<b>Total for selected (current and expected) surveys:</b>			\$85,127	\$106,208
<b>Total for future surveys:</b>			\$2,596	\$3,096

## Appendix F. Estimated Annual Work Schedule for Selected Surveys, January – December.

Survey Name	Survey ID FF03RS QC00-0	Survey Priority	Jan-March	April-June	July-Sept	Oct-Dec
Integrated Waterbird Management and Monitoring Initiative	25	1	A,R,FW,DE,P	T, FW,DE	FW,DE	FW,DE,A,R
Bat Detector Monitoring*	27	2	A, R,P	T, FW, DE	FW, DE	A, R
NVCS*	31	3	R	P	T, FW, DE	A, R
Forest Inventory/ FIAM*	76	4	P	T, FW, DE	FW, DE	A, R
Prairie Vegetation Monitoring	75	5	P	T, FW, DE	FW, DE	A, R
Water Quantity	111	6	P,A,R,FW,DE	T, FW,DE	FW,DE	FW,DE,A,R
Landbirds	110	8	P	FW, DE	FW, DE	A, R,
Massassauga Geo-spatial Database	4	9	P,T, FW, DE	FW, DE	A, R	
Blanding's Turtle Spatial Ecology	30	11	A,R, FW, DE	T, FW, DE	FW, DE	FW, DE,
Water level/ Water Quality Monitoring	13	12	A, R, FW, DE	T, FW, DE	FW, DE	FW, DE
Grassland Bird Transects	41	15	P	FW, DE	FW, DE	A, R,
Wildlife Disease Monitoring*	24	17	P,T, FW, DE	FW, DE	FW, DE	A, R, FW, DE
Mid-Winter Waterfowl Survey	17	18	A, R, FW, DE			
Waterbird Nest Searching	15	20	P	T, FW, DE	FW,	A,R
Weekly Bald Eagle Counts	10	21	P,A, R, T, FW, DE	FW, DE		FW, DE
White-tailed Deer Population Studies	12	22			P	A, R, T FW, DE
Duck Energy Days	112	23		P	FW	A, R, T, DE
Muskrat Houses	111	26	A, R, T, FW, DE			
Management Actions	89	~	A, R,FW, DE	T, FW, DE	FW, DE	FW, DE

P=Planning, T=Training, FW=Field Work, DE=Data Entry, A=Analysis, R=Reporting

\*Denotes Inventory or Monitoring conducted at 2-20 year intervals (not annual work).

## Appendix G. Non-selected Surveys

A status of future denotes surveys that have been prioritized but have low chance of being conducted during the span of the IMP because of low priority or because the capacity to conduct the survey will be difficult to secure. Historic status surveys have been recently completed or discontinued and were only ranked when considered for reactivation (not ranked = NR). Proposed surveys are surveys that are new to the refuge but included in the prioritization process.

Survey Name	Survey ID Number	Survey Priority	Survey Status
Audubon's Christmas Bird Count	FF03RSQC00-022	NR	Historic
Beaver Lodge Counts	FF03RSQC00-018	NR	Future
Big Sit	FF03RSQC00-032	NR	Historic
Blue Bird Nest Boxes	FF03RSQC00-036	NR	Historic
Breeding Bird Mini Route	FF03RSQC00-014	NR	Historic
Butterfly Surveys	FF03RSQC00-019	NR	Historic
Cover Board Surveys	FF03RSQC00-028	16	Historic
Dragonfly Survey	FF03RSQC00-023	NR	Historic
Drift Fence Surveys	FF03RSQC00-006	NR	Historic
Emerald Ash Borer Traps	FF03RSQC00-033	NR	Historic
Gypsy Moth Traps	FF03RSQC00-034	NR	Historic
National Protocol Framework for the Inventory and Monitoring of Bees	FF03RSQC00-042	19	Historic
NA Amphibian Monitoring Program	FF03RSQC00-016	14	Historic
Point Count Surveys	FF03RSQC00-003	NR	Historic
Reed Canary Grass Adaptive Management	FF03RSQC00-029	NR	Historic
Regional Impoundment Survey	FF03RSQC00-038	NR	Historic
Sedge Inventory	FF03RSQC00-039	NR	Historic
Sedge Wren Nesting Survey	FF03RSQC00-040	NR	Historic
Small Mammal Survey	FF03RSQC00-026	24	Future
Turtle Trapping Surveys	FF03RSQC00-002	11	Historic
Vegetation Monitoring- associated with point count data	FF03RSQC00-007	NR	Historic
Weekly Shorebird Counts (Part of IWMM starting in 2011)/ ISS	FF03RSQC00-008	7	Historic
Weekly Waterfowl Counts (Part of IWMM starting in 2011)	FF03RSQC00-020	NR	Historic
White-tailed Deer Aging	FF03RSQC00-009	27	Historic
White-tailed Deer Reproduction and Health (fetus, brain worm, CWD, etc.)	FF03RSQC00-035	NR	Historic
Wood Duck Nest Boxes	FF03RSQC00-037	NR	Historic

## Appendix H. Refuge Condition Summaries

Revisions and improvements to this table are **CURRENTLY UNDER DEVELOPMENT**. Once improvements are completed all IMPs will include this appendix in their IMPs. This summary table will be used as a reporting tool throughout the life of the IMP to track the status, trends, and desired conditions of the selected surveys. Updates to this summary can be made during annual reviews and reported in Annual Habitat Work Plans (AHWP). Table updates will not require an IMP revision, but will be uploaded as a digital file associated with the ServCat record that contains the approved IMP.

**REFUGE SUMMARY TABLE**

Resource Theme Level 1 <sup>1</sup>	Resource Theme Level 2 <sup>1</sup>	Attribute <sup>2</sup>	Current Condition (values) <sup>3</sup>	Source of Current Condition <sup>4</sup>	Desired Condition (values) <sup>5</sup>	Source of Desired Condition <sup>6</sup>	Within Desired Condition? <sup>7</sup>	Survey Name <sup>8</sup>

<sup>1</sup> Level 1 and 2 refer to the PRIMR Resource Themes 1 and 2 and cannot be altered.

<sup>2</sup> Characteristics of a system that are of interest of survey and can be observed or estimated.

<sup>3</sup> If known, current conditions of system being measured.

<sup>4</sup> Document in which current condition is reported. If not available enter "unknown" or "N/A".

<sup>5</sup> Desired conditions of system being measured.

<sup>6</sup> Document in which desired condition is reported. If not available enter "unknown" or "N/A".

<sup>8</sup> Survey name should match PRIMR record.

## Appendix I. Environmental Action Statement (EAS)

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) (40 CFR 1500-1508), and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and determined that the following proposed action does not require additional NEPA documentation.

### Proposed Action, Alternatives, and NEPA Documentation

The proposed action is to implement an Inventory and Monitoring Plan (IMP) for the Loess Bluffs National Wildlife Refuge. This IMP is a step down plan from the 2005 Comprehensive Conservation Plan (CCP) and 2018 Habitat Management Plans (HMP) and associated Environmental Assessments (EA) for the Refuge. This IMP provides more-specific guidance for surveys of Refuge's fish, wildlife, plant, habitat, and abiotic resources to fulfill the Refuge's purposes and help achieve Refuge's goals and objectives.


The EA for Loess Bluffs NWR CCP included goals and objectives for the refuge and assessed the impacts associated with a range of reasonable alternatives to achieve those goals and objectives. The rationale for selection of one specific alternative for implementation is explained in the Finding of No Significant Impact (FONSI) accompanying the CCP. The goals, objectives, and survey strategies included in this IMP fall within the bounds of those described and assessed in the CCP, HMP and EA or EIS.

Pursuant to 40 CFR 1502.9, no additional NEPA documentation is required to implement this IMP beyond the EA and FONSI prepared concurrently with the CCP. No substantial changes to the proposed action alternative that was identified, analyzed, and selected for implementation within the HMP, EA, and FONSI are proposed through this IMP. Similarly, no significant new information or circumstances exist relevant to environmental concerns and bearing on the proposed action or its impacts.

In accordance with 43 CRF 46.205 and 40 CFR 1508.4, some surveys within this IMP are covered by the following Departmental categorical exclusion because they would not have significant environmental effects.

"Research, inventory, and information collection activities directly related to the conservation of fish and wildlife resources which involve negligible animal mortality or habitat destruction, no introduction of contaminants, or no introduction of organisms not indigenous to the affected ecosystem." 516 DM 8.5B(1)

  
Project Leader/Refuge Manager

  
Date

*[Note: this signature and dating is not required if a statement is placed below the IMP signature page indicating that the Project Leaders signing of that page applies to all contents of this IMP].*

References: U.S. Fish and Wildlife Service. 2005. *Environmental Assessment of the Comprehensive Conservation Plan For Loess Bluffs National Wildlife*. USFWS Region 3. Bloomington MN.



## Appendix J. IMP Revision Signature Page

An IMP will be revised according to I&M Policy and as CCP and HMP plans are modified. IMP revisions require signatures from the staff listed in table below, which does not include the Refuge Supervisor or Regional Chief of Refuges. A revised IMP will include the completed and signed Revision Signature Page which will be placed at the beginning of the IMP and before the original signed IMP signature page.

<b>IMP Revisions</b> <b>Loess Bluffs National Wildlife Refuge</b>		
<b><i>Action</i></b>	<b><i>Signature /Printed Name</i></b>	<b><i>Date</i></b>
Survey list and priority changed:		
Submitted By:	Refuge Manager/Project Leader	
Reviewed By:	Regional I&M Coordinator	
Approved By:	Refuge Supervisor	