

**FISH AND WILDLIFE SERVICE
POPULATION MANAGEMENT**

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Chapter 2 Inventory and Monitoring in the National Wildlife Refuge System

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2.1 What is the purpose of this chapter? This chapter provides guidance on how the National Wildlife Refuge System (Refuge System) conducts scientifically rigorous natural resource surveys, and promotes efficiency in their conduct and collaboration with survey partners. The chapter:

- A.** Describes the process by which the U.S. Fish & Wildlife Service (Service) lists, prioritizes, and selects natural resource surveys;
- B.** Provides guidance for the evaluation and selection of survey protocols. It also provides guidance for developing new protocols, including survey design, data collection, management and analysis, and the reporting of survey results; and
- C.** Promotes planning and coordination of inventory and monitoring (I&M) activities at the local, landscape, Regional, national, and international scales, both within and outside of Refuge System lands and waters, and with Federal, State, and other partners.

2.2 What is the scope of this chapter? This chapter:

- A.** Applies to all surveys of fish, wildlife, plants, habitats, abiotic components, and wilderness character on refuges. This includes I&M activities on a single refuge, coordinated monitoring on multiple refuges, and collaboration with partners;
- B.** Applies to research survey activities that are conducted to inform resource management or that will require significant refuge participation; and
- C.** Does not apply to routine refuge operations, or to scientific activities conducted by independent entities on Service lands (e.g., surveys conducted for outreach or visitor services, non-Service research) that are not intended for resource management. External research is regulated by special use permits subject to appropriateness and compatibility (see 603 FW 1 and 2).

2.3 What are the objectives of this policy? Through this policy, the Service seeks to:

- A.** Inform planning and resource management decisions at multiple scales;
- B.** Promote consistency in the conduct of natural resource surveys throughout the Refuge System;
- C.** Implement scientifically rigorous surveys that support informed management decisions, and increase public understanding of Refuge System decisions affecting natural resources;
- D.** Meet Service and Refuge System legal mandates, administrative directives, and other monitoring needs that support the Service's approach to landscape conservation;
- E.** Guide and coordinate the inventory and monitoring of fish, wildlife, plants, habitats, ecological communities, invasive species, abiotic components, and wilderness character on refuges to:
 - (1)** Gather baseline data and record benchmark conditions used to support refuge planning;
 - (2)** Estimate the status of, and trends in fish, wildlife, plant populations, and their habitats;
 - (3)** Assess trends in biological integrity, biological diversity, and environmental health (601 FW 3);
 - (4)** Evaluate the effectiveness of management actions in contributing to established goals for fish and wildlife conservation by using adaptive management (522 DM 1);

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- (5) Provide surveillance to detect changes in the structure and function of ecological systems;
- (6) Establish baseline measures and monitor wilderness character of designated wilderness on refuges to evaluate the effects of refuge management activities and uses (610 FW 2);
- (7) Record impacts of environmental stressors, including climate change, on natural resources and ecological processes; and
- (8) Support the Service's goal of landscape conservation by assessing similar management actions across refuges and with Service partners, including actions by multiple refuges, one or more Regions, Joint Ventures (JVs), and Landscape Conservation Cooperatives (LCCs).

2.4 What is the Refuge System's I&M policy?

A. The policy requires that refuges develop and follow an Inventory and Monitoring Plan (IMP). An IMP:

- (1) Is an operational plan for one or more refuges that clearly states I&M priorities and clarifies operational commitments, depending on available capacity;
- (2) Relates to and follows from a refuge's Comprehensive Conservation Plan (CCP);
- (3) Provides the management rationale, timing, and costs for conducting refuge surveys;
- (4) Lists the prioritized surveys, identifies the surveys selected for implementation, and documents the protocols that describe the survey objectives and methods; and
- (5) Should be reviewed by the Project Leader, Regional I&M Coordinator, Regional Refuge Biologist/Division Chief, and Refuge Supervisor. The Regional Refuge Chief approves the IMP.

B. All refuges will use approved protocols when conducting surveys.

- (1) Survey protocols are scientific documents that are reviewed and approved at the appropriate level by Refuge Biologists, I&M Zone Biologists, Regional I&M Coordinators, or national I&M staff.
- (2) Assignment of an appropriate protocol to each selected survey is documented in an IMP (see Exhibit 1).
- (3) Protocol development, review, and approval is a complementary process described in *How to Develop Survey Protocols: A Handbook (Survey Protocol Handbook)*.

C. The Service established the Refuge System I&M initiative to support implementation of this policy.

- (1) The initiative is organized to assist refuges in planning and coordinating natural resource surveys, and consists of:
 - (a) The Natural Resource Program Center Chief and staff, Regional I&M Coordinators and I&M Data Managers, I&M Zone Biologists, Refuge Biologists, and field technicians; and
 - (b) The National I&M Coordination Team, which is comprised of the National I&M Manager, National I&M Data Manager, Lead Biologist from the national I&M office, and all Regional I&M Coordinators.

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(2) We address broad information needs that may reach beyond individual refuges, and support conservation with partners at the local, landscape, Regional, national, and international scales.

(3) We participate in surveys that support joint management information needs within the Service, or needs of other agencies or organizations. We may implement these cooperative surveys at individual refuges, multiple refuges, or outside Refuge System lands, as appropriate.

D. All refuges collect and manage survey data for consistency, applicability, and scientific rigor so that we can make informed, transparent, and defensible management decisions.

(1) Survey data, including information describing the surveys in the IMP, are permanent records that we must maintain and archive with associated metadata. I&M Data Managers work with refuge staff to ensure that these data are created and maintained in accordance with Service policy on electronic records management (282 FW 4).

(2) We will use approved data standards. One example is the Integrated Taxonomic Information System (ITIS), a database with standardized species names and their hierarchical taxonomic classifications and taxonomic serial numbers that we use as the species identifier for all survey databases.

E. Survey data from refuges should be analyzed and results reported in a timely manner to address management needs and decisions. To promote accountability, survey results should be accessible in the Service's document catalog (ServCat).

(1) Survey results should be disseminated in scientific journals or other appropriate media for broader use (see 117 FW 1).

(2) Survey documentation and results, including reports, posters, graphs, and maps are stored in ServCat.

2.5 What is the authority for this policy? The authority for this policy is the Refuge Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), 16 U.S.C. 668dd-668ee. The Act mandates that we "monitor the status and trends of fish, wildlife, and plants and their habitats in each refuge."

2.6 What terms do you need to know to understand this chapter?

A. Adaptive Management. A structured process that promotes flexible, informed decisions that allow us to make adjustments as we better understand outcomes from management actions and other events. Careful monitoring of these outcomes advances scientific understanding and helps adjust policies or operations as part of an iterative learning process (see section H(2), *Monitoring to Inform Management* below and the Department of the Interior's *Adaptive Management Technical Guide*).

B. Cooperative Surveys. Inventories or monitoring involving partners and designed to meet legal or other directives, assess large-scale resource issues, or improve the effectiveness of the Refuge System. Cooperators include other refuges, Service programs, other Federal or State agencies, or private partners. These surveys may extend beyond refuge boundaries.

C. Habitat Management Plan (HMP). A document guided by the refuge Comprehensive Conservation Plan (CCP) that provides further guidance for managing habitat to achieve long-term refuge goals (see 620 FW 1).

D. Inventory. A survey that estimates the presence, abundance, or distribution of species, habitats, ecological communities, or abiotic features at a particular time.

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E. Inventory and Monitoring Plan (IMP). A description and justification of the selected surveys that a refuge plans to conduct using assigned survey protocols (see Exhibit 1).

F. Landscape Conservation Cooperative (LCC). A partnership that may include State, Federal, tribal, and local governments and nongovernmental organizations established to conduct landscape-scale biological planning and conservation design within designated areas. LCC staff work with other agency and conservation partners to plan, design, and evaluate landscape-scale conservation.

G. Metadata. Description of the content, quality, history, condition, and other characteristics of recorded information. Federal agencies must create metadata that meets specific standards for newly collected or produced geospatial and biological data (see Executive Order 12906, as amended by Executive Order 13286, Federal Geographic Data Committee 2000).

H. Monitoring. A survey repeated through time to document changes in select attributes of wildlife, plants, habitats, ecological communities, or abiotic resources. Two types of monitoring in the policy are:

(1) Baseline Monitoring. Monitoring that is not tied to specific predictions of how a natural resource will respond to management or environmental stressors, but instead is designed to document change over time of a natural resource. Also referred to as surveillance monitoring, examples include monitoring wildlife population trends, disease incidence, climate change, and wilderness character.

(2) Monitoring to Inform Management. Monitoring to assess whether a natural resource is approaching or exceeding a known threshold, or if a resource is responding to a management action or system stressor in a specified manner. This type of monitoring involves defining the threshold values or expected response, then surveying to measure the response or a closely related indicator. Comparing monitoring results with these expected values may show a need for initiating, intensifying, or altering management actions. In this policy, it generally means monitoring in an adaptive management context to improve management or evaluate progress toward achieving management objectives. It is also considered a type of targeted monitoring.

I. Planning and Reporting Inventory and Monitoring at Refuges (PRIMR) Database. A database developed by the I&M initiative that describes and archives the surveys conducted on refuges, and which is also used to generate summaries for an IMP.

J. Protocol. Detailed instructions for conducting a survey. This includes information on sampling procedures, data collection, management and analysis, and reporting of results. Approved survey protocols promote continuity of data collection methods for both the duration of the survey on a refuge and among similar surveys on different refuges. This term collectively refers to a survey protocol framework and a site-specific survey protocol.

(1) Survey Protocol Framework. A survey protocol that was written for application at many locations, but lacks the site-specific information necessary to implement the protocol at an individual refuge (see the *Survey Protocol Handbook*).

(2) Site-specific Survey Protocol. A complete set of instructions used to conduct a survey at a specific refuge. We typically develop these by adding site-specific instructions to a generalized protocol framework or by modifying a site-specific protocol that was developed for conducting a similar survey at another refuge.

K. Refuge. Any unit of the Refuge System, including refuges, wetland management districts, and associated waterfowl production areas. Refuges do not include coordination areas, which are part of the Refuge System, but are managed by States under cooperative agreements.

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L. Refuge Complex. A group of refuges administered by a common office for management efficiency.

M. ServCat. The Service’s document catalog, which is an online repository designed to centralize and preserve Service information. It includes reports, annual narratives, management plans, geospatial data, IMPs, and survey protocols.

N. Survey. A formal effort designed to inventory or monitor natural resources. A survey requires a sampling design, data analysis, and reporting.

O. Survey Coordinator. A Service employee, usually the Refuge Biologist, who oversees the implementation of one or more surveys selected in an IMP. This includes selection of survey protocols that adhere to standards of scientific excellence. The survey coordinator also ensures that survey data are managed, analyzed, and reported, and results are archived in ServCat.

P. Wilderness Character. The combination of biophysical, experiential, and symbolic qualities that distinguishes wilderness from all other lands. Measures chosen by refuges for monitoring fall under the five qualities of wilderness character: natural, undeveloped, untrammled, solitude, or primitive and unconfined recreation, and other features of value.

2.7 What are the responsibilities of Service personnel for implementing this policy? See Table 2-1.

Table 2-1: Responsibilities for the Service’s I&M Initiative	
These employees...	Are responsible for...
A. The Director	Overall policy and priority setting to direct I&M across the Service.
B. Chief, National Wildlife Refuge System	(1) Overseeing policy development and maintenance, and (2) Ensuring that I&M efforts are relevant across the Service.
C. Natural Resource Program Center Chief	(1) Administering and implementing the I&M policy, and (2) Integrating I&M activities across the Service and with partners.
D. Regional Directors	(1) Ensuring policy compliance within their respective Regions, and (2) Ensuring integration across Service programs and among appropriate partners within Regions and other appropriate geographical areas.
E. National I&M Manager	(1) Leading the National I&M Coordination Team; (2) Implementing the I&M policy to ensure national continuity, efficiency and scientific integrity; and (3) Coordinating and reporting I&M progress, needs, and costs.
F. National I&M Coordination Team	(1) Ensuring scientific excellence and relevance for I&M efforts; (2) Integrating national and international I&M priorities with Regional and refuge priorities; and (3) Establishing relationships with partners to conduct surveys.

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Table 2-1: Responsibilities for the Service's I&M Initiative	
These employees...	Are responsible for...
G. Regional Refuge Chiefs	<ul style="list-style-type: none"> (1) Approving refuge IMPs; (2) Ensuring policy compliance and overall program oversight and direction within their Regions; and (3) Facilitating appropriate integration across Service programs within the Region.
H. Refuge Supervisors	<ul style="list-style-type: none"> (1) Reviewing refuge IMPs and approving IMP revisions; (2) Ensuring policy compliance and concurrence on IMPs for their respective refuges; and (3) Facilitating appropriate integration and consistency among refuges.
I. Project Leaders (Refuge Managers)	<ul style="list-style-type: none"> (1) Ensuring policy compliance for refuges under their purview, and (2) Developing, implementing, and revising the refuge IMP.
J. Regional Refuge Biologists (Division Chiefs)	<ul style="list-style-type: none"> (1) Coordinating and conducting reviews of IMPs with the Regional I&M Coordinator; (2) Identifying coordination opportunities both within and among Regions; (3) Overseeing Regional allocation of I&M funds, and (4) Supervising the Regional I&M Coordinator.
K. Regional I&M Coordinators	<ul style="list-style-type: none"> (1) Serving on the National I&M Coordination Team to implement the national I&M initiative; (2) Reviewing IMPs to facilitate scientific integrity and efficiency; (3) Coordinating the development and review of protocols; (4) Providing scientific support to refuges within their Regions, and (5) Coordinating I&M needs with the LCCs, JVs, and other partners.
L. I&M Zone Biologists	<ul style="list-style-type: none"> (1) Assisting refuge staff to prepare IMPs; (2) Participating in protocol assignment and development and amending IMPs as new protocols are adopted; (3) Assisting Refuge System staff with managing and analyzing data and reporting survey results; and (4) Providing scientific support to refuges within their Regions.

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Table 2-1: Responsibilities for the Service's I&M Initiative	
These employees...	Are responsible for...
M. Refuge Biologists	<p>(1) Leading refuge staff in selecting surveys and preparing IMPs;</p> <p>(2) Participating in protocol assignment and development of site-specific survey protocols;</p> <p>(3) Ensuring surveys conducted at a refuge follow approved protocols; and</p> <p>(4) Serving as a survey coordinator, leading surveys and ensuring that survey data are managed, analyzed, reported, and archived.</p>
N. I&M Data Managers	<p>(1) Ensuring scientific integrity by establishing quality assurance standards for data management,</p> <p>(2) Ensuring that I&M data are conserved and archived,</p> <p>(3) Contributing to protocol development, and</p> <p>(4) Assisting Refuge System staff with managing and analyzing data and reporting survey results.</p>

2.8 What is an IMP? An IMP is the description, ranking, selection, and justification of surveys that a refuge intends to conduct using assigned protocols. The IMP includes a signature page documenting review and approval at the Regional level, an introduction linking the refuge's primary purpose to surveys, and a description of the process used to prioritize surveys and assign a status for implementing them. The IMP also includes a narrative for each selected survey that summarizes the refuge management objectives addressed by the survey and justifies why the refuge selected the survey for implementation. A table summarizes characteristics of each survey, including the objectives, required costs, staff time, survey duration, and survey coordinator (see Exhibit 1).

2.9 What is the relationship of an IMP to a CCP and a Habitat Management Plan (HMP)? A CCP is a document that outlines and guides long-term management objectives for a refuge. An IMP reflects the priorities in a CCP (602 FW 4). By specifying objectives that require surveys, an HMP may also contribute to the development of a refuge IMP. An IMP should be revised following approval of a CCP or when survey priorities change at a refuge (see section 2.12B).

2.10 How does the refuge address the National Environmental Policy Act (NEPA) within an IMP?

When developing or revising an IMP, we must comply with NEPA.

A. The Department of the Interior has a categorical exclusion that may cover specific surveys in an IMP if they do not have significant environmental effects (see 43 CFR 46.205 and 40 CFR 1508.4). The appropriate categorical exclusion is 516 DM 8.5B(1).

B. In addition, surveys may be excluded from additional NEPA documentation if they have been identified, addressed, and authorized in an approved CCP or HMP.

C. If the NEPA process is required for an IMP, it may trigger compliance with other laws, such as the National Historic Preservation Act and the Endangered Species Act.

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2.11 How do refuges develop an IMP? Refuges develop an IMP with assistance from I&M staff. A refuge complex administering more than one refuge may complete a single IMP or individual IMPs for each refuge. See Exhibit 1 for details on how to develop an IMP.

A. Identifying needed surveys. After considering refuge management objectives, refuge and I&M staff identify a comprehensive set of proposed surveys, and enter the information describing the proposed surveys in the PRIMR database.

B. Setting priorities for surveys in an IMP. Refuge and I&M staff then prioritize surveys to make objective decisions about which surveys to implement. Proposed surveys are prioritized considering:

(1) Criteria that include relevance to refuge-level objectives as well as contributions to landscape and broader-scale objectives (see Exhibit 1), and

(2) The mission of the Refuge System; refuge purposes; the Alaska National Interest Lands Conservation Act (ANILCA) requirements; maintenance and restoration of biological integrity, diversity, and environmental health (Improvement Act); and refuge, Service, and partner monitoring needs (see the *Handbook on Identifying Refuge Resources of Concern and Management Priorities*).

C. Selecting the surveys to conduct. From the prioritized list of surveys, refuge staff select and the Project Leader submits the surveys that the refuge expects to carry out during the life of the IMP. When selecting surveys, consider survey priority, cost, duration, frequency, and staff time.

D. Assigning protocols to surveys in an IMP. Refuge biologists and I&M staff identify appropriate protocols to implement the surveys selected in the refuge IMP. Staff can select a survey before a protocol is developed. When an approved protocol becomes available, it is documented by adding the protocol citation and status into its ServCat record and linking them to a survey in PRIMR (see section 2.11A and the *Survey Protocol Handbook*).

E. IMP review and approval. After refuge and I&M staff prepare an IMP, the Project Leader sends it to the Region for review to ensure completeness and consistency. The Regional I&M Coordinator, Regional Refuge Biologist, and Refuge Supervisor review the IMP. The final approval comes from the Regional Refuge Chief.

F. Completing an IMP. An IMP is complete when the Regional Refuge Chief approves it (Exhibit 1, Figure 2 shows the signature page). Refuge staff enter the signed IMP into ServCat.

2.12 What is the process for amending or revising an IMP? The Project Leader may change a refuge IMP either by amending or revising it. Amend an IMP when protocols change, and revise it when adding or removing a selected survey. Refuge and I&M staff record changes to the IMP by updating PRIMR and entering the revised version in ServCat.

A. Amending an IMP. After an IMP is approved, the survey coordinator and I&M staff evaluate the assigned protocols and amend the IMP when protocols are changed.

(1) No additional approval is required for an IMP amendment.

(2) An IMP should be amended when:

(a) The status of a survey protocol is changed to “Approved,”

(b) A new version replaces an approved survey protocol, or

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(c) A more appropriate protocol for a survey is developed or becomes available.

B. Revising an IMP. The Project Leader reviews the refuge capacity and status of surveys in an IMP each year and determines which of the selected surveys will be conducted. The IMP doesn't have to be revised if a selected survey is not conducted in a particular year. However, if staff add or remove a selected survey, then the IMP must be revised. The Project Leader should also consider revising the IMP when a new CCP, HMP, or other plans change resource management objectives.

(1) The Project Leader submits an IMP revision to the Regional I&M Coordinator and the Regional Refuge Biologist/Division Chief for review, and then the Refuge Supervisor for approval (see Exhibit 1).

(2) An IMP should be revised when:

- (a) An emerging natural resource problem requires a new survey,
- (b) The Project Leader selects a new survey to conduct that was not on the original survey list, or
- (c) The Project Leader wants to remove a selected survey from an IMP.

C. Keeping track of the changes. Refuge staff update PRIMR to reflect changes and store the new version in ServCat.

2.13 How does a refuge implement an IMP? Survey implementation entails site-specific survey planning, data collection, data analysis, reporting, and archiving. The Refuge Biologist or other survey coordinator oversees compliance with the associated survey protocols through each of these steps. The survey coordinator also ensures continuity of the survey, including training new staff, establishing safety measures, and addressing logistical needs.

A. Developing site-specific survey protocols and recalculating costs. The Refuge Biologist or other survey coordinator, with assistance from I&M staff, develops a site-specific protocol to document how refuge staff should implement a survey. They can develop a site-specific protocol by incorporating additional details to an existing protocol framework, by using a site-specific protocol developed by another refuge, or by developing a new site-specific protocol from various materials compiled as initial survey instructions (see the *Survey Protocol Handbook*). Site-specific protocols:

- (1) Need to include detailed information on sampling location and effort,
- (2) Help to refine survey cost and staffing estimates, and
- (3) Must be stored in ServCat once a draft is complete and ready for testing or review.

B. Ensuring safe and authorized data collection. The survey coordinator ensures that each person working on the survey is trained on the data collection process according to the survey protocol. The survey coordinator and the Project Leader also must ensure that the necessary equipment and authorizations are obtained to conduct the survey.

(1) Surveys must adhere to established standards for proper animal care and use (see the *Survey Protocol Handbook*).

(2) For surveys requiring a special use permit, the permit holder is responsible for obtaining proper reviews and communicating the animal care and use guidelines to the survey coordinator.

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(3) Some protocols may require specialized safety or operational training.

C. Collecting field samples. The survey coordinator must ensure that staff properly collect, process, label, and store field samples. Certain specimens and samples require permits, such as migratory birds or federally-listed species. Others, such as invasive species and diseased specimens, may require special handling and disposal. General guidance for collecting and handling field samples should be included in the survey protocol framework, with additional details provided in the site-specific protocol.

D. Storing and archiving specimens. Service policy (see 701 FW 5) guides the collection and disposal of fish, wildlife, and plant specimens at refuges. The survey protocol must include a description of the final disposition of specimens, and the survey coordinator must ensure these requirements are met.

E. Managing data. The survey coordinator ensures that data are entered or stored in a timely and accurate manner. Each survey protocol should provide details on data management (see the *Survey Protocol Handbook*). Refuge staff with I&M Data Managers should:

(1) Follow existing Service data standards or develop new data standards in compliance with Establishing Service Data Standards (274 FW 2) to ensure consistency of survey data collection, provide for data sharing, and reduce costs;

(2) Create accurate metadata that describes the purpose and current status of the survey data, and defines data formats, storage locations, and procedures for data collection and data quality;

(3) Annually archive one electronic copy of metadata and associated data sets at the refuge coordinating the survey and one location off the refuge in compliance with 282 FW 4; and

(4) For Regional or national surveys, enter data into an appropriate Service-approved database.

F. Analyzing survey data and reporting results.

(1) Analysis and reporting should reiterate the survey objectives and address the links to management objectives specified in the CCP, HMP, or other pertinent plans.

(2) I&M and refuge staff should rely on appropriate statistical methods as specified in a survey protocol when analyzing data. Analysis of survey data may support conclusions at different scales (e.g., refuge, landscape, Regional, national, or international).

(3) The survey coordinator should ensure compliance with reporting procedures, including appropriate biological and statistical review, as specified in the approved protocol.

(4) A survey is complete when the Refuge Biologist or other survey coordinator, in consultation with an I&M Data Manager, archives the data and puts the final report in ServCat (see section 2.13G).

(5) If a site-specific protocol requires an interim report, the survey coordinator must develop it and send it to the Project Leader before the beginning of the next season's fieldwork. These reports should include:

(a) Results of the interim data analysis,

(b) Interpretation relevant to the survey objectives, and

(c) Any operational reasons that caused deviations from the protocol.

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(6) Survey results should be reported in a form that allows widespread dissemination and promotes professional interchange.

G. Storing and archiving protocols and reports. I&M staff ensure that survey protocols are archived. Refuge Biologists or other survey coordinators ensure that field notes and reports are stored in compliance with Service Enterprise Architecture (270 FW 1), Data Resource Management (274 FW 1), and Electronic Records (282 FW 4) policies. Refuge System staff should:

(1) Create accurate metadata that describes the purpose and current status of the survey data, and defines data formats, storage locations, and procedures (including name and version of survey protocol) for data collection and data quality; and

(2) Store data documents, metadata, reports, posters, graphs, maps, and any other documentation of I&M results in ServCat.

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DEPUTY DIRECTOR

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